

Dominance without depth: the smelting superpower that imports its own metal

Indonesia dominates global production of refined nickel and intermediates, but has a shallow manufacturing base and imports its own metal in the form of finished goods

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Key Takeaways

A decade into nickel downstreaming, Indonesia's nickel flows remain opaque. Visibility has been very limited on where it actually goes despite hundreds of studies in this field. The Energy Shift Institute unpacks the layers of the nickel trail and makes the following discoveries:

- **Indonesia has built dominance at the base of the nickel value chain, but not depth beyond it.** Nearly all stainless steel capacity sits upstream, 98% in smelting, 70% stopping at slabs and 85% aimed at exports, leaving the country re-importing finished goods and exposing an inability to link nickel production to its own consumption.
- **Policy incentives are front-loaded.** Powerful initial push factors have driven smelting investment, but without manufacturing pull measures such as demand engineering, bankability support, higher domestic content requirements or technological transfer enforcement, capacity stalls at shallow processing, creating exclusive enclaves instead of inclusivity of the wider manufacturing ecosystem.
- **The same capital deployed in tier-2 conversion, such as stamping and precision engineering, generates four to five times the employment and a far deeper supply chain than a smelter or battery plant.** A USD1.5 billion smelter employs 3,000-5,000 workers and a USD1 billion to USD2 billion battery plant employs 1,000-2,000 in globally sourced supply chains, while the same USD1.5 billion deployed across 30-50 mid-sized tier-2 fabrication firms would generate 15,000-25,000 jobs that stand to spur wider spillovers into the domestic value chain.
- **Indonesia's narrowing window demands urgent course correction** as commodity exposure, social strains and global appetite for less-carbon products rise, while global buyers' diversification from China, and China's own manufacturing offshoring, are giving Indonesia a chance to develop industrial depth, but only if it builds tier-2 capability.

Executive Summary

Indonesia's nickel transformation is the most dramatic commodity-sector reorganisation in recent years. Mined output amounted to 2.57 million tonnes in 2025, representing more than 61% of global supply and a 158% increase in five years. Operating smelters grew from two before 2014 to upwards of 60 by 2024. Exports of nickel derivatives reached USD38 billion to USD40 billion in 2024, up from USD11.9 billion in 2020. The 2020 enforcement of the ore export ban worked: it forced processing onshore, attracted USD30 billion to USD60 billion in Chinese-led investment, and made Indonesia the indispensable swing producer in global nickel markets.

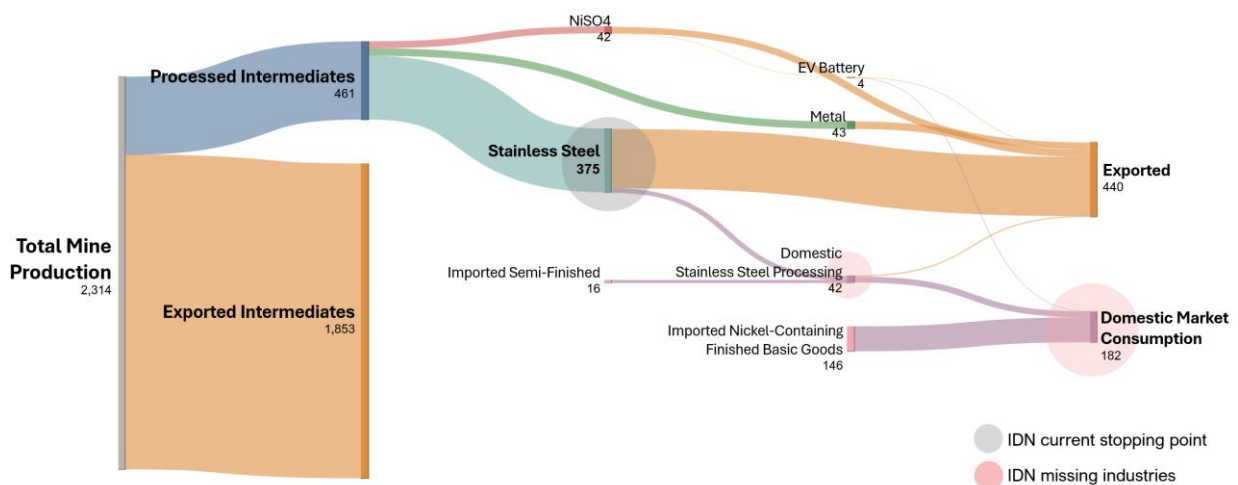
But scale at the first-use stage is not the same as industrial development. Roughly 98% of installed stainless steel capacity sits upstream in smelting and basic steel production, 70% of refinery output stops at the slab stage, and 85% of production capacity is targeted at export markets. Indonesia exports stainless steel in its very early form, as slabs, and re-exports finished kitchenware, fittings and fabricated parts, a structural problem that reflects the absence of a domestic conversion layer. Despite a 300% increase in nickel processing capacity since 2020, Indonesia imports 80% of the finished stainless steel products that serve

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domestic demand, the gap having widened. Manufacturing value added has fallen from 32% of GDP in 2002 to 19% in 2024, while the country's Economic Complexity Index ranking has actually *regressed* from 67 in 2012 to 69 in 2024, the very period during which billions of US dollars flowed into nickel downstreaming.

The framework this report adopts defines three industrial tiers: **Tier 3**, comprising rotary kiln-electric furnace (RKEF) smelting and high-pressure acid leach (HPAL), **tier 2**, consisting of conversion and fabrication such as tube mills and precision components, and **tier 1**, where end manufacturers and original equipment manufacturers (OEMs) deliver ready-to-use products. Indonesia has world-class tier-3 capacity. Tier 2 is the missing middle without which tier 1 cannot develop.

Figure 1. Indonesia Nickel Flow in 2024



Sources: ESI; IEA; CRU; Intracent; other references

Two structural gaps explain the stagnation. The **first** is a policy architecture imbalance. Government instruments that force shallow processing onshore, including the export ban, mining quotas, and tax holidays for special economic zone and national strategic project designations, are powerful and effective. However, factors that pull production into deeper conversion and final manufacturing are absent or dormant, such as demand engineering, bankability infrastructure and standards ecosystems. Push without pull produces an enclave equilibrium which truncates wider spillover effects.

The **second** is enclave industrialisation at the level of park governance. Morowali Industrial Park (IMIP) and Weda Bay Industrial Park (IWIP) are vertically integrated, foreign-anchored, export-oriented complexes whose buyer-structure misalignment, supplier qualification barriers and absence of shared services actively block spillovers into the surrounding domestic business ecosystem, such as small and medium enterprises (SMEs).

Indonesia has built the world's largest nickel processing base, but must now shift policy to turn nickel volume into industrial depth

This equilibrium carries three vulnerabilities that are no longer hypothetical. **First**, commodity cycle exposure. Indonesian nickel pig iron (NPI) and stainless steel producers are price-takers in markets driven by Chinese construction cycles, demonstrated starkly by the 2023-2024 NPI price decline. **Second**, persistent import leakage. Finished stainless steel goods continue to be imported despite upstream scale. **Third**, policy shock sensitivity.

The equilibrium depends on policy support, for example, continued export restriction, which the European Union's challenge at the World Trade Organization in 2022 threatens directly. Without a

developed domestic absorption layer, any relaxation of the export ban undermines the entire processing investment rationale.

The strategic pivot: One layer deeper

This report proposes three strategic pillars to operationalise Energy Shift's proposed pivot to deeper industrialisation of nickel. **Pillar 1: Synchronise the policy stack.** Restructure fiscal incentives into levels, reserving the most generous tax holidays not for more smelter capacity but for firms moving into tier-2 conversion and tier-1 assembly. Make technological transfer requirements enforceable and tied to auditable milestones rather than the contractual formalities in most joint-venture (JV) arrangements. Expand TKDN domestic content rules beyond electric vehicles (EVs) to cover stainless steel-intensive products in construction, water infrastructure, and food processing and industrial equipment, where domestic demand already exists but is now served by imports.

Pillar 2: Turn enclave parks into linkage engines. Require progressive local procurement targets, paired with supplier development programmes that build the capacity of Indonesian SMEs to qualify for entry into anchor supply chains. Establish shared service infrastructure within or next to the parks. Tie the renewal of park fiscal incentives to measurable linkage performance, such as the number of qualified domestic suppliers, local procurement spend as a share of total inputs and workforce localisation rates.

Pillar 3: Build domestic champions and strategic JVs. Develop Indonesian winners from the ground up by supporting the SMEs that broad-based industrialisation requires. At the same time, leverage existing large domestic firms as multi-tier anchors that catalyse the wider ecosystem, with explicit mandates to develop Indonesian SMEs as their tier-2 supplier base. New large-scale JVs should include co-located research and development (R&D) facilities staffed by Indonesian engineers, progressive local procurement targets, and obligations to co-finance shared services such as testing laboratories and tooling hubs that no single SME could afford to build alone.

Why moving step by step downstream is important

Two contrasts make the stakes concrete. First, **tier-3 smelter versus tier-2 conversion ecosystem.** On tier 3, a USD1.5 billion RKEF smelter in Morowali employs 3,000-5,000 workers in capital-intensive, continuous-process operations, obtains its equipment from Chinese suppliers and sells NPI on commodity spot markets at globally determined prices. Its supply chain linkages to the domestic economy are minimal. On tier 2, the same USD1.5 billion deployed across 30-50 mid-sized fabrication firms, from tube mills to fastener producers, would generate **15,000-25,000 jobs** across a far broader skill spectrum. These firms would buy stainless steel coil from domestic tier-3 mills, creating forward linkage demand that does not yet exist. They would engage tooling and calibration services locally, thus spawning backward linkages. And they would sell basic yet specific components to domestic construction, food processing and infrastructure buyers, which form the demand anchoring that buffers the system from global commodity cycles.

Redirecting USD 1.5 billion smelter capex to fabrication firms could create 5x more jobs than smelter/EV build-outs.

Second, **EV batteries versus metallurgical tier 2.** Indonesia's EV battery ambition is real and the Hyundai-LG and Contemporary Amperex Technology (CATL) milestones are genuine. But a single battery cell plant costs USD1 billion to USD2 billion per 10 gigawatt-hours (GWh), employs 1,000-2,000 workers in cleanroom conditions, and draws from a supply chain that is globally sourced and technology-gated. Metallurgical tier 2 has a different industrial profile entirely, distributed across many firms rather than concentrated in a handful, with entry costs of USD5 million to USD50 million per firm, mature transferable technology, domestically anchorable supply chains and labour-intensive skill-building employment. The maths is decisive: **the metallurgical tier-2 route is capable of meeting 70% of global nickel demand, serves a domestic market of 280 million consumers, and can begin**

generating returns within three to five years. The EV battery route addresses less than 1% of Indonesia's nickel output and requires a decade or more to build competitive domestic capability.

This is not an either/or proposal; Indonesia should pursue both routes. But the allocation of policy attention, fiscal incentives and institutional support should reflect the scale of opportunity.

The runway for course correction is shorter than it appears, because several dynamics are converging at once. On the market side, commodity exposure is set to intensify: S&P Global projects Indonesian nickel output reaching nearly 5 million tonnes by 2035, which will structurally suppress prices and compress margins for an export-dependent processing sector that has no domestic demand buffer to cushion the cycle. Each year of delay in building that buffer is a year in which Indonesian producers absorb more of the downside of their own expansion.

