



Nickel Downstreaming and the Question of “For Whom?”: Unpacking the Ecological and Social Burdens of Indonesia’s Energy Transition in North Maluku

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Abstract

Indonesia’s nickel downstreaming strategy has been promoted as a cornerstone of the country’s green industrialization and electric vehicle transition. Yet the expansion of nickel mining and processing in North Maluku raises a fundamental question: who benefits from the economic value generated by the global battery economy, and who bears its environmental and social costs? Focusing on Obi Island and Kawasi, this article examines the unequal distribution of ecological risks associated with nickel extraction, processing, and industrial development. Particular attention is given to water and soil pollution, landscape transformation, displacement, relocation, and the disruption of local livelihoods. The article further investigates how the language of critical minerals and energy transition can obscure the experiences of communities living at the extraction frontier. By placing Kawasi within a broader political-ecological framework, the study explores how value is accumulated across national and global supply chains while environmental burdens remain concentrated in local communities. It argues that an energy transition cannot be considered just merely because its end products are associated with low-carbon technologies. Rather, justice requires attention to the conditions under which minerals are extracted, the distribution of benefits and risks, and the rights of affected communities to participate meaningfully in decisions concerning their territories.

[Strategi hilirisasi nikel Indonesia telah dipromosikan sebagai landasan industrialisasi hijau dan transisi kendaraan listrik negara. Namun, perluasan penambangan dan pengolahan nikel di Maluku Utara menimbulkan pertanyaan mendasar: siapa yang mendapat manfaat dari nilai ekonomi yang dihasilkan oleh ekonomi baterai global, dan siapa yang menanggung biaya lingkungan dan sosialnya? Dengan berfokus pada Pulau Obi dan Kawasi,



artikel ini meneliti distribusi risiko ekologis yang tidak merata yang terkait dengan ekstraksi, pengolahan, dan pengembangan industri nikel. Perhatian khusus diberikan pada polusi air dan tanah, transformasi lanskap, penggusuran, relokasi, dan gangguan mata pencaharian lokal. Artikel ini selanjutnya menyelidiki bagaimana bahasa mineral kritis dan transisi energi dapat mengaburkan pengalaman masyarakat yang tinggal di perbatasan ekstraksi. Dengan menempatkan Kawasi dalam kerangka politik-ekologis yang lebih luas, studi ini mengeksplorasi bagaimana nilai terakumulasi di seluruh rantai pasokan nasional dan global sementara beban lingkungan tetap terkonsentrasi di masyarakat lokal. Artikel ini berpendapat bahwa transisi energi tidak dapat dianggap hanya karena produk akhirnya dikaitkan dengan teknologi rendah karbon. Sebaliknya, keadilan menuntut perhatian pada kondisi di mana mineral diekstraksi, distribusi manfaat dan risiko, serta hak masyarakat yang terdampak untuk berpartisipasi secara bermakna dalam pengambilan keputusan yang menyangkut wilayah mereka.]

Keywords: nickel downstreaming, energy transition, environmental justice, Kawasi, North Maluku

Introduction

The global energy transition is transforming the political and economic significance of mineral resources. The shift from fossil-fuel-intensive energy systems toward electrification, renewable energy, energy storage, and electric mobility requires large quantities of minerals and metals, including lithium, cobalt, copper, graphite, manganese, rare earth elements, and nickel. The International Energy Agency (IEA) identifies nickel as one of the minerals whose demand is increasingly connected to clean-energy technologies, particularly electric vehicle batteries and energy storage (IEA 2024; IEA 2025). In the International Energy Agency's 2025 outlook, global nickel demand is projected to continue increasing, while production and refining remain geographically concentrated. Indonesia occupies a particularly important position in this emerging mineral geography because its rapid expansion of mining and processing has made the country the dominant global producer of mined nickel and an increasingly important center of refined nickel production (IEA 2025; USGS 2025).

The increasing importance of nickel is closely connected to a broader transformation in the political economy of decarbonization. Critical minerals are increasingly described as strategic resources because access to them is considered essential for the deployment of low-carbon technologies and for national economic and geopolitical security. The United Nations Secretary-General's Panel on Critical Energy Transition Minerals has emphasized that minerals such as nickel are indispensable to the energy transition but has simultaneously warned that the transition could reproduce existing patterns of inequality if mineral-rich countries

and local communities do not receive an equitable share of the benefits (United Nations 2024).

This tension is particularly visible in Indonesia. Over the past decade, Indonesia has transformed its nickel sector from a predominantly extractive and export-oriented industry into a major industrial processing complex. The country's downstreaming strategy, commonly referred to as *hilirisasi*, seeks to capture greater domestic value by limiting the export of raw minerals and requiring or encouraging domestic processing. The policy has been central to Indonesia's broader resource-nationalist development strategy. The 2009 Mining Law and subsequent regulations established the institutional basis for domestic mineral processing, while the 2020 ban on exports of nickel ore intensified investment in smelting and refining capacity. The policy has generated significant foreign investment and transformed Indonesia's role in global nickel supply chains (Warburton 2017; Warburton 2023). The World Trade Organization's dispute settlement process confirms that Indonesia's policy included both an export prohibition on nickel ore and domestic processing requirements, measures that were challenged by the European Union under the General Agreement on Tariffs and Trade (WTO 2022).

From the perspective of national economic policy, the logic of downstreaming is compelling. Exporting raw ore captures relatively little value compared with processing and manufacturing. Domestic processing can potentially create employment, infrastructure, tax revenues, technological capabilities, industrial linkages, and opportunities for participation in higher-value segments of global production. Recent research on North Maluku suggests that nickel downstreaming has generated substantial regional economic linkages and that further integration into electric-vehicle and battery-related industries could potentially increase regional economic benefits (Herawan and Susilo 2024). Similarly, research on sustainable and equitable downstreaming has argued that Indonesia's policy can produce substantial economic gains but requires institutional reforms to ensure that producing regions and communities receive more meaningful benefits (Lahadalia et al. 2024).

However, the economic success of downstreaming does not automatically establish its social or ecological legitimacy. The central problem addressed by this article is therefore not whether nickel downstreaming produces economic value. It clearly does. The more difficult question is how that value is distributed, whose interests define development priorities, whose knowledge is recognized, and where the ecological costs of industrialization are concentrated.

This question becomes particularly important in North Maluku, one of Indonesia's major nickel-producing regions. North Maluku contains some of the country's most important nickel extraction and processing zones, including the industrial complex associated with Weda Bay on Halmahera and the Harita Nickel complex on Obi Island. In these areas, mineral extraction is not an abstract economic activity. It directly transforms forests, rivers, wetlands, agricultural land, coastal ecosystems, fisheries, and settlements. The transformation also affects social

relations by altering land tenure, employment patterns, local livelihoods, access to water, and decisions concerning relocation.

Kawasi Village on Obi Island provides an especially revealing case. Scientific research conducted in the Kawasi wetland has documented the accumulation of chromium and nickel in local macrophytes and found that surface runoff from areas of serpentine soil affected by nickel mining contained dissolved chromium and nickel (Amin et al. 2015). Earlier research on drinking water in Kawasi also identified potential health risks associated with exposure to nickel and lead, based on a cross-sectional assessment involving 984 respondents (Hartono et al. 2018). These studies are important because they demonstrate that environmental concerns surrounding Kawasi are not simply recent activist claims; environmental contamination and exposure risks have been objects of scientific investigation for more than a decade.

At the same time, the social geography of Kawasi has been transformed by the expansion of mining. Local reporting and civil-society documentation have described declining access to agricultural land and coastal resources, pollution of rivers and marine environments, and pressure toward relocation. More recent documentation has focused on the development of a new settlement, often referred to as the “EcoVillage,” and disagreements concerning whether relocation is genuinely voluntary and whether the new settlement adequately reproduces the social, economic, cultural, and ecological conditions of the original village.

