

SYMPHONIA

Journal of Theory and Research Output

Volume 1, Issue 2, March 2026



Indonesia's Bauxite Geoeconomics and the Challenge of Green Standards

Geoekonomi Bauksit Indonesia dan Tantangan Standar Hijau Global

Moehammad Bintang Aimar Andika¹ Muhammad Hajran Lillah*² Aldi Hardika Rahman³

Universitas Sebelas Maret, Surakarta, Indonesia ^{1 2 3}

*Corresponding Author: hajranjee@student.uns.ac.id

Submitted : 21 April 2026

Revision : 15 May 2026

Accepted : 30 May 2026

Abstract

This article examines Indonesia's bauxite downstreaming policy within the dynamics of global geoeconomics and emerging green governance standards. Using a qualitative political economy approach and the Global Production Networks (GPN) 2.0 framework, the study analyzes how resource nationalism, strategic coupling with foreign capital, and coal-dependent industrialization shape Indonesia's position in the global bauxite value chain. The findings show that although downstreaming policies strengthen domestic industrial capacity and increase state control over mineral resources, they also create structural vulnerabilities due to technological dependence, carbon-intensive smelter operations, and exposure to global green standards such as CBAM and ESG certification. The study introduces the concept of the "green standard transmission gap" (GSTG) to explain the disconnect between national industrial ambitions and transnational sustainability requirements. The article argues that Indonesia's long-term competitiveness depends on its ability to integrate industrial sovereignty with low-carbon transition strategies and internationally recognized environmental governance standards.

Keywords: Bauxite Geoeconomics; Resource Nationalism; Green Governance; Global Production Networks; Energy Transition

Abstrak

Artikel ini mengkaji kebijakan hilirisasi bauksit Indonesia dalam dinamika geoekonomi global dan perkembangan standar tata kelola hijau internasional. Dengan menggunakan pendekatan ekonomi politik kualitatif dan kerangka Global Production Networks (GPN) 2.0, penelitian ini menganalisis bagaimana nasionalisme sumber daya, strategic coupling dengan modal asing, dan industrialisasi berbasis batu bara membentuk posisi Indonesia dalam rantai nilai bauksit global. Temuan penelitian menunjukkan bahwa meskipun kebijakan hilirisasi memperkuat kapasitas industri domestik dan kontrol negara atas sumber daya mineral, kebijakan tersebut juga menghasilkan kerentanan struktural akibat ketergantungan teknologi, operasi smelter berintensitas karbon tinggi, dan paparan terhadap standar hijau global seperti CBAM dan sertifikasi ESG. Penelitian ini memperkenalkan konsep "green standard transmission gap" (GSTG) untuk menjelaskan ketidaksesuaian antara ambisi industrialisasi nasional dan tuntutan keberlanjutan transnasional. Artikel ini menegaskan bahwa daya saing jangka panjang Indonesia bergantung pada kemampuan mengintegrasikan kedaulatan industri dengan strategi transisi rendah karbon dan standar tata kelola lingkungan global.

Kata Kunci: Geoekonomi Bauksit; Nasionalisme Sumber Daya; Tata Kelola Hijau; Jaringan Produksi Global; Transisi Energi



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INTRODUCTION

For more than three decades, the architecture of the global value chain (GVC) has been built on one dominant principle: cost efficiency. This logic has driven the cross-border fragmentation of production, placing each node of the supply chain in locations offering the cheapest labor, the loosest regulations, or the most efficient infrastructure. However, a series of successive crises, ranging from supply chain disruptions caused by the COVID-19 pandemic, geopolitical tensions between the United States and China, to the acceleration of the clean energy transition, has fundamentally shifted this paradigm. Security of supply now supersedes efficiency as the top priority in the governance of the global GVC. It is within this context that mineral-rich nations have begun to aggressively play a card rarely used before: resource nationalism. The International Energy Agency notes that low-carbon technologies such as electric vehicles and solar power plants require far greater volumes of minerals compared to fossil fuel-based technologies, placing critical mineral-producing nations in a structurally strengthened bargaining position.¹ This trend is not driven solely by short-term economic calculations. As argued by Aspinall,² the new nationalism in many developing countries manifests in the economic sphere as an expression of sovereignty, resistance to the legacy of extractive practices, and an effort to break free from what Malam et al. as “trade neo-colonialism”, a condition where mineral-rich nations remain trapped at the bottom of the value chain while the greatest value-added is absorbed by advanced industrial nations.³ The rise of resource nationalism is thus not merely economic protectionism, but a form of geoeconomic agency that is becoming increasingly structured and strategic.

Among the mineral-producing nations adopting this strategy, Indonesia warrants serious examination. Structurally, Indonesia's economy remains dependent on exports of raw commodities with low value-added, a condition academically termed “commodity export dependency”, which makes economic growth vulnerable to global price volatility.⁴ Awareness of this vulnerability has gradually driven a policy shift from an extractive model toward mineral-based industrialization. Through Law No. 3 of 2020, Indonesia mandates that all mining permit holders process and refine metal ores domestically as an operational prerequisite. This ambition took its most definitive form on June 10, 2023, when the ban on raw bauxite ore exports officially took effect. The impact was immediately felt through a significant change in the value of Indonesia's bauxite exports, which dropped from USD 623 million in 2022 to just USD 68 million in 2023, while national production volume fell by approximately 38 percent over the same period.⁵ This step was not taken without precedent. Indonesia had previously implemented a similar strategy in the nickel sector, with quite dramatic results. The value of exports for nickel derivatives surged from around USD 6 billion in 2013 to nearly USD 30 billion in 2022,

1 International Energy Agency, “The Role of Critical World Energy Outlook Special Report Minerals in Clean Energy Transitions,” 2022, <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>.

2 Edward Aspinall, “The New Nationalism in Indonesia,” *Asia & the Pacific Policy Studies* 3, no. 1 (2015): 72–82, <https://doi.org/10.1002/app5.111>.

3 C Malam, K R. M., and P Diallo, “Compound Criticality of Bauxite Production: Implications for Sustainability and Trade Neo-Colonialism,” *Geoenergy* 2, no. 1 (2024), <https://doi.org/10.1144/geoenergy2023-054>.

4 Dwi Ervinda, Moch Yasin, and I Gede Agus Ariutama, “Economic Interdependence of Indonesia in Global Value Chain: An Analysis of Multiregional Input-Output,” *JEJAK* 15, no. 1 (2022): 151–64, <https://doi.org/10.15294/jejak.v15i1.34747>.