At the same time, the competitive window for tier-2 development is narrowing from the outside, but it is also, paradoxically, opening. Chinese and Indian fabrication ecosystems are maturing quickly, qualifying for global buyer relationships and locking in supplier slots that Indonesian firms could otherwise compete for. The cost of entering conversion industries rises with every year those ecosystems deepen, because the marginal cost of displacing an incumbent qualified supplier is far higher than the cost of becoming one in the first place. Yet the same moment carries a rare strategic opening. Global buyers are actively seeking to diversify away from Chinese-concentrated supply chains, while China itself is migrating up into advanced manufacturing and might offshore more traditional industries to lower-cost jurisdictions. Indonesia sits at the intersection of these two shifts, with the feedstock, the scale and the cost position to absorb the capacity that is leaving China and to occupy the supplier slots that western buyers are creating deliberately.

A separate but reinforcing dynamic is the sustainability gate: Europe's Battery Passport becomes operational in February 2027, and before that, its Carbon Border Adjustment Mechanism (CBAM) is already reshaping the economics of carbon-intensive supply chains. These measures, along with more that will follow, are set to exclude high-carbon, low-traceability intermediates from premium markets. As a result, Indonesian output will be stranded with a shrinking pool of price-only buyers just when the country most needs access to quality demand.

Indonesia's window to leverage its resource advantage and cost position for industrial depth is closing, demanding urgent action

Finally, and most consequentially, the domestic social contract underwriting the entire downstream project is already eroding. Communities in Sulawesi and Maluku are bearing the environmental and social costs of rapid industrialisation today, and will see diminishing returns over time from an enclave model that generates export revenue but not the jobs, SME ecosystem or skill development that constitute durable development dividends. **Resource nationalism is politically sustainable only as long as the population perceives itself to be a beneficiary. If the enclave pattern becomes more entrenched, that perception will recede.**

1. Reframing Indonesia's nickel downstreaming problem: Dominance without depth

Indonesia has undergone one of the most dramatic commodity-sector transformations in modern history. In 2024, it produced about 2.6 million tonnes of mined nickel – more than 61% of global output and a 158% increase over the last five years.¹ This dominance was engineered through the government's nickel ore export ban effective January 2020, which required domestic processing before export. Chinese entities alone committed USD30 billion to USD60 billion in processing infrastructure, while operating smelters rose from two before 2014 to exceed 60 by 2024.² Exports of nickel derivatives reached USD38 billion to USD40 billion in 2024, up from USD11.9 billion in 2020.³

Yet this dominance has simultaneously contributed to structural oversupply, depressing prices on the London Metal Exchange from above USD20,000 to USD14,000 per tonne and forcing closures of higher-cost operations in Australia, New Caledonia and elsewhere.⁴ The upstream scale is no longer in doubt; the real question is what industrial depth has been built downstream.

1.1 The narrative pivot: From metallurgical use to EV-led downstreaming

Policy discourse increasingly frames success around Indonesia becoming an integrated electric vehicle (EV) battery and car manufacturing hub. A couple of projects were hailed as milestones: the battery cell plant on which South Korean companies Hyundai and LG broke ground in July 2024⁵ and the international business company partnership of Chinese firm Contemporary Amperex International (CATL)^{6,7}.

However, two global realities challenge the single-path EV narrative. First, nickel demand remains overwhelmingly metallurgical, with data indicating stainless steel uses about 67% of primary nickel⁸, whereas batteries accounted for roughly 14% in 2024, up from 5% in 2018 but far from dominant. Second, lithium iron phosphate (LFP) chemistry – which contains no nickel – now dominates budget EVs, and plug-in hybrid sales have outpaced battery-EV growth in several markets.⁹

Previous Energy Shift Institute (ESI) research established that the scale gap was profound: Indonesia's planned battery output of about 10 gigawatt-hours (GWh) represented less than 0.4% of roughly 2,800GWh global capacity in 2024.¹⁰ Even by 2035, domestic EV manufacturing will absorb no more than 1% of nickel mined in 2024.¹¹

¹ S&P Global. [Indonesia – mining by the numbers, 2024](#). January 2026

² Lahadalia B, Wijaya C, Dartanto T, Subroto A. [Nickel downstreaming in Indonesia](#). J ASEAN Stud. 2024;12(1):79-106

³ USIP. [Indonesia's nickel bounty sows discord, enables Chinese control](#). March 2024

⁴ Trading Economics. [Nickel – price, chart, historical data, news](#). May 2026.

⁵ Kompas. [Indonesia to host Southeast Asia's largest electric battery plant, optimistic to win global competition](#). May 2026.

⁶ Kementerian ESDM RI. [Groundbreaking of Indonesia's electric battery industry, President Prabowo: A colossal international collaboration](#). June 2025.

⁷ ORF. [Indonesia's nickel strategy: Downstreaming and development](#). October 2025

⁸ Primary nickel refers to nickel produced directly from mined ore and processed via smelting and refining, rather than from recycled scrap. It is categorised into Class 1 (high-purity, >99.8% Ni, often used in batteries) and Class 2 (lower-purity ferronickel or NPI, mainly used in stainless steel).

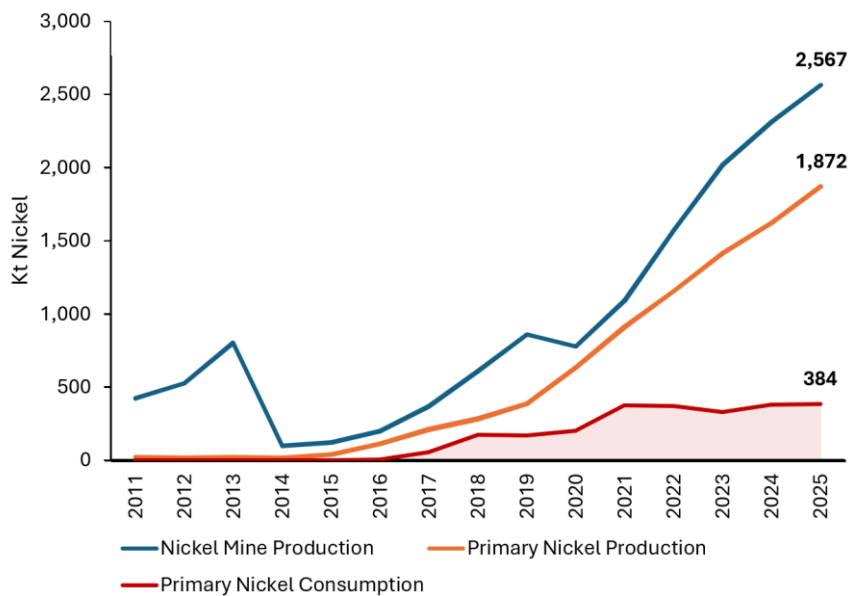
⁹ INSG. [The World Nickel Factbook 2024](#). Lisbon: INSG; 2024

¹⁰ ESI. [EV battery scale mismatch: Indonesia's nickel absorption capacity](#). ESI Research Series. 2024

¹¹ ESI. [A dual-track approach to mineral-led industrialisation in Indonesia](#). ESI Research Series. 2025

This is not an anti-EV position; it is a realism check about absorption capacity relative to supply. Stainless steel – with applications permeating kitchenware, medical instruments, construction, car parts and water infrastructure – remains the baseline absorber upon which any broader industrial ecosystem must be built. Indonesia became the world’s second-largest primary nickel user in 2020¹² through domestic stainless steel production, reaching nearly 400 kilotonnes (kt) by 2024. However, the amount of stainless steel consumed domestically through industrial linkages is far below the volume exported.

Figure 1.1. Indonesia Nickel Production and Consumption (kt)



Sources: ESI; Intracent; CRU. Processed by ESI

1.2 Export dominance without industrial depth

Indonesia now dominates exports of nickel intermediates, namely nickel pig iron (NPI), ferronickel (FeNi), nickel matte and mixed hydroxide precipitate (MHP), yet the depth of industrialisation beyond these stages is limited within the country. This report defines intermediates as NPI, ferronickel, matte and MHP; first use as stainless steel flat products and battery chemicals; and end use as semi-finished, consumer and industrial goods containing nickel. If downstreaming stops at first-use exports, the domestic economy captures limited spillovers in supplier development, small and medium enterprise (SME) growth, and technological diffusion. Moreover, the economic benefits are distributed unevenly. Capital-intensive smelting operations with high entry barriers, concentrated ownership and billion-dollar investment thresholds generate economic rents that reach only a small number of large firms and their foreign equity sponsors, not the broader economy.

If downstreaming stops at first-use exports, the domestic economy captures limited spillovers in supplier development, SME growth and technology diffusion

The hundreds of thousands of smaller businesses that constitute the backbone of Indonesian employment, such as metal fabricators, equipment suppliers, maintenance service providers and

¹² INSG. [Press release – world nickel market](#). October 2025

logistics operators, are structurally excluded from a value chain that does not reach them. Industrial policy that stops at smelting thus concentrates gains among the few firms large enough to enter, rather than distribute them across the industrial ecosystem. Global value-chain literature warns that without deliberate absorptive capacity investments, resource-rich economies risk low-value lock-in despite impressive processing volumes.¹³¹⁴

Figure 1.2. Indonesia’s Position in Global Nickel Export Market



Source: Intracent. Processed by ESI

Indonesia’s global nickel trade position exhibits a striking asymmetry (Figure 1.2). In ferronickel, the country commands 86%, or USD14 billion, of 2025 global trade. In MHP, it holds 75%, amounting to USD4 billion. Yet in stainless steel, Indonesia’s share drops to just 15%, or USD8 billion, reflecting not competitive weakness but structural constraint: domestic conversion capacity from intermediates to stainless steel remains significantly smaller than smelting capacity, limiting how many first-use products the country can actually make.

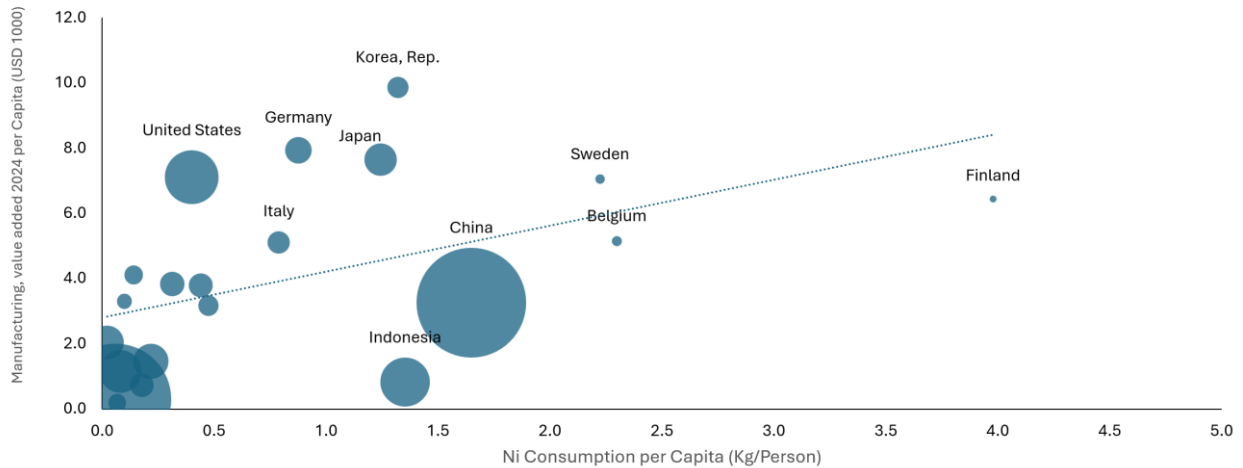
This drawback matters because stainless steel occupies a fundamentally different position in the global trade architecture from intermediates. In most mature markets, particularly Europe, stainless steel is not primarily for export. It is produced near demand centres and used domestically, serving as the first step in local manufacturing rather than a tradeable commodity. European stainless steel trade is overwhelmingly intra-regional. Indonesia presents a limited new model: an export-oriented stainless steel industry that ships material outward rather than feed it into a domestic conversion ecosystem. But that model is itself insufficiently capable of converting intermediates into stainless steel at scale, leaving the bulk of Indonesia’s nickel output stranded at the intermediate stage.

