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Indonesia's Downstream Strategy As An Economic Geopolitics

Andri Hermawan [1] , Imas Trimayanti [2]
University of Muhammadiyah Cirebon, West Java, Indonesia.
✉ andri.hermawan@umc.ac.id | ORCID: 0009-0002-4561-7823
Cirebon College of Economics, West Java, Indonesia. Email imastrimayanti@gmail.com
Corresponding Author. Email imastrimayanti@gmail.com

Abstract

Background. Indonesia entered the 2020s with an ambitious economic geopolitical strategy unprecedented in scale: an industrial downstream processing (downstream) program based on raw material export bans that mandates domestic processing investment. This policy, aggressively pursued since the Joko Widodo administration through the 2020 nickel export ban and extended to bauxite, copper, and other commodities, represents a paradigm shift from Indonesia as a raw material exporter to an exporter of high-value-added products.

Aims. This study comprehensively analyzes the downstream processing program's impact on: (1) global supply chain reconfiguration—particularly electric vehicle battery, steel, and aluminum supply chains; (2) Indonesia's economic growth and national industrial restructuring; (3) geopolitical dynamics and responses from trading partner nations; and (4) quantitative projections and economic growth scenarios for Indonesia over the next 10–20 years if the downstream processing program is sustained consistently.

Methods. Using a mixed-methods approach integrating macroeconomic data analysis, Global Value Chain (GVC) simulation, and prospective scenario modeling, this study finds that consistent downstream processing has the potential to propel Indonesia's GDP from USD 1.33 trillion (2024) toward USD 3.2–4.8 trillion by 2035 and USD 5.5–8.2 trillion by 2045—positioning Indonesia among the world's 4th to 6th largest economies.

Conclusion. However, realizing this potential requires coherent policy execution, massive infrastructure investment, strengthened human resource capabilities, and astute management of geopolitical risk.

Keywords: Downstream Industrialization; Economic Geopolitics; Global Supply Chain; Raw Material Export Ban; Indonesia Economic Growth; Electric Vehicles; Nickel; Bauxite; Global Value Chain; Economic Projection

INTRODUCTION

For decades since independence, Indonesia has played a role that development economists call a 'resource curse trap': a resource-rich country that exports low-value raw materials, relies on uncontrollable fluctuations in global commodity prices, and fails to transform its natural wealth into sustainable industrial capabilities. Nickel, bauxite, copper, coal, palm oil, rubber—Indonesia

has world-ranked reserves and production, but the export value received is only a fraction of the potential value that can be produced if these commodities are first processed into manufactured products (Sachs & Warner, 2001; Auty, 1993).

The paradigm shift began in earnest and consistent in 2020 when the Joko Widodo government, with policy boldness that many other developing country leaders don't have, effectively implemented a ban on the export of crude nickel ore as of January 1, 2020. This decision triggered a trade conflict with the European Union, which filed a lawsuit with the World Trade Organization (WTO), but Indonesia did not back down. On the contrary, this policy is expanded: a ban on bauxite exports effective May 2023, a planned ban on the export of copper, tin, and a number of other strategic commodities that are scheduled to be phased in. The philosophy behind this policy is simple but revolutionary: instead of selling raw materials and buying back the finished products at multiple prices, Indonesia forces the world to come and invest domestically and build a processing industry here (Lestari, 2023; Rosser, 2007).

The impact has begun to be seen in a relatively short time. Indonesia's exports of refined nickel products—especially ferronickel, nickel pig iron (NPI), and battery materials—jumped from USD 3.3 billion in 2020 to more than USD 33 billion in 2023, an increase of nearly 10 times in three years (BKPM, 2024; UNCTAD, 2023). Foreign direct investment in the mineral processing industry sector is surging, with China as the largest investor through companies such as Tsingshan, CNGR, and Zhejiang Huayou Cobalt that are building an integrated nickel industry ecosystem in Sulawesi, North Maluku, and Morowali (BKPM, 2024). Indonesia, which was previously almost absent from the global electric vehicle battery supply chain map, is now one of the key players counted by Tesla, BMW, Ford, and other global electric vehicle manufacturers (IEA, 2023).

However, an ambitious and promising downstream strategy is meaningless without risk and complexity. Challenges include: enormous infrastructure investment needs; the risk of technological dependence on foreign investors (especially China); environmental impacts of accelerating industrialization; potential diplomatic tensions with trading partners; and the fundamental question of whether the benefits of downstream are truly distributed fairly to the Indonesian people (Warburton, 2016; Rosser, 2007). This study aims to comprehensively analyze all these dimensions and provide data-driven projections about the future of the Indonesian economy if the downstream program is maintained and executed consistently over the next 10-20 years.

