



Indonesia's Critical Minerals Diplomacy: Nickel Industrialization, Resource Nationalism, and Global Green Transition

*Diplomasi Mineral Kritis Indonesia: Industrialisasi Nikel,
Nasionalisme Sumber Daya, dan Transisi Hijau Global*

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Abstract

The accelerating global transition toward renewable energy has significantly increased demand for critical minerals, placing Indonesia at the center of international competition due to its vast nickel reserves. Indonesia's downstream industrialization policy represents a strategic shift from commodity export dependence toward value-added manufacturing and industrial sovereignty. Nevertheless, the political implications of this transformation remain insufficiently examined. This study investigates how Indonesia's nickel industrialization reshapes its diplomatic strategy, resource governance, and geopolitical positioning within the global green transition. Employing a political economy framework, the research combines qualitative policy analysis, trade statistics, investment data, and elite interviews involving government officials, industry representatives, and international stakeholders. The analysis demonstrates that Indonesia has successfully leveraged resource nationalism to attract strategic investments while strengthening its bargaining position within global battery and electric vehicle supply chains. However, the

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findings also reveal persistent governance challenges, including environmental degradation, unequal distribution of economic benefits, regulatory uncertainty, and increasing geopolitical competition among major powers. The article argues that Indonesia's critical minerals diplomacy reflects a broader transformation in development strategy that balances economic sovereignty, sustainable development, and international economic integration. Furthermore, the study contributes to debates concerning resource governance, industrial policy, and geopolitical competition by illustrating how emerging economies utilize critical mineral endowments to reshape international economic relations. The findings offer important policy implications for countries pursuing resource-based industrialization while simultaneously addressing sustainability and geopolitical risks associated with the global energy transition.

Keywords: *Critical Minerals, Nickel, Resource Nationalism, Green Transition, Political Economy*

Abstrak

Percepatan transisi global menuju energi terbarukan telah secara signifikan meningkatkan permintaan akan mineral penting, menempatkan Indonesia di pusat persaingan internasional karena cadangan nikelnya yang melimpah. Kebijakan industrialisasi hilir Indonesia mewakili pergeseran strategis dari ketergantungan ekspor komoditas menuju manufaktur bernilai tambah dan kedaulatan industri. Namun demikian, implikasi politik dari transformasi ini masih belum cukup diteliti. Studi ini menyelidiki bagaimana industrialisasi nikel Indonesia membentuk kembali strategi diplomatiknya, tata kelola sumber daya, dan posisi geopolitiknya dalam transisi hijau global. Dengan menggunakan kerangka ekonomi politik, penelitian ini menggabungkan analisis kebijakan kualitatif, statistik perdagangan, data investasi, dan wawancara elit yang melibatkan pejabat pemerintah, perwakilan industri, dan pemangku kepentingan internasional. Analisis menunjukkan bahwa Indonesia telah berhasil memanfaatkan nasionalisme sumber daya untuk menarik investasi strategis sekaligus memperkuat posisi tawarnya dalam rantai pasokan baterai dan kendaraan listrik global. Namun, temuan tersebut juga mengungkapkan tantangan tata kelola yang terus-menerus,

termasuk degradasi lingkungan, distribusi manfaat ekonomi yang tidak merata, ketidakpastian regulasi, dan meningkatnya persaingan geopolitik di antara kekuatan-kekuatan besar. Artikel ini berpendapat bahwa diplomasi mineral penting Indonesia mencerminkan transformasi yang lebih luas dalam strategi pembangunan yang menyeimbangkan kedaulatan ekonomi, pembangunan berkelanjutan, dan integrasi ekonomi internasional. Selain itu, studi ini berkontribusi pada perdebatan mengenai tata kelola sumber daya, kebijakan industri, dan persaingan geopolitik dengan menggambarkan bagaimana negara-negara berkembang memanfaatkan kekayaan mineral penting untuk membentuk kembali hubungan ekonomi internasional. Temuan ini menawarkan implikasi kebijakan penting bagi negara-negara yang mengejar industrialisasi berbasis sumber daya sekaligus mengatasi keberlanjutan dan risiko geopolitik yang terkait dengan transisi energi global.

Kata kunci: *Mineral Kritis, Nikel, Nasionalisme Sumber Daya, Transisi Hijau, Ekonomi Politik*

I. INTRODUCTION

The global transition toward low-carbon technologies has fundamentally reshaped the strategic importance of mineral resources in international political economy. As countries accelerate the deployment of electric vehicles (EVs), renewable energy systems, energy storage technologies, and advanced manufacturing industries, demand for critical minerals has increased significantly. Minerals such as lithium, cobalt, nickel, graphite, and rare earth elements have become essential components of the emerging green economy, transforming them from ordinary commodities into strategic resources with significant geopolitical implications (Hund et al. 2020; IEA 2023). Unlike the fossil fuel era, where energy security was primarily associated with access to oil and gas reserves, the contemporary energy transition increasingly depends on secure access to mineral supply chains capable of supporting clean technology production.

