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Green Arms Race: Indonesia's Critical Minerals and its Sprint for Renewable Energy Sovereignty

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Abstract
The increasing global demand for renewable energy has pushed countries around the world to compete in acquiring critical minerals and developing green technology. This article aims to examine the policies, regulations, and incentives implemented by the Indonesian government to leverage its vast reserves of critical minerals such as nickel, tin, and rare earth elements. It also aims to compare Indonesia's approach with the strategies employed by major players like China and the United States. The analysis highlights Indonesia's strengths, including its mineral wealth and supportive policies, as well as challenges such as technological readiness and regulatory hurdles. The research aims to provide insights into how Indonesia can enhance its renewable energy capabilities and achieve energy sovereignty while navigating the complex geopolitical landscape by using SWOT and intelligence analysis. The results indicate that the Indonesian government must improve its efforts to maximize its own potential, including by maintaining the availability of mineral resources, establishing robust regulations, and providing incentives for developers in the renewable energy sector. Additionally, it is crucial to promptly address the issues that hinder Indonesia's progress in achieving renewable energy sovereignty, such as updating mineral reserve data, adapting technology and improving human resources, and enhancing oversight to prevent illegal smuggling of mineral resources for renewable energy.

1. Introduction

Increasing awareness of climate change and its impacts has driven global efforts to reduce carbon emissions and transition to renewable energy sources. A sense of urgency has formed among nations to adopt green technologies to reduce their carbon emission and comply with the global net zero effort. As a result, there has been a competitive race among nations to lead the development and deployment of green technologies. Each country deployed various strategies to gain advantage in the race, ranging from strategic partnerships and regulatory adjustments.

Noteworthy participants of the race include so-called “superpower” countries such as China and the United States. China’s strategic partnership with Congo through the acquisition of Congo’s cobalt mines based on the Sicomines Joint Venture Agreement (established in 2008, and further revised in 2023) and development of China’s domestic refining facilities gave the country significant leverage in mass producing high-performance batteries and permanent magnets. Both technologies are critical in the development of electric vehicles and wind turbines, respectively. On the other hand, the United States notably took drastic legislative efforts to support its green technology industries by enacting a set of legislative actions, namely the CHIPS and Science Act and the Inflation Reduction Act (IRA). This pair of bipartisan laws provides over $500 billion in funding, tax credits, and other incentives to help push the United States' infrastructure, accelerate its green energy innovation, and ease the nationwide deployment of renewable power, energy efficiency, clean transportation, and emissions-reducing technologies - all critical steps towards achieving the nation's climate goals while boosting economic competitiveness and energy security.

Indonesia is also an eager participant in the race. As a country rich with naturally-occurring minerals that are crucial for the development of many green technologies, Indonesia is aware of its better potential to "sprint" in the race than most other participants. Many of Indonesia's initiatives stem from its desire to protect and develop such minerals, which in turn is expected to ease the development of Indonesia's domestic green technology production. For instance, Indonesia's Minister of Energy and Mineral Resources Decree No. 296.K/MB.01/MEM.B/2023 designate such minerals as "critical minerals'' that have important uses for national economy, defense, and security, and that may be affected by supply shortage due to the absence of any suitable substitutes. In other words, minerals identified as "critical minerals" will be subject to more careful attention and stricter regulations by the Indonesian government for the purpose of further development. To quote Rizal Kasli, the Chairman of the Indonesian Mining Experts Association (Perhapi), the purpose of this classification of critical minerals is to support the development of domestic strategic industry in the mining sector.

The Indonesian government often stated its intention to develop its critical minerals industry by the "downstreaming", or "*hilirisasi*", approach. By "downstreaming", the government intends to reduce exports of raw critical minerals and promote their domestic usage by developing domestic green technology production. To support its drive to develop domestic green technology production, the Indonesian government realized that it has to firstly secure enough critical minerals supply domestically so as to avoid relying on imports. These two policies are essential for the Indonesian government in its green technology development, and as such this article aims to analyze the issues surrounding them.

The issues surrounding Indonesia's "downstreaming" and domestic critical minerals supply policies vary from one critical mineral to another. However, out of a total of 47 identified critical minerals, the issues surrounding tin, nickel, and rare earth elements (REE) take precedence over the others as those three are some of the most common yet important resources for the renewable energy technology development in Indonesia. Therefore, this article will primarily analyze the issues surrounding those three critical minerals. Upon analyzing the issues surrounding the tin, nickel, and REE critical minerals and their effect towards Indonesia's "downstreaming" and domestic critical minerals supply policies, this article will also formulate possible solutions and the impact of such issues and solutions towards Indonesia's position as of now in the international race for the development and deployment of green technologies. Identifying Indonesia's position based on its current strengths and weaknesses serves to help determine the optimal general strategy suited for Indonesia, which this article will also attempt to analyze.

Analyzing Indonesia's capabilities in the green arms race is still a relatively new research endeavor. Most literature that currently exists on the matter has always been focused on decisions done by the more established countries in the sector such as the United States, China, or members of the European Union; little to no research has been done through the viewpoint of developing countries that also stand to benefit from the current situation. On the other hand, current research in Indonesia tends to focus on the technical aspects of the country's critical mineral reserves and potential. In a previous study, Tama (2021) through the research titled "The Role of Economic Intelligence in Rare Earth Element Mining for Strengthening The National Economy" argued that identifying the potential of critical minerals such as REE is not only an economical issue, but also relates to the matters of intelligence and national security.

Thus, this article's originality stems from its use of intelligence and geopolitics perspectives to analyze a mainly economic problem. By incorporating aspects of intelligence analysis, this article will attempt to provide a more strategic view on the matter, with the emphasis on identifying vulnerabilities that the Indonesian government faces with its current regulation and enforcement practices. In doing so, this article can serve as an early warning for the stakeholders to act upon and investigate further on the subject.

2. Literature Review

2.1. Energy Sovereignty and Security

Energy sovereignty refers to the right and ability of individuals, communities, and nations to control, regulate, and manage their own energy resources and systems. Timmermann and Noboa (2022) has identified key values concerning energy sovereignty, such as accessibility, empowerment, stewardship, sustainability, self-sufficiency, resilience, peace, transparency, self-determination, and gender justice. They argue that energy sovereignty in renewables involves designing and managing decentralized energy systems that protect the environment and empower communities to participate in governance and decision-making processes.

This concept is critical in understanding the dynamics and motivation underlying the green arms race. While there is no universal definition of a "green arms race", the term is used to explain the phenomena in which there has been a significant increase of competitive efforts by nations to lead in the development and deployment of renewable energy technologies. The term itself is popularized by New Economy Brief in a report dated April 5th, 2023, which stated that the implementation of the IRA by the US acted as a catalyst to substantial investments made by governments around the world in renewable energy technologies and infrastructure. One may argue that the green arms race shares similarities to the dynamics of a traditional arms race, where nations' decisions to invest in green technologies are influenced by the actions of others. This, as shown by Sjöström and Baliga (2003) in the context of a traditional arms race, creates a strategic interaction where each country's investment decisions are interdependent. As a result, it should be noted that energy sovereignty is not just about environmental sustainability; it is about gaining economic and strategic advantages in the global market, reducing energy costs, and enhancing one country's geopolitical influence.