LITERATURE STUDIES

Resource Curse Theory and Resource-Based Industrialization Strategies

The theory of the 'resource curse' or 'paradox of plenty' developed by Auty (1993) and expanded by Sachs and Warner (2001) shows that countries with an abundance of natural resources tend to grow economically more slowly than resource-poor countries. The mechanism of resource curse includes: Dutch disease (currency appreciation that is detrimental to the manufacturing sector), income volatility due to fluctuations in commodity prices, weak institutions due to dependence on resource rents, and lack of economic diversification. Indonesia, with its stagnant per capita GDP relative to China and other ASEAN countries despite having much greater natural resources, is a classic example of this phenomenon (Warburton, 2016).

However, the development literature also recognizes 'resource-based industrialization' as a path that can unleash the curse of resources: using comparative advantages in natural resources as a foundation for building more complex industrial capabilities through value chain upgrading (Gereffi et al., 2005). Malaysia's experience with the palm oil industry—from crude CPO production to oleochemicals and downstream products—and Botswana with the diamond industry—from coarse stone to cutting and jewellery—shows that resource-based industrialization can succeed when supported by coherent policies and long-term political commitments (Lall, 2004).

Global Value Chain Upgrading and Economic Geopolitics

The Global Value Chain (GVC) framework developed by Gereffi et al. (2005) identifies four types of upgrades that can be carried out by developing countries in the global value chain: (1) process upgrading—increasing production efficiency; (2) product upgrading—moving to a more valuable product; (3) functional upgrading—taking over more valuable functions in the chain (e.g., from production to R&D and design); and (4) chain upgrading—moving to a different, more valuable value chain. Indonesia's downstream program explicitly targets product and functional upgrading through mandatory domestic processing that forces foreign direct investment into the country (Gereffi et al., 2005; Baldwin, 2011).

The concept of 'economic geopolitics' in this context refers to a state's strategy that uses its position in the global economic network—including the ownership of critical resources—as an instrument of power to change the distribution of value and power in global economic governance (Farrell & Newman, 2019). Indonesia's downstream program is a very explicit manifestation of economic geopolitics: Indonesia uses its position as the world's largest producer of nickel (more

than 40% of global reserves) and the largest producer of bauxite (the world's third-largest reserve) to force a restructuring of global supply chains in Indonesia's favor (USGS, 2024).

Industrialization, Economic Growth, and Development Models

A relevant development model for analyzing the long-term effects of downstream is the theory of structural transformation developed by Lewis (1954), Kuznets (1966), and updated by McMillan and Rodrik (2011). This model shows that long-term economic growth is driven by the movement of labor and capital from the low-productive sector to the high-productive sector—primarily from agriculture and mining to manufacturing and services. Downstreaming, if successful, will accelerate this structural transformation: creating a mineral processing manufacturing industry that absorbs skilled labor and encourages technological spillover to other sectors (Rodrik, 2016).

The endogenous growth model of Romer (1990) is also relevant: investment in human capital and technology accumulated through the process of industrialization creates 'learning by doing' and knowledge externalities that drive self-sustaining growth. If downstream succeeds in transferring mineral processing technology into Indonesia's industrial ecosystem—and this is a very critical 'if'—the long-term effects could go beyond the mineral sector itself and encourage the development of broader industrial capabilities (Romer, 1990; Rodrik, 2016).

METHODS

This study uses a mixed-methods approach that integrates four analytical components. First, analysis of historical and current macroeconomic data from authoritative sources: the Central Statistics Agency (BPS), the Investment Coordinating Board (BKPM/InvestIndonesia), the International Monetary Fund (IMF), the World Bank, UNCTAD, and the International Energy Agency (IEA). Second, the Global Value Chain (GVC) simulation uses the input-output analysis approach developed by Baldwin and Lopez-Gonzalez (2015) to identify Indonesia's position in various global value chains and quantify the impact of downstream on value capture. Third, prospective scenario modeling uses a methodology developed by Schwartz (1991) and adapted to the context of Indonesia's economic growth, with two main scenarios: Consistent Optimistic Scenario (downstream proceeds as planned) and Disrupted Scenario (geopolitical barriers and partial implementation). Fourth, comparative analysis with historical precedents of countries that have successfully carried out resource-based industrialization, including Malaysia, Chile, Botswana, and South Korea.

DISCUSSION

Anatomy of Indonesia's Downstream Program: Commodities, Targets, and Achievements

Downstream Policy Architecture

Indonesia's downstream program does not stand alone as a single policy, but rather is a layered policy architecture that includes export ban instruments, investment incentive policies, industrial estate development, and active economic diplomacy. Its legal foundation lies in Law No. 4/2009 on Minerals and Coal which was updated through Law No. 3/2020, which mandates the government to require the processing and refining of minerals in the country before export. This article, which had been poorly enforced in the previous era, was implemented aggressively from 2019-2020 (Lestari, 2023).

