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# DOWNSTREAMING, INDUSTRIALIZATION, AND ENERGY RESILIENCE IN RESPONDING TO ECONOMIC FRAGMENTATION AND CONTEMPORARY GEOPOLITICAL CHANGES

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## Abstract.

Indonesia's energy security impacted by geoeconomic fragmentation and contemporary global geopolitical changes. To achieve energy transition target, Indonesia has a strategy to optimize vast mineral resource potential, particularly nickel, through downstream processing. However, the downstream processing policy is not yet fully equitable and sustainable, and therefore cannot be effectively implemented to strengthen national energy sovereignty, increase economic added value, and maintain environmental sustainability. This study uses a qualitative descriptive method combined with strategic policy analysis, utilizing primary data in the form of transcripts of keynote speeches at the 2025 JGF and interviews with economic and downstream processing experts, representatives of the central government, regional governments, and business actors. Primary data were collected by focusing on industrial areas in Morowali and Central Halmahera, which are among the major downstream processing areas in Indonesia. Secondary data used in the study include laws and regulations, official reports from relevant ministries and institutions, and academic publications. The Astagatra and SWOT analyses show that Indonesia still has weaknesses that reflect the resource curse. Therefore, by referring to the developmental state model, governance theory, sustainable development theory and cases in previous research, the TOWS analysis produces 10 fair and sustainable downstreaming policy strategies.

Keywords: Asta Gatra; developmental state model SWOT; energy security; energy transition; nickel downstreaming; TOWS

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## Introduction

Geoeconomic fragmentation and contemporary global geopolitical changes resulting from various events like the trade war between the United States and China since 2016, the COVID-19 pandemic, the conflict between Russia and Ukraine, the conflict between Israel and Iran, and the crisis in the Strait of Hormuz, have the potential to disrupt supply chains and cause global energy price volatility (1–5). These fragmentations and changes in the landscape no longer occur over years, but rather over months, days, or hours, thus posing a serious challenge to energy security (6,7).

Indonesia is one of the countries whose energy security is affected by geoeconomic fragmentation and contemporary global geopolitical changes due to its continued dependence on energy imports (8). For example, Indonesia's oil production in 2024 will only be 580 thousand barrels per day, which is unable to meet domestic consumption levels of 1.5–1.6 million barrels per day (6,7,9,10). Indonesia also still relies on LPG imports, 54 percent of which comes from the United States (6,7,11). Dependence on energy imports certainly makes Indonesia vulnerable to the risk of global energy price and supply fluctuations. In facing these conditions, the Indonesian Government has set an energy transition target from fossil fuels to new, renewable energy in order to achieve national energy and economic sovereignty (12,13).

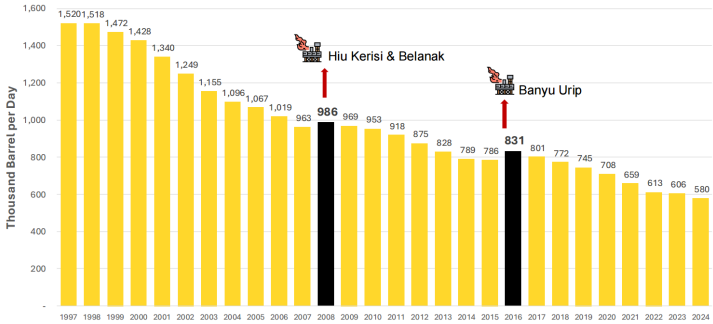


Figure 1. Indonesia's Oil Production
Source: Lahadalia (2025)

Indonesia has a strategy to optimize the potential of its large mineral natural resources, especially nickel through downstreaming, to achieve the energy transition target (14–17). Nickel is designated as a strategic mineral through the Decree of the Minister of Energy and Mineral Resources (ESDM) Number 69.K/MB.01/MEM.B/2024 (18) because the mineral is a raw material for strategic industries, especially the electric vehicle (EV) industry which represents a convergence point between technological innovation, energy transition, and global economic growth (19,20). In addition to increasing the added value of minerals, the development of the nickel downstream industry can also integrate Indonesia into a strategic position in a more complex

and high-value global value chain (16,17). Thus, the development of the nickel downstream industry is in accordance with the Asta Cita of the President of Indonesia points 2, 3, 4, 5, and 8 (21), and can be said to strengthen national competitiveness.