5 Jaewon Chung, “The Mineral Industry of Indonesia,” *U.S. Geological Survey*, 2025, <https://pubs.usgs.gov/myb/vol3/2023/myb3-2023-indonesia.pdf>; Pandu Setiabudi, “Indonesian Bauxite and Aluminum Outlook,” 2024, https://www.petroindo.com/storage/files/research/Indonesian-Bauxite_and_Aluminum_Outlook.pdf.

following the implementation of a ban on raw nickel ore exports in January 2020.⁶ It is this precedent that forms the basis of the government's calculation that regulatory coercion can force the relocation of refinery investments domestically. However, replicating this approach for bauxite faces heavier challenges. Unlike nickel, where Indonesia controls approximately 22 percent of global reserves and holds a dominant position that is not easily replaced, Indonesia's share of global bauxite production is only about seven percent, with Australia, Guinea, and Brazil as far larger producers.⁷ The existing domestic industrial capacity, with only four operational alumina refineries totaling 4.3 million tons per year, remains insufficient to absorb the national bauxite production of approximately 30 million tons per year.⁸ This imbalance between policy ambitions and industrial capacity indicates that Indonesia's bauxite downstream strategy, though narratively strong as an expression of resource sovereignty, contains structural vulnerabilities no less serious than the external pressures it will face in the future.

Although Indonesia's bauxite downstream policy has attracted considerable academic attention, most existing literature focuses its analysis on two separate arenas. First, macroeconomic studies evaluating the impact of the export ban on the trade balance, foreign direct investment flows, and the growth of the domestic processing industry. Second, international economic law studies that examine the compatibility of Indonesia's policies with the WTO regime, particularly regarding the dispute with the European Union over the nickel export ban, which was decided by a WTO panel in 2022.⁹ While both research streams are contributory, they leave an analytical gap that remains unfilled. No study has yet systematically examined how Indonesia's geoeconomic agency within the bauxite value chain procedurally clashes with the increasingly robust global green standards architecture. On one hand, there is pressure from the Aluminium Stewardship Initiative (ASI), which requires compliance with strict governance, environmental, and social standards, including the obligation for Free, Prior, and Informed Consent (FPIC) from indigenous communities in mining-affected areas.¹⁰ On the other hand, the European Union is erecting a new regulatory barrier through the Carbon Border Adjustment Mechanism (CBAM), which will impose a carbon tax on imported products, including aluminum.¹¹ Ironically, Indonesia is building its processing capacity on a foundation of energy that remains largely coal-based.¹² This clash between Indonesia's geoeconomic agency ambitions and the demands of global green standards has not yet been adequately explored analytically in the literature on international relations or international political economy.

6 Faris Abdurrahman, "Assessing Nickel Downstreaming in Indonesia," *East Asia Forum*, 2023, <https://eastasiaforum.org/2023/09/28/assessing-nickel-downstreaming-in-indonesia/>.

7 Robert Walker and Hilman Palaon, "The Future of Indonesia's Green Industrial Policy | Lowy Institute," *LowyInstitute.Org*, 2025, <https://www.loyyinstitute.org/publications/future-indonesia-s-green-industrial-policy>.

8 S M M News, "Indonesia's Ban on Bauxite Exports Leads to Negative Effects, Surplus Bauxite Difficult to Consume - Shanghai Metals Market (SMM)," *Metal.Com*, 2024, <https://news.metal.com/newscontent/102610035>.

9 Arif Satria, "Downstreaming and Reindustrialization of Food & Energy in Response to Change Contemporary Geopolitics," *Proceeding Jakarta Geopolitical Forum*, 2025, <https://doi.org/10.55960/jgf.v9i1.293>.

10 Aluminium Stewardship Initiative, "ASI Performance Standard," 2023, <https://aluminium-stewardship.org/asi-standards/chain-of-custody-standard>.

11 European Commission, "Carbon Border Adjustment Mechanism (CBAM) Combatting Carbon Leakage in the EU Factsheet," 2024, <https://accountancyeurope.eu/wp-content/uploads/2024/01/231024-CBAM-Factsheet.pdf>.

12 World Bank Group, "Laporan Iklim Dan Pembangunan Negara: Ikhtisar – Indonesia" (World Bank, 2023), <https://openknowledge.worldbank.org/server/api/core/bitstreams/fc711754-a583-4f65-8ddd-712456e571fa/content>.

This study argues that Indonesia has successfully utilized its resource sovereignty as a mechanism of strategic coupling to attract downstream investment domestically and enhance its position within the global bauxite GVC. However, at the same time, Indonesia has not yet been able to align the industrial capacity it has built with the emission standard transmission requirements imposed by dominant actors in the global GVC. This situation has the potential to create new structural trade barriers, no longer conventional tariffs, but rather “carbon borders” framed as climate policies yet possessing tangible protectionist effects. Theoretically, this situation reflects what can be termed the “decarbonization divide,” where developed nations reap the benefits of the clean energy transition, whose raw materials largely originate from developing countries, while it is precisely these mineral-producing nations that bear the heaviest environmental burden of extraction processes and face the threat of exclusion from export markets due to the carbon intensity of their production. In other words, Indonesia is caught in a complex paradox because policy instruments designed to correct structural inequalities in GVCs have the potential to create new inequalities within a climate-based trade regime. Thus, understanding this paradox, along with its opportunities and limitations, is the core of this research.

To systematically develop the above argument, this article is organized into five main sections. Following this introduction, the second section establishes a theoretical framework by integrating the concept of geoeconomic agency, the GVC 2.0 theory proposed by Yeung & Coe, and the literature on contemporary resource nationalism.¹³ The third section maps Indonesia's position within the global bauxite and aluminum value chains. This covers production structures, trade patterns, and investment dynamics following the 2023 export ban policy. The fourth section critically analyzes the clash between Indonesia's downstreaming strategy and two major green standards, the ASI Performance Standard and the EU's CBAM mechanism, with particular attention to the gap between policy ambitions and implementation capacity. The fifth section concludes the article with a discussion of theoretical implications and policy recommendations, including pathways that would allow Indonesia to pursue strategic upgrading within the GVC without being sidelined from the increasingly dominant green-standard-based export markets.