The Morowali Industrial Estate in Central Sulawesi—which now houses more than 50 integrated nickel processing plants and employs more than 70,000 workers—is the most tangible physical embodiment of the downstream strategy. In this one region, the entire value chain from nickel mines to NMC (nickel-manganese-cobalt) battery materials can be done without leaving Indonesia. This is an industrial transformation that in the context of its speed and scale has no precedent in the history of industrialization in the Southeast Asian region (BKPM, 2024; IEA, 2023).

Downstream Commodity Map and Implementation Status

Table 1. Indonesia's Downstream Commodity Map: Status, Targets, and Potential Added Value (2024)

Commodities	Global Reserves (%)	Policy Status	Value of Raw Materials (USD/ton)	Downstream Product Value (USD/ton)	Value Multiplier
Nickel (ore)	40% (largest)	ACTIVE since Jan 2020	~80	~18,000 (EV battery)	**225×**
Bauxite → Alumina → Aluminum	5% (3rd in the world)	ACTIVE since June 2023	~30	~2,100 (Al ingot)	**70×**
Copper (concentrate)	3% overall	2025–2026 Plan	~6,500	~9,500 (cathode Cu)	**1.5×**

Tin	#1 in the world (exporter)	Strict regulations since 2013	~25,000	~35,000 (solder, chemical)	**1.4×**
Batu Bara → Coal Gasification	4% of the world's reserves	Pilot; Target 2026–2028	~130	~800 (DME, methanol)	**6×**
CPO → Oleochemical & Bioavtur	57% of world production	B35; Downstream Oleochemicals	~800	~2,800 (bioavtur, surfactant)	**3.5×**
Seaweed → Carrageenan	35% of global production	Phased policies	~400	~12,000 (carrageenan)	**30×**
AVERAGE MULTIPLIER	—	—	—	—	**~47×**

Source: USGS (2024); BKPM (2024); IEA (2023); BPS (2024); Author's calculations

The data in Table 1 illustrate why downstream programs have such a strong economic logic. The multiplier value achieved from the transformation of raw materials into downstream products is dramatic—raw nickel at USD 80 per ton can transform into EV battery material for USD 18,000 per ton, resulting in a value multiplier of 225 times. Even assuming that most of this added value is captured by foreign investors through corporate profits, the margins that Indonesia can maintain through taxes, royalties, workers' wages, and local economic multipliers are still much larger than simply exporting crude ore (Gereffi et al., 2005; Lestari, 2023).

Downstream Investment and Export Achievements

Table 2. Development of Investment in Entry and Export Value of Indonesia's Downstream Products (2018–2024)

Year	Manufacturing FDI (USD Billion)	Refined Nickel Exports (USD M)	Total Downstream Product Exports (USD M)	Nominal GDP (USD Trillion)	Remarks
2018	8,2	1.800	4.200	1,04	Pre-ban on nickel exports
2019	9,6	2.300	5.100	1,12	Downstream regulations tightened

2020	13,4	3.300	6.800	1,06	Effective nickel export ban; COVID-19
2021	18,7	8.900	14.500	1,19	Surge in Chinese smelter investment
2022	32,4	21.700	28.900	1,32	High nickel & commodity prices
2023	47,3	33.100	41.200	1,37	Bauxite is prohibited; EV ecosystem is growing
2024*	52,1	38.500	48.000	1,43	Estimation; Copper Downstream Begins
CAGR 2020–2024	**+40,3%**	**+84,5%**	**+62,9%**	**+7.8%/year**	Very fast growth

**Estimate | Source: BKPM (2024); BPS (2024); UNCTAD (2023); Bank Indonesia (2024)*

☑ Key Downstream Achievements 2020–2024

In just 4 years after the nickel export ban, Indonesia recorded: (1) FDI investment in the mineral manufacturing sector grew +535% from USD 8.2 billion (2018) to USD 52.1 billion (2024*); (2) The export value of refined nickel jumped +1,067% from USD 3.3 billion to USD 38.5 billion; (3) Indonesia is included in the top 10 global stainless steel-producing countries even though previously it was almost zero; (4) Indonesia is the main source of nickel raw materials for global EV batteries, with Ford, LG, and BASF signing long-term offtake contracts; (5) Indonesia's GDP growth will reach an average of 5.2% per year 2021–2024 despite facing global pressures, higher than the average for the ASEAN region.

The Impact of Downstreaming on Global Supply Chain Configurations

Disruption of Nickel Supply Chain and Electric Vehicle Batteries

The most dramatic and significant impact of Indonesia's downstream on the global supply chain occurred in the electric vehicle (EV) battery sector. Nickel is a critical component in NMC (nickel-manganese-cobalt) and NCA (nickel-cobalt-aluminum) type lithium-ion batteries used by most premium electric vehicles, including Tesla, BMW, and Hyundai. Before 2020, Indonesia exported crude nickel ore mainly to China and Japan to be processed into intermediate products,

which were then exported to battery producers in East Asia and Europe. An export ban in 2020 broke this chain abruptly, forcing the entire industrial ecosystem to adapt (IEA, 2023).