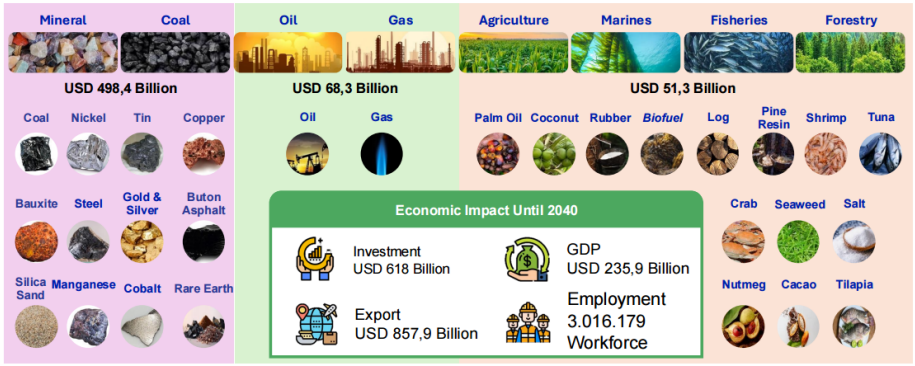


Figure 2. Economic Effects of Downstreaming Strategy
Source: Lahadalia (2025)

The government has established various policies to support nickel downstreaming, even before nickel was designated a strategic mineral (22–24). One exemplar policy is the ban on nickel ore exports since 2020, which has successfully driven a surge in the export value of nickel derivative products from USD 1 billion in 2019 to USD 33 billion in 2023 (25–27). However, this export ban policy has invited a strong global response, as demonstrated by the demands of the World Trade Organization (WTO) and the European Union in 2022 against Indonesia (28,29). Furthermore, the main target of nickel downstreaming has not yet been optimally achieved. In 2023, nearly 80% of Indonesia's nickel derivative product exports were stainless steel and nickel pig iron (NPI) (6,7,22). Meanwhile, the remaining 20%, which is nickel matte, a product with a higher nickel content and can be processed into EV batteries, has not yet reached significant EV battery production and export volumes.

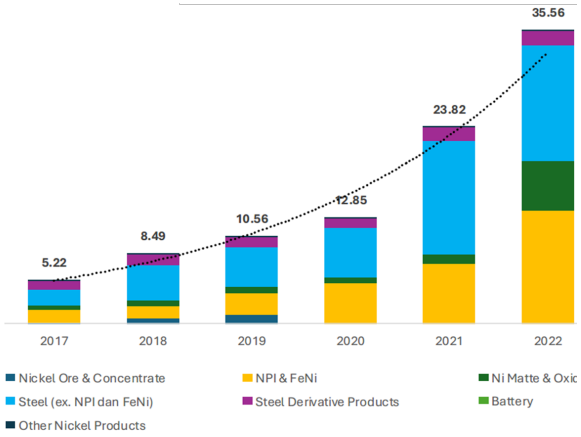


Figure 3. Exports of Nickel and Its Derivative Products
Source: Lahadalia (2025)

However, the benefits of downstreaming yet fully equitable, as most of the profits are enjoyed by foreign investors and the

central government, with limited direct benefits for local communities and regional businesses, and weak post-mining economic diversification plans (16,17,30). Furthermore, occupational safety issues still require attention (31–33). At the end of 2023, a work accident occurred at a nickel smelter in Central Sulawesi Province. Nickel downstreaming is also still not fully sustainable (16,17,34,35). Climate Rights International (CRI) reported in 2024 that nickel downstreaming is considered to contribute to increased deforestation and air and water pollution (36). Nickel downstreaming tends to use coal-fired power plants (PLTUs), which produce large amounts of carbon emissions. Furthermore, issues related to the fairness and sustainability aspects of nickel downstreaming could certainly have a negative impact on the rate of investment in the industry.

With the downstreaming target not yet achieved, accompanied by the challenge of unequal distribution of environmental benefits and risks, the main research question posed is, “How can a just and sustainable downstreaming policy be implemented effectively to strengthen national energy sovereignty, increase economic added value, and maintain environmental sustainability amidst geoeconomic fragmentation and contemporary geopolitical changes?”