Traditional concepts of energy security typically revolved around the 4As, namely availability in the form of easy and consistent access to the energy supply, affordability of energy costs, acceptability of the energy source in order to satisfy public support (i.e., public legitimacy), and accountability of the actors in providing the energy supply. The International Energy Agency summed these up by defining energy security as "uninterrupted availability of energy sources at an affordable price." As the concept evolves however, Krakowiak-Bal et al. (2023) has suggested three distinct perspectives concerning energy security. In the field of political sciences, energy security is related to the sovereignty of nations of their energy supply. Robustness, or the ability to overcome adverse conditions, is the main focus of energy security in technical sciences. Lastly, in economics, the term is tied to the concept of resilience.

Components of energy security also vary among studies. In general, Paravantis and Kontoulis (2020) has reviewed and classified seven dimensions and components in an attempt to formulate an energy security index. The seven components are (ordered from the most to the least important) physical availability, which refers to the security of energy supplies and diversification of energy sources; technology development, which is gauged by the state and maturity of the relevant infrastructure; economic affordability, with focus on energy prices and intensity; governance, such as political stability, quality of regulations, and the rule of law; social accessibility, which relates to the dependency on imported energy and the rate of electrification; unconventional threats to the energy infrastructure; and natural environment. This article will discuss the first two components of energy security, as they represent the vital first steps in initiating green energy development and are heavily featured in the strategies and regulations used by foreign superpowers.

2.2. Indonesia's Critical Minerals Reserves and Potentials

The transition to renewable energy and green technology is heavily dependent on a range of critical minerals. These minerals, which include lithium, copper, nickel, cobalt, and rare earth elements (REE), are essential components in many of today's rapidly growing clean energy technologies (US Geological Survey, 2022). From wind turbines and solar panels to electric vehicles (EVs) and energy storage systems, these minerals play a crucial role in enabling the shift away from fossil fuels towards a more sustainable energy future. Based on those critical minerals, Indonesia has potential critical mineral reserves for renewable energy, namely Tin, Nickel and Rare Earth Metals.

Based on US Geological Survey: Mineral Commodity Summaries (2024), Indonesia occupied the second position as the largest tin mining production with a production output of 70,000 tons in 2022 as shown in figure 1 and occupied the third position with a production output of 52,000 tons in 2023. World Population Review (2022) further affirmed that Indonesia's tin production figure is at 52,000 tons in accordance with figure 2. Also, stated that Indonesia still has tin reserves in the amount of 800,000 tons in 2022 that can be mined for up to 16 years. In the renewable energy sector, tin plays an important role in the raw material for making electric batteries. Savira (2023) explains that in the context of making Lithium Batteries that will be used for EV, tin will be the active ingredient in the anode, which helps store and release energy efficiently.

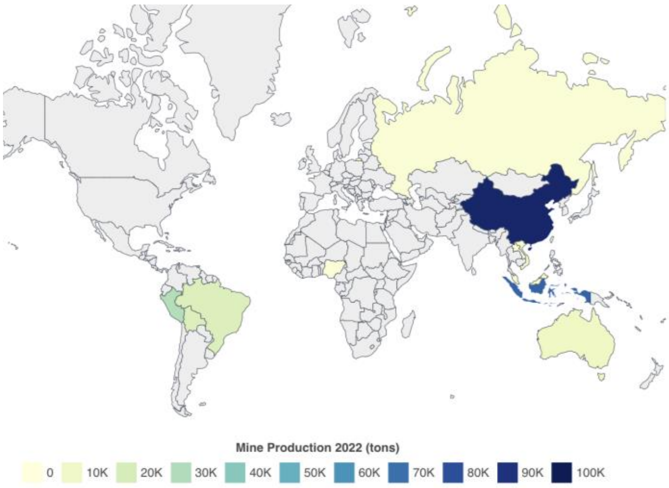

Figure 1. Tin Production by Country

The figure also shows tin production from other countries. China is the leading tin producer, with annual production between 90,000 and 125,000 metric tons. Indonesia follows, producing 70,000 to 84,000 metric tons annually. Peru ranks third with around 27,000 to 29,000 metric tons. Bolivia, Brazil, Australia, Laos, Vietnam, Nigeria, Russia, Malaysia, and Rwanda also contribute significantly to global tin production. Key factors influencing production include geological tin ore reserves and national mining regulations.

Apart from tin, Indonesia is also one of the countries that has the largest nickel reserves in the world. USGS (2024) further affirmed that nickel reserves in Indonesia are at 55 million tonnes with mining production in 2023 at 1.8 million tonnes. These numbers established that Indonesia places first in the amount of nickel reserves and mine production in the world, followed by Australia in second place with nickel reserves of 24 million tonnes and Philippines in second place for mine production. Nickel deposits in Indonesia are spread across several points with the main points being in Southeast Sulawesi, North Maluku and Papua (Anbiyak, N., & Cahyaningrum, T., 2020). As mentioned before, nickel plays an important role in the renewable energy industry as an essential electric batteries component. Quoted from Lombard Ordie (2024), nickel has the ability to enhance battery performance by increasing energy density that can support higher voltages and storage capacities without compromising stability.

Another mineral that plays a main role in development of renewable energy is Rare Earth Elements (REE). REE is a group of seventeen chemical elements that generally occur together with the lanthanides (Suwargi, Et al, 2010). In the development of renewable energy, REE are important building blocks for various sectors such as hybrid cars, wind turbines, next generation rechargeable batteries and biofuel catalysts (Balaram, 2018). In Indonesia, the presence of REE is generally found in Monazite and Xenotim granite rocks which are composed of several lead-bearing chemical compounds (Tama, 2021). The Center for Mineral, Coal and Geothermal Resources (PSDMBP) has divided the presence of REE into 4 clusters in Indonesia, namely Clusters I and II in Sumatra, Cluster III in Kalimantan and Cluster IV in Sulawesi. As a member of the international tin belt countries, Indonesia has recognizable potential for REE as well, especially in Bangka Island. Based on a Kumparan.com interview with the Head of the Geological Agency of the Center for Marine Geological Survey and Mapping (BBSPL), Herry Rodiana Eddy (2022) stated that Indonesia has a potential of around 4.6 billion cubic meters of heavy minerals consisting of REE.

2.3. Indonesia's Regulations Regarding Foreign Investments In Mining Critical Minerals

To achieve its renewable energy goals, the Indonesian government updated its Law No. 4 of 2009 on Mineral and Coal Mining by implementing Law No. 3 of 2020 and Government Regulation in lieu of Law No. 2 of 2022 (altogether Mineral and Coal Mining Law). The Mineral and Coal Mining law facilitates the exploration and extraction of critical minerals by providing the basic legal framework for permit extensions, which are designed to attract more foreign and domestic investment into Indonesia's mining sector; notably, the amendments made through Government Regulation in lieu of Law No. 2 of 2022 simplifies the Mineral and Coal Mining Law's licensing processes for businesses in the renewable energy sector and provides incentives in the form of tax breaks, subsidies, and easier access to financing. This reduces bureaucratic hurdles and accelerates the development of renewable energy projects. With less bureaucratic hurdles and more conceivable benefits, the Indonesian government clearly demonstrates its intention to accelerate the development and implementation of green energy in Indonesia.

The Indonesian government also offered various advantages in investing in Indonesia, especially in the mining sector. Companies that invest capital in business fields that are classified as priority business fields, such as nickel mining (KBLI 07295) and tin ore mining (KBLI 07291), may receive fiscal and non-fiscal incentives. The differences between the fiscal and non-fiscal incentives are as follows:

1. Fiscal incentives: this type of incentive includes customs and tax incentives
    a. Customs incentives: these cover exemptions from import duties on machinery, goods, and materials used for construction or industrial development.
    b. Tax incentives: these cover the following types of incentives:
        i. Tax allowance: An income tax relief provided for investment in certain business fields and/or in certain regions.
        ii. Tax holiday: A corporate income tax reduction.
        iii. Investment allowance: Corporate income tax reduction and a facility for reducing net income for capital investment as well as reducing gross income for certain activities.
2. Non-fiscal incentives: this type of incentive includes streamlined business licensing, infrastructure support, guaranteed energy availability, access to raw materials, immigration facilitation, and employment benefits.