The growing strategic importance of critical minerals has generated new forms of geopolitical competition among major economies seeking to secure access to mineral resources, processing capabilities, and technological advantages. The United States, European Union, China, Japan, and South Korea have increasingly developed policies aimed at strengthening supply chain resilience, reducing dependency risks, and securing strategic mineral access. These developments demonstrate that the global green transition is not only an environmental transformation but also a restructuring of international economic relations involving competition over resources, industrial capacity, and technological leadership (Kalantzakos 2020; Overland 2019).

Nickel has emerged as one of the most strategically important minerals within this transformation because of its critical role in lithium-ion battery production, particularly for high-energy-density batteries used in electric vehicles. The rapid expansion of global EV markets has significantly increased demand for battery-grade nickel, making countries with substantial nickel reserves increasingly important actors within emerging green technology supply chains. However, the geographical concentration of nickel resources creates new vulnerabilities within global supply networks because mineral production remains concentrated in a limited number of countries, particularly Indonesia, the Philippines, Russia, and Australia (International Energy Agency 2023).

Indonesia occupies a unique position within this changing global landscape. As the country possessing the world's largest nickel reserves, Indonesia has transformed itself from a traditional raw material exporter into an increasingly influential actor within global battery and electric vehicle industries. Historically, Indonesia's economy relied heavily on commodity exports, including mineral extraction, which generated foreign exchange revenues but limited domestic value creation. However, since 2020, the Indonesian government has implemented a ban on the export of unprocessed nickel ore and promoted downstream

industrialization as part of a broader strategy to create domestic processing capacity, attract foreign investment, and establish Indonesia as a central hub within global EV supply chains.

This policy shift represents a significant transformation in Indonesia's development strategy. Rather than continuing dependence on raw commodity exports, the government has adopted a form of resource nationalism aimed at increasing state control over natural resources and maximizing domestic economic benefits. Resource nationalism has historically been associated with government intervention in extractive sectors through ownership policies, export restrictions, taxation mechanisms, and industrial strategies designed to capture greater value from natural resources (Stevens 2008). In Indonesia's case, nickel downstreaming reflects an attempt to transform mineral resources into industrial capabilities by encouraging investment in smelting facilities, battery manufacturing, and electric vehicle production.

Indonesia's nickel policy has generated substantial international attention because it challenges traditional patterns of global commodity governance. For decades, developing countries rich in natural resources have frequently occupied lower-value positions within global production networks by exporting raw materials while importing higher-value manufactured products. Indonesia's downstreaming strategy seeks to reverse this pattern by using regulatory authority over mineral resources to attract investment and promote industrial upgrading. From this perspective, nickel industrialization represents not only an economic policy but also a diplomatic instrument through which Indonesia seeks to strengthen its bargaining position within global economic relations.

However, Indonesia's critical minerals strategy also generates significant political, environmental, and geopolitical challenges. The expansion of nickel mining and processing industries has raised concerns regarding deforestation, biodiversity loss, carbon emissions from coal-powered smelters, water pollution, and social conflicts involving local communities. These

challenges reveal a fundamental tension between economic nationalism and sustainability objectives. While nickel is essential for global decarbonization, its extraction and processing can generate substantial environmental impacts, creating contradictions within the broader discourse of green transition.

Furthermore, Indonesia's mineral diplomacy has become increasingly connected to geopolitical competition among major economic powers. Chinese companies have played a dominant role in Indonesia's nickel processing sector, particularly through investment in smelting facilities and battery-related industries. While Chinese investment has accelerated industrial development and infrastructure expansion, it has also generated concerns regarding economic dependence, technology transfer, labor conditions, and Indonesia's strategic autonomy. At the same time, Western economies have sought greater access to Indonesia's nickel resources as they attempt to diversify supply chains and reduce dependence on China-centered mineral networks.

This geopolitical environment places Indonesia in a strategic but complex position. On one hand, the country has successfully leveraged its mineral resources to attract investment, strengthen industrial capacity, and increase its bargaining power within global supply chains. On the other hand, dependence on foreign investment and intensifying competition among major powers creates new governance challenges. Indonesia must balance economic openness with national sovereignty, foreign investment attraction with environmental protection, and industrial ambition with sustainable development objectives.