## Literature Review

One common challenge in countries rich in natural resources is the phenomenon of the “resource curse,” or paradox of abundance (37–40). This curse refers to the fact that countries rich in natural resources generally become dependent on these resources through the dominance of foreign capital without technology transfer, thus experiencing unstable economic growth. To face this paradox, structural transformation through industrialization is necessary (16,17,30). The developmental state model emphasizes the role of the state in establishing measured policies, market protection, technological mastery, and domestic financing (41–44). The developmental state is characterised by the state’s involvement in the prescription of calibrated policies, market protection, technological control, and domestic finance (41–44). Improving this model, public governance theory require the coordination across the institutions, creation of specialized organizations, and adoption of result-oriented policies (45–47). Sustainable development theory underscores the relationships among the economic, equitable and environmental aspects of development (48,49).

Table 1. Indonesia's Natural Resource Potential
Source: Lahadalia (2025)

| | | Global Reserves | | Global Production | |
|---|---|---|---|---|---|
|  | NICKEL | 1st | In the world (42 % of global reserves) | 1st | In the world (50,5% of global production ) |
|  | BAUXITE | 4th | In the world (9,8% of global reserves) | 6th | In the world (2,6% of global production) |
|  | COPPER | 9th | In the world (2 % of global reserves) | 6th | In the world (3,9% of global production) |
|  | GOLD | 4th | In the world (5,8% of global reserves) | 8th | In the world (3,5% of global production) |
|  | TIN | 1st | In the world (34,47% of global reserves) | 1st | In the world (22.2% of global production) |
|  | COAL | 6th | In the world (3% of global reserves) | 3rd | In the world (8,8% of global production) |

East Asian countries like Japan, South Korea, China, and Taiwan have successfully implemented industrialization policies that have driven structural transformation and high, sustainable economic growth (6,7,43,44,50–54). Compared with these East Asian countries, Indonesia's industrialization policies have been suboptimal in two aspects (44,53). The first aspect is the lack of "coercion" on domestic companies to enter the manufacturing sector with higher productivity and participation in global supply chains. In Indonesia, several conglomerates have been allowed to continue expanding their businesses and become dominant in traditional sectors like mining or agriculture (16,17). Furthermore, Indonesia's downstreaming strategy tends to be inward-looking, as opposed to the outward-looking paradigm of encouraging greater participation in global supply chains (23,24,55). The second aspect is the lack of stringent requirements for local companies to receive government support or incentives (16,17).

There have been various studies on downstreaming policies based on natural resources, for example the ban on wool exports from England in the 16th century which supported the industrial revolution (56), the imposition of import tariffs by the United States government in the 19th to 20th centuries to protect the domestic market and lead to the development of the industrial sector (57–59), iron downstreaming in India (60,61), copper downstreaming in Chile (62–64), diversification between wood downstreaming to the machinery and electronics industry in Finland (65–67), and the policy of restricting the export of raw materials for rare earth metals (LTJ) commodities by China (68–70). Various studies have identified several challenges faced by natural resource-based industrialization (16,17,71). The first challenge is the high need for investment or capital expenditure and obstacles to mastering downstreaming technology, especially for developing countries. The second challenge is how the global supply chain has experienced a concentration on optimizing production cost efficiency and ensuring standards, making it difficult for new

players to participate in the supply chain. The third challenge is that the economic activity segments that are most easily accessible to developing countries in the downstream supply chain generally do not provide a significant impact on increasing production capacity.

## Methods

The study uses a qualitative descriptive method combined with strategic policy analysis, utilizing primary data in the form of transcripts of keynote speeches at the 2025 JGF and interviews with economic and downstream experts, representatives of the central government, regional governments, business actors (comprise of Micro, Small, and Medium Enterprises), and investors (6,7,72–74). Primary data were collected by focusing on industrial areas in Morowali and Central Halmahera, which are among the major downstream areas in Indonesia. These two industrial areas were selected because their gross domestic product (GDP) has reflected an industrial shift to the manufacturing sector (16,17).

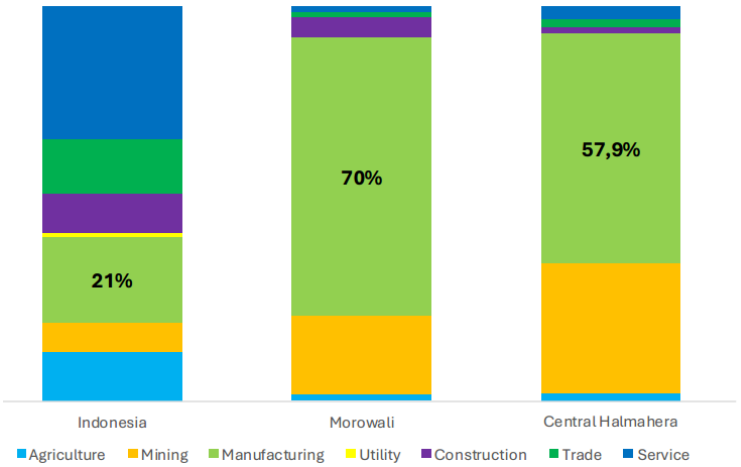


Figure 4. GDP by sector in Morowali and Central Halmahera in 2023
Source: Lahadalia (2025)