This pattern quantifies the paradox at the heart of the current research: Indonesia dominates at intermediate level but has not converted that dominance into downstream market leadership. The country holds a runaway lead as the largest exporter of nickel products, yet its resilience is limited by the absence of strength in finished, value-added products.

¹³ Cohen WM, Levinthal DA. [Absorptive capacity: A new perspective on learning and innovation](#). Adm Sci Q. 1990;35(1):128-152

¹⁴ Gereffi G, Fernandez-Stark K. [Global value chain analysis: A primer](#). 2nd ed. Duke University; 2018

Figure 1.3. Manufacturing Value Added per Capita vs. Nickel Usage per Capita, 2024



Sources: ESI; International Energy Agency (IEA); CRU; MMC; International Institute for Sustainable Development (IISD).
Processed by ESI

Figure 1.3 positions Indonesia within a cross-country comparison that exposes a striking anomaly.

Indonesia's nickel usage of about 1.4kg per person is among the highest globally, comparable to China and exceeding most advanced economies. Yet, its manufacturing value added per capita of less than USD1,000 sits far below the regression line. By comparison, South Korea, Germany and Japan demonstrate that high nickel usage is typically associated with deep manufacturing ecosystems generating USD7,000 to USD10,000 in manufacturing value added per capita. An important caveat applies: Indonesia's high per-capita nickel usage is itself an artefact of the export-processing model rather than evidence of genuine domestic industrial absorption. Much of the nickel "consumed" in Indonesia is processed into stainless steel and intermediates within enclave industrial parks and exported immediately without engaging the broader manufacturing economy.

Indonesia's position below the trend line confirms its strong nickel development contributes little to domestic manufacturing depth as processed nickel is exported, not converted into diversified manufactured goods that drive broad-based industrialisation

In countries above the regression line, nickel consumption reflects genuine domestic industrial use: thousands of downstream firms convert stainless steel into appliances, construction systems, medical equipment and car parts. In Indonesia, the nickel is consumed by the smelter, not by the economy. The gap between Indonesia's position and the trend line thus measures not merely a shortfall in manufacturing capability, but a structural absence of the domestic conversion and fabrication industries that would translate nickel throughput into broad-based industrialisation.

Three questions guide this research: (1) What metallurgical capacities and product mixes has Indonesia built from intermediates to stainless-steel first use? (2) How much domestic transformation occurs beyond first use – in fabrication, components and nickel-bearing manufacturing? (3) What structural bottlenecks impede progress, and what should Indonesia do to build resilience?

2. Indonesia's nickel value chain: A structural perspective

By 2024, Indonesia was accounting for roughly half of global mined nickel supply and had become the dominant force in nickel intermediates trade.¹⁵ Yet aggregate export figures conceal a more complex reality: upstream mining and processing have scaled far faster than domestic transformation into broad manufacturing value added.¹⁶ To avoid analytical confusion that permeates much of the policy literature, this chapter adopts a rigorous value-chain framework:

ore → intermediates → first use (tier 3) → conversion and fabrication (tier 2) → final manufacturers (tier 1) → end use

This terminological precision matters because conflating production stages has led to systematic overstatement of Indonesia's industrial depth in policy discourse. Scholars of resource-based industrialisation have long observed that processing capacity does not translate automatically into backward or forward linkage development.¹⁷ Backward linkages arise when a new industry's demand for inputs spawns new local suppliers, while forward linkages form when a processing industry's output creates opportunities for downstream users to establish new productive activities.¹⁸

The critical insight – often overlooked in Indonesian policy discourse – is that linkages are not an automatic by-product of investment. They require a domestic ecosystem of buyers, suppliers and service providers with sufficient scale, capability and proximity to respond to opportunities. When that ecosystem is absent, processing capacity operates as an enclave: ore enters, a commodity exits, and the surrounding economy remains largely untouched. Mineral economies display a recurrent pattern in which large-scale upstream processing coexists with underdeveloped or embryonic downstream industries, particularly where foreign capital dominates processing and export orientation is the default commercial logic.¹⁹

2.1 Upstream scale surge with new vulnerabilities

Following the 2014 ore export ban and its rigorous enforcement after 2020, domestic smelters running on rotary kiln-electric furnaces (RKEFs) expanded capacity dramatically, producing NPI and ferronickel at scales that reshaped global supply. By 2024, Indonesia was supplying an estimated 2.3 million tonnes of nickel, mostly intermediates. This growth was facilitated by Chinese capital flows into special economic zones (SEZs), particularly Indonesia Morowali Industrial Park (IMIP) and Weda Bay Industrial Park (IWIP).²⁰ Nickel revenues contributed significantly to Indonesia's current account improvement between 2020 and 2022.^{21, 22} However, sectoral multipliers remained narrowly concentrated, with limited diffusion into general manufacturing.²³

The intermediates-heavy growth makes Indonesia the swing producer on the global marginal supply curve, conferring pricing influence but also amplifying vulnerability to demand cycles. When a

¹⁵ S&P Global. [Indonesia – mining by the numbers, 2024](#). January 2026

¹⁶ CSIS. [Indonesian industrialization: Downstreaming up the value chain](#). 2025

¹⁷ Patunru AA, Rahardja S. [Trade Protectionism in Indonesia: Bad Times and Bad Policy](#). Lowy Institute Analysis, July 2015

¹⁸ Hirschman AO. [The strategy of economic development](#). Yale University Press; 1958

¹⁹ Morris M, Kaplinsky R, Kaplan D. [One thing leads to another](#). Resources Policy. 2012;37(4):408-416

²⁰ IEA. [Global Critical Minerals Outlook 2024](#). Paris: IEA; 2024

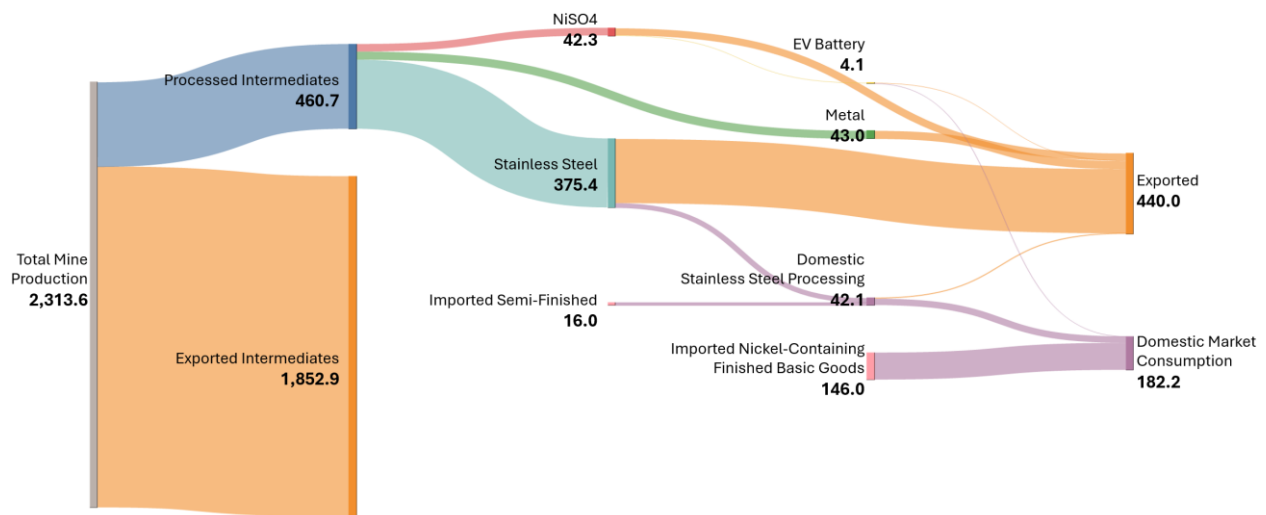
²¹ CSIS. [Diversifying Investment in Indonesia's Mining Sector](#). 2025

²² Schreier M, Lou J, Dahiwardkar A, Rader A, Squire C, Tumiwa F. [Industrial Parks in Indonesia](#). UMD CGS, June 2024

²³ Pane DD, Patunru AA. [The role of imported inputs in firms' productivity and exports](#). Working Papers in Trade and Development 2020/08, ANU; or Asian J Economic Modeling 2025;13(3):358-376

country’s export basket concentrates in goods whose prices are determined globally, domestic income volatility increases. During the 2023-2024 stainless steel downturn, Indonesian NPI prices fell sharply, illustrating this price-taker vulnerability.^{24,25} Battery-grade forms MHP and nickel sulphate are growing but remain a minority of total throughput.²⁶

Figure 2.1. Value Chain Complexities: Imbalances at Play by Indonesian Annual Nickel Output (kt)



Sources: Intracent; IEA; CRU. Processed by ESI²⁷

Figure 2.1 visualises the full material flow through Indonesia’s nickel value chain and exposes the scale of structural imbalance. From total mine production of 2,313.6kt, an overwhelming 80% exits the country as intermediates before any domestic industrial value is created. Only 20% goes on to intermediates processing, of which 81% enters stainless steel production. Outside stainless steel, the value chain splinters into metal (43kt), nickel sulphate (42.3kt) and EV batteries (a mere 4.1kt).

The most revealing feature is what happens at the point of first-use output: 440kt is exported, while domestic market consumption absorbs just 182.2kt – and even that is supplemented by imported semi-finished products and imported finished basic goods. The diagram shows exactly where Indonesia’s value chain disconnects from industrial depth: at the stainless steel stage, where output is predominantly diverted to export rather than fed forward into domestic conversion and fabrication. The industries that should exist are largely absent, namely domestic stainless steel processing, component fabrication, precision engineering and downstream manufacturing.

The result is a profound structural paradox: the world’s largest nickel producer captures export revenue but not diffused value creation – in jobs, SMEs, supplier ecosystems and industrial services – that distinguishes an industrial economy from an extraction economy. Indonesia mines the nickel, processes

²⁴ Sachs JD, Warner AM. [Natural resource abundance and economic growth](#). NBER Working Paper No. 5398. 1995

²⁵ Frankel JA. [The natural resource curse: A survey](#). NBER Working Paper No. 15836. 2010

²⁶ WRI. [Nickel’s climate cost and Indonesia’s push for cleaner production](#). 2025

²⁷ The Sankey diagram was created by tracing the flow of nickel from production, export, import, and estimated domestic consumption, using data gathered from various sources including direct data provided by CRU, and Trade Map, as well as indirect data from interviews with related associations and estimates from news report.