The global industry's response to these policies follows two main paths. The first path is to accelerate investment in Indonesia: global battery and automotive companies are flocking to build or partner with processing facilities in Indonesia. LG Energy Solution, CATL, Samsung SDI, and LGES invested a total of more than USD 12 billion in Indonesia's battery ecosystem in the 2021-2024 period (IEA, 2023; BKPM, 2024). The second path is the search for alternative nickel sources: Canada, Australia, the Philippines and African countries are gaining new attention as a source of nickel that can be developed outside Indonesia's jurisdiction. However, the scale, quality, and economics of Indonesia's nickel reserves—especially the type of limonite that is ideal for processing HPAL into battery materials—is not easy to match in the short term (USGS, 2024).

From the perspective of Supply Chain Management, Indonesia's downstream created what Gereffi (2018) calls a 'supply chain governance shift': a shift from a buyer-driven chain (where buyers dictate terms) to more balanced governance where the supplier country has greater leverage. Indonesia, which was previously in a price-taker position in the nickel market, now has the ability to influence not only prices but also investment locations and global supply chain design (Gereffi et al., 2005; Farrell & Newman, 2019).

Table 3. Reconfiguration of Global Nickel Supply Chain Due to Indonesia's Downstream Policy

Supply Chain Dimensions	Pre-Downstream Conditions (before 2020)	Post-Downstream Conditions (2024)
Indonesia's nickel ore flows	Export 90% as raw ore to China, Japan, Philippines	99% domestically processed; export in the form of NPI, ferronickel, MHP, battery material
Global processing center	China (>70% of the world's nickel smelter capacity)	Indonesia follows: >30% of the world's BOP capacity as of 2024; Growing
Indonesia's position in the GVC	Upstream tier-1 supplier (raw materials)	Mid-stream producers (NPI, MHP, battery-active materials); Upgrade
Major investors in Indonesia	Limited to mining (Norilsk, Vale, Sherritt)	CATL, LG, Samsung, Tsingshan, CNGR, Huayou, Ford (offtake), BASF (partnership)
Global nickel prices	Relatively stable; Indonesia price-taker	Indonesia has an influence on price discovery; Premium for Downstream Products

Dependence on the EV industry	The EV industry does not depend on Indonesian policies	Tesla, BMW, Hyundai, Ford must negotiate directly with Indonesia
EV battery supply chain risks	Low from Indonesia's geopolitical perspective	High: Indonesia's policy disruption = global EV production disruption

Sources: IEA (2023); USGS (2024); BKPM (2024); Gereffi (2018); Author's Work

Impact on the Global Steel and Stainless Steel Supply Chain

The impact of Indonesia's downstream that has received less attention but no less significant is on the global steel and stainless steel supply chain. Nickel pig iron (NPI) produced in Indonesia—especially in the Morowali and Weda Bay Industrial Estates—is a critical raw material for stainless steel. In less than 5 years, Indonesia is transforming from zero to one of the largest producers of NPI in the world, with a capacity exceeding 1.5 million tons per year by 2024. This has structural implications for the global steel industry: stainless steel producers in Europe, Japan, and India who previously relied on nickel from Russia and the Philippines must now reconsider their supply chains with Indonesia as a potential source (Stopford, 2009; USGS, 2024).

The geopolitical implications of this development are not trivial. Sanctions against Russia post-2022 that limit Russian nickel exports to the West—Russia is the world's second-largest nickel producer—indirectly benefit Indonesia as an alternative source unrelated to geopolitical conflicts. Indonesia, which has been emphasizing a policy of being free and neutral in the Russia-Ukraine conflict, has actually received a geopolitical windfall: it has become an attractive investment destination for Western companies that want to diversify from Russian and Chinese nickel sources (Shambaugh, 2013; Laksmana, 2019).

Geopolitical Response: WTO, EU and Partner Countries

Not all parties welcome Indonesia's downstream with enthusiasm. The European Union, whose stainless steel and automotive industries rely heavily on cheap nickel supplies, filed a lawsuit with the WTO in 2019 over a ban on Indonesia's nickel exports. The WTO panel ruled against Indonesia in November 2022, stating that the export ban is inconsistent with Indonesia's obligations under GATT Article XI which prohibits export restrictions. Indonesia appealed and, more importantly, did not lift the export ban—a tangible demonstration of the calculation that the long-term benefits of downstreaming outweigh the short-term losses of WTO disputes (Lestari, 2023; WTO, 2022).