Secondary data used in this study include laws and regulations, official reports from relevant ministries and institutions, and academic publications. The analysis was conducted through the application of the Asta Gatra, SWOT, and TOWS concepts (75–78). The Asta Gatra analysis was used to analyze the relationship between nickel downstreaming and national resilience. The results of the Asta Gatra analysis were then analyzed using the SWOT concept to identify the strengths, weaknesses, opportunities, and threats of downstreaming policies already implemented in Indonesia. From the Asta Gatra and SWOT analyses, Indonesia also experiences a "resource curse." Finally, the TOWS analysis, which is based on the developmental state model, governance theory, sustainable development theory,

and findings from previous research, was used to formulate strategies to encourage equitable and sustainable nickel downstreaming.

## Results and Discussion

Asta Gatra analysis shows that Indonesia's geographical position on international trade routes and proximity to East Asian market centres like China, Japan, and South Korea provides significant potential for Indonesia to become a global nickel demand centre (16,17,79,80). In terms of natural resources, Indonesia has the largest nickel reserves globally, giving it a position as a major player in the international nickel industry (14,15,81). However, there is still a dependency on raw commodities in the downstream industry, thus creating vulnerability to global price fluctuations (16,17,82). In addition, Indonesia still has a high dependence on fossil fuel energy, which has an impact on carbon emissions and environmental pollution (34–36). In terms of demographics, although Indonesia has abundant labour potential, the nation still face limitation in skilled labour, which hinders the adoption of nickel-based processing and manufacturing technologies (16,17,83). In terms of ideology, nickel downstreaming aligns with the mandate of Article 33 of the 1945 Constitution concerning the control of resources by the state for the prosperity of the people, so that the government has a normative basis in determining the governance of nickel downstreaming oriented towards national interests (16,17,84). In terms of politics, the government's commitment to nickel downstreaming is reflected in the nickel ore export ban policy, which has successfully improved Indonesia's position in the export of nickel derivative products globally (25–27). However, challenges come from weak coordination between ministries, inconsistent protection of the domestic industry, and limited comprehensive policy evaluation (6,7,16,17). In terms of the economy, Indonesia has become a major exporter of stainless steel and has begun developing an electric vehicle battery industry that supports Indonesia's position in the global supply chain (6,7,16,17). However, the scheme for sharing resource benefits that is not yet fair to producing regions, limited diversification of post-nickel industries, and funding barriers for local investors. In the social and technological aspects, full mastery of nickel downstream technology remains limited, particularly among domestic industry players (6,7,16,17,83). Furthermore, technology transfer requirements for investment are relatively lax. Meanwhile, in the defence and security aspect, no significant factors were found to influence nickel downstreaming in Indonesia. Thus, Asta Gatra's analysis shows that national resilience is closely linked to nickel downstreaming in Indonesia, with gaps still needing to be tackled.