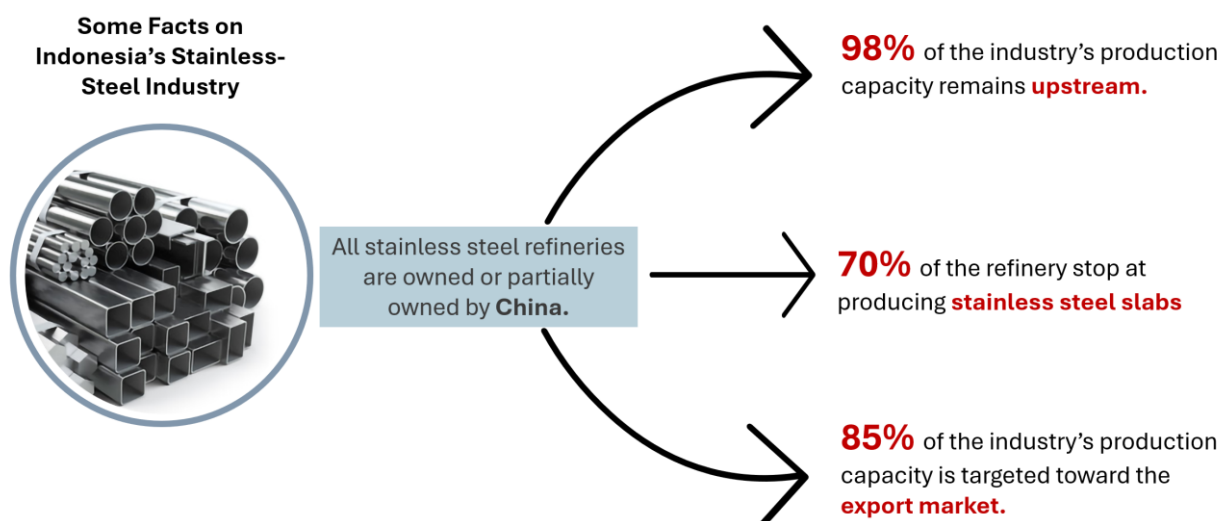
it by one step, exports it, then imports the finished goods made from its own resources at a multiple of the price it receives on the exports.

2.2 Stainless steel: Large first-use output, shallow linkages and high concentration

Indonesia has developed significant stainless steel capacity, primarily concentrated in the Morowali cluster and operations linked to Chinese firm Tsingshan. By 2022, it had emerged as one of Asia's largest makers of stainless-steel flat products.²⁸

However, the economic significance must be assessed not by volume but by integration into domestic ecosystems. Processing that is concentrated in spatially bound enclaves generates limited spillovers into the surrounding economy. A study of mineral processing in Africa found that concentrated foreign-led processing hubs fostered enclave dynamics rather than broad-based supplier development.²⁹ To counter this tendency in the East Asian context, the depth of domestic linkages depends critically on deliberate policy design, not merely installed capacity.^{30,31}

Figure 2.2. Indonesia's Stainless Steel Industry



Source: Ministry of Industry, Indonesia. Processed by ESI

Enclave characteristics are distinct in Indonesia's stainless steel sector (Figure 2.2). All stainless steel refineries are owned or partially owned by Chinese entities. The sector is concentrated upstream and focused on smelting and basic steel production rather than conversion or fabrication. About 70% of refinery output stops at the stainless-steel slab stage, the most basic first-use form, without further processing into higher-value coil, sheet or fabricated items. And production capacity prioritises exports, leaving domestic industries and consumers largely unserved.

This configuration is the textbook definition of an export-oriented processing enclave: vertically integrated, foreign-owned, upstream-concentrated and externally oriented. Dominant firms internalise supply chains rather than promote capability spillovers or cultivate local supplier ecosystems that

²⁸ Southeast Asia Iron and Steel Institute. [SEAFISI Statistical Yearbook](#). 2024

²⁹ Myrdal G. [Economic theory and under-developed regions](#). Gerald Duckworth; 1957

³⁰ Fessehaie J, Morris M. [Value chain dynamics of Chinese copper mining in Zambia](#). Eur J Dev Res. 2013;25:537-556

³¹ Warwick K. [Beyond industrial policy: Emerging issues and new trends](#). OECD STI Policy Papers No. 2. 2013

would have engendered domestic buyers creating technically demanding off-take.³² When first-use producers lack incentives to invest in quality improvement and grade diversification, industrial deepening is muted.³³

2.3 Leakage: Persistent imports of stainless steel goods

One of the most revealing indicators of structural imbalance is the chronic prevalence of imports related to stainless steel despite large upstream capacity. Every year, Indonesia imports about USD29.2 million of basic stainless steel cutlery (HS 732393) from China; for cold-rolled flat products (HS 7219), it imports USD170.5 million from China, USD88.8 million from Japan and USD31.4 million from South Korea.³⁴

Industrialisation literature suggests that first-use producers create forward linkage demand only when domestic downstream industries exist to absorb output in processed form. When downstream fabrication is absent, stainless steel is exported and finished goods re-imported – a structural paradox documented in Brazil’s steel sector and Malaysia’s palm oil downstream. The persistence of cold-rolled imports indicates quality gaps, logistical constraints, or a lack of local industry buyers that can process it further.^{35,36} The import of finished consumer goods reveals an industrial capability deficit in stamping, drawing, polishing and assembly, precisely the tier-2 manufacturing activities whose absence defines the structural gap.

2.4 Industrial depth indicators: Manufacturing value added and export sophistication

Broader macroeconomic indicators corroborate Energy Shift’s argument. Indonesian manufacturing value added as a share of gross domestic product (GDP) fell from about 32% in 2002 to around 19% in 2024 – one of the most pronounced de-industrialisations among major emerging economies. Literature says that resource booms generate real exchange rate appreciation and labour cost increases that crowd out traded manufacturing.³⁷ It is a “resource curse”, a negative correlation between resource abundance and long-term growth that is due in part to a hollowing out of manufacturing. Further examination finds the curse conditional on institutional quality and trade openness.^{38,39,40} Indonesia has made a structural shift away from labour-intensive manufacturing towards services and resource extraction, driven partly by premature de-industrialisation and partly by a failure of industrial policy to develop upstream-downstream linkages.

Indonesian manufacturing data from 1995 to 2016 provides further empirical grounding for this concern. The share of domestic value added in exports is found to be statistically insignificant with either total GDP contribution or export-related job creation. In other words, an exclusive focus on increasing the domestic content of exports, which characterises the

³² Pack H, Saggi K. [Is there a case for industrial policy?](#) *World Bank Res Obs*. 2006;21(2):267-297

³³ Rodrik D. [Industrial policy for the twenty-first century](#). CEPR Discussion Paper No. 4767. 2004

³⁴ International Trade Centre (ITC), Trade Map. [Trade statistics for international business development](#). 2026

³⁵ Hirschman AO. [The strategy of economic development](#). Yale University Press; 1958

³⁶ Wie TK, Aswicahyono H. [Trade policy and industrialisation in Indonesia](#). *J Intern Commerce Econ Policy*. 2010;1(2):231-252

³⁷ World Bank. [Indonesia Economic Prospects](#). Washington: World Bank; 2024

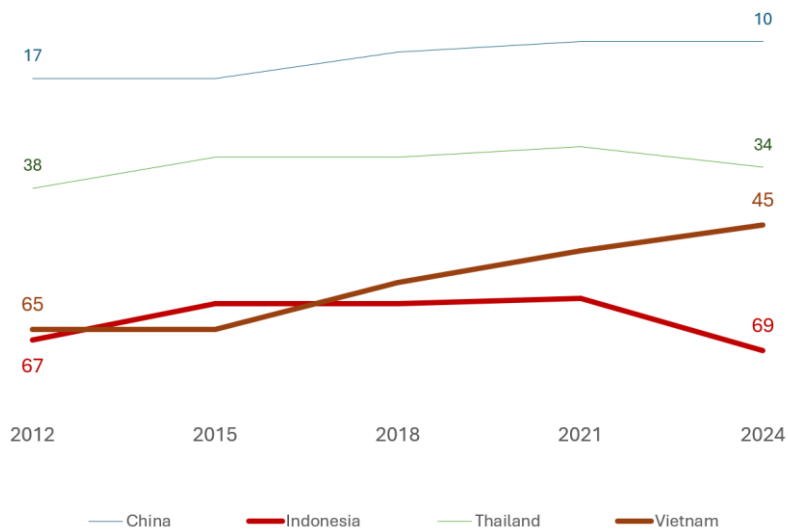
³⁸ Corden WM, Neary JP. [Booming sector and de-industrialisation in a small open economy](#). *Econ J*. 1982;92(368):825-848

³⁹ Sachs JD, Warner AM. [The curse of natural resources](#). *Eur Econ Rev*. 2001;45(4-6):827-838

⁴⁰ International Monetary Fund. [Can the natural resource curse be turned into a blessing? The role of trade policies and institutions](#). Working Paper No. 07/55. 2007.

downstreaming emphasis on smelter volume, does not translate automatically into broader employment or income gains. While the analysis predates the nickel downstreaming boom, the structural logic still applies: Indonesia's manufacturing landscape has since shifted towards even heavier dependence on nickel processing driven by foreign direct investment (FDI), sharpening its focus on capital-intensive, export-oriented smelting and taking the sector even further away from GDP contribution and the job market. To reverse this trend, the country needs to develop industrial depth through tier-2 conversion activities that generate domestic linkages.⁴¹

Figure 2.3. Complexity Index Rank: Cross-country Analysis



Source: Atlas of Economic Complexity. Processed by ESI

Indonesia's Economic Complexity Index (ECI) rankings alongside regional peers from 2012 to 2024 reveal a deeply concerning trajectory (Figure 2.3). China improved from 17 to 10, reflecting its progressive movement into higher-complexity manufacturing. Vietnam advanced from 65 to 45, demonstrating rapid manufacturing sophistication despite a lack of resource advantages. Thailand also improved, from 38 to 34. Indonesia, by contrast, regressed from 67 in 2012 to 69 in 2024, a deterioration to pre-downstreaming levels.

This is a damning diagnostic: the very period during which Indonesia poured billions of US dollars into nickel downstreaming coincided with stagnation and regression in the overall complexity of its manufacturing base. The finding is consistent with literature that predicts commodity-heavy export baskets, even when processed, do not contribute to economic complexity unless they generate linkages into diversified manufacturing ecosystems.⁴²

Vietnam's trajectory deserves particular attention because it demonstrates what Indonesia could and arguably should be achieving. The country has no nickel reserves, no significant bauxite-to-aluminium chain and no comparable resource endowment. Yet it climbed 20 places in the ECI rankings in just over a decade by integrating into global production networks in electronics, textiles and machinery parts,

⁴¹ Athukorala PC, Patunru AA. [Domestic value added, exports and employment: an I-O analysis of Indonesian manufacturing](#). Bulletin of Indonesia Economic Studies. 2023;59(3):365-390

⁴² Hausmann R, Hidalgo CA. [The atlas of economic complexity](#). MIT Press; 2014

progressing from assembly towards increasingly sophisticated intermediate manufacturing. The Vietnamese strategy combined aggressive FDI attraction with deliberate local supplier development programmes, vocational training aligned to investor needs, and domestic content requirements that ratcheted up as local capabilities matured.

Indonesia possesses structural advantages that Vietnam does not: the world's largest nickel reserves, abundant and cheaper energy, a domestic market of 280 million consumers, and a labour force of more than 140 million. There is no fundamental reason Indonesia should not pursue both resource-based and manufacturing complexity simultaneously – using nickel as the anchor for a domestic conversion and fabrication ecosystem while also deepening participation in non-resource manufacturing value chains.

The fact that Indonesia has failed to do so where Vietnam has succeeded without resources suggests the bottleneck is not endowment but policy architecture: a deliberate construction of the linkages, standards and domestic demand signals that convert raw capability into industrial depth.