Specifically for tax incentives, Minister of Finance Regulation No. 130/PMK.010/2020 on Income Tax Deduction Facilities regulates the disbursement of income tax deduction for the corporate taxpayers who make new investment in priority business fields. The tax deduction applies to corporate taxpayers' primary business activities income. The minimum new investment of IDR 100 billion is required in order to obtain the corporate income tax deduction. The corporate income tax deduction shall be given in the following amount:

1. 100% of corporate income tax payable for new investments amounting of ≥ IDR 500 billion.
2. 50% of corporate income tax payable for new investments amounting of ≥ IDR 100 billion and < IDR 500 billion.

The duration of corporate income tax deduction are as follows:

1. 5 years for new investments amounting of ≥ IDR 500 billion and < IDR 1 trillion
2. 7 years for new investments amounting of ≥ IDR 1 trillion and < IDR 5 trillion
3. 10 years for new investments amounting of ≥ IDR 5 trillion and < IDR 15 trillion

4. 15 years for new investments amounting of ≥ IDR 15 trillion and < IDR 30 trillion

5. 20 years for new investments amounting of ≥ IDR 30 trillion

The Indonesian government also regulates technology transfer of foreign companies. Based on Government Regulation No. 20 of 2005 on Transfer of Intellectual Property Technology and Research and Development Results by Universities and Research and Development Institutions, this technology transfer, which stems from research and development activities, adheres to the following guidelines: Priority recipients of intellectual property technology and research results must be based in Indonesia; Recipients should be capable of utilizing and understanding science and technology for the benefit of the society and state; Intellectual property and research results transferred as technology should not be considered confidential, in accordance with statutory regulations; and The implementation of technology transfer from research and development activities must align with public order and other relevant legal requirements.

Furthermore, based on Law No. 25 of 2007 on Capital Investment (as amended) (Investment Law), investment companies that employ foreign workers are required to provide training and transfer technology to Indonesian workers. Business actors may face potential administrative sanctions for the noncompliance of transfer of technology obligations under the Investment Law. The administrative sanctions are in the following forms: written warnings, limitation of business activities, suspension of business activities and/or investment facilities, and/or revocation of business activities and/or investment facilities.

Save for the transfer of technology to Indonesian workers, the Indonesian government's approach to implementing technology transfer primarily benefits business actors. In other words, these actors may receive incentives for engaging in technology transfer. Additionally, Presidential Regulation No. 10 of 2021 on Investment Business Lines (as amended by Presidential Regulation No. 49 of 2022) mandates technology transfer in certain business fields. However, there are no specific technical regulations in outlining how business actors can fulfill these requirements. It appears that such matters rely more on policy-based approaches. Needless to say, the implementation of technology transfer in Indonesia remains uncertain.

3. Method

This study employs a qualitative research design, deemed appropriate for exploring and understanding the complex, human-centered issues surrounding the green arms race and renewable energy in Indonesia. As Creswell (2014) suggests, qualitative research is well-suited for interpreting the meanings individuals or groups assign to social or human problems. Merriam and Tisdell (2016) further emphasize that the aim of qualitative research is to uncover the significance of occurrences for those involved. In this context, a qualitative approach helps elucidate the internal and external factors affecting Indonesia's progress in renewable energy, providing a meaningful interpretation of the data (Neuman, 2014). The primary instrument for data collection and analysis is the researcher. The researcher will be directly engaged with data sources, including government documents, laws, reports, and data analytics. Additionally, the study references relevant articles, research findings, and journals to support its objectives. No standardized protocols are employed; instead, the research relies on publicly available regulatory records and pertinent research to gather data. The focus is on attempts to secure acquisitions of critical minerals and government incentives aimed at fostering green technology development.

Data analysis in this study involves several key methodologies. A SWOT analysis is utilized to assess Indonesia's capability in achieving renewable energy sovereignty, examining strengths, weaknesses, opportunities, and threats. Intelligence analysis is then applied to identify current regulatory vulnerabilities and recommend appropriate actions. Comparative analysis plays a crucial role, with Indonesian regulations compared to those of other countries to highlight regulatory gaps. This analysis draws on energy security theory to determine which aspects require clearer regulation to meet Indonesia's needs effectively. Ethical considerations are paramount in this research. As it does not involve human subjects for data collection, International Review Board (IRB) approval is not required. However, the study adheres to ethics in intelligence, respecting individual privacy, ensuring accountability, and promoting the ethical use of technology. Validity and reliability are ensured through data triangulation, comparing multiple data sources to corroborate findings and enhance the study's credibility.

Methodological limitations are acknowledged, with data sources limited to publicly accessible research or those available through the Indonesian Higher School of Intelligence (STIN) database. These limitations are addressed in the discussion section of the research findings, ensuring transparency. To facilitate replicability, the research provides detailed methods for assessing Indonesia's capability through SWOT and intelligence analysis.

3.1. SWOT Analysis

Sammut - Bonnici and Galea (2015) stated that a "SWOT analysis evaluates the internal strengths and weaknesses, and the external opportunities and threats in an organization's environment". Furthermore, the main objective of a SWOT analysis is to combine the knowledge from the internal and external environment to formulate the right strategies accordingly. The following is a SWOT analysis diagram as can be seen at Figure 2.

Figure 2. SWOT Analysis Diagram

In determining the appropriate quadrant and strategy, a number of internal and external factor calculations are carried out. Calculations are assisted using the EFAS (External Strategic Factor Analysis Summary) and IFAS (Internal Strategic Factor Analysis Summary) approaches. EFAS represents opportunities and threats that can impact an institution and IFAS represents opportunities and threats that can impact an institution (Oetomo et al., 2012:171-186). In this section, the institutions will be reflected as a country. The input stages of IFAS and EFAS data are as follows :

a. Weighting is determined based on the importance of the indicator on a scale of 0 to 1 (0=unimportant, 1=very important)

b. Assign relative weights to each indicator so that their total equals 1. Repeat this process for opportunities and threats. Relative weights are crucial in determining the weighted value, obtained by multiplying the weight by the rating.

c. The third step is to determine the rating. Rating is rated from 1 to 5. (1=bad, 5=very good). A strength indicator rated 5 indicates improvement in performance, while a rating of 1 suggests poor or declining performance. This assessment mirrors the evaluation of opportunity indicators. Conversely, in weakness indicators, a score of 1 signifies greater weakness, whereas a score of 5 indicates a decrease in weakness. Similar rating principles apply to threat indicators. In this article, performance can be interpreted as the influence of a substance towards Indonesia's capabilities in reaching renewable energy sovereignty.

The score is obtained based on the result of weighted value multiplied by rating value. Then, the results of the EFAS and IFAS factors will be used as coordinate points in the SWOT diagram to determine the appropriate strategy for addressing the problem of Indonesia's capabilities in reaching renewable energy sovereignty.

3.2. Intelligence Analysis

Soegirman (2009) has defined Intelligence Analysis as a type of analysis that comprises four elements: Judgment, Forecasting, Early Warning, and Problem Solving. Intelligence Analysis is used to firstly determine and identify the problem, and predict the effect of the problem in the short term and in the future, including the solution for the problem.