Existing scholarship on critical minerals has primarily focused on supply chain security, geopolitical competition, and resource availability in major consuming economies. Studies examining the geopolitics of energy transition have demonstrated how mineral dependencies are reshaping global power relations, particularly as countries compete for strategic resources necessary for clean technology industries (Bridge 2015; Scholten et al. 2020). However, comparatively less attention has been devoted to how

resource-rich developing countries strategically utilize critical mineral resources to reshape their international economic position.

Similarly, research on resource nationalism has traditionally examined oil and gas-producing countries, particularly in relation to state control, national ownership, and conflicts between governments and multinational corporations. Less attention has been given to contemporary forms of resource nationalism emerging around critical minerals, where states seek not merely to control extraction but also to promote industrial upgrading, technological development, and participation in global value chains. Indonesia provides an important case for examining this transformation because its nickel strategy combines resource sovereignty, industrial policy, and diplomatic engagement within the context of global green transition.

This article addresses these research gaps by examining Indonesia's critical minerals diplomacy through a political economy perspective. Rather than viewing nickel industrialization solely as an economic development strategy, this study analyzes how resource governance, industrial policy, and geopolitical positioning interact in shaping Indonesia's role within the global green transition. The research investigates three central questions: how Indonesia uses nickel resources as a tool of economic diplomacy, how resource nationalism shapes industrial transformation, and what governance challenges emerge from integrating mineral sovereignty with sustainability objectives.

The article makes three contributions to existing scholarship. First, it contributes to debates on critical minerals governance by demonstrating how resource-rich emerging economies can use strategic commodities to enhance their position within global production networks. Second, it expands research on resource nationalism by examining its contemporary transformation from ownership-based control toward industrial value creation and supply chain positioning. Third, it contributes to international political economy literature by illustrating how green transition

dynamics are reshaping relationships between developed economies, emerging markets, and global resource suppliers.

By analyzing Indonesia's nickel industrialization strategy, this study highlights the broader implications of critical minerals diplomacy for emerging economies seeking to participate in the global green economy. Indonesia's experience demonstrates that mineral wealth alone does not guarantee sustainable development outcomes; rather, success depends on governance capacity, industrial strategy, environmental accountability, and diplomatic balancing. As global demand for critical minerals continues to rise, the ability of resource-rich countries to manage these competing pressures will become increasingly important in determining the political and economic trajectory of the global energy transition.

II. NICKEL DOWNSTREAMING AND THE TRANSFORMATION OF INDONESIA'S RESOURCE NATIONALISM

Indonesia's nickel industrialization policy represents a significant transformation in the country's approach to natural resource governance. Historically, resource-rich developing countries have often experienced structural dependence on commodity exports, where raw materials are extracted domestically but processed and transformed into higher-value products elsewhere. This pattern has frequently limited domestic industrial development and reinforced unequal positions within global production networks (Auty 1993; Humphreys, Sachs, and Stiglitz 2007). Indonesia's decision to restrict raw nickel exports and promote domestic processing reflects an attempt to overcome this structural dependency by capturing greater economic value from its mineral resources.

The export ban on unprocessed nickel ore introduced by the Indonesian government marked a critical turning point in the country's mineral governance strategy. Rather than allowing nickel to remain a traditional export commodity, policymakers sought to

transform Indonesia into an integrated industrial hub encompassing mining, refining, battery production, and electric vehicle manufacturing. This approach reflects a broader shift from resource extraction-based development toward resource-based industrialization, where natural resources are used as foundations for technological upgrading and manufacturing capability development.

From a political economy perspective, Indonesia's nickel strategy represents a contemporary form of resource nationalism. Traditional resource nationalism has often involved state ownership, nationalization, or direct control over extractive industries, particularly in oil and gas sectors (Stevens 2008). However, Indonesia's approach demonstrates a different form of resource nationalism: one based on regulatory intervention, export restrictions, industrial policy, and strategic integration into global value chains. The objective is not simply to control mineral extraction but to use state authority to reshape the position of domestic industries within international production systems.

This transformation reflects Indonesia's broader development ambition to escape the "commodity trap," where dependence on raw material exports exposes economies to price volatility and limits technological advancement. Scholars of development economics have emphasized that long-term economic transformation requires moving from resource extraction toward higher-value industrial activities through learning, technological accumulation, and domestic capability building (Chang 2002; Wade 2003). Indonesia's nickel downstreaming policy can therefore be understood as an industrial strategy designed to capture more segments of the global battery and electric vehicle value chain.