2.5 Defining the tiers: Structured value-chain classification

Tier 3: First-use producers. Producers of stainless-steel flat products (slabs, HRCs, CRCs) and nickel intermediates. Defined by scale intensity, export-parity pricing, low product differentiation and concentrated ownership. In Indonesia, tier 3 is dominated by large integrated complexes in Morowali and Weda Bay SEZs, producing largely undifferentiated materials whose values are set outside the domestic market.

Tier 2: Conversion industries – the “missing middle”. Firms converting stainless steel into components and assemblies: tube and pipe mills, fittings manufacturers, fastener producers, stamping operations, machining centres, metal service centres and specialist fabricators. Economic literature calls this tier the “missing middle” in many developing-country industrial structures. Conversion industries form the locus of capability accumulation: where engineering skills develop, quality management is institutionalised, and supplier relationships are established with both upstream material producers and downstream original equipment manufacturers (OEMs). Without a functioning tier 2, tier-1 OEMs cannot source domestically, perpetuating the import leakage documented in Chapter 2.^{43,44}

Tier 1: Final manufacturers and OEMs. Producers of finished goods: appliances, industrial machinery, construction systems, and marine and energy parts. Critically dependent on a functioning tier-2 supplier base for components and sub-assemblies.⁴⁵

⁴³ Ohno K. [Avoiding the middle-income trap](#). ASEAN Econ Bull. 2009;26(1):25-43

⁴⁴ Pack H, Saggi K. [Is there a case for industrial policy?](#) World Bank Res Obs. 2006;21(2):267-297

⁴⁵ Lall S. [Technological capabilities and industrialization](#). World Dev. 1992;20(2):165-186

2.6 Synthesis: Rich tier 3, missing tier 2, import-dependent tier 1

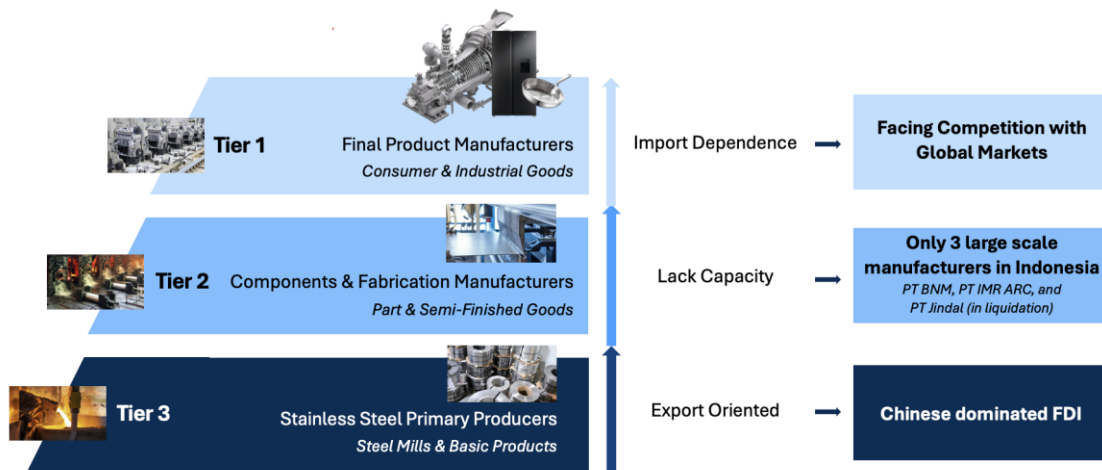
Tier-3 activities about mining, smelting and first-use production are well developed and internationally competitive by volume. However, tier 2 remains thin and fragmented, such as the conversion and fabrication ecosystem comprising metal service centres, component makers, precision engineering firms and surface treatment facilities. This is the critical missing layer.

Tier-2 industries serve as connective tissue between first-use producers and end-use manufacturers, enabling domestic value capture, technical capability accumulation and supplier network formation

In economies that have deepened mineral-linked industrialisation successfully, tier-2 industries serve as connective tissue between first-use producers and end-use manufacturers, enabling domestic value capture, technical capability accumulation and supplier network formation. South Korea’s transformation from steel importer to globally competitive capital goods exporter went through deliberate construction of this tier-2 layer during the 1970s and 1980s. Tier 1, requiring precision fabrication into end-use goods, remains import-dependent.^{46,47} This is “linkage truncation”:

large-scale upstream capacity in the absence of downstream linkage industries.⁴⁸

Figure 2.4. Extended Stainless Steel Value Chain in Indonesia



Source: ESI analysis

Figure 2.4 maps the extended stainless steel value chain across the three tiers. At tier 3, primary producers make hot rolled coils (HRCs), cold rolled coils (CRCs) and stainless steel bars and wire rods through furnace casting, hot rolling, cold rolling and annealing processes. At tier 2, component and fabrication manufacturers perform precision engineering: slitting, shearing, blanks creation and surface treatment to produce precision sheets, blanks and stainless steel tubes. Indonesia has only three large-scale manufacturers at this stage, one of which is in liquidation, leading to a critically thin industrial base. At tier 1, final product manufacturers carry out welding, forming, polishing, assembly and layering to make engine exhaust systems, water sinks, structural brackets and other consumer and industrial goods. This tier competes with global markets because of its import dependence. The

⁴⁶ United Nations Industrial Development Organization (UNIDO). [Industrial Development Report 2022](#). Vienna: UNIDO; 2022

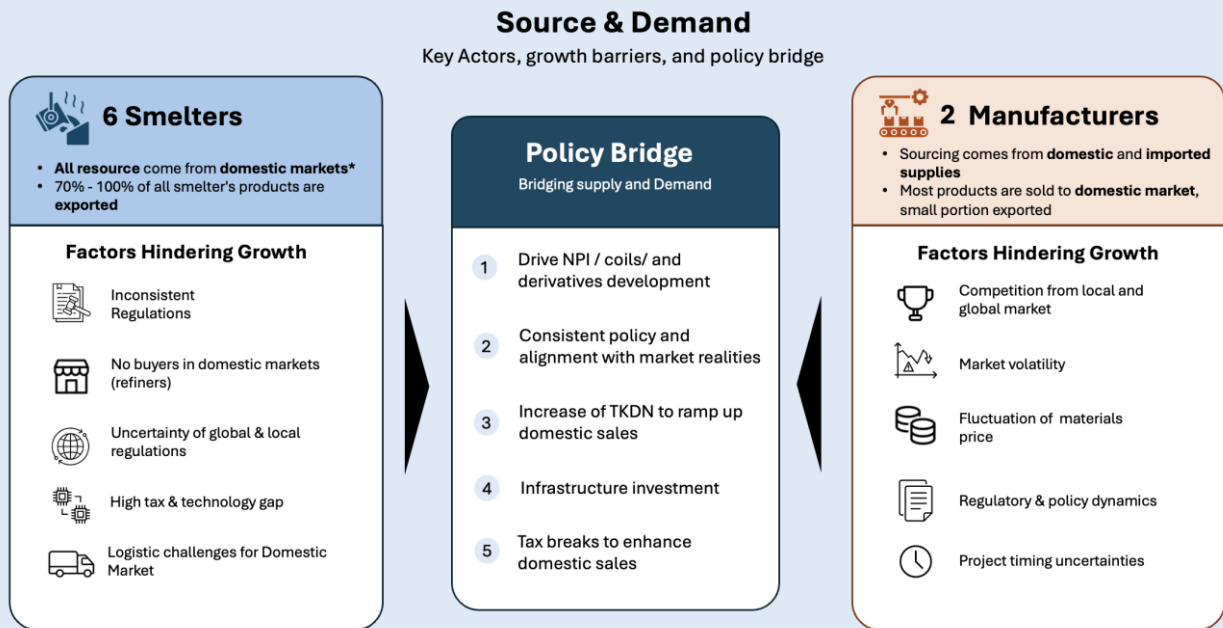
⁴⁷ Lane N. [Manufacturing revolutions: the role of industrial policy in South Korea’s industrialisation](#). VoxDev. 2017

⁴⁸ Morris M, Kaplinsky R, Kaplan D. [One thing leads to another](#). Resources Policy. 2012;37(4):408-416

diagram shows the structural gap: tier 2 lacks capacity, while tier 1 relies heavily on imports for the inputs that a domestic tier 2 should be providing.

What producers say

Figure 2.5. ESI Survey of Nickel-related Industry Players



Source: ESI survey

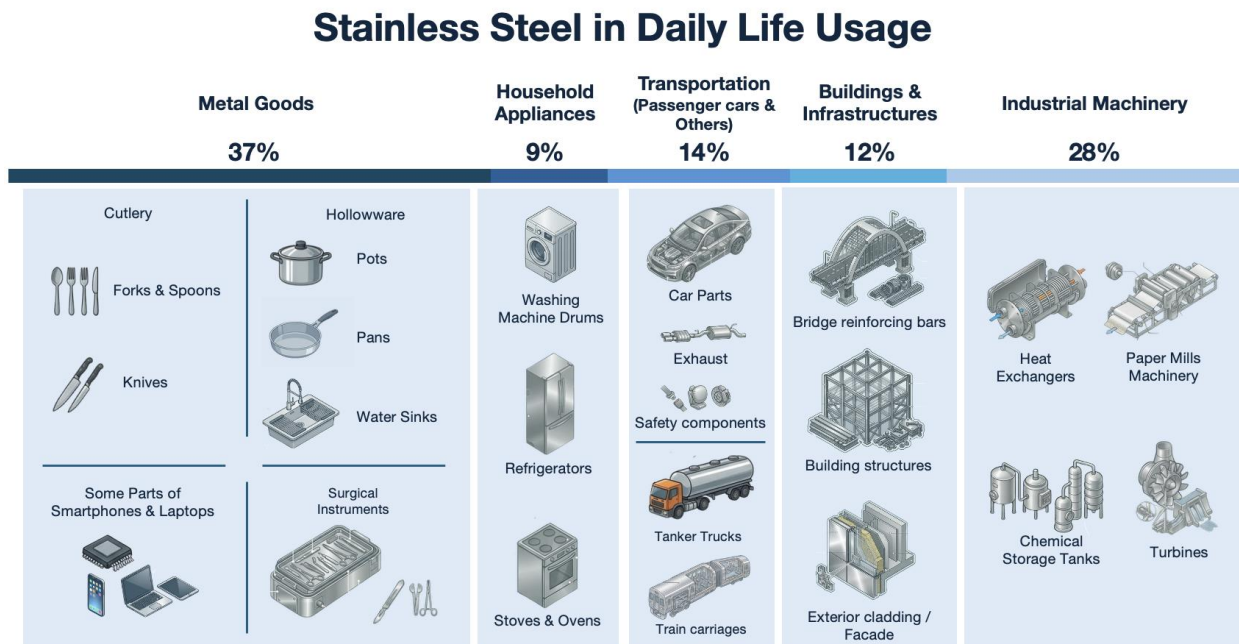
Energy Shift's survey shows significant structural gaps in the industry, where the six smelters operate almost entirely for export, 70%-100% of their production being outbound, while the two manufacturers struggle to balance domestic and imported sourcing. The primary hurdle for smelters is regulatory inconsistency and a lack of domestic buyers, while manufacturers are squeezed by global market volatility and material price fluctuations. The survey indicates that a policy bridge is needed, given the mismatch in the industry landscape, where domestic intermediates are shipped abroad rather than used by local industry, leaving both ends of the chain vulnerable to external shocks.