Method

This study employs a descriptive qualitative research design using the Global Production Networks (GPN) 2.0 approach to examine Indonesia's geoeconomic agency within the global bauxite value chain.¹⁴ The GPN 2.0 framework is particularly relevant because it emphasizes the relational interaction among various actors, including states, firms, financial institutions, and global governance regimes, in shaping production networks and the distribution of economic value. In contrast to conventional Global Value Chain (GVC) approaches that primarily focus on firm-centered governance, GPN 2.0 recognizes that global production processes are embedded within broader political, institutional, and territorial dynamics. This perspective enables a more comprehensive understanding of how state policies, foreign investment, and international standards interact within the process of mineral downstream industrialization.

The study relies on secondary data collected from academic journals, government regulations, policy reports, international organization publications, and industry documents related to Indonesia's bauxite and aluminum sectors. These sources are analyzed qualitatively to identify the mechanisms through which Indonesia utilizes regulatory instruments, such as export bans

13 Henry Wai-chung Yeung and Neil M Coe, “Toward a Dynamic Theory of Global Production Networks,” *Economic Geography* 91, no. 1 (2014): 29–58, <https://doi.org/10.1111/ecge.12063>.

14 J. W Creswell, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*, 3rd ed. (Thousand Oaks, CA: SAGE Publications., 2013).

and licensing requirements, to strengthen domestic processing capacity and reposition itself within the global production network. Furthermore, the GPN 2.0 approach allows this research to analyze the emerging tension between Indonesia's resource nationalism agenda and the growing influence of global green governance mechanisms, particularly ESG standards, the Aluminium Stewardship Initiative (ASI), and the European Union's Carbon Border Adjustment Mechanism (CBAM). Through this framework, the study explores how domestic industrial strategies are increasingly shaped and constrained by global decarbonization pressures.

RESULTS AND DISCUSSION

Mapping the Bauxite GPN in Indonesia

Within the framework of the Global Production Network (GPN), a lead firm is an actor that holds dominant control over the direction and mechanisms of a commodity's flow. Lead firms are defined by their capacity to control products or markets while expanding global production networks across various industrial sectors.¹⁵ In Indonesia's bauxite mining industry, the role of the lead firm is almost entirely held by Chinese companies. While the bauxite sector in Indonesia is not solely dominated by domestic actors, within the GPN local resource owners do not fully control the existing bauxite. This illustrates the framework of lead firms in Indonesia, where foreign investors are not merely financial contributors but also key actors shaping the architecture of the entire production chain. There are several advantages that Indonesia lacks, namely refinery technology, market access, and the ability to manage risks in long-term investments. In this context, dominance over resources alone is insufficient to fully control the bauxite industry. As long as Indonesia cannot fulfill these three elements, whoever replaces the lead firm's position will not alter the dependency relationship within the system.

Companies such as China's Hongqiao Group hold a majority stake in PT Well Harvest Winning Alumina Refinery in Kalimantan. This company is a foreign direct investment (FDI) in the form of a joint venture between Indonesia and China. The shareholders consist of China's Hongqiao Group Co. Ltd, PT Cita Mineral Investindo Tbk (Harita Group), Winning Investment (HK) Company Limited, and Shandong Weiqiao Aluminium & Electricity ("WHW"). China Hongqiao Group is the most dominant lead firm, holding a 56 percent stake in PT Well Harvest Winning Alumina Refinery in West Kalimantan.¹⁶ This smelter is designed for a capacity of two million tons of alumina per year. In addition to private companies, China's largest state-owned aluminum firm, Chalco, has also partnered with PT Antam and PT Inalum. This partnership aims to develop a smelter-grade alumina refinery in Mempawah, West Kalimantan.¹⁷

Indonesia's vulnerability lies in its inability to develop its own refinery engineering capabilities. For the Bayer Process refinery technology, China Aluminium International Engineering Corporation (CHALIECO) is involved in the Borneo Alumina Indonesia project supported by Antam. Every new refinery construction relies on Chinese EPC contractors, creating a technology outflow from Indonesia. Showa Denko serves as one of the entry points for technology not originating from China. This Japanese company holds a 20 percent stake in the Tayan chemical-grade refinery operated by PT Antam, with a capacity of 300,000 tons per year.¹⁸

15 Neil M Coe and Henry Wai-Chung Yeung, *Global Production Networks: Theorizing Economic Development in an Interconnected World* (Oxford University Press, 2015).

16 Setiabudi, "Indonesian Bauxite and Aluminum Outlook."

17 Anastasia Arvirianty, "Bangun Smelter Gandeng China, Inalum Bakal Hemat Rp 9,10 T," *CNBC Indonesia*, 2018, <https://www.cnbcindonesia.com/news/20181012132722-4-37141/bangun-smelter-gandeng-china-inalum-bakal-hemat-rp-910-t>.

18 Graham W Lederer, "Resource Nationalism in Indonesia—Effects of the 2014 Mineral Export Ban," *Fact Sheet*, 2016, <https://doi.org/10.3133/fs20163072>.

MIND ID, as the state-owned enterprise (SOE) holding company in the mining sector, oversees five companies: PT Aneka Tambang Tbk, PT Freeport Indonesia, PT Indonesia Asahan Aluminium, PT Bukit Asam Tbk, and PT Timah Tbk. Within the context of the Global Production Network (GPN) for bauxite, MIND ID occupies a strategically mid-level position yet finds itself in a tight spot. On one hand, it controls upstream resources, but on the other, it remains dependent on foreign capital and technology for midstream processing. MIND ID holds bauxite reserves of approximately 198.43 million tons, with production expected to reach 1.33 million tons by 2024.¹⁹ Meanwhile, the first phase of the SGAR Mempawah project has an annual production capacity of 1 million tons of alumina, which serves as the primary feedstock for INALUM's aluminum smelter in Kuala Tanjung.