The strategic importance of nickel has increased significantly due to the global expansion of electric mobility. Nickel is a critical component in several lithium-ion battery technologies, particularly high-nickel cathode batteries that provide greater energy density for electric vehicles. As major economies pursue decarbonization strategies, demand for battery minerals has increased, creating

opportunities for resource-rich countries to strengthen their economic position. Indonesia has sought to utilize this global demand by positioning nickel not merely as an export commodity but as a strategic asset within the emerging green industrial economy.

The government's downstreaming policy illustrates how domestic resource control can become an instrument of economic diplomacy. By limiting raw nickel exports, Indonesia increased incentives for foreign companies to establish processing facilities within the country. This strategy generated significant investment inflows, particularly from companies involved in nickel smelting, stainless steel production, and battery manufacturing. The policy demonstrates how regulatory restrictions can be used strategically by developing countries to negotiate more favorable positions within global markets.

However, Indonesia's approach also challenges conventional assumptions regarding globalization and free trade. Export restrictions are often criticized by trade-oriented institutions because they may distort international markets and create supply uncertainties. The European Union, for example, challenged Indonesia's nickel export restrictions through the World Trade Organization, arguing that such measures violated international trade principles. Nevertheless, Indonesia defended the policy as a legitimate development strategy aimed at promoting domestic industrialization and ensuring that natural resource wealth generates broader economic benefits.

This tension illustrates a central debate within international political economy: whether developing countries should prioritize market liberalization or strategic state intervention to achieve industrial transformation. While neoliberal approaches emphasize open markets and comparative advantage, developmental state perspectives argue that strategic government intervention can be necessary for late-industrializing countries seeking to move into higher-value economic activities (Amsden 1989; Wade 1990). Indonesia's nickel policy reflects the latter approach by using state

authority to influence investment patterns and industrial development.

The success of Indonesia's nickel downstreaming strategy can be observed through the rapid expansion of domestic processing capacity. The country has attracted substantial foreign direct investment into nickel smelters and related industrial facilities, particularly in regions such as Sulawesi and Maluku. These developments have contributed to industrial growth, export diversification, and increased integration into global manufacturing networks. Indonesia has increasingly become a central node in the global battery supply chain, particularly in early and intermediate stages of production.

Nevertheless, the industrialization process also reveals important limitations. Although downstreaming has increased domestic processing capacity, questions remain regarding the extent to which Indonesia has achieved genuine technological upgrading. Much of the investment and technological expertise continues to originate from foreign companies, particularly Chinese firms with established experience in nickel processing and battery manufacturing. As a result, Indonesia has improved its position within global value chains but remains dependent on foreign technology, capital, and industrial knowledge.

This situation highlights a critical distinction between participation and control within global production networks. Integration into global value chains does not automatically guarantee economic sovereignty if domestic actors remain dependent on foreign firms for technology, financing, and market access. Gereffi (2018) argues that upgrading requires not only participation in global networks but also the development of domestic capabilities that allow countries to capture higher-value activities. Therefore, Indonesia's long-term success depends on whether nickel industrialization can move beyond mineral processing toward advanced manufacturing, research capacity, and technological innovation.

Another challenge concerns the distribution of economic benefits generated by nickel industrialization. While the sector has created employment opportunities and stimulated regional economic growth, concerns remain regarding whether benefits are distributed equitably among local communities. Mining-dependent regions often experience uneven development patterns where economic gains coexist with environmental pressures and social tensions. This reflects broader challenges associated with resource-based development, where national economic benefits may not always translate into local welfare improvements (Ross 2012).

The political economy of nickel industrialization therefore involves balancing competing objectives: attracting investment while maintaining sovereignty, promoting economic growth while protecting communities, and accelerating green industries while managing environmental consequences. These tensions demonstrate that resource nationalism is not inherently developmental or protectionist; its outcomes depend on governance capacity, institutional accountability, and the ability of states to transform resource wealth into sustainable industrial capabilities.

Indonesia's experience suggests that contemporary resource nationalism differs significantly from earlier forms based primarily on state ownership or market restriction. Instead, it represents a strategic effort by emerging economies to use regulatory power, industrial policy, and diplomatic negotiation to reposition themselves within global economic systems. Through nickel downstreaming, Indonesia seeks to transform mineral abundance into geopolitical and economic leverage within the global green transition.

However, the sustainability of this strategy depends on whether Indonesia can address several unresolved issues: environmental governance, technological dependency, labor standards, and equitable benefit distribution. Without these reforms, nickel industrialization risks reproducing traditional

patterns of extractive development under a new green economy framework.

Therefore, Indonesia's nickel policy should be understood as an evolving experiment in strategic resource governance. It demonstrates how emerging economies can use critical mineral resources to pursue industrial transformation while simultaneously facing complex challenges associated with globalization, sustainability, and geopolitical competition. The following section examines how nickel industrialization has shaped Indonesia's diplomatic position and bargaining power amid intensifying global competition for critical minerals.