However, the policy bridge that industry requires should provide a consistent, long-term regulatory road map to maintain investor confidence in further building the full value chain. The government's 2026 Rencana Kerja dan Anggaran Biaya (RKAB)⁴⁹, which could reduce mining volumes by 30% to about 260 million tonnes, has opened the door for Indonesia to improve the quality of its own nickel use. Furthermore, the survey also indicates that the government needs to formulate more policies to ensure connectivity between smelters and end manufacturers, such as higher local content requirements (LCRs) and targeted tax breaks for these applications, in order to transform the sector from an exporter of intermediates into a diversified, high-value manufacturing powerhouse that serves broad industrial needs.

⁴⁹ RKAB / Rencana Kerja dan Anggaran Biaya / Work Plan and Budget: Official mandatory document that companies must submit annually to the Ministry of Energy and Mineral Resources (MEMR) to get their production quotas and operational plans approved.

3. Making nickel downstreaming a layer deeper: Industrial development through tier-2 conversion

Figure 3.1. Stainless Steel in Daily Life Usage



Source: Team Stainless. Processed by ESI

Stainless steel is not an exotic material confined to high-tech applications. It is among the most ubiquitous industrial materials in daily life (Figure 3.1). These are not aspirational products requiring frontier technology. They are the manufactured goods that every industrialising economy needs, from the kitchen to the factory floor, from the road to the airport. The capabilities needed to produce them, from stamping, welding, forming and surface treatment to assembly, are well-established manufacturing processes practised at scale in dozens of countries, including Indonesia’s regional peers.

Yet Indonesia, the world’s largest nickel producer and a major stainless-steel slab maker, imports the vast majority of these finished stainless products, predominantly from China and all manufactured from a material that Indonesia itself produces in abundance. This gap is not technological but one of linkage. The raw material exists domestically, the end-market demand exists domestically, and the manufacturing processes are neither proprietary nor prohibitively capital-intensive. What is missing is the conversion layer that would connect Indonesian stainless steel output to Indonesian consumer and industrial demand.

The choice to import rather than manufacture is not inevitable. It is the consequence of a policy design that invested heavily in smelting scales while neglecting the downstream ecosystem that would have manifested that scale on an industrial level.

3.1 One layer deeper: From first use to conversion and fabrication

The preceding chapter has established that Indonesia is strong in upstream throughput but weak in domestic diffusion. The logical response is not to leapfrog immediately into finished consumer goods – such a step would require capabilities, brand equity and distribution infrastructure Indonesia does not

yet possess at scale. The more tractable near-term strategy is to deepen integration by one layer: bridging the existing tier-3 first-use base with conversion and fabrication in tier 2.

This distinction between sequential deepening and leapfrogging is foundational in industrial policy. Technological capabilities build up through stages, each layer providing the learning, standards discipline and supplier density required to support the next. Governments in South Korea and Taiwan were found to have sequenced industrial promotion deliberately to ensure that conversion industries were developed before final assembly operations were expected to compete internationally. The Indonesian case presents an analogous imperative: tier-3 capacity exists and is globally competitive in scale; the next feasible step is tier-2 development.^{50,51,52}

The choice of where to focus industrial deepening matters enormously, and the contrast between Indonesia's two nickel pathways, EV batteries and metallurgical usage, is instructive. The EV battery route has dominated policy attention and the public narrative, yet even under optimistic projections, domestic EV battery manufacturing would consume no more than 1% of current nickel production by 2035. The metallurgical route, by contrast, already processes 16%, or about 375kt of Indonesian nickel, into stainless steel annually (Figure 2.1), with a domestic market for nickel-containing goods such as kitchenware, construction materials, food processing equipment, car parts and water infrastructure estimated at more than USD1 billion per year, now served almost entirely by imports.

The industrial multiplier effects differ just as markedly. Each step deeper into the metallurgical value chain, for example, from slab to coil to fabricated component to assembled product, involves progressively more SMEs, creates more jobs per unit of metal processed, and builds engineering capabilities that are transferable across sectors.

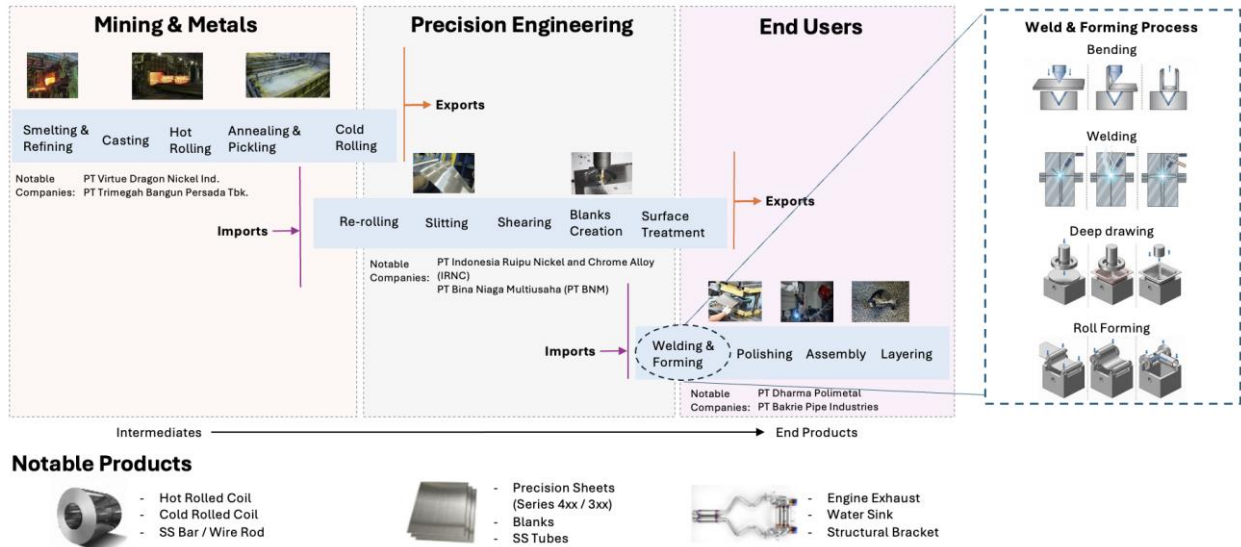
The EV battery chain, while strategically important, is capital-intensive, technology-gated and dominated by a small number of global players whose production processes limit Indonesian SME participation. Again, this is not an argument against EV investment. It is an argument for proportionality. Indonesia's near-term industrial deepening strategy should be anchored in the metallurgical route, where scale, existing capacity, domestic demand and employment multipliers are largest, while EV battery development proceeds as a complementary long-term objective. Tier 2, conversion in the stainless-steel value chain, is the feasible next step precisely because the material, the market and the entry-level capabilities already exist. They need only to be connected.

⁵⁰ Lall S. [Technological capabilities and industrialization](#). World Dev. 1992;20(2):165-186

⁵¹ Amsden AH. [Asia's next giant: South Korea and late industrialization](#). Oxford University Press; 1989

⁵² Wade R. [Governing the Market](#). Princeton University Press; 1990

Figure 3.2. Value Chain: From Metallurgical Process to Engineering to End Users



Sources: WorldStainless⁵³; Cabaro Group⁵⁴; Aperam⁵⁵; MDPI⁵⁶; TU Munich⁵⁷. Processed by ESI

Figure 3.2 maps the full production pathway from metallurgical process through engineering process to end users. Metal producers make HRCs, CRCs, stainless steel bars and wire rods that are overwhelmingly for export. The precision engineering stage is where tier 3 can progress to tier 2 to make, for example, precision sheets, blanks and stainless steel tubes. At the manufacturing stage, final goods that can be produced include engine exhaust systems, water sinks and structural brackets. The technical capabilities to manage this value chain from end to end exists within Indonesia, as proven by the presence of companies already in the business. Moving one layer deeper – from metal production into precision engineering – is achievable with existing capabilities and moderate capital investment.

Yet the ecosystem remains structurally fragile. The premature export of intermediate materials starves the precision engineering segment of feedstock, while heavy reliance on imports at the manufacturing stage bypasses domestic converters of first-use materials entirely. For the tier-2 layer to flourish and fulfil the specific needs of tier-1 manufacturers, a strategic portion of smelter output must go to the domestic market rather than be exported fully; at the same time, the flood of competing imports in tier 1 (Figure 2.4) needs to be managed. Indonesia’s conversion industries will then get a chance to scale by leveraging their clear potential to transform raw resources into sophisticated finished products, instead of succumbing to the risk of hollowing out.

3.2 Why bridging tiers 3 and 2 is the feasible next step

Tier-1 OEM development faces structural barriers: brand equity, distribution, regulatory compliance across markets and after-sales service require sustained investment, best developed through supplier roles. Tier-2 conversion is more tractable for several reasons.⁵⁸ First, demand signals are more predictable – defined by technical specifications anchorable through government procurement and state-owned enterprise (SOE) off-take. Second, capital requirements per firm are substantially lower than tier-3 smelters or tier-1 OEMs, helping domestic SMEs and mid-sized investors to access finance.

⁵³ World Stainless Association. [Manufacturing Process of Stainless Steel Long Products](#). February 2025.

⁵⁴ Cabaro Group. [Comprehensive Guide to Stainless Steel Manufacturing: Understanding the Process](#). July 2025

⁵⁵ Aperam. [Manufacturing Process Global](#). June 2018

⁵⁶ MDPI. [Advanced Stainless Steel](#). 2025

⁵⁷ Technical University of Munich (TUM). [Blanking of Stainless Steel](#). 2022

⁵⁸ Ohno K. [Avoiding the middle-income trap](#). ASEAN Econ Bull. 2009;26(1):25-43

Third, shared infrastructure such as service centres and certification laboratories can serve multiple firms, reducing fixed-cost barriers.⁵⁹

Fourth, tier 2 is where standards discipline is internalised – the process of meeting customer specifications, achieving quality certifications and passing third-party audits builds precisely the capabilities that enable subsequent tier-1 development. The most effective industrial policies target “feasible next steps” in the capability ladder rather than attempt leapfrogging. Tier 2 is not merely a production stage – it is a system which trains capabilities.^{60,61} The standards, engineering skills, quality management practices and supplier relationships that firms accumulate in conversion activities are the prerequisites for tier-1 competitiveness.

3.3 Economic benefits of bridging tiers 3 and 2

The case rests on three arguments: greater labour intensity, broader firm-level diffusion and stronger domestic value retention. Conversion activities are substantially more labour-intensive per tonne of metal than smelting. The International Labour Organization (ILO) estimates that employment intensity in metal fabrication is two to four times higher per unit of value added than in primary smelting, consistent with UNIDO cross-country evidence.⁶² The World Steel Association, drawing on Oxford Economics research, gives a global perspective: every USD1 of value added in the steel industry supports USD2.50 of value-added activity across other sectors through supply-chain purchases, and for every two jobs in the steel sector, 13 more jobs are supported throughout its supply chain – resulting in a 40 million industry workforce and more than USD1.2 trillion of added value.⁶³

Employment intensity in metal fabrication brings two to four times higher per unit of value added than primary smelting

Beyond employment, tier 2 generates broader firm-level diffusion: precision fabricators are typically mid-market companies with access to domestic capital, unlike billion-dollar RKEF complexes requiring large FDI. A broader firm base implies greater resilience: an industrial ecosystem comprising many tier-2 companies is more robust to individual firm failure, market exit or trade disruption than one dominated by a small number of capital-intensive anchor players. The enabling conditions include accessible working capital for SME fabricators, a functioning standards

and certification infrastructure, and anchor demand nodes willing to buy off-take from emerging domestic suppliers.