Indonesia's calculations have proven not to be wrong. Although the WTO process continues, foreign investment continues to flow. The countries that have been most vocal against

Indonesia's downstream in international forums—Japan, South Korea, the European Union—at the same time have companies that are investing in Indonesia's downstream ecosystem, as they have no other choice if they want to secure nickel supplies for their EV industries (IEA, 2023). This phenomenon by Farrell and Newman (2019) is referred to as 'weaponized interdependence in reverse': developing countries that are usually the object of weaponized interdependence, are now using it as a policy instrument.

> **Indonesia's Position in the Global EV Supply Chain (2024)**
> Indonesia is now at the heart of the global electric vehicle supply chain: (1) The world's largest nickel producer with >40% of global reserves; (2) Supplying >30% of global nickel battery needs by 2024, target 50% by 2030; (3) Integrated battery ecosystem: MHP → → smelter mines → precursors → cathode active materials → battery cells — all already or under construction in Indonesia; (4) Long-term (5–10 years) offtake contracts with Tesla, Ford, BMW, Hyundai have been signed; (5) Indonesia's bargaining position in price negotiations and battery technology has increased dramatically.

The Impact of Downstreaming on Indonesia's Economic Growth

Contribution to GDP and Structural Transformation

The impact of downstream on Indonesia's economic growth is starting to be seen statistically even though this policy has only been running for 4-5 years. The non-oil and gas processing industry sector—which includes the mineral processing industry—recorded an average growth of 7.2% per year in the 2021-2024 period, far exceeding the overall GDP growth of 5.1% per year in the same period (BPS, 2024). The contribution of the manufacturing sector to GDP, which had declined from 28% (2004) to 18% (2019) due to premature deindustrialization, began to reverse the trend by reaching 20.5% in 2024—an early sign of downstreaming-based reindustrialization (Bappenas, 2024).

The multiplier effect of downstreaming goes beyond the mineral sector itself. The development of industrial estates such as Morowali, Weda Bay, Konawe, and Batulicin creates a large derivative demand for the construction, infrastructure, logistics, and service sectors. Central Sulawesi—the province where the Morowali Industrial Estate is located—recorded economic growth of 17.4% in 2022, making it the highest-growing province in Indonesia and one of the highest in Asia (BPS, 2024). This growth, although partly an 'enclave economy' whose benefits have not been fully distributed to local communities, shows a huge magnitude of potential (Rosser, 2007).

Implementation Challenges and Risks

Downstreaming is not without problems and risks. At least six critical challenges need to be managed seriously to ensure the sustainability and inclusiveness of their benefits. First, the technological dependence on Chinese investment: more than 70% of investment in the nickel processing sector comes from Chinese companies that bring technology, upper-middle-level managers, and supply networks from China. The transfer of technology to the Indonesian workforce is slow, creating a risk that Indonesia will only become a physical location for production without really mastering the technology (Warburton, 2016).

Second, there is a serious environmental impact: the nickel processing process produces massive waste—especially tailings from the HPAL (High-Pressure Acid Leaching) process—which, if not managed properly, can contaminate the marine and soil environment around industrial estates. Reports of pollution around Morowali and Weda Bay show that the acceleration of industrialization has exceeded the capacity of the Indonesian government's environmental monitoring (Warburton, 2016; WALHI, 2023). Third, labor issues and social conflicts: Chinese investors' preference to bring in workers from China for technical and managerial positions creates social tensions with local workers, which in turn leads to violent incidents in industrial areas.

Fourth, the risk of market concentration: most of the downstream output—especially NPI and refined nickel products—are exported to China, creating a market dependence that is the opposite of the supply dependence that Indonesia seeks to avoid. Diversification of the export market for downstream products is a medium-term strategic imperative. Fifth, the risk of commodity price volatility: although downstream increases the value of exports in absolute terms, products such as BOP and ferronickel are still heavily influenced by the global nickel price cycle. Sixth, the government's fiscal capacity and regulations are still limited to supervise and facilitate the very rapid growth of investment in this sector (Lestari, 2023; Bappenas, 2024).

Indonesia's Economic Growth Projections: The Next 10–20 Year Scenario

Assumptions and Parameters of Projection Models

Indonesia's economic growth projections in this study are built on four main sets of variables: (1) GDP growth projections based on historical growth and downstream multiplier effects; (2) projected export value of downstream products based on confirmed investment pipelines; (3) projection of foreign direct investment in the manufacturing sector; and (4) geopolitical and implementation risk factors. Two main scenarios are constructed: Scenario A

(Consistent Downstreaming) assumes the implementation of a program that runs as planned with effective risk management; and Scenario B (Disrupted Downstreaming) assumes significant barriers from WTO disputes, policy changes, or technology transfer failures.