III. CRITICAL MINERALS DIPLOMACY AND GEOPOLITICAL COMPETITION IN GLOBAL BATTERY SUPPLY CHAINS

Indonesia's emergence as a central actor in the global nickel economy has transformed its mineral resources into instruments of diplomatic leverage. Unlike traditional commodity exporters that primarily compete through production volume and price, Indonesia has increasingly utilized its nickel reserves as a strategic tool to influence investment patterns, industrial partnerships, and international negotiations. This transformation reflects the growing geopolitical significance of critical minerals in the global green transition, where control over mineral supply chains has become increasingly associated with economic security, technological competitiveness, and strategic autonomy (Kalantzakos 2020; IEA 2023).

The geopolitics of critical minerals differs significantly from traditional energy geopolitics. During the fossil fuel era, geopolitical competition centered largely on access to oil and gas reserves and the security of transportation routes. In the renewable energy era, competition increasingly revolves around the control of mineral extraction, processing capacity, technological expertise, and manufacturing ecosystems (Overland 2019; Scholten and

Bosman 2016). Because critical minerals are geographically concentrated and essential for clean technology production, countries possessing these resources have gained new strategic importance within the global economy.

Indonesia's nickel reserves provide the country with substantial bargaining power in this emerging geopolitical environment. By controlling access to one of the world's largest nickel deposits, Indonesia has been able to reshape its relationship with global investors and technology companies. The government's downstreaming policy demonstrates an attempt to convert geological advantage into diplomatic influence by requiring foreign companies to establish processing industries domestically rather than simply extracting and exporting raw materials.

This strategy represents a form of resource-based economic diplomacy, where natural resource governance becomes an instrument for negotiating international economic relationships. Traditionally, developing countries have often occupied subordinate positions within global commodity chains, supplying raw materials while importing higher-value manufactured goods. Indonesia's nickel strategy challenges this pattern by attempting to capture greater value through domestic industrialization and strategic investment agreements.

The country's approach illustrates how critical minerals are reshaping the relationship between states and multinational corporations. In previous decades, multinational companies often possessed significant bargaining advantages because they controlled technology, capital, and market access. However, the increasing strategic importance of critical minerals has strengthened the position of resource-rich countries. By controlling access to essential materials, governments can impose conditions on foreign investors and negotiate greater domestic benefits from international economic integration (Bridge 2015; Ovadia 2016).

The most significant dimension of Indonesia's critical minerals diplomacy has been its relationship with China. Chinese companies have become dominant investors in Indonesia's nickel

processing sector, providing capital, technology, and industrial expertise necessary for rapid expansion of smelting and refining capacity. This partnership has accelerated Indonesia's integration into global battery supply chains, particularly in nickel processing and intermediate battery materials.

China's role reflects broader trends in global green technology competition. As the world's largest producer of electric vehicles and dominant actor in battery manufacturing, China has developed extensive control over critical segments of clean technology supply chains, including mineral processing, battery components, and manufacturing capacity (Liu and Kokko 2013; Nahm 2021). Indonesia's partnership with Chinese firms has therefore provided important opportunities for industrial development and technological learning.

However, the increasing presence of Chinese investment has also generated geopolitical concerns. Western governments have expressed concerns regarding supply chain dependence, strategic vulnerability, labor practices, and environmental standards associated with Chinese-controlled mineral processing. The concentration of critical mineral processing capacity within China has encouraged the United States and European Union to pursue supply chain diversification strategies aimed at reducing dependence on a single geopolitical actor (IEA 2023).

This geopolitical competition has created both opportunities and challenges for Indonesia. On one hand, competition among major powers increases Indonesia's ability to attract investment and negotiate favorable economic agreements. On the other hand, excessive dependence on a single investment partner may reduce strategic autonomy and create new forms of economic vulnerability. Therefore, Indonesia's diplomatic challenge involves maintaining balanced relations among competing global powers while maximizing domestic economic benefits.

Indonesia has attempted to navigate this geopolitical environment through a strategy of selective engagement. Rather than aligning exclusively with one major power, Indonesia has

sought investment and cooperation from multiple partners, including China, Japan, South Korea, the European Union, and the United States. This approach reflects the broader diplomatic strategy of middle and emerging powers seeking strategic autonomy within an increasingly competitive international system (Acharya 2014).