Table 2. Asta Gatra Analysis

| Number | Gatra | Pro | Kontra |
|---|---|---|---|
| 1 | Geography | Indonesia is located on international trade routes and has a strategic location for access to East Asian markets (China, Japan, South Korea) as a centre of nickel demand. | - |
| 2 | Natural Resource | Indonesia has the largest nickel reserves globally, making Indonesia a major player in the international nickel industry. | • Overreliance on raw commodities makes the domestic nickel downstream supply chain vulnerable to global price fluctuations.<br>• The nickel downstream process still relies on coal-fired power plants (PLTU), which produce high carbon emissions and have the potential to increase deforestation and air pollution around industrial areas. |
| 3 | Demography | Indonesia has the potential for an abundant workforce if it is properly prepared for nickel downstreaming. | Limited skilled labour hampers the adoption of nickel-based processing and manufacturing technologies. |
| 4 | Ideology | Article 33 of the 1945 Constitution concerning the control of resources by the state for the prosperity of the people, is the mandate that underlies nickel downstreaming. | - |
| 5 | Politic | The government's commitment through the nickel downstreaming policy and the ban on nickel ore exports (ESDM Ministerial Regulation No. 11/2019) has begun to bear fruit, as seen in Indonesia's rising ranking in nickel derivative product exports worldwide. | • Coordination between ministries and institutions is suboptimal, with no single authority specifically responsible for orchestrating nickel downstreaming.<br>• Protection for the domestic industry remains weak, as evidenced by the implementation of import tariffs and policies.<br>• The Domestic Component Level (TKDN) is sporadic, thus not providing consistent protection for strengthening the competitiveness of the national industry.<br>• The conditionalities and evaluation approaches to nickel downstreaming policies are still less than ideal, as evidenced by weak monitoring mechanisms for policy implementation. Consequently, strategic partnerships between entrepreneurs or investors and local MSMEs have not been optimal.<br>• Requirements for technology transfer related to nickel downstreaming from investors remain lax. |
| 6 | Economy | Indonesia has become one of the largest exporters of stainless steel (ingots) and the second largest exporter of flat-rolled stainless steel. Furthermore, the establishment of several EV battery factories in Indonesia strengthens Indonesia's position in the nickel derivatives supply chain. | • The natural resource revenue-sharing scheme does not Favor producing regions, resulting in limited financing for local investors, and minimal diversification of the post-nickel industry.<br>• Indonesia's manufacturing sector is unable to optimally support the nickel downstream industry.<br>• Limited access to financing for local investors, as nickel downstreaming relies on capital. |
| 7 | Social and Culture (Include Technology) | - | Domestic industry players have not yet fully mastered nickel downstream technology due to limited funding and lax technology transfer requirements from investors. |
| 8 | Security | - | - |

Analysis using the SWOT framework shows that nickel downstreaming in Indonesia has a strength that lies in the availability of abundant resources, with control of 42% of the world's nickel reserves and a contribution of 50.5% to global production by 2023, which positions Indonesia as a key player in the international supply chain. Strategic policies like the ban on nickel ore exports through ESDM Ministerial Regulation No. 11 of 2019 strengthens domestic industrialization, drives a surge in the export value of nickel derivative products, increases the contribution of the base metal sector to national GDP, and spurs GRDP growth in downstreaming centres like Morowali and Central Halmahera by more than 20% per year. Indonesia's geographical

position on international trade routes close to major East Asian markets (China, Japan, South Korea) strengthens the potential for nickel downstreaming development, which is reflected in Indonesia's position as the largest exporter of stainless-steel ingots, second in stainless steel flat rolled and the commencement of construction of several EV battery factories.

Nevertheless, equity and sustainable downstreaming are still weak links even in nickel. The fact that only 20 % of the Revenue Sharing Fund is allocated to local governments has prevented meaningful contributions to local development in the nickel-producing regions. The pre-eminence of alien investors and the minor local business players as well as the perceived shortage of credit deals alike contribute to the weakening of the national industrial business, in which the national industry depends relatively more on raw commodity exports in comparison to other ASEAN countries, is vulnerable post-nickel economic diversification and their limited ability to catch up with the use of technology in a downstreaming manner by local industries. These weaknesses are exacerbated by lack of technology transfer requirements and the low availability of skilled labor. In addition, the application of occupational safety regulations tends to fall short and there are no clear import duty and the Level of Domestic Component policy that inhibits the growth of the domestic industry. In environmental point of view, the downstreaming process is still very dependent on power plant using coal with high carbon emission and has deforestation potential that is not compatible with energy transition agenda. Furthermore, there is no institution that optimally orchestrates coordination between ministries and the private sector, creates conditionalities, and monitors and evaluates policy implementation. The weaknesses found in Indonesia's nickel downstreaming are consistent with the concept of the resource curse, where the dominance of foreign capital without technology transfer has the potential to hinder the independence of the national industry.

In terms of opportunities, the prospects for nickel downstreaming are very promising, particularly due to the increasing demand for nickel as a key ingredient in electric vehicle batteries amidst global commitments to a clean energy transition. Demand from major markets like the European Union, the United States, and China creates strategic momentum for Indonesia to strengthen its position in the global supply chain. Furthermore, opportunities for international partnerships and the entry of foreign investors in the downstream sector can encourage technology transfer, increase human resource capacity, and diversify nickel-based industries and other derivative products with high added value.