These developments expose a contradiction at the heart of the contemporary energy transition. Nickel from Obi Island may ultimately become part of a global supply chain associated with electric vehicles and low-carbon technologies. At the point of final consumption, the material can therefore be represented as part of the solution to climate change. Yet at the point of extraction and processing, the same mineral may be associated with deforestation, water contamination, altered landscapes, industrial emissions, displacement, livelihood disruption, and conflicts over land and political participation.

This contradiction does not mean that electric vehicles or the energy transition are inherently undesirable. Nor does it imply that all nickel mining should necessarily be rejected. Such a conclusion would oversimplify the problem. Instead, the contradiction requires a more sophisticated understanding of what a just energy transition means. If decarbonization depends on mineral extraction, then justice must extend upstream to the territories where minerals are extracted and processed. The transition cannot be evaluated solely according to the carbon intensity of the final technology. It must also be evaluated according to the social and ecological conditions under which the materials for that technology are produced.

This article consequently asks a deceptively simple question: *for whom is nickel downstreaming?* The question has three dimensions. First, it concerns *distribution*: who receives income, employment, infrastructure, investment, tax revenues, and industrial opportunities, and who bears pollution, land loss,

livelihood disruption, and health risks? Second, it concerns *recognition*: whose relationship with land and nature is recognized by state institutions and corporations, and whose knowledge and values are marginalized? Third, it concerns *participation and power*: who has the ability to influence decisions concerning mining concessions, environmental management, industrial development, and relocation?

These questions are central to environmental justice scholarship. Schlosberg (2007), for example, argues that environmental justice cannot be reduced to the equal distribution of environmental goods and bads. Justice also involves recognition, participation, capabilities, and the ability of communities to sustain meaningful forms of life. Similarly, the literature on energy justice has emphasized that energy transitions must consider not only the distribution of benefits and burdens but also procedural fairness and the recognition of affected communities (Sovacool and Dworkin 2015).

The political-ecological perspective adds another important dimension. Environmental conflicts are frequently conflicts over competing ways of valuing nature. What a corporation or state institution describes as “mineral resources” may simultaneously represent farmland, fishing grounds, water sources, ancestral territory, sacred landscapes, or the ecological foundation of a community’s livelihood. Martínez-Alier (2002) describes such conflicts as ecological distribution conflicts, in which communities frequently mobilize not only around monetary compensation but also around the protection of the ecological conditions necessary for survival.

This perspective is particularly useful for understanding Kawasi because the economic valuation of nickel does not necessarily capture the full range of values attached to the territory. A hectare of land can be valued by a mining company according to its mineral potential, while residents may value the same land through agricultural production, family history, burial sites, social relations, ecological services, and future livelihood possibilities. The conflict therefore cannot be resolved simply by asking whether monetary compensation equals the market value of the land.

The concept of “green grabbing” is also relevant. Fairhead, Leach, and Scoones (2012) use this term to describe processes through which land and natural resources are appropriated in the name of environmental goals or sustainability. Although nickel downstreaming is not identical to conservation-based land grabbing, the broader conceptual insight is relevant: environmental or sustainability narratives can legitimize forms of resource appropriation when the benefits are defined at scales larger than those of the communities directly affected.

In the case of nickel, the legitimizing narrative is increasingly associated with the global energy transition. Nickel can be presented as a “green” or “critical” mineral because it is an input into certain battery technologies. Yet the environmental and social consequences of producing that nickel may be geographically separated from the places where the benefits of electrification are

realized. The result is a spatial asymmetry between the location of extraction and the location of value realization.

This article argues that such asymmetry is one of the defining justice problems of Indonesia's nickel downstreaming strategy. The argument is not that Indonesia should abandon industrialization or surrender the economic opportunities associated with its mineral resources. Rather, the argument is that downstreaming should be assessed against a broader conception of justice. The success of downstreaming should not be measured only by export revenues, foreign direct investment, smelter capacity, or national GDP. It should also be measured through indicators such as environmental quality, community health, livelihood security, land rights, meaningful participation, benefit sharing, corporate accountability, and the capacity of affected communities to determine the future of their territories. The case of Kawasi is therefore not merely a local environmental problem. It is a window into the political geography of the global energy transition.

The article addresses four interrelated research questions. *First*, how has Indonesia's nickel downstreaming strategy reshaped the economic and political position of nickel-producing regions such as North Maluku? *Second*, what ecological and social burdens have emerged in Kawasi as a consequence of nickel extraction, processing, and industrial expansion? *Third*, how are the benefits and burdens of nickel downstreaming distributed across local, national, and global scales? *Fourth*, to what extent can Indonesia's nickel downstreaming strategy be understood as a just energy transition when evaluated through the dimensions of distribution, recognition, participation, and restoration? The primary objective is therefore to move beyond a binary debate between "economic development" and "environmental protection." Instead, the article seeks to identify the institutional and political mechanisms through which economic value and ecological costs are distributed.

A secondary objective is to contribute to the emerging literature on critical minerals and just transitions by demonstrating that the question of justice must be extended upstream into extraction territories. The growing literature on critical minerals has increasingly recognized that the transition toward renewable energy may reproduce existing inequalities if mineral supply chains are developed without sufficient environmental safeguards and community participation (IEA 2024; United Nations 2024; Riggs et al. 2026).

This study adopts a *qualitative political-ecological case study approach* centered on Kawasi Village, Obi Island, South Halmahera, North Maluku. A case-study design is appropriate because the research seeks to understand the interaction between national industrial policy, global mineral demand, corporate investment, ecological transformation, and community-level social change. Rather than treating Kawasi as an isolated locality, the analysis situates the village within a multi-scalar political economy. At the national level, nickel is embedded in Indonesia's industrialization and resource-nationalist strategy. At the regional level, North Maluku has become a major extraction and processing frontier. At the local level,

communities encounter the material consequences of mining through changes in land, water, livelihoods, employment, health, and settlement. At the global level, nickel enters supply chains associated with stainless steel, batteries, electric vehicles, and other industrial products.

The analysis is organized around four dimensions of environmental and energy justice:

1. Distributive justice — the distribution of economic benefits and environmental burdens;
2. Procedural justice — the ability of affected communities to participate meaningfully in decision-making;
3. Recognition justice — recognition of different identities, forms of knowledge, cultural relationships, and ways of valuing land and nature;
4. Restorative justice — responsibility for remedying historical and ongoing environmental and social harms.

This framework is derived primarily from environmental justice scholarship (Schlosberg 2007) and energy justice scholarship (Sovacool and Dworkin 2015), while also being informed by the political-ecological literature on ecological distribution conflicts (Martínez-Alier 2002). The framework is especially relevant to critical minerals because international institutions increasingly recognize that mineral supply chains cannot be judged exclusively by their contribution to decarbonization. The United Nations' 2024 Panel on Critical Energy Transition Minerals explicitly emphasizes equity, justice, local value addition, environmental integrity, human rights, and the meaningful participation of communities in mineral value chains (United Nations 2024).

The central conceptual problem of the article is the assumption that a technology is environmentally just because its final use contributes to decarbonization. This assumption creates what may be called a *green end-product fallacy*: the environmental legitimacy of the final technology is projected backward onto the entire supply chain. An electric vehicle is associated with lower operational emissions than an internal-combustion vehicle; therefore, the minerals required for its battery can be implicitly framed as environmentally beneficial. Yet this reasoning ignores the material conditions through which the battery is produced.

The IEA and World Bank have repeatedly emphasized that clean-energy technologies are mineral intensive. The World Bank's Climate-Smart Mining initiative, for example, notes that decarbonization will require substantial increases in mineral production and that poorly managed mining could impose serious costs on vulnerable communities and ecosystems (World Bank 2020). The implication is straightforward: *the energy transition does not eliminate extraction; it changes the composition and geography of extraction*. Consequently, justice must be evaluated throughout the mineral chain.