However, there are three structural weaknesses that require attention. First, Indonesia still lacks an engineering firm capable of independently mastering refinery technology. Second, most refinery facilities owned by Chinese investors in Indonesia are indeed designed to re-export alumina to the Chinese market, meaning MIND ID has not yet achieved independence in accessing the global market. Third, from the perspective of the Global Production Network (GPN), governance encompasses standard-setting, the establishment of reference prices, and control over market information; currently, all these elements are still dominated by lead firms from China, not by Indonesia. China's market position grants it significant bargaining power over global mining investment trends and underscores the importance of maintaining secure overseas supply chains.²⁰

Procedural Mechanisms of the Export Ban

The bauxite export ban policy is part of a national downstreaming strategy aimed at increasing domestic value added. The government explicitly targets reducing dependence on aluminum imports, as previously approximately 56% of domestic demand still came from imports.²¹ Through this policy, the state uses regulations to create pressure to attract investment. This policy is rooted in Law No. 3 of 2020 on Mineral and Coal. Article 102(1) requires every holder of an IUP and IUPK at the Production Operation stage to increase the value added of minerals through processing and refining for metal mineral commodities. Article 103(1) further stipulates: processing and refining must be conducted domestically.²² This regulation requires every holder of a Mining Business License (IUP) to build refining facilities or enter into partnerships for processing and refining operations by no later than 2023, as stipulated in Articles 47, 83, 102, 103, 170A, and 172E.²³ This means companies without a smelter plan cannot obtain an IUP. Smelter development policies will not be effective without support from mechanisms in the trade sector. Furthermore, Indonesia has implemented a ban on bauxite ore

19 MIND ID, "MIND ID Strengthens Energy Transition Commitment through Bauxite Downstreaming," *Mind.Id*, 2025, <https://mind.id/en/news/mind-id-perkuat-komitmen-transisi-energi-lewat-hilirisasi-bauksit>.

20 John Zadeh, "Global Bauxite Production: Top 5 Countries Leading 2025 Supply," *Discovery Alert*, 2025, <https://discoveryalert.com.au/bauxite-importance-production-2025-countries/>.

21 Reuters, "Indonesia Launches \$941 Mln Smelter-Grade Alumina Refinery," *Reuters*, 2024, <https://www.reuters.com/markets/commodities/indonesia-launches-941-mln-smelter-grade-alumina-refinery-2024-09-24/>.

22 PUSHEP, "Nasib Hilirisasi Mineral Dan Batubara Pasca UU Nomor 3 Tahun 2020 Tentang Perubahan Atas UU Nomor 4 Tahun 2009 Tentang Pertambangan Minerba Dan UU Nomor 11 Tahun 2020 Tentang Cipta Kerja," *PUSHEP*, 2021, <https://pushep.or.id/nasib-hilirisasi-mineral-dan-batubara-pasca-uu-nomor-3-tahun-2020-tentang-perubahan-atas-uu-nomor-4-tahun-2009-tentang-pertambangan-minerba-dan-uu-nomor-11-tahun-2020-tentang-cipta-kerja/>.

23 Bambang P. Jatmiko, "Poin Penting UU No 3 Tahun 2020 UU Minerba Terbaru," *Kompas*, 2020, <https://money.kompas.com/read/2020/05/13/152543126/ini-poin-poin-penting-dalam-uu-minerba-yang-baru-disahkan?page=all>.

exports effective from 2023, as part of the implementation of Law No. 3 of 2020.²⁴ This regulation mandates that all raw minerals must be processed domestically before they can be exported. Consequently, Indonesia's bauxite exports plummeted to 68 million USD in 2023, down from 623 million USD in 2022.²⁵ Such a drastic decline in value is a situation no mining company can afford to ignore. As a solution, the government allows companies to continue exporting on the condition that their smelter construction progress has exceeded 50 percent.²⁶ Companies that have made no progress in smelter construction are not granted this exemption.

In addition to the export ban, there is an administrative instrument that operates more subtly yet remains strictly binding: the RKAB (Work Plan and Budget). This document must be prepared by every IUP holder and submitted to the Ministry of Energy and Mineral Resources for approval. Without RKAB approval, companies are not permitted to conduct any mining activities at all. If an RKAB submission is rejected, the company has only one opportunity to revise and resubmit it. If it is still not approved, the company must wait until the next period to resubmit. Additionally, progress on smelter construction must be reported in the RKAB, so companies that fail to demonstrate progress will face sustained pressure during each evaluation cycle and permit renewal.²⁷ The Minister of Energy and Mineral Resources has the authority to impose administrative sanctions on IUP holders for violations of Article 102(1) and Article 103(1) (Law No. 3 of 2020 on the Management of Mineral Resources). Sanctions are imposed through a series of written warnings, up to three times, each valid for 30 days. If there is no compliance, this is followed by a temporary suspension of operations 60 days after the expiration of the final warning. Under Article 119 of the Minerba Law, an IUP or IUPK may be revoked by the Minister if the permit holder fails to fulfill the obligations specified in the permit or the provisions of applicable laws and regulations.

This policy enforcement mechanism has proven effective; investments have flowed in, and refinery facilities have begun construction. However, this success has unfolded with dynamics not fully anticipated by policymakers. The absence of domestic technology partners and the lack of competitiveness in domestic financing schemes created a gap subsequently filled by Chinese companies, supported by access to cheap capital from their state-owned banks and EPC technology from their own contractors. From a Global Production Network (GPN) perspective, this situation can be understood as a form of state-orchestrated investment coercion, in which the state uses licensing instruments to encourage foreign investment in the midstream sector. Meanwhile, the 51 percent divestment requirement in Article 112 of the Minerba Law is formally intended to limit foreign ownership in the long term (CNN Indonesia, 2020).²⁸ However, its implementation still faces uncertainty.

24 Muhammad Farhan, "Indonesia Justifies Bauxite Export Ban to Boost Domestic Smelter Industry," *Jakarta Globe*, 2025, <https://jakartaglobe.id/business/indonesia-justifies-bauxite-export-ban-to-boost-domestic-smelter-industry>.

25 Chung, "The Mineral Industry of Indonesia."

26 Indonesia Business Post, "Bauxite Export Ban to Enter into Effect after June 10, 2023," *Indonesia Business Post*, 2023, <https://indonesiabusinesspost.com/840/Politics/bauxite-export-ban-to-enter-into-effect-after-june-10-2023>.

27 Ayik Candrawulan Gunadi, Mahatma Hadhi, and Kenny Poltak, "New Indonesian Regulation Streamlines Mining Plan Rules but Imposes Tough New Sanction for Non-Compliance," *Lexology*, 2023, <https://www.lexology.com/library/detail.aspx?g=9758f6d6-a8e4-4285-8bde-869b4a854644>.

28 Adhi Wicaksono, "UU Minerba Baru, Asing Wajib Divestasi 51 Persen Saham Ke RI," *CNN Indonesia*, 2020, <https://www.cnnindonesia.com/ekonomi/20200617180043-85-514447/uu-minerba-baru-asing-wajib-divestasi-51-persen-saham-ke-ri>.