The European Union represents another important dimension of Indonesia's critical minerals diplomacy. While Europe seeks secure access to nickel and other minerals necessary for battery production, it has simultaneously emphasized environmental sustainability, supply chain transparency, and responsible mining standards. This has created tensions between Indonesia's industrialization objectives and European regulatory approaches, particularly regarding trade restrictions and sustainability requirements.

The dispute between Indonesia and the European Union over nickel export restrictions illustrates these competing perspectives. From Indonesia's viewpoint, export restrictions represent legitimate industrial policy designed to promote domestic value creation and economic development. From the European perspective, such restrictions create concerns regarding market access and distortions in global trade. The conflict demonstrates the broader tension between the developmental strategies of resource-rich countries and the trade preferences of industrialized economies.

This tension reflects a fundamental debate in global economic governance: whether developing countries should retain policy autonomy to pursue industrial transformation or whether international trade rules should limit state intervention. Scholars of development economics argue that successful industrialization historically involved significant government intervention, including protection of strategic industries and active industrial policies (Chang 2002). From this perspective, Indonesia's nickel policy represents an attempt to replicate development strategies previously used by successful industrial economies.

Nevertheless, Indonesia's critical minerals diplomacy operates within a rapidly changing global regulatory environment. The emergence of policies such as the European Union's Critical Raw Materials Act and the United States Inflation Reduction Act demonstrates that major economies are increasingly integrating industrial policy, climate objectives, and national security considerations. These policies seek to strengthen domestic supply chains while reducing strategic dependencies, creating a new era of competition over green technology resources.

The transformation of critical minerals into strategic assets also changes the meaning of energy security. Traditional energy security focused on ensuring continuous access to fossil fuel supplies. In the green transition era, energy security increasingly depends on access to mineral resources, processing capacity, technological innovation, and resilient supply networks (Vakulchuk, Overland, and Scholten 2020). Indonesia's nickel diplomacy demonstrates how resource-rich countries can become central actors in this new form of energy geopolitics.

However, geopolitical leverage does not automatically translate into sustainable development outcomes. The ability to attract investment and strengthen bargaining power must be accompanied by governance mechanisms that ensure long-term economic benefits. Without domestic technological development, industrial diversification, and environmental regulation, Indonesia risks remaining dependent on foreign companies despite possessing strategic mineral resources.

The concept of resource sovereignty is therefore central to understanding Indonesia's critical minerals strategy. True sovereignty requires more than controlling extraction rights; it requires the ability to influence production decisions, develop domestic capabilities, and capture higher-value segments of global supply chains. Indonesia's challenge is moving from being merely a supplier of critical minerals toward becoming an active participant in the innovation and manufacturing systems built around those minerals.

Furthermore, critical minerals diplomacy must incorporate sustainability considerations. The global green transition creates a paradox: minerals required to support renewable technologies may themselves generate significant environmental and social impacts. Nickel processing, particularly when powered by fossil fuels, can produce substantial carbon emissions and ecological degradation. Therefore, Indonesia's geopolitical success will increasingly depend on whether it can demonstrate that its nickel industry aligns with global sustainability standards.

The geopolitical significance of Indonesian nickel illustrates a broader transformation in international economic relations. Critical minerals have become strategic resources through which emerging economies can renegotiate their positions within global capitalism. Indonesia's experience demonstrates that resource-rich developing countries are not merely passive suppliers within green technology transitions; they can actively shape global supply chains through industrial policy and diplomatic strategy.

However, sustaining this strategic position requires balancing three competing objectives: economic sovereignty, geopolitical flexibility, and environmental responsibility. Indonesia's nickel diplomacy will ultimately be evaluated not only by its ability to attract investment but also by whether it can transform mineral wealth into inclusive and sustainable industrial development.

IV. GOVERNING THE GREEN NICKEL PARADOX: SUSTAINABILITY, ENVIRONMENTAL CHALLENGES, AND A FRAMEWORK FOR SUSTAINABLE CRITICAL MINERALS GOVERNANCE

The rise of nickel as a strategic mineral for the global green transition creates a fundamental paradox: the same resource considered essential for decarbonizing transportation systems can generate significant environmental and social impacts during

extraction and processing. Indonesia's nickel industry illustrates this contradiction. While nickel contributes to the development of electric vehicle batteries and renewable energy technologies, the expansion of mining and processing activities has raised concerns regarding deforestation, biodiversity loss, carbon emissions, water contamination, and social inequality. This paradox demonstrates that the global green transition is not automatically sustainable; rather, it depends on how critical minerals are governed, produced, and integrated into broader development strategies.