Distributive justice asks who receives benefits and who bears costs. In a conventional economic assessment, the benefits of nickel downstreaming may

include increased export value, investment, industrial output, government revenues, employment, infrastructure, and technological development. Such indicators are important but incomplete. A political-ecological approach asks a second set of questions: Who loses agricultural land? Who loses access to fishing grounds? Who pays for polluted water? Who experiences declining environmental quality? Who bears the costs of relocation? Who experiences health risks? Who receives compensation? And how does the value created at the extraction site compare with the value realized farther along the supply chain?

This is particularly important because mineral value chains are spatially differentiated. A community located beside a mine may receive a relatively small share of the economic value generated by the final product while experiencing a disproportionately large share of ecological risk. The question “for whom?” therefore refers not simply to ownership but to the geography of value and harm.

Procedural justice concerns the ability of affected people to participate in decisions that shape their lives. The existence of formal consultation procedures does not necessarily guarantee meaningful participation. A process may satisfy administrative requirements while still failing to provide communities with adequate information, bargaining power, time, alternatives, or the ability to reject a proposal. This distinction is crucial in the context of mining and relocation. If a community is presented with relocation after environmental degradation has already undermined the viability of the original settlement, the formal choice to relocate may not constitute a genuinely free choice. The community may effectively be choosing between an increasingly unlivable original settlement and an alternative settlement whose social and economic conditions remain uncertain.

The emerging international framework on critical minerals increasingly recognizes this problem. The United Nations has emphasized the importance of local communities having meaningful roles in decision-making, while the OECD due-diligence framework stresses the identification, prevention, mitigation, and remediation of adverse impacts throughout mineral supply chains (United Nations 2024; OECD 2016).

Recognition justice asks whether different communities, identities, values, and forms of knowledge are treated as legitimate. This is particularly important in resource frontiers because state and corporate institutions frequently translate territories into administrative categories: concession areas, production forests, industrial zones, mining blocks, or strategic projects. Local communities, however, may understand the same territories through completely different categories: ancestral land, farming land, fishing grounds, water sources, burial sites, sacred spaces, or living ecosystems. A failure of recognition occurs when only the state or corporate valuation of territory is treated as legitimate.

This issue is closely related to Martínez-Alier’s (2002) concept of ecological distribution conflicts. Such conflicts are often not simply about the quantity of money offered in compensation. They are also about competing systems of valuation. A river may have economic value as a source of industrial water, but it

may simultaneously possess social, cultural, ecological, and subsistence value that cannot be adequately represented through a market price. For Kawasi, therefore, the destruction or degradation of ecological resources must be understood as more than an environmental externality. It can constitute a transformation of the material basis of social and cultural reproduction.

Finally, restorative justice asks what happens after harm occurs. A just transition cannot be reduced to preventing future harm. Existing pollution, land dispossession, livelihood loss, and ecological degradation require remediation. Communities may require clean water, restoration of agricultural land, rehabilitation of ecosystems, compensation for lost income, health monitoring, or legal recognition of land rights. The United Nations Panel on Critical Energy Transition Minerals has explicitly included legacy issues, transparency, traceability, environmental integrity, and benefit sharing within its recommendations for mineral governance (United Nations 2024). The OECD similarly emphasizes due diligence as a continuous process involving the identification, prevention, mitigation, and accounting for actual and potential adverse impacts (OECD 2016; OECD 2023). Restoration therefore represents an important test of whether the energy transition is genuinely just. If communities are expected to absorb irreversible ecological losses in exchange for temporary employment or limited compensation, then the transition reproduces an extractive model rather than overcoming it.

Taken together, these conceptual dimensions lead to the central proposition of this article: *Indonesia's nickel downstreaming strategy should not be evaluated as a just energy-transition strategy merely because nickel contributes to low-carbon technologies; its justice must be assessed through the distribution of economic value and ecological risk, the recognition of community rights and values, the meaningfulness of participation, and the availability of effective remedy and restoration.*

This proposition does not reject downstreaming as such. Instead, it challenges the assumption that adding processing capacity automatically constitutes development for producing regions. The distinction is important. Downstreaming refers to the movement from extraction toward processing and manufacturing. Just downstreaming, by contrast, requires that the additional value captured through processing also generate fair and durable benefits for affected territories and communities. This distinction is central to the paper's contribution. Indonesia has successfully demonstrated that resource-rich countries can challenge the traditional position of exporting raw commodities and can use industrial policy to force greater domestic value addition. The country's experience therefore offers an important alternative to conventional extractive development models. However, the spatial concentration of environmental burdens raises the possibility that downstreaming may simply move the country from one form of extraction to another: from exporting raw ore while externalizing some economic value abroad to retaining more economic value domestically while continuing to externalize substantial ecological and social costs onto mining frontiers.

This is why the question of “*for whom?*” is analytically important. A policy can be nationally beneficial while remaining locally unjust. A project can be economically productive while being ecologically destructive. A technology can be low-carbon at the point of use while being carbon-intensive at the point of production. And a country can capture greater value from a mineral while the communities located above that mineral deposit remain politically and economically marginalized. These contradictions do not invalidate the energy transition. They reveal the need to redesign its governance.

The case of Kawasi provides an especially important empirical setting for examining this problem because it connects all four dimensions of justice. The village illustrates questions of environmental burden through water and ecosystem degradation; distributive justice through changing livelihoods and uneven access to economic benefits; procedural justice through disputes over consultation and relocation; recognition justice through competing understandings of land and territory; and restorative justice through unresolved questions concerning remediation, compensation, and long-term community welfare.

The subsequent sections of this article therefore move from the macro-scale political economy of Indonesia’s nickel downstreaming toward the micro-scale experiences of Kawasi, before returning to the global mineral value chain. This movement across scales is necessary because the apparent success of downstreaming at the national level cannot be understood independently of the social and ecological transformations occurring at the extraction frontier.

In other words, the question is not simply whether Indonesia is winning from nickel. The more important question is *who is winning, who is losing, and who has the power to define what counts as winning in the first place.*

Nickel Downstreaming, Resource Nationalism, and the Political Economy of Indonesia’s Energy Transition

A. From Commodity Exporter to Industrial Power: The Political Logic of Downstreaming

Indonesia’s contemporary nickel strategy cannot be understood solely as a response to the global demand for electric vehicle batteries. It is also the product of a longer political-economic struggle over natural-resource governance, industrialization, and the distribution of value between resource-producing countries and global corporations. The language of *downstreaming* (*hilirisasi*) therefore needs to be situated within Indonesia’s broader history of resource nationalism.

For much of the postcolonial period, Indonesia’s natural resources have been central to the country’s development strategy. Yet the economic structure of extraction has often been characterized by a relatively limited capacity to capture value beyond the initial stages of production. Raw or minimally processed commodities have historically been exported into global markets, while higher-value processing, manufacturing, technology, and branding have frequently been

located elsewhere. This structural pattern is characteristic of what dependency-oriented political economy describes as unequal participation in global commodity chains, where resource-rich countries may remain concentrated in relatively lower-value segments despite possessing the underlying natural resources (Frank 1967; Gereffi, Humphrey, and Sturgeon 2005).

Indonesia's resource nationalism emerged partly as a response to this structural vulnerability. Rather than accepting the role of a supplier of raw materials, successive governments have sought greater domestic control over natural resources and greater domestic value capture. Warburton (2017, 2023) describes this trajectory as a distinctive form of Indonesian resource nationalism, in which the state seeks to increase national ownership, domestic processing, and regulatory control over strategic commodities.