Figure 3.3. Comparison between Tiers 3 and 2

Characteristic	Tier 3 (First Use/Smelting)	Tier 2 (Conversion/Fabrication)
Capital intensity	Very high (RKEF, HPAL)	Moderate (mills, presses, machining)

⁵⁹ UNIDO. [Meeting standards, winning markets: Trade standards compliance](#). Vienna: UNIDO; 2015

⁶⁰ Chang HJ. [Kicking away the ladder](#). Anthem Press; 2002

⁶¹ Rodrik D. [Industrial policy for the twenty-first century](#). CEPR Discussion Paper No. 4767. 2004

⁶² ILO. Employment intensity of output. ILO Research Paper No. 31. 2019

⁶³ World Steel Association. [Steel’s social and economic impact](#). Brussels: worldsteel; 2019

Characteristic	Tier 3 (First Use/Smelting)	Tier 2 (Conversion/Fabrication)
Employment intensity	Low to moderate per unit of output	Moderate to high; 2-4 times tier 3 per value added
Firm structure	Few large anchors; concentrated	Scattered; SME-compatible
Product differentiation	Low; commodity/export-parity pricing	Moderate to high; specification-driven pricing
Standards requirements	Grade/chemistry	Dimensional, quality assurance systems
Capability spillovers	Limited; enclave dynamics	High; engineering skills, supplier networks
SME integration	Minimal; scale barriers	Substantial; service centres, sub-tier suppliers

Sources: ESI analysis based on UNIDO⁶⁴, ILO⁶⁵, OECD⁶⁶ and Morris et al.⁶⁷

3.4 What comes after tier 2: Growing tier 1

The development of tier 2 is not an end in itself. It is the precondition for building a competitive tier-1 OEM base that can displace imports of stainless steel-intensive finished goods and, over time, diversify export positions. The sequencing argument of developing tier 2 first, then tier 1, follows from the capability-accumulation logic of industrial development literature.

The near-term market for tier-1 development rests principally on import substitution. As discussed in Chapter 2, Indonesia imports substantial volumes of semi-fabricated stainless steel products and finished consumer goods such as kitchen equipment despite its upstream capacity. Capturing even a fraction of this domestic market represents a substantial opportunity: it provides the volume and demand stability that new tier-1 entrants need to learn, invest and iterate.^{68,69}

Targeted FDI would complement skill development in tier 1. Water and sanitation systems, food processing equipment, industrial kitchen infrastructure, marine and energy parts, and construction system fabrication are all sectors in which Indonesia has latent demand because of urbanisation, infrastructure investment and food industry development. They are also areas where the country commands a tier-3 material supply and a defensible basis for cost-competitive local production. FDI in these areas would transfer product design and quality management capabilities while creating anchor

⁶⁴ UNIDO. [Industrial statistics database](#). Vienna: UNIDO; 2024

⁶⁵ ILO. Employment intensity of output. ILO Research Paper No. 31. 2019

⁶⁶ Warwick K. [Beyond industrial policy: Emerging issues and new trends](#). OECD STI Policy Papers No. 2. 2013

⁶⁷ Morris M, Kaplinsky R, Kaplan D. [One thing leads to another](#). Resources Policy. 2012;37(4):408-416

⁶⁸ Rodrik D. [Industrial policy for the twenty-first century](#). CEPR Discussion Paper No. 4767. 2004

⁶⁹ Lall S, Teubal M. [Market-stimulating technology policies in developing countries](#). World Dev. 1998;26(8):1369-1385

demand for tier-2 components made in Indonesia – a classic virtuous circle of the kind observed in South Korean heavy industry.⁷⁰

SOEs and large public buyers have a critical role to play as demand anchors in the early stages of tier-1 development. Public-sector procurement preferences for domestically made equipment that is technically equivalent and cost-competitive can validate demand, derisk investment and allow new entrants to accumulate the production experience needed to compete on fully commercial terms. The use of public procurement as an industrial policy instrument is well established in development literature and permitted under Government Procurement Agreement provisions from the World Trade Organization (WTO) for developing countries in defined circumstances.^{71,72}

Export readiness is the longer-term objective. It requires building compliance infrastructure such as standards certification, quality assurance laboratories and product traceability systems that allow Indonesian tier-1 producers to prove conformance to international buyer requirements credibly. The ASEAN market, with its shared tariff framework and growing middle-class demand for durable goods, is the most accessible initial export target; the Middle Eastern, South Asian and African markets provide medium-term opportunities in stainless steel-intensive infrastructure and food processing equipment.

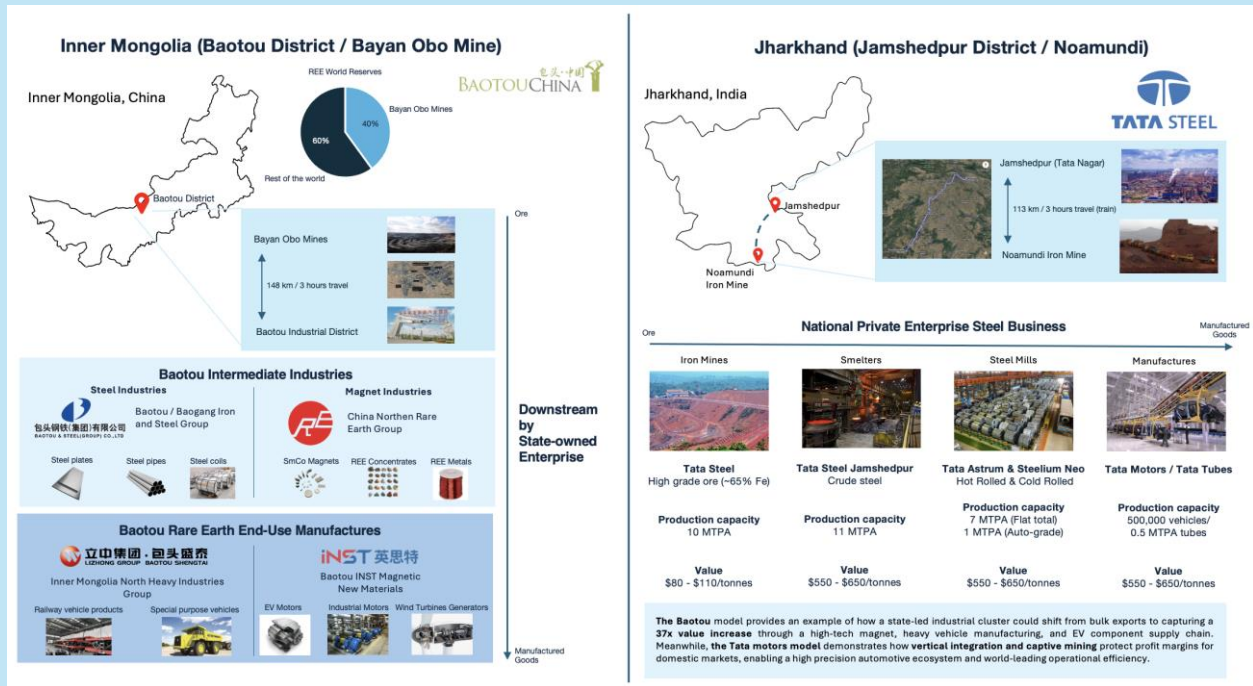
⁷⁰ Amsden AH. [Asia's next giant: South Korea and late industrialization](#). Oxford University Press; 1989

⁷¹ Chang HJ. [Kicking away the ladder](#). Anthem Press; 2002

⁷² Lall S, Teubal M. [Market-stimulating technology policies in developing countries](#). World Dev. 1998;26(8):1369-1385

Case studies

Figure 3.4. Baotou ‘Rare Earth Elements Capital’ and Jamshedpur ‘Steel City’ Industrial Cluster



Sources: Shanghai Metal Markets⁷³; Tata Steel 118th Integrated Report⁷⁴; India Brand Equity Foundation⁷⁵; Jamshedpur Continuous Annealing and Processing Company⁷⁶. Processed by ESI

Mining industrial parks with end-to-end production capabilities and high domestic absorption are not new to some countries. Baotou city of China transformed itself from a traditional iron and steel centre into the world’s “rare earth capital” through a deliberate state-led evolution in which the Baogang Group shifted its focus on the iron ore of Bayan Obo mines to rare earth elements (REEs) because those resources commingled with the ore. The Chinese government dispatched more than 300 scientists to the area to pioneer extraction technologies, then designated it officially as a National Rare-Earth Hi-Tech Industrial Development Zone, prioritising high-value industrialisation over raw mining. This top-down approach had the effect of mandating the consolidation of all local mining under the state-owned Baotou Iron and Steel Group to eliminate competition. Authorities also implemented strict quotas and licensing to confine the value chain domestically.

The impacts are visible on the cityscape, which now hosts more than 3,000 enterprises, including seven of China’s top 10 magnetic materials firms and many research institutes, such as the Baotou Rare Earth Research Institute. Baotou processes 88% of locally refined products into finished goods, a strategy of high domestic absorption that ensures the value of raw minerals is captured locally through the production of finished, high-tech goods rather than exported at low margins. Baotou has become a global choke point for green technology, generating more than RMB100 billion in annual industrial output that has funded a transition to Industry 4.0.

⁷³ Metal.com. [Baotou: From the Discovery of Rare Earths to the Rare Earth Capital of the World](#). September 2025

⁷⁴ Tata Steel. [Integrated report & annual accounts 2024-25](#). June 2025

⁷⁵ India Brand Equity Foundation (IBEF). [Jharkhand – State Infographic](#). October 2025

⁷⁶ Jamshedpur Continuous Annealing and Processing Company (JCAPCPL). [Company Profile](#). 2026

Similarly in India, the so-called “city of metals” Jamshedpur is an example of a mining-to-manufacturing city built by private entities. It was originally a hub for smelting iron supplied by the Noamundi and Jade East mines to Tata Steel. The state-supported industrial framework encouraged private companies including Tata Motors to invest, moving the city from smelter slabs to precision-engineered cars within a single urban cluster. This strategy ensured that the economic value of India’s mineral wealth was captured locally.

Today, the steel is made into train engines and heavy vehicles. Institutions such as the CSIR-National Metallurgical Laboratory and the Xavier School of Management have grown alongside the factories, creating a workforce that specialises in green steel technology and hydrogen-powered mobility. The developments show that industry can grow domestically although it may take time.

3.5 Sustainability leverage: Why tiers 2 and 1 enable traceability and green differentiation








Intermediates are fundamentally fungible. A tonne of ferronickel produced in Indonesia using coal-fired RKEF smelting is chemically indistinguishable from a tonne of ferronickel produced in New Caledonia using hydroelectric power, or a tonne produced in Finland under some of the world’s most stringent environmental standards. Once these products enter commodity markets, their origin and carbon intensity become invisible to the buyer. A Chinese stainless steel mill buying NPI on spot terms neither knows nor cares whether the material was smelted with 11 tonnes of carbon dioxide per tonne of nickel, as in BHP’s now-suspended Nickel West operations, or 93 tonnes of CO₂, the Indonesian coal-powered average. The price is set by chemistry and specifications, not by sustainability credentials.

This fungibility creates a structural trap: even if Indonesia invested heavily in greening its smelting operations – switching to renewable energy, implementing carbon capture, meeting international environmental, social and governance (ESG) benchmarks – the country would struggle to recover that investment through higher prices at the intermediate stage because commodity markets do not differentiate. A cleaner tonne of NPI sells for the same price as a dirtier version.