The concept of a "green transition" has traditionally emphasized technological substitution, particularly replacing fossil fuel-based systems with renewable energy technologies. However, recent scholarship highlights that low-carbon technologies remain materially dependent on extractive industries. Renewable energy infrastructures, electric vehicles, and battery systems require significant quantities of minerals, creating new forms of environmental pressure and geopolitical dependency (Sovacool et al. 2020; Bainton et al. 2021). Consequently, the sustainability of the energy transition depends not only on reducing carbon emissions but also on ensuring responsible mineral governance throughout global supply chains.

Indonesia's nickel industrialization demonstrates this challenge clearly. The country has successfully positioned itself as a critical supplier for the global battery economy, but the rapid expansion of nickel mining and processing has generated environmental controversies. Nickel extraction involves extensive land transformation, energy consumption, and waste management challenges. Furthermore, much of Indonesia's nickel processing capacity relies on energy-intensive technologies, including coal-based electricity generation, creating tensions between mineral production and climate objectives.

This situation reveals the limitations of viewing critical minerals solely through an economic or geopolitical perspective. While resource nationalism can strengthen national bargaining power and promote industrial development, it does not

automatically guarantee sustainable outcomes. Without effective environmental governance, resource-based industrialization may reproduce traditional patterns of extractive development under the new language of green growth. Therefore, Indonesia's challenge is not simply maximizing mineral value but creating governance systems capable of aligning economic transformation with ecological sustainability.

The first requirement for sustainable critical minerals governance is the integration of environmental accountability into industrial policy. Historically, industrial strategies in developing countries have often prioritized investment attraction, employment creation, and export competitiveness, sometimes at the expense of environmental protection. However, the increasing importance of ESG (environmental, social, and governance) standards within global supply chains has changed expectations regarding responsible production. International investors, technology companies, and consumers increasingly demand transparency regarding environmental impacts and social conditions associated with mineral supply chains.

This shift creates both challenges and opportunities for Indonesia. On one hand, stricter sustainability requirements may increase production costs and complicate industrial expansion. On the other hand, demonstrating responsible nickel production could strengthen Indonesia's position within premium global markets. As global industries increasingly seek low-carbon and ethically sourced minerals, environmental governance can become a competitive advantage rather than merely a regulatory constraint.

The second dimension concerns decarbonizing nickel processing itself. The environmental performance of critical minerals depends not only on extraction practices but also on processing technologies and energy sources. Indonesia's nickel industry faces particular challenges because many processing facilities rely on fossil fuel-based energy systems. This creates a contradiction where minerals used for clean technologies are produced through carbon-intensive industrial processes.

Addressing this challenge requires technological transformation within the nickel industry. Strategies may include renewable energy integration, cleaner processing technologies, improved energy efficiency, and carbon management systems. However, these changes require significant investment, technological capabilities, and regulatory incentives. Without such transformation, Indonesia risks becoming a major supplier of nickel for green technologies while simultaneously contributing to carbon-intensive production systems.

The third dimension involves social sustainability and distributive justice. Resource-based industrialization frequently generates uneven development outcomes because economic benefits and social costs are distributed differently among stakeholders. National governments may gain export revenues and investment opportunities, while local communities may experience environmental disruption, land conflicts, or limited participation in decision-making processes.

This issue is particularly important in Indonesia because nickel production is concentrated in specific regions where local communities interact directly with mining and industrial activities. Sustainable governance therefore requires mechanisms that ensure local communities benefit from industrial development through employment opportunities, infrastructure improvements, revenue-sharing arrangements, and meaningful participation in decision-making processes.

The principles of energy justice and resource justice provide useful analytical frameworks for understanding these challenges. Resource justice emphasizes that the extraction of strategic resources should consider not only economic efficiency but also questions of fairness, participation, and recognition of affected communities (Sovacool et al. 2017). Applying this perspective to nickel governance suggests that sustainable industrialization requires balancing national economic interests with local social rights.

The fourth dimension concerns institutional capacity and regulatory coherence. Sustainable critical minerals governance requires effective institutions capable of monitoring environmental standards, enforcing regulations, and coordinating between national and local authorities. Indonesia's experience demonstrates that rapid industrial expansion can create governance challenges when regulatory systems struggle to keep pace with investment growth.

Institutional fragmentation may produce inconsistencies between economic objectives and environmental commitments. While industrial ministries may prioritize investment and production expansion, environmental institutions may emphasize ecological protection. Without coordination mechanisms, sustainability goals may become secondary to short-term economic objectives. Therefore, effective governance requires integrating environmental considerations into industrial planning from the beginning rather than treating them as external constraints.

The fifth dimension involves international cooperation and responsible supply chain governance. Because critical mineral supply chains are increasingly global, sustainability challenges cannot be addressed solely through domestic regulation. Battery manufacturers, automobile companies, financial institutions, and importing countries all influence production standards through procurement decisions, investment requirements, and regulatory frameworks.