Nickel has become the most prominent contemporary example of this strategy. The fundamental proposition underlying downstreaming is straightforward: a country endowed with a natural resource should capture more of the value generated from that resource before it leaves the country. Instead of exporting ore, Indonesia seeks to process it domestically, produce intermediate products such as nickel pig iron (NPI), ferronickel, mixed hydroxide precipitate (MHP), nickel matte, and eventually battery materials and batteries themselves. In principle, such a strategy can create industrial linkages, expand employment, attract investment, increase fiscal revenues, encourage technological upgrading, and diversify the domestic economy.

This logic is consistent with the developmental-state tradition. In this model, the state does not merely correct market failures but actively shapes markets and directs investment toward strategic sectors. The recent literature explicitly interprets Indonesia's nickel downstreaming as a new form of developmental industrial policy, in which government intervention is intended to transform the country from a resource exporter into an integrated industrial and electric-vehicle manufacturing hub (Lahadalia et al. 2024). The significance of this transformation should not be underestimated. Indonesia is now the world's largest producer of mined nickel. According to the U.S. Geological Survey, Indonesia accounted for approximately 62 percent of global mined nickel production in 2024. The country's mining and quarrying sector excluding mineral fuels contributed approximately 3 percent of national GDP, while base-metals manufacturing contributed another approximately 1 percent (USGS 2025).

These figures illustrate the scale of Indonesia's transformation from a relatively important nickel producer into the central node of the global nickel supply system. Yet the expansion of domestic value capture creates a paradox. Capturing more value nationally does not necessarily mean distributing that value more equitably locally. This distinction is crucial to the argument of this article.

Downstreaming can increase the economic surplus retained within Indonesia while simultaneously concentrating environmental costs in particular territories such as Obi Island and Halmahera. The relevant question is therefore not simply

whether Indonesia captures more value than it did under a raw-ore export model. The relevant question is how that newly captured value is distributed among the Indonesian state, regional governments, domestic companies, foreign investors, workers, consumers, and communities located at the extraction frontier. The distinction between national value capture and local justice forms one of the central analytical foundations of this article.

B. The Export Ban as an Instrument of Resource Nationalism

The institutional foundation of contemporary nickel downstreaming can be traced to Indonesia's mining regulatory framework, particularly Law No. 4 of 2009 on Mineral and Coal Mining and its subsequent amendments. The policy trajectory culminated in increasingly restrictive measures concerning the export of unprocessed mineral ore. The rationale was explicitly developmental. If Indonesian nickel ore could be exported freely, foreign processors would retain a significant share of the value generated through refining and processing. By restricting ore exports, the Indonesian government sought to compel investment in domestic processing facilities.

The policy generated considerable international controversy. The European Union challenged Indonesia's nickel export restrictions through the World Trade Organization. The WTO dispute, DS592, concerned both the export prohibition and the requirement that nickel ore be processed domestically. The WTO panel found that the export ban constituted a quantitative restriction under Article XI:1 of the General Agreement on Tariffs and Trade (GATT) 1994. It also found that Indonesia had not demonstrated that the measures met the relevant exception invoked by the government.

The dispute is significant because it illustrates a tension between two different understandings of economic governance. From the perspective of international trade law, export restrictions can distort access to raw materials and create disadvantages for downstream industries in importing countries. From the Indonesian developmental perspective, however, unrestricted exports can perpetuate a commodity-export model that prevents domestic industrial upgrading.

The conflict therefore goes beyond nickel. It concerns the question of whether resource-rich developing countries should be able to use trade restrictions as instruments of structural transformation. Indonesia's position has been that natural resources should not simply be extracted for external markets but should support domestic industrialization. This is consistent with a broader trend among resource-rich states seeking to increase local value addition. Similar debates have occurred around lithium in Latin America, cobalt in Central Africa, bauxite in West Africa, and other critical minerals.

The Indonesian case is nevertheless distinctive because the country possesses both large nickel resources and sufficient political capacity to impose export restrictions on a globally important commodity. The result has been a significant reorganization of global supply chains. Rather than merely selling nickel ore to

processors abroad, Indonesia has encouraged companies to locate processing capacity within Indonesian territory. The result has been a dramatic expansion of smelting and refining investment.

This development demonstrates the effectiveness of industrial policy in altering the geography of mineral processing. But it also produces another question: If the state successfully forces global capital to relocate processing into Indonesia, what prevents the environmental and social costs of that processing from being concentrated in particular Indonesian communities? The answer cannot simply be “environmental regulation.” The political economy of extraction determines who has bargaining power, whose interests are prioritized, and which territories are treated as suitable locations for industrial sacrifice.

C. The Rise of China-Indonesia Nickel Industrial Networks

One of the most consequential dimensions of Indonesia’s nickel downstreaming strategy has been the rapid expansion of Chinese investment. China’s role is not accidental. Chinese firms possess extensive technological, financial, and industrial capabilities in nickel processing, stainless steel, battery materials, and electric-vehicle manufacturing. Indonesia, meanwhile, possesses enormous nickel resources and has adopted policies that make domestic processing a condition of access to those resources.

The two economic structures are therefore complementary. Indonesia provides mineral resources, land, labor, and increasingly industrial infrastructure. Chinese companies provide capital, technology, equipment, managerial expertise, and access to downstream markets. The result has been the creation of vertically and geographically integrated production networks.

The development of nickel-processing complexes illustrates this process. Indonesian policy has attracted large-scale investment in industrial parks, smelters, and hydrometallurgical processing. Chinese-linked firms have become major participants in these projects. Recent scholarship identifies Chinese investment as a central component of Indonesia’s emergence as a major global nickel-processing center, although questions remain regarding technology transfer and the extent to which foreign investment produces autonomous domestic technological capabilities.

This development complicates simplistic narratives of “foreign exploitation.” The relationship is not simply one in which Chinese companies extract Indonesian resources and export them abroad. The Indonesian state has actively designed policy to attract foreign processing investment and has used its control over mineral resources as bargaining leverage. The relationship can therefore be understood as a form of strategic interdependence. Indonesia needs foreign capital, technology, and industrial capabilities to accelerate downstreaming. Chinese firms need secure access to Indonesian nickel and the ability to establish processing capacity near the resource base. Both sides therefore obtain significant advantages. Yet strategic interdependence does not automatically guarantee social justice.

The benefits of this arrangement are primarily captured at multiple institutional and corporate scales: national governments, multinational corporations, investors, industrial operators, and increasingly integrated global supply chains. The environmental burdens, by contrast, are geographically concentrated.

This produces a fundamental spatial asymmetry in the geography of nickel. Capital can move across borders in search of lower costs and higher returns. Nickel ore can be extracted in one territory, processed in another, and incorporated into global supply chains far from the landscapes where it originated. Processed materials can circulate through international markets, while profits can be transferred across jurisdictions and accumulated elsewhere. The environmental and social consequences of extraction, however, are far less mobile. Polluted rivers remain in place. Altered landscapes cannot be relocated. Degraded soils, damaged ecosystems, and displaced communities remain territorially bound to the sites where extraction takes place.

This asymmetry lies at the heart of a central insight of political ecology: environmental burdens tend to be territorially fixed, while economic value is comparatively mobile. The benefits generated by resource extraction can be distributed across distant networks of corporations, investors, consumers, and states, whereas many of the costs are concentrated in particular landscapes and borne by communities with limited capacity to relocate or influence the terms of extraction (Bebbington et al. 2018; Martinez-Alier 2002). What appears, from the perspective of global markets, as a flexible and mobile commodity chain is therefore experienced locally as a much more enduring transformation of place.

The geography of nickel consequently matters not simply because extraction occurs somewhere, but because the spatial organization of extraction determines who captures value, who bears environmental costs, and where those costs become embedded. Following the movement of nickel through space thus reveals a deeper political question: how are the benefits and burdens of the energy transition distributed across territories and across scales?