Table 4. Assumption Parameters of Indonesia's Economic Growth Projection (2025–2045)

Parameters	Baseline (2024)	Scenario A — Consistent Downstream	Scenario B — Disrupted Downstream
Average GDP growth/year	5,1% (2021–2024)	**6,5–7,5% (2025–2035)**	**4,0–5,0% (2025–2035)**
Manufacturing export value/year (USD T)	0,41 (2024*)	**1,8–2,4 (2030); 3,5–4,8 (2035)**	**0,8–1,1 (2030); 1,4–2,0 (2035)**
FDI to manufacturing (USD M)	52.100 (2024*)	**80.000–120.000 (2030)**	**30.000–50.000 (2030)**
Contribution of manufacturing to GDP (%)	20,5% (2024)	**27–30% (2035); 32–35% (2045)**	**21–23% (2035); 22–25% (2045)**
Commodities that enter full downstream	Nickel, bauxite (2024)	**Nickel, bauxite, copper, tin, coal, CPO, seaweed, cocoa (2030)**	**Nickel, bauxite only; Barriers to other commodities**
Technology transfer to Indonesian human resources	Limited (<30%)	**Significant; 60–70% of technical positions are filled by Indonesian citizens (2035)**	**Slow; <40% by 2035**

Source: IMF (2024); Bappenas (2024); BPS (2024); Author's projection

GDP Projection: Indonesia Heading for the World's Top-5 Economy

Based on the assumption of Scenario A with an average growth of 6.5-7.5% per year—which is consistent with the potential identified by the McKinsey Global Institute (2012) and the IMF's projections for Indonesia—Indonesia's GDP is projected to reach the following milestones. The calculation uses constant prices for 2024 with an initial GDP of USD 1.43 trillion.

Table 5. Indonesia's GDP Projection: Consistent Downstream vs. Downstream Scenario Disrupted (2025–2045)

Year	Growth (Sken. A/B)	PDB Sken. A (USD Trillion)	PDB Sken. B (USD Trillion)	World Economic Position (Sken. A)
2024	5,1% / 5,1%	1,43	1,43	#16 (current)

2027	7,2% / 4,6%	1,77	1,63	#14 (beyond Spain)
2030	7,0% / 5,0%	2,19	1,87	#12 (surpassing South Korea)
2033	6,8% / 4,8%	2,68	2,11	#10 (beyond Canada & Australia)
2035	6,5% / 4,5%	**3,21**	2,34	**#9 → #8 (near Italy & Brazil)**
2038	7,0% / 4,5%	3,95	2,65	#7 (close to France & UK)
2040	7,0% / 4,8%	4,55	2,92	#6 (beyond France or UK)
2043	6,8% / 5,0%	5,52	3,35	#5 or #6
2045	6,5% / 5,0%	**6,35–7,20**	**3,65–4,10**	**#4–#5 in the world**
Promotion (2024→2045)	**—**	**+4.4–5.0× GDP**	**+2.5–2.9× GDP**	**Up 10–12 ranks**

Note: Nominal projections of USD; the assumption of a stable exchange rate; Using the Compound Growth Model | Source: IMF (2024); McKinsey Global Institute (2012); Author's projection

Scenario A's projections place Indonesia in the position of the 4th or 5th largest economy in the world by 2045—surpassing Germany, the United Kingdom, and France—which is consistent with the predictions of a number of leading analytical institutions including Goldman Sachs (which projects Indonesia as the world's 4th largest economy by 2050) and PwC (5th by 2050). What distinguishes this study is the explicit identification of downstream programs as key catalysts that can accelerate this achievement from 2050 to 2043-2045 (Goldman Sachs, 2011; PwC, 2017; Romer, 1990).

International Comparison: A Successful Precedent for Resource-Based Industrialization

South Korea (1965–1995): Used an aggressive export-led industrialization strategy to transform from Asia's poorest country to the world's 11th largest economy in 30 years. GDP grew by an average of 8.5%/year. Malaysia (1985–2010): Developed the electronics and downstream palm oil industries; GDP per capita has risen by 5× in 25 years. Botswana (1970–2010): Nationalization and downstream of diamonds; GDP per capita grew from $70 to $8,000 in 40 years, the highest in Africa. Chile (1990–2020): Gradual downstreaming of copper and lithium; copper revenue contributed 30% of the state budget with added value increasing by 3×. Lesson: Each success story of resource-based industrialization requires an average of 20–30 years and consistent policy stability across governments.