Table 3. SWOT Analysis

| SWOT | Number | Item | Description |
|---|---|---|---|
| ***Strength*** | 1 | Dominance of Global Reserves and Production | By 2023, Indonesia will control 42% of the world's nickel reserves and produce 50.5% of total global production, making the nation a major player in the international nickel industry. This strategic position provides a significant competitive advantage in controlling global supply. |
| | 2 | Strategic Location on International Trade Routes | Indonesia is located on international trade routes and has a strategic location for access to East Asian markets (China, Japan, South Korea) as a centre of nickel demand. |
| | 3 | Government Commitment | The nickel ore export ban policy through the Minister of Energy and Mineral Resources Regulation Number 11 of 2019, which is based on the mandate of Article 33 of the 1945 Constitution, is a strong signal of the government's commitment to encouraging industrialization and strengthening added value within the country. |
| | 4 | Large Number of Workers | Indonesia, with its large population, has an abundant workforce. |
| | 5 | Success of the Initial Stage of Downstreaming | Indonesia has achieved significant downstream nickel processing, as evidenced by its position as the largest exporter of stainless steel in ingot form and second place for flat-rolled stainless steel in 2022. |
| | 6 | Private Sector Involvement | The establishment of several electric vehicle (EV) battery factories in Indonesia demonstrates private sector support for the nickel downstream ecosystem and renewable energy-based industries. |
| ***Weakness*** | 1 | Occupational Safety and Industry Standards | The implementation of occupational safety standards in the nickel downstream sector remains a concern, with a workplace accident at a smelter facility in Central Sulawesi indicating the need for increased safety oversight and regulation. |
| | 2 | Fiscal Policy Gaps | The exisiting profit-sharing scheme (80% central, 20% regional) is considered suboptimal for encouraging the development of nickel-producing regions, especially since corporate income tax and VAT are not included in this profit-sharing mechanism. |
| | 3 | Sporadic Industrial Protection | Import tariff policies and the implementation of the Domestic Component Level (TKDN) remain sporadic, thus not providing optimal protection for the domestic industry. |
| | 4 | Lack of Industrial Diversification and Integration | Domestic business participation in the downstream sector is minimal, with no strong policy incentives to promote post-nickel economic diversification or vertical integration into high-productivity manufacturing sectors. |
| | 5 | Limited Technology Transfer and Skilled Human Resources | Technology transfer requirements from foreign investors remain lax, compounded by the limited skilled workforce available to add value to nickel commodities. |
| | 6 | Limited Access to Financing | There is no adequate financing mechanism for local investors to master nickel processing technology, despite the capital-intensive nature of this sector and the significant investment required. |
| | 7 | The Nickel Downstream Process in Indonesia is Not Environmentally Friendly | The energy source for the nickel downstream process still relies on coal-fired power plants (PLTU), which produce high carbon emissions and have the potential to increase deforestation and pollution around industrial areas. |
| | 8 | Weak Institutionalization, Coordination, Monitoring, and Policy Evaluation | There is no single institution that orchestrates coordination between ministries and the private sector in implementing downstream processing, and the mechanisms for conditionalities, policy evaluation, and implementation monitoring remain suboptimal. |
| | 9 | High Dependence on Raw Commodities | Indonesia's high dependence on raw commodity exports is higher than that of other ASEAN countries. |
| ***Opportunity*** | 1 | Growth of the EV Battery Industry | The increasing global demand for nickel for electric vehicle batteries opens up significant opportunities for Indonesia to become a hub for battery technology production and innovation. |
| | 2 | Potential for Technology Transfer | The entry of foreign investors into the downstream sector has the potential to facilitate technology transfer, which can be utilized to build national capacity in nickel-based processing and manufacturing. |
| ***Threat*** | 1 | Global Trade Pressures and Disputes | The WTO and European Union lawsuits against the 2022 nickel ore export ban pose a risk of retaliation and restrict market access for Indonesian downstream products. |
| | 2 | Geoeconomic Supply Chain Volatility | Global geoeconomic dynamics like price fluctuations, supply chain disruptions, and changes in market access make the Indonesian economy vulnerable. |

Despite promising prospects, nickel downstreaming in Indonesia also faces a number of external threats that must be anticipated. Geoeconomic fragmentation and contemporary geopolitical changes have the potential to disrupt supply chain

stability and limit access to international markets. Fluctuations in global commodity prices can impact the profitability of downstream industries. These risks could be exacerbated by potential retaliation, for example restrictions on market access for Indonesian downstream products, against various policies, like the nickel ore export ban that was challenged by the WTO and the European Union in 2022.