D. Nickel, Stainless Steel, and the Problem of the “Battery Narrative”

Another important complication is that nickel downstreaming should not be understood exclusively through electric vehicles. The contemporary public narrative frequently associates Indonesian nickel with lithium-ion batteries and electric vehicles. This association has become powerful because it allows nickel to be positioned as a strategic input into the global energy transition. However, the nickel industry is historically and industrially broader than the battery economy. Nickel has long been essential to stainless steel production and other industrial applications. Consequently, a substantial portion of Indonesia’s nickel expansion has been connected to stainless steel and nickel pig iron rather than exclusively to battery-grade materials.

This distinction matters for environmental analysis. If nickel mining is justified primarily through the language of the energy transition, the public may assume that the environmental costs of mining are directly proportional to the benefits of decarbonization. Yet when the mineral enters stainless-steel production, the relationship with decarbonization becomes less direct.

The “green” character of nickel, therefore, cannot be determined by its geological identity alone. A tonne of nickel does not possess an inherently green or brown character; its environmental significance depends on the value chain into which it enters, the technologies through which it is processed, and the energy system that sustains its production. The same mineral may be directed towards conventional stainless-steel production, battery-grade materials, intermediate chemical products, or, further downstream, electric-vehicle batteries. These pathways carry very different technological, economic, and environmental implications. It is therefore analytically misleading to describe the Indonesian nickel industry as a single “green industry” without distinguishing between end uses, processing technologies, and production pathways.

This distinction is particularly important because the political legitimacy of Indonesia’s downstreaming strategy increasingly rests on its association with electric vehicles and the global energy transition. The closer the connection between Indonesian nickel and battery production, the easier it becomes to frame industrial expansion as a contribution to global climate action. Nickel extraction and processing can consequently be presented not simply as resource exploitation, but as an essential upstream component of decarbonization. Yet this narrative risks obscuring a crucial contradiction: the production of materials intended to support a low-carbon technological system may itself depend on highly carbon-intensive forms of energy.

This constitutes what can be understood as the carbon contradiction of nickel downstreaming. A mineral that is increasingly important to decarbonization technologies may be extracted and processed through energy systems that remain deeply dependent on fossil fuels. Recent analyses of Indonesia’s nickel industry have highlighted the extensive reliance of major processing operations on coal-fired electricity, raising a fundamental question about the carbon intensity embedded within supposedly “green” material supply chains. Contemporary reporting has similarly drawn attention to coal-powered nickel processing as a significant source of embedded emissions. The issue, therefore, is not simply whether nickel eventually enters an electric vehicle, but what forms of energy and infrastructure are mobilized to transform the mineral into that component in the first place.

This contradiction should not be interpreted as an argument against electrification or against the expansion of renewable technologies. Rather, it reveals the limitations of understanding the energy transition as a simple technological substitution: replacing internal-combustion vehicles with electric vehicles does not, by itself, constitute decarbonization. The transition must instead be understood as a transformation of an interconnected energy–material system. The climate

performance of an electric vehicle depends partly on the electricity used to manufacture its battery and components. The environmental performance of a battery depends partly on the conditions under which its constituent minerals are extracted, refined, and processed. And the social legitimacy of the transition depends partly on the conditions under which these materials are produced and the distribution of the benefits and burdens associated with their production.

The implications are therefore cumulative. Carbon emissions, environmental degradation, and social inequalities are not external to the energy transition; they can become embedded within its material foundations. A technology can be low-carbon at the point of use while relying on carbon-intensive production upstream. A mineral can be essential to decarbonization while being produced through environmentally destructive processes. And an energy transition can be presented as globally beneficial while concentrating its material and environmental costs in particular territories. Following nickel through its entire chain—from extraction, to processing, to manufacturing, to final use—thus shifts the analytical question from whether a mineral is “green” to a more consequential one: under what material, energetic, environmental, and social conditions is the green transition being produced?

E. The Economic Case for Downstreaming in North Maluku

A serious analysis of nickel downstreaming should not dismiss its economic benefits. Doing so would weaken the argument by creating an artificial opposition between economic development and environmental justice. The question is not whether nickel industrialization produces economic value—it clearly does—but rather where that value is generated, how it is distributed, and who bears the costs of producing it.

There is empirical evidence that downstreaming has generated substantial economic linkages in North Maluku. Herawan and Susilo’s (2024) input-output analysis examines the regional economic effects of nickel downstreaming and finds that greater integration into electric-vehicle and battery-related industries can produce positive regional economic impacts. In particular, their analysis identifies a scenario in which a portion of nickel reserves is allocated to EV- and battery-related downstream industries as having positive implications for the regional economy. This evidence is important because it challenges any interpretation of nickel industrialization as producing only externally captured value.

Nickel downstreaming is therefore not simply an external enclave imposed upon North Maluku. Its expansion has the capacity to generate genuine regional economic linkages and multiplier effects. These may include employment opportunities, transportation infrastructure, port development, construction activity, demand for accommodation and food services, opportunities for local businesses, government revenues, investment in public infrastructure, and increased demand for skilled and semi-skilled labor. Through these linkages, the effects of industrialization can extend beyond the mining and processing facilities

themselves, connecting the nickel economy to wider sectors of the regional economy.

From a conventional development perspective, these effects are significant. They can increase regional economic activity, create new sources of income, improve physical connectivity, and potentially expand the fiscal capacity of local and regional governments. For communities and households facing limited employment opportunities, industrial investment can also represent a tangible source of economic mobility. Any critical analysis that ignores these benefits risks presenting an overly simplified account of nickel extraction and downstreaming.

The central problem, however, is that economic multipliers do not automatically translate into equitable development. Aggregate growth can coexist with highly uneven distributions of both benefits and costs. A region may experience rapid increases in GDP and investment while particular communities experience declining access to land, forests, fisheries, or clean water. A worker may gain a wage-paying job while a fisher simultaneously loses access to fishing grounds. A government may receive additional tax or royalty revenues while households bear the everyday costs of declining environmental quality. A company may construct roads, ports, and other infrastructure that improve regional connectivity, while the construction and operation of these facilities transform the ecological systems upon which local livelihoods depend.

The key issue, therefore, is not simply whether nickel downstreaming produces development, but what kind of development it produces and for whom. Economic benefits and environmental burdens can be distributed across different groups, territories, and timescales. The gains from industrialization may be captured through wages, corporate profits, government revenues, and infrastructure investment, while its environmental costs are experienced through changes in land access, water quality, fisheries, and other livelihood resources. These processes can occur simultaneously rather than sequentially.

Economic development and environmental justice can consequently move in different directions. A project can generate positive regional economic multipliers while producing negative livelihood effects for particular communities. Likewise, aggregate improvements in income or infrastructure do not necessarily compensate for the loss of ecological resources that cannot easily be replaced through monetary transfers. This is why aggregate economic indicators should not be treated as sufficient evidence of welfare improvement.

The analytical task is therefore to hold these two realities together: nickel downstreaming can generate genuine economic development while simultaneously producing uneven environmental and social costs. Recognizing the former does not require overlooking the latter. On the contrary, it makes the question of distribution more important. The critical issue becomes whether the economic value created by nickel industrialization is sufficient, fairly distributed, and institutionally capable of compensating for—or preventing—the environmental

and livelihood losses imposed upon the communities located along its material frontier.

Downstreaming, Territorial Transformation, and the Political Economy of Just Development

Indonesia's nickel downstreaming policy should be understood not merely as an industrial strategy, but as a process through which the state is attempting to reorganize the economic, territorial, and political relations surrounding mineral extraction. At the economic level, downstreaming seeks to shift Indonesia from a predominantly raw-material supplier toward a more integrated position within processing, refining, manufacturing, and global battery and electric-vehicle value chains. At the territorial level, however, this strategy requires the expansion of mining areas, smelters, industrial estates, ports, roads, energy infrastructure, and other forms of industrial development. At the political level, it expands the role of the state in directing capital, allocating territory, regulating mineral production, and defining which forms of land use are considered nationally strategic. The central analytical problem is therefore not simply whether downstreaming creates economic value, but how that value is produced, captured, distributed, and legitimized across different territories and social groups.