Judgment is the first step of Intelligence Analysis, which means making an assessment on a case or situation in the form of bridging the gap between current facts and national interests. Afterwards, this exercise will connect any findings to the strategic environment, which is followed by specific problem identification. Forecasting is the second step, which aims to explain "a pattern of thought" that provides an overview of the possible situations that might happen in the future based on the condition and the judgments previously made. The purpose of forecasting is to decrease uncertainties regarding future outcomes, which in turn is intended for stakeholders to incorporate it in their decision-making processes.

The third step is Early Warning, which focuses on identifying dangerous impacts or risks that may arise in the future based on problem identification, judgment, and forecasting. The difference between Forecasting and Early Warning is that the context provided by Early Warning is intended to provide early awareness of potential threats that will occur in the future. The final step, Problem Solving, is the attempt to draw conclusions in the form of actionable strategies related to the discussed issues involving considerations on several highly probable alternatives. Generally, problem solving entails addressing challenges based on the current situation.

4. Result and Discussion

4.1. Foreign Powers' Strategies in the Acquisition of Critical Minerals and Development of Green Technology

China's control of global critical minerals supply has been heavily supported by its government policies. One of them is the Belt and Road Initiative (BRI), launched by Chinese President Xi Jinping in 2013, which is a global development strategy aimed at enhancing regional connectivity and economic integration through infrastructure investments and trade partnerships. While not specifically aimed at acquiring and developing critical minerals, BRI has made it a priority for China to invest in resource-rich countries. Overall, China invested around 6.6 billion USD in the mining & metals sector in partner countries of the BRI (Farooki, 2018). Even though that number is small when compared to investments in other sectors ('Oil and Gas', for example, valued at 38.6 billion USD), its effects are still significant. There have been Chinese-related mining investments detected in countries rich in critical minerals for green technology such as Democratic Republic of Congo (DRC), Papua New Guinea, and in the Latin Americas. In the DRC, 15 cobalt mines were either financed or controlled by a majority share by Chinese companies (Searcey et al. 2021). In exchange for control over 600,000 tonnes of cobalt and 10 million tonnes of copper, China paid for the construction of roads, hospitals, rail lines, schools, and electricity projects. Through the Chinese state-owned enterprise, China Molybdenum, the country has even bought Tenke Fungurume and Kisanfu mines, both of which were previously owned by the American company Freeport-McMoran.

On the other half of the world, Papua New Guinea (PNG) is one of the Pacific nations that has signed on to the BRI, seeking to leverage Chinese investments to address its significant infrastructure needs (Satchwell, 2024). China's main interest, however, lies in the investment of Ramu nickel and cobalt mine, a project that costs about 2 billion USD, which after the BRI agreement was subsequently owned by a joint partnership between PNG and China Metallurgical Group Corporation (MCC). Farooki (2018) argued that this huge amount of investment and PNG's dependence on it lead to a 'debt-for-resource' situation between both countries, where infrastructure investments are repaid through access to mineral resources. In other terms, BRI has provided China with long-term access to critical minerals while also increasing its geopolitical influence in PNG.

Even the closest neighbors of the US are not left untouched by China's BRI investments. China consistently made investments in Argentina, Chile, and Bolivia, which are states that are said to possess approximately 56 percent of the world's lithium resources (Adler & Ryan, 2022). Chinese companies Zijin

Mining and Ganfeng Lithium have been noted to take a significant portion of lithium mining and production in the area. In 2022, Zijin Mining planned to invest around 380 million USD in a lithium carbonate plant in Catamarca, Argentina, and owned copper mining projects in Chile. Meanwhile, Gangfeng Lithium has partially acquired the Mariana lithium mining project from International Lithium Corporation in Argentina.

Aside from utilizing BRI to invest in infrastructure projects and consequently secure critical mineral sources from others, China also bought stakes in existing mining companies from non-BRI countries, as is the case with China's acquisition of REE. Domestically, China has significant REE reserves and mining operations, with the Bayan Obo mine in Inner Mongolia being the world's largest REE mine, accounting for more than 40% of the total known REE reserves globally according to the reports made by NS Energy in 2020. However, due to undersupply in recent years, Chinese company Shenghe resources has bought shares from Greenland Minerals that operates the Kvanefjeld Rare Earth Project (Wishnick, 2020). Along with buying supplies from Canada and Tanzania, China has invested around 248 billion USD, and in return has imported over 27,000 tonnes of REE oxides in 2023 (He, 2024).

China's influence on the global nickel market is also massive. China is the biggest importer of raw nickel in the world, with imports as high as 4 billion USD worth of materials. According to a report by the Observatory of Economic Complexity. It primarily imports raw nickel from Australia, Russia, Canada, Madagascar, and Singapore. Indonesia, who supposedly has banned exports on nickel ore since 2020, is also recorded as one of the countries that China imported nickel from according to the General Administration of Customs in China – notably, it was recorded that China imported 78,245 tonnes of nickel ore from Indonesia in December 2020 (Daly & Chow, 2021). However, this is a mistake due to a data mismatch in defining 'nickel ore' and rather classified as 'iron ore', as the mineral being shipped consists of 1% nickel and 50% iron.

With an abundance of raw critical minerals, China has also taken measures to process them into high quality materials for green technology. Liu et al. (2024) highlighted substantial Chinese government investments in the green technology sector through direct subsidies. For instance, BYD, a leading electric vehicle manufacturer, received more direct subsidies from approximately 217 million USD in 2020 to 2.28 billion USD in 2022. Similarly, Mingyang, a prominent wind turbine manufacturer, experienced an increase in direct subsidies from 22 million USD in 2020 to 54 million USD in 2022. Beyond direct subsidies, the report identifies various forms of government policies that benefit Chinese companies. These include preferential access to critical raw materials, mandatory technology transfers, strategic public procurement, and preferential treatment in administrative procedures. The pervasive nature of these subsidies is evident, with more than 99% of listed firms in China receiving direct government subsidies in 2022. These investments have aided the processing of over 142,000 tonnes of raw tin, 1,870,000 tonnes of raw nickel, and approximately 140,000 tonnes of REEs in 2021 alone (DiPippo et al., 2024). In summary, by utilizing strategic partnerships and policy, China has managed to control the supply and refinement of many 'clean energy metals', i.e., the critical minerals used in green technology development.

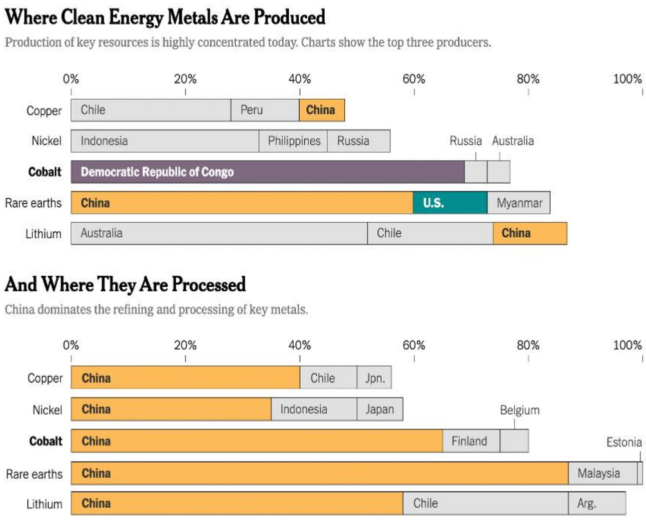

Figure 3. Chinese Majority on Production and Processing of Critical Minerals

The graph consists of two main sections: the first section will discuss where clean energy metals are produced, while the second section will discuss where they are processed. In the production section, the chart shows the top three producers for several key resources. For copper, the largest producers are Chile, Peru, and China, with China accounting for the highest percentage. Nickel production is led by Indonesia, the Philippines, and Russia, with Indonesia having the largest share. Congo dominates cobalt production, while China leads in REE production. Lithium production is primarily led by Australia and Chile, with China also contributing significantly. In the processing section, the graph illustrates that China dominates the refining and processing of these key metals. For copper, nickel, cobalt, REE, and lithium, China is the largest processor by a significant margin. Other notable processing countries include Chile and Japan for copper, Indonesia and Japan for nickel, Finland and Estonia for cobalt, Malaysia for REE, and Chile and Argentina for lithium. The data highlights China's substantial role in both the production and processing of essential clean energy metals, emphasizing its influence in the global supply chain for these resources.