The Transition from Green Standards to Domestic Realities

When two opposing regulatory frameworks operate simultaneously, tensions arise. On one hand, global sustainability standards demand emissions transparency, independent audits, and low-carbon supply chains. On the other hand, the bauxite processing capacity developed in Indonesia remains heavily reliant on an increasingly coal-intensive energy system. There are two relevant global green standard mechanisms for the aluminum industry in Indonesia. The ASI Performance Standard is the most widely adopted standard in the global aluminum value chain. This standard covers stages from bauxite mining, alumina refining, smelting, to recycling, encompassing 59 environmental, social, and governance criteria. Several Indonesian companies, such as PT Bintan Alumina Indonesia, PT Inalum, and PT Indoaluminium Intikarsa, are members of ASI and are required to obtain certification within two years of joining. ASI standards require the implementation of the Free, Prior, and Informed Consent (FPIC) principle for indigenous communities in areas affected by mining activities; this social aspect has not been a primary focus in Indonesia's domestic permitting system to date.²⁹ Additionally, the Carbon Border Adjustment Mechanism (CBAM) imposes further pressure on developing countries. In the Cooperation scenario, CBAM imposes tariffs on these countries to bridge the carbon price gap between the European Union and its trading partners.³⁰ This policy targets imports from high-carbon-intensity industries, including aluminum, and will be fully implemented starting in January 2026 following a transition period from 2023 to 2025. Indonesia is projected to face a CBAM tariff of approximately 12.14 percent on aluminum products.³¹ Without a standardized monitoring, reporting, and verification (MRV) system, domestic industries will struggle to demonstrate their low carbon emissions, thereby risking a loss of competitiveness in the EU market.

However, the following data reveals a contrasting reality. The energy infrastructure built to support downstream processing is moving in the opposite direction of global green standards. Bauxite and alumina smelters in Indonesia are constructing their own coal-fired power plants, known as Captive Power Plants (CPPs). Since Indonesia signed the Paris Agreement, the total capacity of coal-fired CPPs has tripled from 5.7 GW in 2019 to 15.2 GW as of July 2024. By 2026, there are still plans to build CPPs with a total capacity of 11 GW. Of this, 5.8 GW is currently under construction, 1.64 GW is still in the permitting process, and 3.6 GW has just been announced.³² Indonesia is ranked as the third-largest contributor to global coal-fired power plant capacity expansion, following China and India. Approximately 80% of this increase comes from coal-fired power plants built specifically to support industrial zones for nickel, cobalt, and aluminum processing.³³ Analytically, the most problematic aspect is the domestic policy response to this pressure. After revising its green investment taxonomy, Indonesia faced criticism for including several coal-fired power plants as part of its contribution to the Low-Carbon Transition (Kay Lee). Indonesia's Just Energy Transition Partnership (JETP) roadmap,

29 Initiative, "ASI Performance Standard."

30 Xinlu Sun et al., "The Carbon Border Adjustment Mechanism Is Inefficient in Addressing Carbon Leakage and Results in Unfair Welfare Losses," 2024, <https://pmc.ncbi.nlm.nih.gov/articles/PMC11630705/pdf/main.pdf>.

31 Danial M Wirdyansyah, "Carbon Border Adjustment Mechanism (CBAM) and Its Implications for Developing Economies: A Systematic Literature Review," *Indonesian Journal of Energy* 8, no. 2 (2025): 162–76, <https://doi.org/10.33116/ije.v8i2.292>.

32 Cintya Faliana, "Captive Coal Power Plants Holding Back Indonesia's Energy Transition [Op-Ed]," *Energy Tracker Asia*, 2025, <https://energytracker.asia/captive-coal-power-plants-holding-back-indonesias-energy-transition/>.

33 Hans Nicholas Jong, "Indonesia Defies Global Coal Retreat with Captive Plant Boom," *Mongabay Environmental News*, 2025, <https://news.mongabay.com/2025/04/indonesia-defies-global-coal-retreat-with-captive-plant-boom/>.

the Comprehensive Investment and Policy Plan, acknowledges significant loopholes and exemptions regarding off-grid captive coal-fired power plants, which are even classified as “low-carbon transition contributors.” Emissions from these captive power plants are projected to exceed the 290 metric ton emissions cap for Indonesia’s electricity sector, potentially hindering the achievement of the national net-zero target.

The Indonesian government is firmly prioritizing accelerated industrialization at present, even if it must bear the consequences of deferred environmental costs in the future. At the Mandiri Investment Forum, President Prabowo stated that Indonesia does not need to be lectured on climate change. This does not indicate inconsistency, but rather a political choice made consciously and deliberately. Such incentives are deeply embedded in Indonesia’s political structure. Many companies are joint ventures between Indonesian business actors and Chinese investors. This relationship creates harmony between business and political interests, leading to both profit generation and job creation, and ultimately reinforcing the legitimacy of the ruling regime.³⁴ This situation illustrates what this study refers to as the “decarbonization divide”, a condition where countries supplying raw materials for the global energy transition bear the heaviest environmental burden while simultaneously facing the risk of being excluded from export markets due to the high carbon intensity of their production processes.

Strategic Coupling and Its Contradictions

The ban on bauxite exports imposed by Indonesia in June 2023, through the SKT mechanism and the suspension of new export approvals, was not a sudden policy. It is a logical escalation of the regulatory framework established since the Mining Law No. 3/2020. In Yeung’s terms, this policy constitutes strategic coupling: the deliberate mobilization of territorial assets to dictate the terms of integration into Global Production Networks (GPN).³⁵ What distinguishes the bauxite case from other commodities is the combination of two factors: Indonesia’s geological position, which holds approximately 28 percent of the world’s bauxite reserves (U.S. Geological Survey), and the global aluminum industry’s structural dependence on alumina as a precursor to production. This combination grants Jakarta leverage unavailable to most other developing nations.

The mechanism operates through regulatory lock-in: IUPs are procedurally tied to the obligation to build domestic smelters. Without verified evidence of construction progress from the Ministry of Energy and Mineral Resources (ESDM), companies lose their export rights. This mirrors the 2020 nickel precedent, which proved effective in driving massive smelter investment, particularly at IMIP in Central Sulawesi.³⁶ The results in the bauxite sector are consistent: PT Well Harvest Winning Alumina Refinery in Ketapang is accelerating its expansion toward a target of 4 million tons of alumina per year, while PT Bintan Alumina Indonesia announced a subsequent construction phase worth over USD 1 billion following the ban.