The legal foundation of this strategy is particularly revealing. The Indonesian mining regime explicitly frames mineral resources as instruments of national development and value creation. Law No. 4 of 2009 on Mineral and Coal Mining, as amended most significantly by Law No. 3 of 2020 and subsequently by Law No. 2 of 2025, places mineral resources within a framework of state control and national economic development. Law No. 3 of 2020 amended Article 102 of the Mining Law to provide that holders of IUP or IUPK at the production-operation stage “wajib meningkatkan nilai tambah Mineral” through processing and/or refining, while Article 103 requires the processing and/or refining of mined minerals to take place domestically. In other words, downstreaming is not merely an economic preference of individual companies; it is embedded in a statutory obligation to increase the domestic value added of mineral resources (Law No. 3 of 2020, Arts. 102–103).

The significance of Articles 102 and 103 extends beyond the technical regulation of mining. They institutionalize a particular conception of resource nationalism: the state seeks to prevent the economic value of Indonesia's mineral wealth from being realized predominantly outside the country. The objective is therefore not simply to extract nickel more efficiently, but to restructure the spatial location of economic value. In political-economic terms, downstreaming represents an attempt to move Indonesia upward within the global value chain by requiring economic activities that were previously undertaken elsewhere to take place domestically. This logic is consistent with resource-nationalist and developmental-state approaches, in which the state intervenes in commodity markets to capture a

larger share of resource rents, promote industrial upgrading, and reduce dependence on primary commodity exports.

The legal framework itself, however, indicates that value creation is not supposed to be separated from environmental and social responsibilities. Article 8A of the amended Mining Law requires the national mineral and coal management plan to consider, among other things, “daya dukung sumber daya alam dan lingkungan,” environmental preservation, and spatial plans. This is significant because it establishes an internal legal tension within downstreaming: the same state that is legally required to maximize mineral value is also required to consider ecological carrying capacity and spatial planning in managing mineral resources (Law No. 3 of 2020, Art. 8A). Downstreaming therefore cannot be understood legally as an unrestricted mandate to industrialize. Its legitimacy depends upon whether industrial expansion remains compatible with environmental limits and other applicable spatial and social protections.

This tension becomes clearer when downstreaming is examined through the classical concept of the resource enclave. Enclave economies are characterized by strong connections to international capital and markets but comparatively weak integration with surrounding local economies. Infrastructure is typically organized around commodity extraction and export; high-value functions may remain under external control; and economic benefits can circulate beyond the producing territory while environmental costs remain localized. Nickel downstreaming appears, at first sight, to challenge this model because processing and refining are physically relocated closer to the resource. Yet geographical proximity does not automatically eliminate enclave characteristics. A smelter located in Indonesia is not necessarily economically integrated with the communities surrounding it. The more important questions concern ownership, control, procurement, labor, technology, taxation, profit distribution, and political influence.

The ownership structure of Indonesia’s nickel industry illustrates why this distinction matters. The IEA has documented that Indonesia accounts for a dominant share of global nickel mining and refining, while ownership and control of production remain distributed among Indonesian and foreign companies, including major Chinese participation (IEA, 2024). This means that the geographical localization of production and the localization of economic control should not be treated as equivalent. Industrial facilities may be located in North Maluku while capital, technology, managerial expertise, and downstream market access remain embedded in transnational corporate networks. Downstreaming can therefore reduce Indonesia’s dependence on raw-ore exports without necessarily eliminating enclave-like relationships at the local level.

The distinction between territorial industrialization and community-centered development is therefore essential. Territorial industrialization occurs when factories, smelters, ports, roads, power plants, and industrial estates are physically established within a particular region. Community-centered development requires more: local populations must possess meaningful opportunities to participate in,

benefit from, and influence the economic transformation of their territory. The first can occur without the second. A region may experience an extraordinary increase in industrial investment while communities located immediately around the industrial complex experience declining access to land, water, fisheries, forests, and other livelihood resources.

This does not mean that the economic benefits of downstreaming should be dismissed. There is empirical evidence that nickel industrialization can generate significant regional economic linkages. Herawan and Susilo (2024), using an input-output approach, find positive regional economic effects associated with greater integration of nickel into electric-vehicle and battery-related downstream industries. Such effects may operate through employment, construction, transportation, port activity, accommodation, food services, local procurement, public infrastructure, and wider economic multipliers. From a conventional development perspective, these are meaningful benefits because they can expand regional income, employment opportunities, infrastructure, and productive capacity (Herawan & Susilo, 2024).

The analytical problem begins when economic value capture is confused with equitable value distribution. Value capture concerns how much economic value is retained within Indonesia as opposed to being transferred through international commodity and corporate networks. Value distribution concerns how that value is subsequently allocated among corporations, governments, workers, producing regions, and local communities. These are fundamentally different questions. Indonesia may capture a larger share of global nickel value while communities located near mines and industrial facilities receive only a limited proportion of the resulting economic benefits.

This distinction produces what can be described as a value–risk mismatch. Along the nickel value chain—ore extraction, processing, refining, intermediate products, battery materials, batteries, electric vehicles, and final consumption—economic value can increase as the material moves downstream. Yet environmental and social risks can remain concentrated near the extraction and processing frontier. Communities may experience deforestation, erosion, sedimentation, water pollution, dust, noise, traffic, land-use change, livelihood disruption, and displacement, while much of the value associated with downstream products is realized elsewhere. The geographical distribution of benefits and burdens therefore becomes a central issue of political ecology.

This problem is also reflected in the legal treatment of land and spatial planning. Law No. 26 of 2007 on Spatial Planning, as amended, establishes that spatial planning is not merely an administrative exercise but a process intended to create space that is safe, comfortable, productive, and sustainable. Article 65(1) provides that spatial planning is carried out by government “dengan melibatkan peran masyarakat.” Article 65(2) further identifies community participation in the formulation of spatial plans, the utilization of space, and the control of spatial utilization (Law No. 26 of 2007, Art. 65). The significance of this provision is

substantial for nickel industrialization because mining concessions, industrial estates, ports, and relocation projects are all forms of territorial transformation. The law therefore does not conceive spatial transformation as something that can legitimately occur solely through administrative or corporate decision-making.

Article 66 of the same law strengthens this principle by providing that communities harmed by spatial planning may bring a claim before the courts (Law No. 26 of 2007, Art. 66). In theoretical terms, these provisions create a legal basis for procedural justice: affected populations are not merely objects of spatial planning but possess legally recognized opportunities to participate and, where harmed, to challenge decisions. From a political-ecology perspective, this is important because control over territory is not only a question of physical possession. It is also a question of whose knowledge, interests, and claims become institutionally recognized in the process through which territory is reclassified for industrial purposes.

The same issue arises in land acquisition. Law No. 2 of 2012 on Land Acquisition for Development in the Public Interest provides in Article 7(3) that land acquisition must be planned “dengan melibatkan semua pengampu dan pemangku kepentingan.” Article 9(1) further requires land acquisition to consider “keseimbangan antara kepentingan pembangunan dan kepentingan masyarakat,” while Article 9(2) requires the provision of compensation that is “layak dan adil” (Law No. 2 of 2012, Arts. 7(3), 9(1)–(2)). These provisions are particularly relevant when industrial expansion requires the transformation or relocation of settlements. They establish, at least normatively, that development interests cannot be treated as the sole legitimate interest and that compensation must be assessed through standards of fairness rather than merely through the market value of physical assets.

This is where the political-ecology concept of lived territoriality becomes important. Land has an economic value that can be calculated through property valuation, compensation, investment, and productivity. But for communities, territory can simultaneously constitute a source of livelihood, social reproduction, cultural identity, ecological knowledge, and historical memory. A coastal area may therefore be simultaneously a potential industrial site, a fishing ground, a social space, and a cultural landscape. A relocation program may reproduce housing structures without reproducing the ecological and social relations through which the original community sustained itself. The difference between compensating for land and restoring a livelihood is therefore analytically significant.