Geopolitical implications as a result of China's near-dominance in acquiring critical minerals and developing the renewable energy sector has promptly put western countries on alert. The US is no exception; with reliance on over 50% supply on Chinese imports in 26 critical minerals (U.S. Geological Survey, 2023), the US is highly impacted by Chinese policies. For instance, in September 2010, China halted exports of REE to Japan due to tensions over a territorial dispute involving the Senkaku/Diaoyu islands in the East China Sea, where Japanese authorities apprehended a Chinese fishing trawler in the area (Bradsher, 2010). This halt resulted in the rising prices of REE in Japan. For instance, the price of cerium oxide, a major REE compound, skyrocketed from 4.7 USD/kg in April 2010 to 36 USD/kg in October 2010 (King & Armstrong, 2013).

In response, the US in June 2022 has proposed a reordering of supply chains to countries that are politically aligned or friendly to the US in the form of the Minerals Security Partnership (MSP) (United States Department of State, 2024). This partnership aims to reduce reliance on China. Founding members of this partnership include the US, Australia, Canada, the European Union, Finland, France, Germany, Japan, South Korea, Sweden, and the UK, with Norway joining later. Through the MSP, the United States acquired several critical minerals essential for the energy transition and various advanced technologies. Notably, Australia, a member of the MSP, provided significant quantities of REE through companies like Lynas Rare Earths. Lynas expects its REE production capacity, especially neodymium and praseodymium (NdPr), to increase to approximately 10,500 tonnes per year by the end of 2024. Nickel imports is also secured through this partnership, where they imported approximately 4.43 USD billion worth of nickel in 2023, with significant portions of this supply coming from Canada and Australia (Vivoda, 2023). Although the numbers remain insignificant in comparison to China, it still represents the starting point of the American shift away from its reliance on Chinese critical mineral imports.

The US also implemented laws to further incentivize companies to process critical minerals. In August 2022, The United States enacted the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act, which aims to advance the American research efforts in semiconductor production and research in green energy technologies (Badlam et al., 2022). Through the CHIPS and Science act, around 700 million USD was made available for energy-related research. The second law that was put in place was the Inflation Reduction Act. The IRA was signed by President Joe Biden in 2022, providing substantial tax credits and subsidies aimed at attracting investment and promoting domestic production within the United States. Wochner (2023) estimated that the act has a budget of 369 billion USD, with subsidies in the form of uncapped tax credits effective from 2023 and expiring in 2031. These subsidies cover various sectors, including low-emission energy production. Surprisingly, not all U.S. allies agree with the policy in place. Experts in France and Germany have voiced significant concerns about the IRA's negative effects on their own domestic green technology development. The lucrative deal is argued to have the potential to cause firms to relocate to the United States. An article made by The Week in 2023 argued that by enacting IRA and CHIPS and Science Act, the US has effectively put itself along with China and even with its long-term allies in an arms race in procuring critical minerals and technologies in green energy transition.

Compared to Indonesia, where the goals of sustainable investments remain somewhat unclear, the United States takes a distinct approach to maintaining an investment-friendly climate within the country. The United States government focuses on making transformative investments that create well-paying union jobs, elevate the middle class and provide tangible benefits to often overlooked and marginalized communities – areas that may also be burdened by legacy pollution. The United States government offers substantial consumer incentives – amounting to billions of dollars to promote the adoption of clean vehicles and commits to producing more of these vehicles and their components domestically. Further, the Act also allocates resources toward building a cleaner industrial sector, revitalizing American manufacturing and reducing climate super-pollutants from key industrial sources.

4.2. Problems Regarding Indonesia’s Critical Minerals Reserves and Green Technology Development

As Indonesia progresses, it encounters various challenges in the critical minerals sector (e.g., tin, nickel, REE), encompassing issues of both reserves and management. In the tin management sector, Indonesia faces problems in price monopoly and corruption in the internal leadership of tin companies. An example of price monopoly in the tin industry is related to Indonesia's bilateral cooperation with China if there is dominance in the provision of state debt. Munandar, et al. (2019) estimate that tin price volatility in Indonesia is based on interest rates and bilateral relations between Indonesia and China. On the other hand, internal corruption in tin companies is still rampant. The Indonesia Corruption Watch report (2024) explains that from 2004 to 2015, Indonesia experienced losses of IDR 5.714 trillion due to illegal tin smuggling and non-payment of royalties and company taxes.

Problems with Indonesia's bilateral relations also occur in the nickel management sector. In this case, the problems that occurred were caused by the policy determination of the Indonesian government through Minister of Energy and Mineral Resources Regulation No. 11 of 2019 in stopping the export of low-grade nickel. As a result, the European Union filed a lawsuit against Indonesia regarding its export policy through the WTO on 1 January 2020 (Ramadhana, et al., 2024).

The REE industry in Indonesia also faces a number of problems in its development. There are at least three reasons why the development of Indonesia’s REE industry is not as effective as it could have been, namely regulations that do not thoroughly support exploration, absence of an economic ecosystem model for REE, and absence of real exploration data regarding the potential of REE in Indonesia (Tama, 2021). These obstacles render inefficient REE development in Indonesia. On the other hand, there have also been cases of illegal smuggling of tin processing residues in Indonesia that contain REE components. This is due to Indonesia's lack of technology to process the residue into REE minerals. As a result, the potential losses experienced by Indonesia are quite large because the remaining results of the refining, which should be maximized for domestic needs, are instead smuggled abroad. An indication of this is that the largest recorded REE production is in Myanmar, Vietnam, Thailand and Malaysia.

On the other hand, Indonesia faces significant challenges in the green technology sector due to its limited expertise and innovation capabilities compared to global leaders like China and the US. This weakness is evident in Indonesia's relatively low number of patent applications and technological advancements in renewable energy. Between 2020 until 2022, Indonesia has only filed 2 patent cooperation treaty (PCT) publications in renewable energy, a stark contrast to China’s 1,563 and the United States’ 1,351 (WIPO, 2024). This gap highlights Indonesia's struggle to foster innovation and compete in green technology development. Compared to China, their dominance in patent applications and substantial investments in research and development, particularly in renewable energy technologies, underscores its strong research ecosystem. Supported by government policies and subsidies, China has built a robust framework for green technology advancement. Similarly, the United States also maintains its competitive edge through significant investments in green technologies, facilitated by initiatives like the CHIPS and Science Act and the Inflation Reduction Act. These investments reflect the US's strong commitment to advancing its technological leadership in the renewable energy sector. Additionally, although the Indonesian government has initiated efforts to transfer technology to priority industries within the country, there are currently no specific regulations governing the technical aspects of the technology transfer. As a result, the requirements for technology transfer in these priority sectors remain undefined and unactionable. In summary, Indonesia's commitment to developing green technologies is hindered due to the underdeveloped domestic industry for renewable technology components. There is a need for greater technological readiness and innovation to support the deployment of renewable energy projects.