But the investment figures mask a more critical question: who captures the value, and under what conditions of asymmetry? Warburton introduces the concept of “nationalist enclaves” to

34 Jennifer Nguyen, “Indonesia’s Just Energy Transition Must Not Just Be More of the Same,” *New Security Beat*, 2024, <https://www.newsecuritybeat.org/2024/09/indonesias-just-energy-transition-must-not-just-be-more-of-the-same/>.

35 Henry Wai-chung Yeung, “Regional Development in the Global Economy: A Dynamic Perspective of Strategic Coupling in Global Production Networks,” *Regional Science Policy & Practice* 7, no. 1 (2015): 1–23, <https://doi.org/10.1111/rsp3.12055>.

36 Alvin Camba, Guanie Lim, and Kevin Gallagher, “Leading Sector and Dual Economy: How Indonesia and Malaysia Mobilised Chinese Capital in Mineral Processing,” *Third World Quarterly*, 2022, 1–21, <https://doi.org/10.1080/01436597.2022.2093180>.

capture this paradox: mineral-based industrial zones meet the demands of resource nationalism, yet function as reconfigured economic enclaves rather than machines for distributing benefits.³⁷ This paradox applies more acutely to the bauxite-alumina sector than to nickel, as Chinese capital dominance here is far more concentrated. Unlike nickel, which at least involves POSCO, LG, and BASF, Indonesia's bauxite-alumina value chain is almost entirely controlled by Chinese conglomerates.

The most critical, and least discussed, dimension is technological dependence. The Bayer process is operated using technology owned by Chinese companies, senior technicians largely brought in from China, and a supply chain for process chemicals linked to Chinese suppliers. Kesuma et al. refer to this as “refined dependency”: apparent progress masks an ongoing structural dependency. Indonesia has shifted from exporting raw ore to exporting semi-finished products processed with foreign technology.³⁸ The dependency has not disappeared; it has merely changed form. In GPN 2.0 terminology, this is a deeper form of structural coupling than functional coupling, but it is still far from true strategic coupling, where the host country has a say in the architecture of production technology.³⁹

The biggest challenge for long-term development is energy. Tritto documents that the energy infrastructure bundled with BRI smelters in Indonesia largely relies on subcritical coal-fired power plants, a technology with lower thermal efficiency and higher emissions than modern ultra-supercritical standards.⁴⁰ In Ketapang, the PT Well Harvest Winning smelter relies on a 120 MW coal-fired power plant. Sandria et al. highlight a deeper contradiction: the government has committed to the JETP to halt new coal-fired power plants after 2023, yet the current Presidential Regulation permits new plants until 2030 under the guise of captive power for smelters.⁴¹ This is not a mere regulatory inconsistency. The downstreaming agenda and the decarbonization agenda run parallel, and there is no mechanism requiring them to converge.

The Green Paradox: Carbon Border Risks and the Limits of Geoeconomic Agency

The Indonesian government's official narrative positions bauxite downstream processing as a pillar of its strategy to enter the supply chain for critical minerals for green energy. Aluminum is indeed a critical material in the energy transition: every electric vehicle requires an average of 130–170 kg of aluminum for its frame and battery casing, and wind turbines and solar panels also depend on it. From the perspective of the critical minerals supply chain, Indonesia's position as an alumina supplier is indeed strategic. But this logic contains a fatal implicit assumption: that the process of producing alumina is ecologically acceptable to the destination market. It is this assumption that is being rigorously tested by the European Union's trade policy framework.

37 Eve Warburton, “Nationalist Enclaves: Industrialising the Critical Mineral Boom in Indonesia,” *The Extractive Industries and Society* 20 (2024): 101564, <https://doi.org/10.1016/j.exis.2024.101564>.

38 Muhammad Ramadhani Kesuma et al., “Unveiling Sentiment and Financial Risks: OJK's 10% Co-Payment in Health Insurance,” *RIGGS: Journal of Artificial Intelligence and Digital Business* 4, no. 2 (June 14, 2025): 3150–59, <https://doi.org/10.31004/riggs.v4i2.997>.

39 Haiying Xu et al., “Information Application of the Regional Development: Strategic Couplings in Global Production Networks in Jiangsu, China,” *Information* 11, no. 9 (August 31, 2020): 420, <https://doi.org/10.3390/info11090420>.

40 Angela Tritto, “China's Belt and Road Initiative: From Perceptions to Realities in Indonesia's Coal Power Sector,” *Energy Strategy Reviews* 34 (2021): 100624, <https://doi.org/10.1016/j.esr.2021.100624>.

41 Andriko Sandria, Kresna Damar Adjii, and Jericho Julius Prabowo, “Exceptions for Stop Building Coal-Fired Power Plants in Indonesia,” *E3S Web of Conferences*, 2023, <https://doi.org/10.1051/e3sconf/202346705007>.

The EU's CBAM, which entered its transition phase on October 1, 2023, changes how market access is determined: for the first time, emissions embedded in a product's production process become a determining factor, not just the selling price. Aluminum is included among the six sectors covered, alongside steel, cement, fertilizers, electricity, and hydrogen.⁴² The mechanism is straightforward: importers are required to declare the embedded emissions intensity of the products they import, then purchase CBAM certificates equivalent to the difference between the carbon price already paid in the country of origin and the carbon price within the EU-ETS. In 2024, European ETS prices fluctuated between EUR 55–75 per ton of CO₂e. For alumina producers not operating under any carbon regime, such as those in Indonesia, the full emissions intensity of their production could potentially become an additional cost burden in the European market.

The figures are significant. The global aluminum industry averages about 16.5 tons of CO₂e per ton of primary aluminum, but the variance across energy sources is substantial. Aluminum from coal-fired power plants can reach 20–22 tons of CO₂e per ton, while renewables can be as low as 4–6 tons of CO₂e per ton.⁴³ At a carbon price of EUR 60/ton CO₂e, one ton of coal-based aluminum bears a CBAM burden of approximately EUR 960–1,080, while renewable-based aluminum bears approximately EUR 240–360. The difference is not marginal.