Environmental law reinforces this broader understanding. Article 22(1) of Law No. 32 of 2009 on Environmental Protection and Management establishes that activities with significant environmental impacts must have an environmental impact assessment (AMDAL). The provision is particularly relevant to mining and industrial projects because Article 23 identifies activities involving changes to landforms, exploitation of renewable and non-renewable natural resources, and activities with potential for pollution or environmental degradation among the categories of activities requiring environmental scrutiny (Law No. 32 of 2009, Arts.

22–23). The legal significance of AMDAL is therefore preventive rather than merely compensatory: environmental consequences are supposed to be considered before a project proceeds, rather than treated only as damage to be addressed after industrialization has occurred.

More importantly for questions of procedural justice, Article 26(1) of Law No. 32 of 2009 provides that AMDAL documents are prepared by project proponents “dengan melibatkan masyarakat.” Article 26(2) requires such participation to be based on transparent and complete information and to occur before the activity is undertaken; Article 26(4) provides that the relevant public may object to the AMDAL document (Law No. 32 of 2009, Art. 26). These provisions transform participation from a purely normative aspiration into a component of environmental decision-making. Their analytical importance lies in the fact that environmental justice is not only about the distribution of pollution after the fact. It is also about whether affected populations have meaningful opportunities to influence decisions that produce environmental risks in the first place.

Article 65 of Law No. 32 of 2009 provides an even broader rights-based foundation. It recognizes that every person has a right to a good and healthy environment and establishes rights relating to environmental information, participation, and access to justice (Law No. 32 of 2009, Art. 65). Article 70 further provides that communities have equal and broad opportunities to participate actively in environmental protection and management, including through social monitoring, providing suggestions and objections, and submitting complaints or information (Law No. 32 of 2009, Art. 70). The implication is significant: environmental governance under Indonesian law is not conceptually limited to government and corporations. Communities are recognized as actors with rights and participatory functions.

These provisions allow the downstreaming debate to be connected directly to the theory of environmental justice. Schlosberg’s (2007) multidimensional conception of environmental justice emphasizes not only distribution, but also recognition and participation. This is highly relevant to nickel industrialization. Distribution asks who receives economic benefits and who bears environmental burdens. Recognition asks whose identities, livelihoods, knowledge systems, and relationships to territory are acknowledged. Participation asks who has the ability to influence decisions. Indonesian environmental and spatial laws contain elements corresponding to all three dimensions, although the existence of formal legal rights does not itself demonstrate that those rights are effectively realized in practice.

The Mining Law also contains provisions that can be interpreted through this framework. Article 96 of the Minerba regime requires holders of IUP and IUPK to implement good mining practices, including environmental management and monitoring, conservation, and the management of mining waste. Article 99 requires the preparation of reclamation and post-mining plans, while Article 100 requires the provision of reclamation and/or post-mining guarantees (Law No. 3 of 2020, Arts. 96, 99–100). The current framework has subsequently been amended by Law

No. 2 of 2025, including changes to Article 100 that explicitly connect reclamation and post-mining obligations to the protection of impacts on communities and regions.

These provisions are important because they demonstrate that environmental responsibility is not legally external to mining. It is incorporated into the definition of proper mining practice itself. Nevertheless, a critical question remains concerning the temporal and spatial scale of remediation. Reclamation obligations generally concern mining sites and post-mining land conditions, while communities may experience cumulative effects across watersheds, coastlines, fisheries, air quality, and settlement systems. A narrow interpretation of reclamation can therefore fail to address broader socio-ecological transformations. Political ecology helps expose this gap by examining environmental change as a process distributed across interconnected landscapes rather than as a series of isolated impacts confined to individual concession boundaries.

The legal framework also contains an important provision concerning community development. Article 108 of the Minerba regime requires mining companies to prepare and implement programs for the development and empowerment of communities around mining operations. The 2025 amendment further provides that the preparation of such programs is to be consulted with the Minister, local government, and local and/or customary communities (Law No. 2 of 2025, Art. 108). This provision is particularly relevant to the distinction between territorial industrialization and community-centered development. It indicates that the legal conception of mining development extends beyond production and fiscal revenues toward the social development of affected communities. The analytical question, however, is whether such programs generate substantive local economic capacity or function primarily as compensatory corporate social responsibility.

This brings the analysis back to the developmental state. Indonesia's nickel strategy displays many characteristics associated with developmental-state industrial policy: strategic resource identification, restrictions on raw-material exports, state-directed investment, infrastructure development, industrial parks, foreign capital mobilization, and technological upgrading. Yet the developmental state becomes problematic when its effectiveness is measured primarily by its capacity to mobilize capital and increase production. A state can be highly effective at attracting investment while being less effective at protecting communities. It can be strong in industrial policy while weak in environmental governance. It can negotiate successfully with multinational corporations while providing local populations with comparatively limited influence over the projects transforming their territories.

This tension can be described as the risk of developmental authoritarianism, although the concept should be employed cautiously and empirically rather than as a categorical description of the Indonesian state. The relevant question is whether the imperative of national development narrows the political space available for dissent, contestation, and alternative development visions. The issue becomes

especially important where industrial projects are presented as nationally strategic, because the language of national interest can transform disagreement into an apparent opposition to development itself.

The political significance of critical minerals intensifies this dynamic. Indonesia's dominance in nickel production gives the state considerable bargaining power within global supply chains. The IEA has emphasized the increasing concentration of critical-mineral supply chains and the strategic importance of diversification and secure supply (IEA, 2024, 2025). Indonesia can therefore use its market position to demand domestic processing and greater value capture. Yet geopolitical leverage can simultaneously increase pressure on extraction regions. The more strategically important nickel becomes, the stronger the argument that extraction must accelerate to satisfy global demand for batteries, stainless steel, and other industrial applications.

This produces a critical-mineral paradox. Global demand for minerals associated with the energy transition can strengthen the bargaining position of resource-producing states while weakening the ability of local communities to resist the transformation of their territories. The language of "critical minerals" can convert local environmental disputes into questions of national economic security or global climate necessity. Political ecology is useful here because it asks who is authorized to define a resource as "critical," whose interests are represented by that designation, and whose territories become responsible for satisfying the resulting demand.

The concept of the sacrifice zone therefore becomes relevant. A territory becomes a sacrifice zone when environmental degradation is normalized because the territory is considered sufficiently important to justify the costs imposed upon it. In the context of nickel, extraction and processing areas can be framed as necessary frontiers for national industrialization and global decarbonization. The critical question, however, is not simply whether environmental costs exist, but who decides that those costs are acceptable. If the communities bearing the costs do not possess meaningful influence over the decision, then the sacrifice raises fundamental questions of distributive and procedural justice.

Kawasi is particularly significant in this respect. The case should not be reduced to a question of pollution or relocation alone. It provides an empirical lens through which to examine the relationship between national industrial policy and local territorial transformation. The relevant question is whether the economic benefits generated through nickel industrialization are distributed in ways that compensate for, prevent, or otherwise address the ecological and social burdens experienced by the communities at the extraction frontier. This is ultimately a question of power over territory.

The concept of displacement must also be treated in broader terms. Physical relocation can be legally organized through land acquisition, compensation, and the provision of replacement housing. Yet livelihood displacement can occur even when households receive compensation and new houses. Fishers may lose access

to fishing grounds; farmers may lose productive land; households may lose access to forests and coastal resources; and social networks may become fragmented. These effects demonstrate why compensation cannot be equated automatically with justice. The relevant question is not merely whether a household receives a payment, but whether it retains the material and social capacity to reproduce its livelihood after territorial transformation.