4.3. SWOT Analysis: Identifying Indonesia's Capability in Reaching Renewable Energy Sovereignty

To identify Indonesia's capability overall in the green arms race to dominate the renewable energy sector, a SWOT analysis serves as a crucial tool to systematically evaluate Indonesia's internal strengths and weaknesses as well as external opportunities and threats. This analytical framework helps identify the nation's strategic advantages, such as its rich deposits of critical minerals and supportive government policies, while also highlighting internal challenges like inadequate infrastructure and regulatory hurdles. Externally, the analysis explores opportunities arising from increasing global demand for clean energy and potential international partnerships, juxtaposed with the threats posed by competitive pressures from China and the US and other geopolitical risks. By leveraging the insights gained from this SWOT analysis, Indonesia can formulate effective strategies to enhance its renewable energy capabilities and secure its position in the global green energy race. Analysis of internal strategic factors concerns the conditions that occur within a country, which in this context means Indonesia's domestic conditions in achieving renewable energy sovereignty. Internal strategic factor analysis further consists of two factors, namely strengths and weaknesses. The information below shows the strengths and weaknesses of the Indonesian state in achieving renewable energy sovereignty.

1. Strength

   a. Nickel Reserves

   Indonesia's substantial reserves of nickel is a critical strength for the country's economic development and global influence. With the largest nickel reserves in the world and significant mining production, Indonesia holds a pivotal role in the global nickel market. Nickel's essential role in the renewable energy sector, particularly in electric batteries, underscores Indonesia's strategic advantage.

   b. Tin Reserves

   Indonesia's significant tin production and reserves positions it as a crucial player in the global tin mining industry and the renewable energy sector. With the second-largest tin output in 2022 and substantial reserves that can sustain production for the next 16 years, Indonesia is well-placed to capitalize on this resource. Tin's role in EV battery production, essential for energy storage, highlights its strategic importance. Leveraging these resources can boost economic growth and enhance geopolitical standing. Strategic investments in sustainable mining and processing can maximize benefits, ensuring Indonesia's key role in the global green energy transition.

   c. Potential REE Reserve

   Indonesia's significant REE reserves positions it as a key player in renewable energy development. As mentioned previously, REE are essential for hybrid cars, wind turbines, next-generation batteries, and biofuel catalysts. Found in Monazite and Xenotim granite rocks, with major deposits in Sumatra, Kalimantan, Sulawesi, and Bangka Island, Indonesia has an estimated 4.6 billion cubic meters of REE-rich minerals. This potential should be a strength for Indonesia, boosting economic growth, enhancing geopolitical standing, and ensuring a vital role in the global green energy transition through strategic investment in sustainable mining and processing.

   d. Defining Strategic Minerals

   In 2023, The Indonesian Government's classification of 47 critical minerals, including tin, nickel, and REE, highlights their importance for the national economy, defense, and security due to potential supply shortages and lack of substitutes. This initiative, as stated in the Minister of Energy and Mineral Resources Decree No. 296.K/MB.01/MEM.B/2023, aims to support domestic strategic industries in the mining sector. According to Rizal Kasli, Chairman of Perhapi, this law and the policy it represents strengthens Indonesia's economic growth and national security, making it a key player in the global mining and renewable energy markets.

e. Indonesia’s Incentives on Nickel and Tin Development

The Indonesian government offers a range of incentives to attract investments in the nickel and tin sectors, enhancing its appeal as a mining destination. Fiscal incentives include customs exemptions on machinery and materials, tax allowances, tax holidays, and investment allowances, providing significant cost-saving for investors. Non-fiscal incentives further streamline the investment process with simplified business licensing, infrastructure support, guaranteed energy availability, and facilitated access to raw materials. Additional benefits include immigration facilitation for skilled workers and employment-related advantages, collectively creating a robust environment for nickel and tin development. Since the implementation of Minister of Finance Regulation No. 130/PMK.010/2020 on Income Tax Deduction Facilities, there has been an increase in investments in mineral and coal subsectors. Investments reached USD 5.69 billion, surpassing the target of USD 5.01 billion, while PNBP hit IDR 183.35 trillion, well above the IDR 101.84 trillion goal (Ministry of Energy and Mineral Resources, 2023).

2. Weakness

a. Lack of Regulation in REE Industry

Indonesia's efforts to develop the Rare Earth Element (REE) industry face significant challenges, primarily due to inadequate regulations that do not effectively support exploration. This regulatory issue is compounded by the absence of an economic ecosystem model for REE and a lack of comprehensive exploration data on their potential. These obstacles result in suboptimal development of the REE industry, limiting Indonesia's ability to fully leverage its REE resources and weakening its position in the global renewable energy market.

b. Illegal Export of Residues (Potential Loss of Minerals)

Indonesia's inability to process tin processing residues into REE and the resulting illegal smuggling represent a significant weakness that leads to substantial losses, as valuable residues are smuggled abroad instead of being used domestically. High REE production in neighboring countries suggests Indonesia's potential is being exploited elsewhere. Additionally, despite a ban on nickel ore exports since 2020, China reported importing 78,245 tonnes of nickel ore from Indonesia in December 2020 due to a classification issue, with nickel ore being mislabeled as iron ore. This data mismatch could potentially facilitate illegal smuggling.

c. Lacking Expertise in Technology Development

Indonesia's lack of advanced technology and limited research and development capabilities hinder its ability to compete globally. The country’s patent applications per million inhabitants rank 77th worldwide, and its contributions to international patent applications related to renewable energy are minimal. This disparity underscores the critical need for Indonesia to enhance its expertise and innovation capacity in green technology to capitalize on opportunities in the renewable energy market and strengthen its competitive position globally. Nurcahyo (2022) argued that Indonesian higher education institutions should have added more to their curricula that discusses renewable technologies.

d. Lack of Technology Transfer

Although the requirements of technology transfer are explicitly stated in Minister of Finance Regulation No. 130/PMK.010/2020 on Income Tax Deduction Facilities, there has not been specific technical regulations about the mechanism yet. This will pose a problem for authorities to monitor companies’ compliance to the rule. Without proper technology transfer, there will be a potential loss of production after the company has been divested to Indonesian owners.

Indonesia's progress towards energy sovereignty in renewables is also highly influenced by external factors. Although the increasing global demand for nickel, tin, and REE may provide opportunities for Indonesia to increase its market, it also comes with increasing tension from countries who are aiming to dominate the market, namely China and the United States. A global shift into policies to protect national interest in securing supply chains also led to the formation of strategic alliances designed to pressure non-member countries. Although Indonesia is a part of BRI, the country itself holds a free and non-aligned foreign policy and therefore stands in the middle between rivalries of other nations. This approach means that Indonesia is also vulnerable to pressures from all sides of the political spectrum.