Wiridyansyah, in a systematic literature review that explicitly places Indonesia among the most exposed countries, identifies five dimensions of vulnerability: trade competitiveness, industrial vulnerability, access to green technology, climate justice, and policy response capacity.⁴⁴ Indonesia scores poorly across nearly all dimensions. Okoro emphasizes that the CBAM is not merely an environmental instrument;⁴⁵ it redistributes competitiveness from carbon-intensive producers in the Global South toward producers in the Global North or developing countries that have already transitioned, without proportional compensation. Maliszewska et al. found that while aggregate macroeconomic impacts may appear small, impacts on specific sectors and countries can be highly significant, a finding particularly relevant to Indonesia, given the concentration of its smelter investments in high-carbon technologies.⁴⁶

The issue becomes even more significant if the CBAM succeeds and becomes a model. The United States, through the Clean Competition Act proposed in Congress since 2021, and several other jurisdictions are developing similar mechanisms. Magacho et al. warn that the simultaneous adoption of CBAM-like measures across various advanced jurisdictions will exponentially worsen the position of developing economies, as the premium market for low-carbon aluminum narrows further, leaving it accessible only to producers that have already transitioned.⁴⁷ Erdogan refers to this as a “geopolitical tension generator”: CBAM is an environmental policy that simultaneously serves as an instrument for restructuring global supply

42 Jiarui Zhong and Jiansuo Pei, “Carbon Border Adjustment Mechanism: A Systematic Literature Review of the Latest Developments,” *Climate Policy* 24, no. 2 (2023): 1–15, <https://doi.org/10.1080/14693062.2023.2190074>.

43 Guilherme Magacho, Etienne Espagne, and Antoine Godin, “Impacts of the CBAM on EU Trade Partners: Consequences for Developing Countries,” *Climate Policy* 24, no. 2 (2023): 243–59, <https://doi.org/10.1080/14693062.2023.2200758>.

44 Wiridyansyah, “Carbon Border Adjustment Mechanism (CBAM) and Its Implications for Developing Economies: A Systematic Literature Review.”

45 Chiamaka Okoro, “Impact of Carbon Border Adjustment Mechanisms (CBAMS) on the Export Competitiveness of Developing Nations,” *International Journal of Economic Policy* 5, no. 4 (2025): 53–61, <https://doi.org/10.47941/ijecop.3252>.

46 M Maliszewska et al., “Carbon Border Adjustment Mechanism (Cbam) Exposure Indices Methodological Note” (The World Bank, 2025).

47 Magacho, Espagne, and Godin, “Impacts of the CBAM on EU Trade Partners: Consequences for Developing Countries.”

chains, benefiting producers in technologically and financially advanced nations during the energy transition.⁴⁸

This tension is exacerbated by the architecture of Indonesia's own JETP. Indonesia received a USD 20 billion commitment from G7 countries through the 2022 JETP, with a target of a peak electricity sector emissions of 290 Mt CO₂e by 2030 and a 34 percent renewable energy mix.⁴⁹ However, Seiler et al.⁵⁰ and Ordonez et al.⁵¹ highlight significant implementation barriers: regulatory inconsistencies, opposition from the fossil fuel industry, and most critically, the absence of mechanisms to integrate the JETP's electricity sector targets with the energy requirements of smelters built under downstreaming policies. The two policies operate in separate silos: downstreaming is coordinated by the Ministry of Energy and Mineral Resources (ESDM) and the Investment Coordinating Board (BKPM), while the JETP is managed by a task force under the Coordinating Ministry for Maritime Affairs and Investment. Consequently, every new smelter resulting from the downstreaming policy has the potential to add to the emissions burden that must be reduced through the JETP. This is not an administrative inefficiency. It is a fundamental failure of policy synchronization.

This gap takes concrete form at the certification level. The Aluminium Stewardship Initiative (ASI), the leading sectoral ESG standard in the global aluminum industry, requires verification of emissions reductions, responsible energy procurement, and waste management. ASI certification is increasingly becoming a prerequisite for contracts with premium buyers in Europe and North America. Indonesian alumina facilities that use captive coal power struggle to meet these criteria. The result is a sharp market bifurcation: Indonesian alumina and aluminum are competitive only in markets that have not yet adopted strict ESG standards, primarily China itself, while being shut out of European and North American markets, which offer the highest price margins and the most stable long-term demand for low-carbon aluminum.

Contribution: Sovereignty, Standards, and Asymmetries in Green Conditionality

The findings above demand a theoretical reformulation that goes beyond the currently available analytical frameworks. GPN 2.0 has offered significant progress in understanding the agency of non-firm actors and the role of the state in shaping production network configurations.⁵² However, as identified by Fu et al. in their analysis of Sino-German production networks in Jieyang, GPN 2.0 still tends to treat regional assets as pre-existing and relatively stable, while overlooking how these assets are actively reconfigured, and disqualified, by shifts in global standards.⁵³ This paper fills this gap by identifying a specific mechanism that has not yet been adequately conceptualized: the green standard transmission gap (GSTG).

48 Erkan Erdogan, "The Carbon Border Adjustment Mechanism: Opportunities and Challenges for Non-EU Countries," *WTREs Energy and Environment* 14, no. 1 (2025), <https://doi.org/10.1002/wene.70000>.

49 A R Wardhana et al., "Breakthrough on Indonesia's Energy Policy: Adaptive Governance Perspective for Just Energy Transition Partnership (JETP)," *Journal of Physics: Conference Series*, 2024, <https://doi.org/10.1088/1742-6596/2828/1/012001>.

50 Annik Seiler, Hannah Brown, and Matthews Samuel, "The JETPs of South Africa and Indonesia a Blueprint for the Move Away from Coal?," 2023, <https://www.cgdev.org/sites/default/files/jetps-south-africa-and-indonesia-blueprint-move-away-coal.pdf>.

51 Jose A Ordonez et al., "Just Energy Transition Partnerships and the Future of Coal," *Nature Climate Change*, 2024, <https://doi.org/10.1038/s41558-024-02086-z>.

52 Neil M Coe and Henry Wai-chung Yeung, "Global Production Networks: Mapping Recent Conceptual Developments," *Journal of Economic Geography* 19, no. 4 (2019): 775–801, <https://doi.org/10.1093/jeg/lbz018>.

53 Wenying Fu and Kean Fan Lim, "The Constitutive Role of State Structures in Strategic Coupling: On the Formation and Evolution of Sino-German Production Networks in Jieyang, China," *Economic Geography*, 2021, 1–24, <https://doi.org/10.1080/00130095.2021.1985995>.