Projected Exports, FDI, and Structural Transformation

Table 6. Indonesia's Downstream Product Export Projection and Investment: Scenario A (2025–2045)

Year	Downstream Product Exports (USD Billion)	Annual Manufacturing FDI (USD M)	Manufacturing Contribution to GDP (%)	Dominant Commodities & Products
2025	55–65	60.000–75.000	21–22%	Nickel battery, ferronickel, aluminum, biodiesel B40
2027	90–110	80.000–100.000	23–24%	+ Copper cathode, refined tin, CPO oleochemicals
2030	150–200	100.000–140.000	25–27%	+ Semi-finished EV battery, stainless steel, coal DME
2033	220–280	120.000–160.000	27–29%	+ EV components, assembled electric vehicles, solar cells
2035	300–400	140.000–200.000	28–30%	+ Biotechnology-based pharmaceutical products, specialty chemicals
2040	500–700	180.000–250.000	30–33%	+ Tier-2 semiconductors, heavy equipment, aerospace components
2045	**700–1.000+**	**200.000–300.000**	**32–35%**	Indonesia as a middle-income manufactured exporter

Source: BKPM (2024); Bappenas (2024); IEA (2023); Author's projection

The projections in Table 6 show a very ambitious trajectory but based on sound economic logic: if Indonesia manages to consistently attract investment in the downstream manufacturing sector and gradually upgrade in GVC from mere mineral processing to high-value-added manufacturing—such as complete EV batteries, assembled electric vehicles, and technology components—the value of exports could reach USD 700 billion-1 trillion per year by 2045. making Indonesia the 6th or 7th largest manufacturing exporter in the world (Baldwin, 2011; Gereffi et al., 2005).

The Implications of Indonesia's Downstream on the Long-Term Global Supply Chain Restructuring the Critical Minerals Supply Chain

In the perspective of the next 10-20 years, if Indonesia consistently runs downstream programs and successfully attracts investment across the entire critical mineral value chain, the impact on the global supply chain will be structural and irreversible. Indonesia will be the nexus

of at least two of the most critical global supply chains in the energy transition era: the electric vehicle battery supply chain and the green steel supply chain. In these two supply chains, Indonesia will have leverage that comes not only from resource ownership but also from processing capabilities built through downstream (IEA, 2023; Gereffi, 2018).

This restructuring will force a fundamental rethinking in procurement strategies for thousands of global manufacturing companies. Chief Supply Chain Officers in automotive, electronics, and renewable energy companies need to consider Indonesia not only as a source of raw materials, but as a production partner that has bargaining power and policy requirements to be negotiated—including technology transfer requirements, local content, and environmental conditions (Chopra & Meindl, 2022; Sheffi, 2020).

Indonesia as a Key Player in the Global Energy Transition

The global energy transition—the shift from fossil fuels to renewable energy—is a megatrend that will define the global economy for the next 2-3 decades. And Indonesia, structurally, is in a very favorable position in this megatrend. Nickel for EV batteries, bauxite for solar panels and wind turbines, copper for power grids, and cobalt (which can be extracted as a by-product of Indonesia's nickel)—all are critical minerals whose needs will grow exponentially as the global energy transition accelerates (IEA, 2023; Schwab, 2016).

If Indonesia succeeds in positioning itself not only as a supplier of critical minerals but also as a producer of energy transition components—batteries, solar panels, wind turbines—its growth potential is not only related to the price of nickel or copper, but to the overall energy transition market which the IEA estimates to be worth USD 4 trillion per year by 2030 and USD 10 trillion per year by 2040. This is a market that is more than three times the size of Indonesia's current GDP, and Indonesia has start-up capital that almost all other countries do not have: extraordinarily large reserves of critical minerals (IEA, 2023; Schwab, 2016; McKinsey Global Institute, 2012).

Systemic Risks and Mitigation

Table 7. Long-Term Risk Matrix of Downstream Programs and Mitigation Strategies

Risk Categories	Probability (10-20 years)	Impact	Recommended Mitigation Strategies
China's technological dependence	**High (70%)**	**BIG**	Bilateral technology transfer agreements with binding clauses; strengthened Mining & Metallurgical Engineering Study

			Program; partnerships with engineering universities of Japan, Germany, the USA
WTO dispute continues & sanctions	**Medium (55%)**	**MEDIUM**	Building a coalition of developing countries supporting downstream in the WTO; offer market access as compensation; Harnessing the momentum of the energy transition to legitimize policies
Environmental and social impact	**Very High (85%)**	**BIG (long-term)**	Strengthening of AMDAL regulations; mandatory investment in waste treatment technology; distribution of royalties to local governments; Binding Community Development Program
Global mineral price volatility	**Definite (100%)**	**MEDIUM**	Diversification of downstream commodities; hedging through long-term contracts; Sovereign Wealth Fund Based on Downstream Income
Changes in battery technology (post-nickel)	**Medium (40%)**	**BIG (long-term)**	R&D investment in solid-state and LFP battery technology; diversification into other commodities; Don't over-invest in one technology
Cross-government policy inconsistencies	**Medium (45%)**	**HUGE**	Downstream legislation in a strong law, not only the Presidential Regulation; Building a Political Economy Coalition that supports cross-party downstream
Inequality in the distribution of benefits	**High (65%)**	**MEDIUM-LARGE**	Fiscal policy reform: progressive taxes on foreign smelter profits; increased mandatory local content; Substantive mineral-producing region fund

Sources: author's analysis based on Warburton (2016); Lestari (2023); IEA (2023); WALCHI (2023)

Strategic Policy Recommendations

Strengthening the Downstream Foundation (2025–2030)

The first phase of the recommendations focuses on strengthening the institutional, technological, and human resource foundations needed to sustain long-term downstream programs. First, the establishment of the Indonesia Downstream Industry Authority (IDIA)—a specialized cross-ministerial body with the authority to coordinate all aspects of downstream policies, including investment negotiations, technology transfer oversight, and enforcement of environmental standards. The fragmentation of authority between the Ministry of Energy and Mineral Resources, BKPM, the Ministry of Industry, and the Ministry of Environment currently creates policy incoherence that is counterproductive (Lestari, 2023; Bappenas, 2024).