1. Opportunities

a. Increasing Global Demand for Nickel

A report by the International Energy Agency (2024) estimates global demand for nickel will be at 4.75 million tonnes by 2030, and 6.24 million tonnes by 2024. As global demand for nickel increases, Indonesia with its substantial nickel reserves is projected to benefit considerably. Its significant nickel production capacity places it as a crucial supplier for the rapidly growing electric vehicle (EV) and battery storage sectors. This rising demand is likely to attract foreign investments in mining and processing infrastructure, thereby stimulating the local economy and generating employment. Additionally, Indonesia can use this demand to secure favorable trade agreements and enhance international collaborations, further embedding itself into global supply chains. By improving its processing capabilities and committing to sustainable mining practices, Indonesia can establish itself as a key player in the transition to green energy.

b. Increasing Global Demand for Tin

Indonesia has been known as a tin producing country since before independence, and is still experiencing high production growth in general (Mordor Intelligence, 2024). Although the global demand has relatively stabilized (projected increase from 418,000 tonnes in 2024 to 475,000 tonnes in 2029), Indonesia still stands to benefit significantly from the rising global demand driven by the electronics, automotive, and packaging industries. This surge can attract substantial foreign investments in mining and processing facilities, enhancing economic growth and job creation. Furthermore, Indonesia can leverage this demand to negotiate advantageous trade deals and foster international partnerships. Strengthening processing capabilities and ensuring sustainable practices will position Indonesia as a crucial supplier in the global tin market.

c. Increasing Global Demand for REE

Indonesia's potential reserves of REE position it to benefit from the growing global demand. With the expansion of clean energy technologies and increase of green projects including wind turbines and electric vehicles, the demand for REE is set to rise. This rise is projected to be at 98,000 tonnes by 2030, and further leading up to 121,000 tonnes by 2040. Indonesia can attract investments in mining and processing facilities, boosting the local economy and creating jobs. Enhancing processing capabilities and ensuring sustainable practices will enable Indonesia to become a key supplier in the global market.

d. Availability of Foreign Investments for Renewables

Globally, the renewable energy sector has seen a significant rise in Foreign Direct Investments (FDI), with international project finance accounting for a substantial share of global project finance values, especially in developing countries where it exceeds 75% in least developed countries (LDCs) (IMF, 2023). Developing nations, which need about $1.7 trillion annually for renewable energy investments, however have attracted only $544 billion in 2022. This disparity provides an opportunity for the Indonesian government to compete in attracting FDI by building partnerships among international investors, public sectors, and multilateral financial institutions.

2. Threats

a. Monopoly in Mineral Pricing by China

Approximately 60% of the world's tin production and over 40% of the reserves come from China and Indonesia. As a result, the selling price of tin is also expected to depend on interest rates and bilateral relations between the two producers (Munandar et al., 2019). Despite being a major global tin producer, over 98% of Indonesia's tin is exported, with less than 2% for domestic use (PT Timah Tbk, 2020). Conversely, since 2015, China has been an importer of tin despite being the largest producer globally (Yang et al., 2018). This condition causes losses for tin-exporting countries but benefits tin-importing countries when global prices fall. The mining holding system described in the previous section is also intended to encourage the absorption of Indonesian tin products by domestic industries.

b. Tensions to Secure Supply Chains by Geopolitical Coalitions

Indonesia faces substantial risks from geopolitical tensions as global powers like the United States and China compete to secure supply chains for critical minerals. The establishment of coalitions such as the US-led Minerals Security Partnership (MSP) aims to decrease dependency on Chinese imports, potentially disrupting Indonesia's trade relationships and market access. This shifting geopolitical landscape could result in market volatility and complicate Indonesia's efforts to negotiate favorable terms for its critical mineral exports.

The increasing global demand for critical minerals has intensified geopolitical competition, leading to significant investments and strategic alliances to control these resources. The US and its allies are reconfiguring supply chains to lessen their reliance on China, which might impact Indonesia's position in the global market. Given that over 98% of Indonesia's tin production is for export, any disruptions in trade dynamics due to geopolitical tensions could have serious repercussions for the country's economy.

c. Competition in Providing Incentives to Renewable Development

The United States' Inflation Reduction Act and CHIPS and Science Act provide substantial subsidies and incentives for renewable energy and green technology development. Similarly, China’s direct subsidies to companies like BYD and Mingyang significantly boost their competitiveness in the global market. As a result, Indonesia might struggle to compete for critical investments needed to develop its renewable energy sector, potentially slowing its progress towards energy sovereignty and economic growth in this industry.

Based on the explanation of internal and external factors above, an EFAS and IFAS calculation approach is needed. This way, the right strategy can be determined for the problem of renewable energy sovereignty. The following table containing EFAS and IFAS values are displayed for a better view on the problem and to better determine the SWOT strategy.

	Strategic Factors		Weight	Rating	Weighted Score
	No	Description			
Strength	1	Nickel Reserves	0.25	5	1.25
	2	Tin Reserves	0.2	4.5	0.9
	3	Potential REE Reserves	0.2	4	0.8
	4	Defining Strategic Minerals	0.2	3.5	0.7
	5	Indonesia's Incentives in Nickel and Tin Development	0.15	4	0.6
Total Strength Score			**1**		**4.25**
Weakness	1	Lack of Regulation in REE	0.278	4.5	1.25
	2	Illegal Export of Residues (Potential Loss of Minerals)	0.278	5	1.389
	3	Lacking Expertise in Technology Development	0.167	3	0.5
	4	Lack of Technology Transfer	0.278	3	0.833
Total Weakness Score			**1**		**3.972**
IFAS					**0.278**

	Strategic Factors		Weight	Rating	Weighted Score
	No	Description			
Opportunity	1	Increasing Global Demand for Nickel	0.278	4.5	1.25
	2	Increasing Global Demand for Tin	0.222	4.3	0.956
	3	Increasing Global Demand for REE	0.278	4	1.111
	4	Availability of Foreign Investments for Renewables	0.222	5	1.111
Total Opportunity Score			**1**		**4.428**
Threat	1	Potential Monopoly in Mineral Pricing by China	0.250	3	0.75
	2	Tensions to Secure Supply Chains by Geopolitical Coalitions	0.417	4.5	1.875
	3	Competition in Providing Incentives to Renewable Development	0.333	4	1.333
Total Threat Score			**1**		**3.958**
EFAS					**0.469**

Figure 4. SWOT Analysis of Indonesia’s Capabilities in Reaching Renewable Energy Sovereignty

As can be seen at Figure 4, the weight and the rating score is based on the findings from existing literature. The IFAS score shows that Indonesia's total strength score is greater than its total weakness score, indicating that Indonesia's potential to develop renewable energy is quite high, with the greatest potential being the strength of its nickel reserves. On the other hand, the EFAS score shows that Indonesia has significant opportunities to develop renewable energy, driven by support and a growing demand in foreign markets. Based on the above IFAS and EFAS scores, the next step is to determine the coordinate points on the SWOT diagram so the right strategy for the development of renewable energy can be taken. The following is a SWOT diagram based on the IFAS and EFAS scores that have been obtained.