The GSTG is defined as the structural gap between a host country's exercise of resource sovereignty through regulatory policies and its procedural capacity to align the outcomes of those policies with the emissions, ESG, and sustainability standards embedded in the downstream product markets of its destination. The GSTG is not merely a failure of implementation or a technical capacity gap; it is a predictable product of the sequential logic of resource nationalism that prioritizes the development of production capacity over the decarbonization of that capacity itself. This sequential logic is politically rational: the immediate benefits of smelter development (jobs, foreign exchange, fiscal revenue, nationalist legitimacy) are far more visible and electorally prominent than the medium-term risks of carbon border exposure.

GSTG opens a new dimension in the debate on green extractivism. Andreucci et al. in their analysis of “decarbonization by dispossession” in the nickel case, argue that a capital-driven energy transition structurally reinforces the colonial character of energy provision: it expands the boundaries of transition minerals and the associated dispossession effects, creating concentrated zones of extraction and processing sacrifice in post-colonial nations.⁵⁴ Wijaya et al. deepen this argument through the concept of the “EV-fix” for Indonesia:⁵⁵ where extractive conglomerates reconfigure their interests to benefit from the energy transition, forming new alliances between state capital, domestic conglomerates, politicians, and international battery and EV manufacturers under the nexus of green development and resource nationalism. The findings of this study add a new layer to their argument: this nexus also generates procedural mismatches with green standards that, paradoxically, threaten the sustainability of the nexus itself.

Dunlap and Jakobsen offer a more radical perspective, arguing that green extractivism is fundamentally the exploitation of socio-ecological and climate crises to reinforce existing markets or create new profit opportunities, while mobilizing claims of ecological sustainability to legitimize and rationalize extraction.⁵⁶ From this perspective, the downstream processing of Indonesian bauxite can be read as a more complex version of the same pattern: it claims the benefits of a green transition while operationally reproducing fossil fuel dependency. However, this interpretation needs to be modified for the specific Indonesian context: unlike classical green extractivism, which is entirely driven by transnational capital, Indonesia's downstream processing also contains genuine elements of developmentalist sovereignty, an ambition to capture greater value from national natural resources. This is real agency, not fiction. The issue with “ ” is that this agency operates within a framework of structural conditions that constrain the trajectory of its outcomes.

The specific theoretical contribution offered by this paper is the proposition that resource-rich developing countries practicing resource nationalism in the era of the green transition now face a triple constraint that has not been comprehensively analyzed in the literature: first, pressure from GPN lead firms seeking supply guarantees at competitive prices; second, conditionalities from capital-exporting nations (particularly China) that package investments with specific energy technologies; and third, green conditionalities from export destination markets (particularly the European Union and North America) that require specific emissions profiles for market access. These three constraints operate simultaneously yet often with conflicting

54 Diego Andreucci et al., “The Coloniality of Green Extractivism: Unearthing Decarbonisation by Dispossession through the Case of Nickel,” *Political Geography* 107, no. 107 (2023): 102997, <https://doi.org/10.1016/j.polgeo.2023.102997>.

55 Trissia Wijaya and Lian Sinclair, “An EV-Fix for Indonesia: The Green Development-Resource Nationalist Nexus,” *Environmental Politics* 34, no. 2 (2024): 1–23, <https://doi.org/10.1080/09644016.2024.2332129>.

56 Alexander Dunlap, Judith Verweijen, and Carlos Tornel, “The Political Ecologies of ‘Green’ Extractivism(S): An Introduction,” *Journal of Political Ecology* 31, no. 1 (2024): 436–63, <https://doi.org/10.2458/jpe.6131>.

demands. Success in negotiating the first and second constraints, which Indonesia has achieved through export bans and regulatory lock-in, does not automatically lead to success in negotiating the third constraint. GSTG is the term for the gap between success on the first and second constraints and failure on the third.

From a policy theory perspective, GSTG implies that an effective resource sovereignty regime in the 21st century must be tri-synchronous: synchronizing value-added nationalization policies, technology attraction policies, and decarbonization policies within a single integrated regulatory architecture. A sequential model, building capacity first, then decarbonizing, is no longer viable once carbon border standards are in effect and smelter assets have an economic lifespan of 25–30 years. Every year of delay in this synchronization is a year of investment in carbon lock-in that complicates convergence in the future.

CONCLUSION

This study demonstrates that Indonesia's bauxite downstreaming policy reflects a broader strategy of geoeconomic resource nationalism aimed at strengthening industrial sovereignty and increasing the country's position within the global mineral value chain. Through the Global Production Networks (GPN) 2.0 framework, the article reveals that Indonesia's strategic coupling with foreign capital, particularly Chinese investment and technology, has accelerated refinery development and domestic industrial expansion. However, the findings also show that this industrialization trajectory simultaneously produces structural vulnerabilities, including technological dependence, coal-intensive energy reliance, and increasing exposure to transnational green governance mechanisms such as Carbon Border Adjustment Mechanism (CBAM), ESG certification, and Aluminum Stewardship Initiative (ASI) standards. These dynamics create a contradiction between national industrial ambitions and global sustainability demands, which this article conceptualizes as the "green standard transmission gap" (GSTG).

The study contributes theoretically by expanding debates on GPN, resource nationalism, and green governance through the introduction of GSTG as a conceptual framework for understanding the uneven transmission of environmental standards into resource-based industrialization strategies in developing economies. Empirically, the article contributes to the growing scholarship on critical minerals and energy transition governance by positioning Indonesia's bauxite sector as a strategic case within contemporary geoeconomic competition. The findings highlight that downstream industrialization alone does not automatically guarantee sustainable upgrading if industrial expansion remains dependent on carbon-intensive infrastructures and externally controlled technological systems. At the policy level, the article emphasizes the importance of integrating industrial policy with low-carbon transition planning, renewable energy development, and internationally recognized environmental governance standards to maintain long-term competitiveness in future green markets.

Nevertheless, this study has several limitations. The analysis primarily relies on qualitative policy interpretation and secondary data, limiting the ability to provide detailed quantitative measurement of emissions intensity, industrial efficiency, and comparative lifecycle impacts. In addition, the research focuses mainly on Indonesia's domestic governance structure and does not comprehensively compare the country's experience with other critical mineral-producing economies. Future research should therefore incorporate comparative regional studies, firm-level environmental assessments, and longitudinal analyses of industrial transition pathways to better understand how developing countries can balance resource sovereignty, economic upgrading, and global decarbonization pressures within evolving green production networks.

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