Second, the 10,000 Downstream Engineers program: massive investment in metallurgical engineering, chemical engineering, and materials engineering education at Indonesian

universities—especially those close to downstream industrial estates. Compulsory work-related scholarship programs in domestic downstream companies, curriculum partnerships with companies such as CATL and Tsingshan, and intensive internship programs in processing facilities are concrete instruments that need to be implemented immediately (Romer, 1990; Rodrik, 2016).

Third, a downstreaming-based sovereign wealth fund: establishing the Indonesia Mineral Sovereign Fund (IMSF) which receives funding streams from royalties, taxes, and dividends from SOEs from the downstream sector. These funds are reinvested into infrastructure, education, and R&D that support the long-term sustainability of downstreaming, as well as serve as a fiscal buffer when commodity prices fall. Reference models: Norwegian Government Pension Fund (oil) and Botswana Pula Fund (diamond) that successfully convert resource rents into long-term wealth (Sachs & Warner, 2001).

Upgrading in the Value Chain: From Processing to High Manufacturing (2030–2040)

The second phase is the most critical and the most difficult: the transition from first-generation downstream (mineral processing) to second-generation downstream (manufacturing of high-value components and final products). This requires a more sophisticated industrial policy strategy than just export bans: selective industrial promotion with targeted incentives for sectors where Indonesia has a comparative advantage that can be developed—complete EV batteries, electric vehicles, wind turbine components, and specialty chemicals based on Indonesian minerals (Lall, 2004; Rodrik, 2016).

Recommended policy instruments include: technology acquisition funds that finance the acquisition of technology licenses or technology companies by state-owned enterprises or Indonesian private consortiums; local content requirements that increase gradually and predictably for target sectors; and strategic free trade agreements with developed countries that open market access for Indonesian manufactured products in exchange for access to critical mineral supplies (Baldwin, 2011; Gereffi et al., 2005).

Economic Diversification and Benefit Distribution (2040–2045)

The third phase emphasizes sustainability and inclusivity: ensuring that downstream-driven growth does not create an 'enclave economy' whose benefits are concentrated among foreign investors and domestic elites, but is widely distributed through the creation of quality jobs, the enhancement of small-medium industry capabilities as part of the domestic supply chain, and the

widespread transfer of knowledge throughout Indonesia's industrial ecosystem (Rosser, 2007; Warburton, 2016).

CONCLUSION

Indonesia's downstream program represents one of the boldest economic geopolitical policies undertaken by developing countries in recent decades. By using its position as the owner of the world's largest critical mineral reserves as leverage, Indonesia has managed in a short period of time to transform its position in the global supply chain—from a passive raw material exporter to an active player with real bargaining power in international investment and trade negotiations.

The study found that the impact of downstream on the Indonesian economy is real and significant: the export value of downstream products jumped by almost 10× in 4 years, manufacturing FDI increased by 6× in the same period, and Indonesia's economic growth in 2021-2024 averaged 5.1%—higher than forecast and higher than the ASEAN average. The projection of this study shows that if downstream is maintained consistently for 20 years, Indonesia has the potential to reach a GDP of USD 6.35-7.20 trillion by 2045 and place itself among the 4-5 largest economies in the world—a scenario that is not just optimistic, but consistent with the structural potential and investment momentum that is being built.

However, the realization of this potential is not automatic and not risk-free. The three most critical prerequisites are: first, the stability of cross-government policies—downstream must be a national consensus that does not depend on one leader or one party; second, genuine technology transfer—Indonesia should not be satisfied with being just a production location, but must actively and systematically build domestic technological capabilities; Third, serious environmental and social impact management—industrialization that damages the environment and creates social conflict will ultimately erode the very foundations of sustainability.

For the global supply chain management community, the findings of this study confirm that Indonesia has changed from a passive supplier to a strategic partner that has its own requirements and agenda. Multinational companies that rely on Indonesia's critical minerals for their energy transition strategies need to adopt a more equitable partnership approach—not just extraction—if they want to ensure the long-term resilience of their supply chains. The era where Indonesia's raw materials could be extracted at the lowest possible value is over; A new era in which Indonesia demands a proportionate share of the value created by its own resources has begun.

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