The TOWS analysis in table 3, based on the developmental state model (43,44), governance theory (45), sustainable development theory, and findings from previous research, yielded 10 strategies. First, the mechanism for transferring funds from the central government to regional governments, through DBH (Regional Revenue Sharing Funds), DAK (Special Allocation Funds), DTP (Direct Funds to be Transferred), and DID (Direct Investment Funds), needs to be improved to ensure fairness. Financing support in the form of equity and soft loans can be utilized to increase access to funding for national downstream entrepreneurs. Second, regulating the procurement scheme for goods and services from local businesses in regional government procurement, while simultaneously encouraging the formation of regionally-owned enterprises (BUMD) through capital, technology, and ease of doing business support, thus strengthening value-added economic transformation. Third, downstream investors are required to develop economic diversification plans and reinvest in high-value, sustainable sectors. Fourth, partnerships are strengthened by requiring collaboration between investors and local entrepreneurs through incubation schemes, MSME certification, technology access, and strict oversight of the implementation of these partnership regulations.

From a sustainability perspective, fifth, environmental regulation enforcement is enhanced by increasing the number of supervisory human resources and utilizing modern monitoring technology, for example water quality sensors in rivers around industrial areas. Sixth, improving labour protection in the downstream sector by strengthening the implementation of K3 through increasing the number of supervisory human resources, utilizing information technology, and opening a direct complaint channel for workers to the relevant authorities. Seventh, increasing mastery of downstream technology by giving BRIN a greater mandate to obtain downstream technology licenses, encouraging research collaboration with industry and universities, and ensuring that state-owned enterprises (SOEs) involved in the commercialization of innovations. Eighth, establishing carbon trading for coal-fired power plants (PLTU) used in the downstream industry, so that carbon emissions can be gradually reduced in line with the energy transition agenda.

Ninth, adjust fiscal and trade policies, also covering limiting

exports of low-value-added products like nickel pig iron, while simultaneously relaxing import restrictions for critical raw materials in the battery ecosystem, especially lithium, phosphate, and graphite. Finally, tenth, strengthen institutions through the establishment of a task force to synchronize and accelerate downstreaming, comprised of representatives from various ministries, institutions, and the private sector. This task force must have a clear mandate from the highest political leadership to coordinate, direct, and oversee the implementation of the nickel downstreaming policy in an integrated manner. Furthermore, an institution must be established that can mobilize Indonesia's resources.

Table 4. TOWS Analysis

| Number | TOWS | Strategy |
|---|---|---|
| **1** | W2, W6, O1, O2 | Improve the mechanism for transferring funds from the central government to regional governments (DBH, DAK, DTP, and DID) to ensure greater equity. Support financing for downstream entrepreneurs, either through equity or soft loans. This will improve access to funding to support nickel downstreaming. |
| **2** | S4, T2 | Regulate the procurement scheme for goods and services from regional businesses for procurement by regional governments, thereby empowering MSMEs and stimulating the regional economy in support of nickel downstreaming. Furthermore, encourage the formation of regionally-owned enterprises (BUMD) (through capital, technology, and ease of doing business) to support economic transformation toward more value-added and sustainable sectors, while remaining close to the local economic structure. |
| **3** | W4, W9, T1, T2 | Require investors/entrepreneurs in the downstream sector to develop economic diversification plans and reinvest in more sustainable and high-value-added sectors. |
| **4** | W6, O2 | Strengthen partnership schemes between investors and local entrepreneurs, supported by incubation, MSME certification, and access to technology (technology transfer). Furthermore, enforce oversight and evaluation of regulations on partnerships between investors and local entrepreneurs. Enhancing enforcement of environmental conservation regulations by increasing the number of environmental supervisors and utilizing the latest technology (the use of sensors in rivers to regularly monitor water quality). |
| **5** | W7, W8, T2 | Strengthening the implementation of OHS (Occupational Health and Safety) regulations by increasing the number of supervisors, optimizing information technology, and providing access for workers to file complaints with relevant agencies regarding alleged violations of OHS regulations. |
| **6** | W1, W8, T2 | Improving technological mastery by strengthening the National Agency for Research and Innovation (BRIN), which provides the mandate and authority to purchase downstream technology licenses, encourages collaboration with industry and universities to educate human resources, and encourages state-owned enterprises (SOEs) to commercialize developed technologies. |
| **7** | W5, W6, O1, O2 | Applying carbon trading regulations to coal-fired power plants (PLTU) in the downstream industry will gradually reduce carbon emissions from the downstream industry. |
| **8** | W7, T2 | Adjusting import and export duties to support downstreaming by limiting the export of low-value-added nickel downstream products like nickel pig iron. Furthermore, easing import restrictions, especially for critical raw materials in nickel downstreaming, especially lithium, phosphate, and graphite, will be implemented. Strengthening institutions and synergy between Ministries, Institutions, and the private sector, as well as establishing a Task Force for synchronization and acceleration of downstreaming whose members are representatives from various ministries in charge of nickel downstreaming, where the task force is given a clear mandate from the highest political leadership to direct, plan, lead, and coordinate policies related to downstreaming, and is given the authority to mobilize resources owned by Indonesia. |
| **9** | S1, S3, S2, S5, T1, T2 | Improve the mechanism for transferring funds from the central government to regional governments (DBH, DAK, DTP, and DID) to ensure greater equity. Support financing for downstream entrepreneurs, either through equity or soft loans. This will improve access to funding to support nickel downstreaming. |
| **10** | W8, W3, W4, W6, O1 | Regulate the procurement scheme for goods and services from regional businesses for procurement by regional governments, thereby empowering MSMEs and stimulating the regional economy in support of nickel downstreaming. Furthermore, encourage the formation of regionally-owned enterprises (BUMD) (through capital, technology, and ease of doing business) to support economic transformation toward more value-added and sustainable sectors, while remaining close to the local economic structure. |