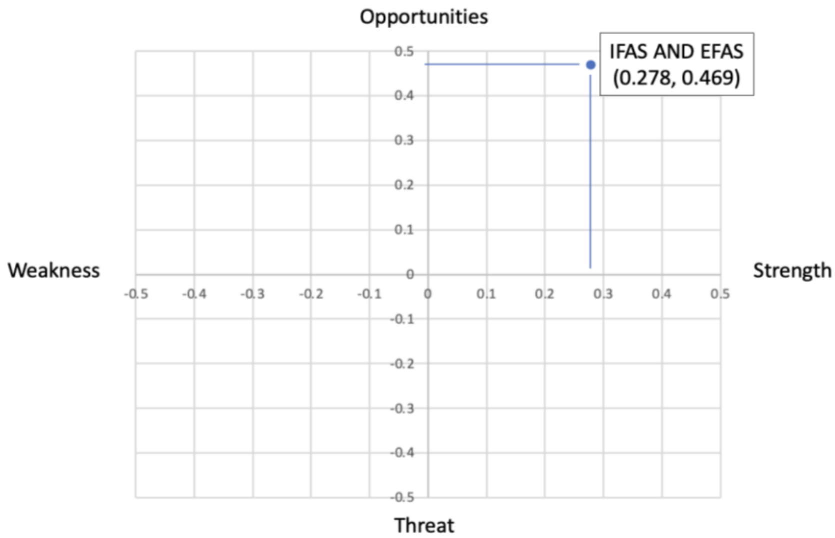

Figure 5. SWOT Matrix of Indonesia's Capabilities in Reaching Renewable Energy Sovereignty

Based on Figure 5, the SWOT diagram evidently shows that the intersection of IFAS and EFAS falls within quadrant I, indicating that the appropriate strategy to adopt is an Aggressive Support Strategy. The Aggressive Support Strategy suggests that Indonesia possesses ample domestic strengths to fully exploit current opportunities, particularly due to the significant foreign interest in renewable energy. This way, Indonesia's capabilities in the renewable energy sector – especially in supplying raw minerals essential for renewable energy development – may be considered as highly capable of achieving renewable energy sovereignty. However, to achieve this goal, Indonesia must address its shortcomings, including technological challenges, regulatory issues, and the need for further exploration of mineral potentials and their derivatives

4.4. Intelligence Analysis

Indonesia has significant potential to achieve renewable energy sovereignty, primarily due to its abundant mineral reserves, including nickel, tin, and REEs. However, efforts to fully utilize this potential have been insufficient. Even with regulations in place, there are still instances such as the smuggling of unprocessed, raw critical minerals, and the mislabeling of certain ore exports. In regard to green technology development, there is still a lack of expertise in the field due to a lack of assertiveness in regulating technology transfer in the industry. Overseas, Indonesia's reserves also invite geopolitical pressures from superpowers such as China and The United States.

By looking at the number of existing problems, it is highly likely that Indonesia's development in achieving renewable energy sovereignty will be hindered. Exploration problems and mineral data updates that have not been maximized (including the problem of illegal smuggling that occurs in the strategic mineral sector) may cause uncertainty for foreign investors to invest in Indonesia's renewable energy sector. On the other hand, problems in the technology transfer sector could potentially hamper efforts to adapt to renewable energy in Indonesia so that the creation of an economically-sustainable ecosystem for the renewable energy sector may also be hampered. Since Indonesia also lacks the funding to its own mining and processing of green technology materials, it makes the country an easy target for exploitation (as with the case of BRI investments in other developing countries) if the government is not careful enough. If Indonesia does not promptly address the hindrances in energy adaptation, mineral exploration, and renewable energy regulations, achieving renewable energy sovereignty will be challenging. Additionally, the opportunities currently available may be seized by other countries that are better prepared to compete in the renewable energy resource race.

In order to mitigate the problems faced in the increasingly competitive geopolitical arena, Indonesia should further strengthen its regulation and economic environments on foreign investments in critical minerals acquisition and development of green technology materials. Authorities such as the police, military, and the intelligence community also should synergize to anticipate further loss of minerals for renewable energy through illegal smuggling that can impact data collecting efforts on mineral reserves. Indonesia should be able to take advantage of the ongoing power struggle between countries to put itself in a stronger bargaining position. By being politically neutral, Indonesia can make a more business-oriented approach towards mining and refining entities in rivaling sides in the global green arms race. Furthermore, Indonesia could and should put itself as a beacon for other developing countries to collaborate with, such as those situated in Africa and Latin America.

4.5. Discussion

The research highlights the role of the United States and China in the green arms race, specifically the competition for acquiring critical minerals and developing green technology. It also makes a comparative analysis of their strategies with those implemented by Indonesia. In regards to the ongoing geopolitical situation, this article provides a comprehensive overview of Indonesia's capabilities in acquiring critical minerals and developing renewable energy technology.

Results obtained from the SWOT analysis showed that Indonesia has considerable potential to compete in the renewable energy industry development sector while noting that there are still a number of weaknesses that must be examined in order to strengthen the domestic development of renewable energy. Additionally, the opportunities that Indonesia has in international trade in the renewable energy sector are also quite numerous. This is characterized by the increasing demand for critical mineral resources for the needs of the world's renewable energy industry. However, Indonesia still faces threats that can hinder the utilization of existing opportunities and can suppress the pace of the development of renewable energy. With such results in mind, this article argues that Indonesia can be a major player in the race as one of the suppliers for green technology materials. Compared to existing literature, this research has taken a more holistic approach to the issues at hand. The countries that are classified as actors in the green arms race are thoroughly analyzed from economic, legal, and geopolitical viewpoints. Furthermore, this research has also improved upon the findings from a previous study by Tama (2021) and provided policy recommendations for the Indonesian government to counteract the negative factors (both internal and external).

However, there remain several limitations embedded in this research. First of all, the primary data sources are limited; they mainly only cover findings on the threat of smugglings of processed tin remains not subjected to downstream processing and subsequently smuggled to countries such as Myanmar, Vietnam, Thailand, and Malaysia. Meanwhile, findings in other sectors still mainly rely on secondary data. Thus, the validity of the data needs to be confirmed by experts and policymakers both within Indonesia and abroad. As a result, this article's risk assessment through SWOT is primarily based on the authors' personal views in regards to the developing issues obtained from publicly-accessible data and reports. Second, there is a scarcity of data due to the lack of research specifically addressing the implications of the green arms race in Indonesia. Discussions on foreign strategies are often limited to China and the United States as the two main actors in the race. There has yet been any assessment on the strategies by other entities and their effects on Indonesia, such as the European Union, Australia, and multinational corporations. Lastly, this article has not yet addressed socio-cultural factors (such as local oppositions against the construction of mines and smelters) in evaluating Indonesia's capabilities.

There are several implications as a result of analyzing the findings in this research. Theoretically, this research has contributed to the body of knowledge in a relatively new field of research, i.e., Indonesia's renewable energy sovereignty. This article can be used as a reference to further enrich research in the area. Practically, this research has given the stakeholders within the Indonesian government with insight that can be utilized toward protecting national interests and security.

5. Conclusion

Indonesia has considerable potential to achieve renewable energy sovereignty and has equally great opportunities to compete as a world supplier of renewable energy resources, especially considering Indonesia’s large potential reserves of nickel, tin, and REEs that can be used as basic materials in world renewable energy technology. On the other hand, Indonesia's opportunity to achieve sovereignty in renewable energy is quite large, as seen through the efforts done by other countries to hinder Indonesia’s progress.. Indonesia can take a role in acquiring and developing green technology minerals without needing to get involved in conflicts of interest from such countries. Nevertheless, Indonesia also faces a number of obstacles and threats that could affect the achievement of renewable energy sovereignty. Issues such as the transfer of renewable energy technology (or the lack thereof), the shortage of expertise and qualified human resources for renewable energy development, and the threat of mineral smuggling for critical minerals must be addressed by the Indonesian government. Resolving these problems promptly is crucial for Indonesia to accelerate and achieve renewable energy sovereignty.

There are some recommendations for further research on the subject. More research is needed to examine how much loss the Indonesian government is experiencing through the smuggling of critical minerals. Furthermore, there should be more research on other countries' responses to China and the United States’ strategies in the green arms race to further evaluate Indonesia’s position. Finally, more research should be done to accurately measure the reserves of other critical minerals in Indonesia, starting with REE.

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