The distinction between value capture and value distribution is therefore inseparable from the distinction between economic growth and welfare. A regional economy can expand while particular households become economically more vulnerable. Government revenues can increase while environmental costs are transferred to communities. Corporate investment can generate employment while simultaneously undermining subsistence activities. Infrastructure can improve regional connectivity while transforming the ecological systems that previously supported local livelihoods.

The result is not necessarily a contradiction between development and environment. It is a contradiction between different distributions of development.

This is why the question “development or environment?” is analytically weaker than the question “development for whom, at whose cost, and under whose authority?” The latter captures the central concerns of political ecology because it connects environmental transformation to power, property, institutions, and distribution. It also avoids romanticizing the “community” as a homogeneous actor. Workers, fishers, farmers, landowners, tenants, younger residents, older residents, and households facing different economic circumstances may have different preferences toward industrialization and relocation. Justice therefore requires attention not only to conflicts between companies and communities, but also to conflicts and inequalities within communities themselves.

Taken together, these arguments suggest that conventional definitions of downstreaming are insufficient. Downstreaming is usually measured through processing capacity, investment, production, exports, employment, government revenues, and domestic value added. These indicators are necessary for evaluating industrial transformation, but they do not establish whether industrialization is socially or environmentally just. A more comprehensive framework should therefore assess downstreaming according to five interconnected dimensions: national value capture, local benefit distribution, ecological integrity, procedural justice, and recognition and restoration.

National value capture concerns whether Indonesia succeeds in retaining greater economic value through domestic processing, manufacturing, technological upgrading, fiscal revenues, and industrial linkages. Local benefit distribution asks whether producing regions and affected communities obtain meaningful employment, procurement opportunities, infrastructure, public services, revenue sharing, and livelihood security. Ecological integrity concerns whether industrialization remains within acceptable environmental limits, including the protection of water, soil, forests, biodiversity, marine ecosystems, air quality, and

climate stability. Procedural justice concerns access to information, participation, consultation, grievance mechanisms, legal remedies, monitoring, and influence over decisions. Recognition and restoration concern the recognition of customary, cultural, and livelihood relationships with territory and the remediation of environmental and social harm where it occurs. This can be expressed analytically as:

$$\begin{aligned} \textit{Just Downstreaming} = & \textit{National Value Capture} + \textit{Local Benefit} \\ & \textit{Distribution} + \textit{Ecological Integrity} + \textit{Procedural Justice} + \\ & \textit{Recognition and Restoration}. \end{aligned}$$

The concept of just downstreaming does not reject industrialization. Nor does it deny the economic benefits of nickel development. Rather, it proposes a different standard for evaluating industrial success. The question becomes whether the state can transform resource wealth into industrial capacity without systematically externalizing environmental and social costs onto the territories and populations from which that wealth originates.

Such an approach is also consistent with the constitutional logic underlying Indonesia's natural-resource regime. Article 33(3) of the 1945 Constitution provides that "bumi dan air dan kekayaan alam yang terkandung di dalamnya dikuasai oleh negara dan dipergunakan untuk sebesar-besar kemakmuran rakyat." The constitutional principle of state control therefore establishes a purpose beyond state ownership or administrative authority: natural resources are to be managed for the greatest prosperity of the people. The phrase "sebesar-besar kemakmuran rakyat" provides an important normative benchmark against which resource nationalism can be evaluated. Increasing national industrial output is relevant, but it is not necessarily sufficient if the distribution of benefits and burdens remains highly unequal.

From this perspective, Indonesia's nickel downstreaming strategy represents both an achievement and a test. It is an achievement because it has significantly increased Indonesia's bargaining power within global nickel value chains, expanded domestic processing, attracted investment, and created substantial industrial linkages. It is a test because the same strategy is transforming territories in which communities depend upon land, forests, fisheries, and coastal ecosystems. The success of downstreaming must therefore be evaluated not only through national economic indicators but through its capacity to produce broad-based welfare while respecting ecological limits and political rights.

The central political-economic contradiction can thus be stated clearly. At the national level, downstreaming can represent a major success of resource nationalism. At the regional level, it can generate investment, employment, infrastructure, and economic multipliers. At the corporate level, it creates opportunities for profit and accumulation. At the global level, it strengthens battery and critical-mineral supply chains. Yet at the community level, the same process

can generate environmental degradation, livelihood disruption, territorial dispossession, and unequal political power.

These outcomes are not necessarily mutually exclusive. They can be produced by the same industrial system. The legitimacy of downstreaming therefore depends on whether Indonesia can convert resource power into socially distributed and ecologically sustainable development. The relevant question is not whether Indonesia has successfully moved downstream, but whether it can move downstream without reproducing the spatial inequalities characteristic of extractive economies. Kawasi provides a critical empirical test of this question. It allows the analysis to move from the national statistics of investment, production, and value capture to the material reality of the extraction frontier. The issue is ultimately whether the national promise of nickel-led industrial development is experienced locally as expanded opportunity, or whether the costs of national industrial transformation are disproportionately borne by the communities and ecosystems that occupy the territory where that transformation begins.

Conclusion

This article has demonstrated that Indonesia's nickel downstreaming agenda must be understood not merely as an industrial policy or technological pathway to decarbonization, but as a political-ecological process that redistributes environmental risks, economic benefits, and territorial power. The experiences of Obi Island and, particularly, Kawasi reveal how the material foundations of the global energy transition are produced through intensified extractive activities that transform landscapes, ecosystems, livelihoods, and social relations. Water and soil pollution, environmental degradation, displacement, relocation, and the disruption of customary and local livelihoods indicate that the costs of nickel-based industrialization are disproportionately borne by communities located at the extraction frontier. In this sense, Kawasi increasingly resembles a *sacrifice zone* in which particular territories and populations are rendered expendable in the pursuit of national development, industrial competitiveness, and global decarbonization. The notion of a "green" transition therefore cannot be separated from the extractive relations through which its critical minerals are produced.

From a political-ecological and environmental justice perspective, the central issue is not whether nickel is necessary for the energy transition, but how, where, and for whom the transition is organized. Nickel downstreaming creates value across national and global supply chains, linking local extraction sites to battery production, electric vehicles, and broader low-carbon markets. Yet the distribution of this value remains highly uneven: economic gains and industrial opportunities are concentrated across corporate, national, and transnational actors, while ecological risks and social disruptions remain localized. This unequal distribution reflects not only a problem of distributive injustice, but also issues of procedural and recognitional injustice, particularly where affected communities have limited influence over decisions concerning land, relocation, environmental management,

and the future of their territories. The discourse of “critical minerals” can consequently depoliticize extraction by presenting mining expansion as an unavoidable requirement of decarbonization, while obscuring the historical and contemporary power relations that determine whose environments are protected, whose livelihoods are disrupted, and whose voices are prioritized.

A genuinely just energy transition therefore requires a fundamental reorientation of Indonesia’s nickel downstreaming model from extractivist accumulation toward ecological and social justice. Such a transition cannot be evaluated solely through indicators of investment, export value, industrial capacity, or contribution to electric-vehicle production; it must also be assessed according to the ecological integrity of extraction areas, the equitable distribution of benefits and burdens, the protection of livelihoods, and the recognition of affected communities as rights-bearing political actors. In the case of Kawasi, this means strengthening environmental safeguards, ensuring transparent and accountable relocation processes, guaranteeing meaningful participation in territorial decision-making, and establishing mechanisms through which local communities can obtain a fair share of the value generated from resources extracted from their territories. More fundamentally, the case demonstrates that decarbonization does not automatically constitute justice. Unless the global energy transition confronts the extractive structures and unequal power relations embedded within critical-mineral supply chains, the transition may reproduce a familiar geography of sacrifice in which the environmental and social burdens of a “green” future are displaced onto marginalized communities. The question of “for whom?” must therefore remain at the center of debates on nickel downstreaming and energy transition in Indonesia.

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