## Conclusion

This study concludes that equitable and sustainable downstreaming, particularly for nickel mineral resources, is a strategic instrument for Indonesia to strengthen national energy sovereignty, increase economic added value, and maintain environmental sustainability amidst geoeconomic fragmentation and global geopolitical uncertainty. The Astagatra and SWOT analyses show that, although downstreaming in Indonesia has abundant resource strengths, a strategic geographical position, and a constitutional basis that supports downstreaming as a mandate for resource management for the prosperity of the people, nickel downstreaming in Indonesia still has weaknesses that reflect the resource curse. Therefore, by referring to the developmental state model, governance theory, sustainable development theory and examples obtained from previous research, the TOWS analysis produces 10 equitable and sustainable downstreaming policy strategies. First, the mechanism for transferring funds from the central government to regional governments needs to be improved to be more equitable, so that the benefits of downstreaming can be directly felt by producing regions. Second, the government needs to regulate the procurement scheme for goods and services from regional business actors in government procurement and encourage the formation of regionally-owned enterprises (BUMD) that support the economic transformation towards a value-added and sustainable sector. Third, investors and entrepreneurs operating in the downstream sector are required to develop economic diversification plans and reinvest in sustainable, high-value-added sectors. Fourth, partnership schemes between investors and local entrepreneurs must be strengthened through clear and binding mechanisms. Fifth, enforcement of environmental conservation regulations must be enhanced through strict monitoring and the application of modern technology. Sixth, labour protection needs to be strengthened by strengthening the implementation of Occupational Health and Safety (K3) provisions. Seventh, mastery of downstream technology must be enhanced by strengthening the role of BRIN in research, licensing, and technology transfer. Eighth, carbon trading provisions need to be applied to coal-fired power plants (PLTU) used in the downstream industry to support the energy transition agenda. Ninth, import and export duty policies must be adjusted to encourage value-added products while maintaining strategic industrial ecosystems, covering the electric vehicle battery sector. Finally, tenth, institutional arrangements and synergy between ministries, institutions, and the private sector need to be strengthened by establishing a task force (Satgas) for synchronizing and accelerating downstreaming, which has a clear mandate to oversee integrated policy implementation and has the authority to mobilize Indonesia's resources.

Future research should expand the study to evaluate the effectiveness of downstreaming policies in other strategic energy sectors like bauxite and copper, with a comparative approach across regions and quantitative analysis of socio-environmental impacts. For decision-makers, policy recommendations include reformulating the Revenue Sharing Fund (DBH) to increase the share of producing regions, strengthening local partnerships to integrate MSMEs into the downstreaming industry supply chain, establishing a National Financing Fund to strengthen the capacity of domestic companies, diversifying the post-mining economy to ensure sustainability, and establishing a special institution at the ministerial level or a national task force with a full presidential mandate to ensure effective cross-sectoral coordination.

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