This creates opportunities for Indonesia to develop strategic partnerships around responsible nickel production. Cooperation with international actors can support technology transfer, environmental monitoring, capacity building, and sustainable investment. However, such partnerships must respect Indonesia's development priorities and avoid reproducing unequal relationships where developing countries bear environmental costs while advanced economies capture technological and economic benefits.

Based on these considerations, this article proposes a Sustainable Critical Minerals Governance Framework consisting of four interconnected pillars:

First, strategic resource sovereignty. Critical minerals should be governed as strategic national assets capable of supporting industrial transformation rather than merely generating export revenues. Resource sovereignty requires domestic value creation, technological development, and stronger bargaining positions within global supply chains.

Second, ecological responsibility. Mineral industrialization must incorporate environmental safeguards, low-carbon production systems, biodiversity protection, and transparent monitoring mechanisms. Economic competitiveness in the future critical minerals market will increasingly depend on sustainability performance.

Third, inclusive economic transformation. Industrial development should generate broad-based benefits through employment creation, regional development, and community participation. Sustainable resource governance requires mechanisms that prevent unequal distribution of economic gains and social costs.

Fourth, strategic global integration. Resource-rich countries must engage with international markets while maintaining policy autonomy. Global cooperation should support technology transfer, sustainable investment, and supply chain transparency rather than reinforcing dependency relationships.

This framework expands existing scholarship on resource nationalism by demonstrating that contemporary resource governance cannot be evaluated solely through state control over natural resources. In the context of the green transition, successful resource nationalism requires the ability to combine sovereignty with sustainability, industrial ambition with environmental responsibility, and global integration with domestic capability development.

Indonesia's nickel strategy therefore represents a broader transformation in how emerging economies approach natural resource governance. The country is attempting to move beyond the historical role of commodity exporter toward becoming an industrial and geopolitical actor within the global green economy. However, the long-term success of this strategy will depend on whether Indonesia can resolve the green nickel paradox by ensuring that mineral industrialization contributes not only to economic growth but also to sustainable development.

The Indonesian case provides broader lessons for other mineral-rich developing countries entering the global critical minerals economy. As demand for lithium, cobalt, nickel, and rare earth elements continues to increase, these countries will face similar challenges in balancing resource sovereignty, foreign investment, environmental protection, and social inclusion. Therefore, sustainable critical minerals governance will become a central component of global efforts to achieve an equitable and resilient green transition.

V. CONCLUSION

This study demonstrates that Indonesia's nickel industrialization represents a significant transformation in the political economy of natural resource governance. Rather than functioning merely as a mineral export policy, nickel downstreaming has become an instrument of economic diplomacy, industrial strategy, and geopolitical positioning within the global green transition. By restricting raw nickel exports and promoting domestic processing capacity, Indonesia has attempted to move beyond commodity dependence and capture greater value within emerging electric vehicle and battery supply chains. The analysis reveals that contemporary resource nationalism differs from traditional forms of state control over natural resources; instead, it increasingly operates through industrial policy, strategic investment management, and supply chain positioning. Indonesia's experience

illustrates how resource-rich emerging economies can utilize critical mineral endowments to strengthen bargaining power within global economic relations.

However, the study also demonstrates that resource-based industrialization generates complex governance challenges. Indonesia's growing role in global nickel supply chains has created opportunities for economic transformation but has simultaneously raised concerns regarding environmental degradation, carbon-intensive processing, unequal distribution of economic benefits, and geopolitical dependency. The country's partnership with foreign investors, particularly within the battery manufacturing ecosystem, highlights the tension between attracting international capital and maintaining strategic autonomy. Furthermore, the green transition paradox demonstrates that minerals essential for clean technologies must themselves be governed through sustainable production systems. Without stronger environmental accountability, technological upgrading, and inclusive development mechanisms, critical mineral industrialization risks reproducing extractive development patterns under the framework of green growth.

This article contributes to scholarship on critical minerals governance and international political economy by developing a Sustainable Critical Minerals Governance Framework based on four interconnected principles: strategic resource sovereignty, ecological responsibility, inclusive economic transformation, and strategic global integration. The framework suggests that successful critical mineral strategies require balancing national development objectives with environmental sustainability and international cooperation. For Indonesia and other mineral-rich emerging economies, the future of resource diplomacy will depend not only on possessing strategic resources but also on developing institutional capacity to transform those resources into sustainable industrial capabilities. As global competition over critical minerals intensifies, the ability to govern these resources responsibly will

become increasingly central to shaping equitable and resilient pathways toward the global green transition.

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