The implication is that sustainability investment at smelter level, while necessary for regulatory compliance and reputational risk management, cannot by itself generate the green premium needed to justify the cost. The pathway to eliminating this fungibility runs downstream. Indonesian nickel acquires product identity when it is converted into a branded stainless steel tube sold under a long-term contract to a European kitchen equipment manufacturer subject to reporting under the European Union’s Corporate Sustainability Reporting Directive (CSRD), or into a traceable car exhaust component supplied to a Hyundai assembly plant operating under Scope 3 reduction targets. The material is no longer anonymous ferronickel – it is a specific component, from a specific supplier, with a verifiable carbon footprint embedded in a contractual relationship. At that point, and only at that point, does sustainability differentiation become commercially viable.

Moving downstream changes this dynamic fundamentally. Tier-1 OEMs and large tier-2 converters hold named, long-term supply relationships with buyers subject to the CSRD, Carbon Border Adjustment Mechanism (CBAM) and Batteries Regulation of Europe, which require tracing environmental profiles backwards through the supply chain. The contractual architecture allows downstream development to strengthen environmental governance. When lead firms in buyer-driven value chains set standards that cascade to all suppliers, this occurrence is known as “chain governance”.

Figure 3.5. Companies’ Carbon Neutrality Commitments Using Greener Supply Chains

Company	Sustainability First Publish	Sector	Commitment	Commitment Story
	2015	Home Appliances	15% Scope 3 emissions reduction by 2030 (vs. 2019 baseline).	Miele partners with H2 Green Steel and Salzgitter AG to secure fossil-free metals for its "Immer Besser" promise, de-risking supply chains against carbon taxes like CBAM while driving the luxury segment toward a more circular metal value chain.
	2003	Home Appliances	65% Scope 1 & 2 and 25% Scope 3 (Cat. 11) emissions reduction by 2030.	Whirlpool is updating its SBTi-validated targets to tackle data gaps in Tier 2 processing, leveraging its status as an American industrial icon to push domestic metal producers toward a more transparent and greener supply chain.
	2003	Automotive	40% Scope 3 reduction by 2035 and 90% by 2045 (vs. 2023 baseline).	As an early EV manufacturer in Indonesia, Hyundai is decarbonizing its metal supply chains and leveraging its hydrogen leadership to drive heavy industry toward renewables, backed by HMMI's 100% renewable energy achievement in 2023.
	2015	Automotive	Carbon Neutrality by 2050, 30% CO2 reduction from new vehicles by 2025 (vs. 2010) and 50% by 2035 (vs. 2019)	As a major manufacturer in Indonesia, Toyota is integrating green steel through Japan's GX initiative and aligning its 980-supplier network with responsible purchasing standards. By hitting its first emission milestone ahead of schedule, Toyota is using its scale to pull the Japanese metal sector toward accelerated decarbonization.
	2009	Technology	Carbon Neutral by 2030, with a 75% reduction in related emissions (vs. 2015).	With 25% global market share, Apple is mapping every smelter and refiner in its chain to decarbonize rare material mining, driving 73% of avoided emissions through clean energy suppliers in 2024. Today, Apple's influence acts as a global "green engine," mandating renewable energy adoption across mining and refining industries.
	2008	Technology & Electronics	Net Zero by 2030, company-wide (including Semiconductors) by 2050.	Through its "Galaxy for the Planet" initiative, Samsung is integrating recycled materials and renewable energy across its products, using its 19% global smartphone market share to push the electronics industry toward AI-driven factories and circular supply chains.
	2024 (as standalone) - GE Vernova	Energy & Electrification	Carbon Neutrality for Scope 1 & 2 by 2030, Net Zero Scope 3 by 2050.	Investing \$1 billion annually in R&D for SMRs and hydrogen-ready turbines, GE is creating demand for cleaner metallurgical inputs. As a provider of 25% of the world's electricity, GE is setting new carbon-intensity metrics that pull the global utility sector toward a more transparent and low-carbon power infrastructure.

Sources: Various company sustainability reports. Processed by ESI

Figure 3.2 maps the sustainability commitments of major corporations across home appliances, cars, technology and stainless steel manufacturing. All seven companies have established binding Scope 3 emission reduction targets that implicate raw material supply chains directly, including nickel and steel. Their commitments signify a fundamental transition from a price-based nickel commodity market to a contract-driven compliance market, where the economic value of a material is dictated increasingly by its carbon intensity. These companies are no longer merely buying nickel or steel, but rather acquiring “low-emission assets” to secure access to markets that are governed by carbon regulations, such as the CBAM. Their willingness to pay a green premium is driven by an urgent need to mitigate supply chain risks and meet stringent due diligence requirements.

The pathway to achieve this credible green value lies downstream, where product identity, traceability and long-term contractual relationships make differentiation viable, backed by monitoring, reporting and verification. Since selling intermediates does not lend itself to sustainability differentiation, Indonesia’s ability to participate in these premium supply chains depends heavily on the development of its downstream industries.

The stakes of failing to develop this tier-2 layer extend beyond missed economic opportunities. If Indonesia remains locked in its current configuration – exporting intermediates and first-use products while importing the finished goods made from its own nickel – it will have built one of the largest commodity processing sectors in the world without creating the industrial ecosystem needed to sustain it. The metallurgical route, which absorbs 70% of global nickel demand, offers a far larger and more immediate pathway to industrial depth than the EV battery route, which uses less than 1% of Indonesia’s nickel output. Every year that tier-2 development is delayed is a year in which stainless steel slabs leave the country at commodity pricing, only to return as imported cookware, surgical instruments and industrial parts at value-added multiples. The choice is not between EVs and

metallurgy; it is between building the conversion layer that captures value from both routes, and continuing to subsidise the industrialisation of other countries with Indonesia's cheapest resource.

4. What success may look like: Strategies for deeper industrial layers

Two structural gaps explain why Indonesia's nickel chain stalls at the first-use stage. The first is a policy stack imbalance. Instruments at the mining and smelting stages, including the 2014 ore export ban, RKAB quotas, SEZ tax holidays and national strategic project (PSN) designations, are powerful and have demonstrably driven the upstream expansion documented in earlier chapters. Yet the instruments needed to pull production into tier-2 conversion and tier-1 assembly are conspicuously thin: TKDN coverage is narrow, Indonesia's bank credit facilities for fabrication remain limited, and *Standar Nasional Indonesia*/Indonesian National Standard (SNI) for stainless steel conversion products are incomplete. Forcing volume into processing without engineered demand, accessible finance or a working standards ecosystem produces an export-heavy equilibrium exposed to global stainless steel cycles, persistent imports of finished goods and any future WTO-driven relaxation of the export ban itself.

The second gap operates at the level of park governance. Indonesia's nickel processing concentrates in a small number of large industrial parks, principally Morowali and Weda Bay, that function as classic export enclaves: vertically integrated, foreign-anchored and optimised for throughput to Chinese stainless steel mills. Three mechanisms keep spillovers from reaching the surrounding economy. Park tenants serve commodity buyers at scale, leaving fragmented domestic demand commercially unattractive. Local SMEs face qualification thresholds in certification, insurance and track records that few outside Java can satisfy. And the shared services that tier-2 industries depend on are largely absent, including testing laboratories, tooling hubs and surface treatment facilities. The result is a tier-3 base that cannot diffuse into the tier-2 or tier-1 layers around it.

4.1 Defining success: Industrial resilience and depth beyond processing volume

This chapter translates that diagnosis into a working definition of what success would look like, operationalises that definition into three strategic pillars and specifies measurable criteria for assessing progress.

Success, in the framework adopted here, is not defined by processing volume. Indonesia already processes nickel at a scale that commands global market attention. The defining weakness is the limited domestic absorptive capacity that leaves value capture vulnerable to export cycles, commodity price volatility and trade policy shocks. Accordingly, success is defined by industrial resilience and industrial depth.

Industrial resilience means that Indonesian nickel-linked income and employment become less dependent on any single downstream destination, product form or global demand cycle. Resilience is structurally produced by diversified value-chain participation: when domestic tier-2 and tier-1 industries absorb a meaningful share of first-use output and generate domestic demand that partially decouples from Chinese stainless steel cycles, the overall system becomes less fragile.

Macroeconomic resilience literature has argued that economic resilience in developing countries is a function of diversification in both production and institutions, not merely the accumulation of foreign exchange reserves or export volumes. For Indonesia, resilience improvement is measurable as a reduction in the share of first-use output exported to a single destination, and an increase in domestic conversion and fabrication throughput relative to total first-use production.

Figure 4.1. Strategies: What We See Today, Why This Is Fragile, What Success Looks Like



Sources: UNIDO; IMF; World Bank. Processed by ESI

Industrial depth means that the value chain is genuinely one layer deeper: first-use output increasingly translates into tier-2 components and fabricated assemblies, and those tier-2 products increasingly support the growth of tier-1 final manufacturers competing domestically and, over time, as exporters. Depth is observable in company density, employment composition, standards compliance rates, and the product sophistication of Indonesia’s export basket. Economic complexity literature sees industrial depth and inter-firm productive relationships as the most robust predictors of long-term income growth, because they reflect accumulated capabilities that are difficult to replicate or displace.

Synchronising the policy stack

The first strategic pillar of moving towards success extends Indonesia’s industrial policy instruments from mining and smelting – where they are already robust – into the conversion, fabrication and final manufacturing stages where they are now absent. Three mechanisms are at work.

1. Restructure fiscal incentives into levels that reward value-chain depth, reserving the most generous tax holidays not for more smelter capacity but for firms demonstrating progress to tier-2 conversion (tube mills, fastener production, metal service centres) and tier-1 assembly. South Korea’s heavy and chemical industry drive of the 1970s is a precedent. The government conditioned preferential credit access on firms meeting progressive domestic content thresholds, creating a ratchet mechanism that pulled investment along the value chain rather than allow it to concentrate at the base.
2. Enforce technological transfer requirements in investment approval decisions and tie renewal to auditable milestones – not the contractual formalities of most joint-venture (JV) arrangements.
3. Expand TKDN domestic content rules for nickel-containing goods beyond EV applications to cover stainless steel-intensive products in construction, water infrastructure, food processing and industrial equipment – the sectors where domestic demand already exists but is now served by imports.

Turning enclave industrial parks into linkage engines

The second pillar redesigns the governance of Indonesian industrial parks so that they generate backward and forward linkages with the domestic economy. The goal is not to dismantle the park model, which has proven effective at mobilising capital, but to plug it firmly into the country's industrial ecosystem. Three mechanisms apply.

1. Implement mandatory local procurement targets progressively, accompanied by supplier development programmes that build the capacity of Indonesian SMEs to qualify for entry into anchor supply chains. Malaysia's Proton programme, despite its well-documented inefficiencies in the final vehicle, succeeded in creating an ancillary parts ecosystem of more than 400 domestic suppliers within a decade by mandating vendor development as a condition of assembly licences – a model adaptable to stainless steel conversion.
2. Establish shared services infrastructure within or next to nickel industrial parks: testing laboratories accredited to generally accepted standards, tooling hubs with precision cutting and forming capabilities, and surface treatment facilities for passivation and finishing. The Korea Institute of Metals and Machinery has demonstrated how a shared certification facility can allow mid-sized fabricators to qualify for defence and infrastructure procurement they could never have accessed independently.
3. Tie the park's renewal of fiscal incentives to measurable linkage performance – not merely export tonnage but the number of qualified domestic suppliers, local procurement spend as a share of total inputs, and workforce localisation rates.

Building domestic champions and strategic joint ventures

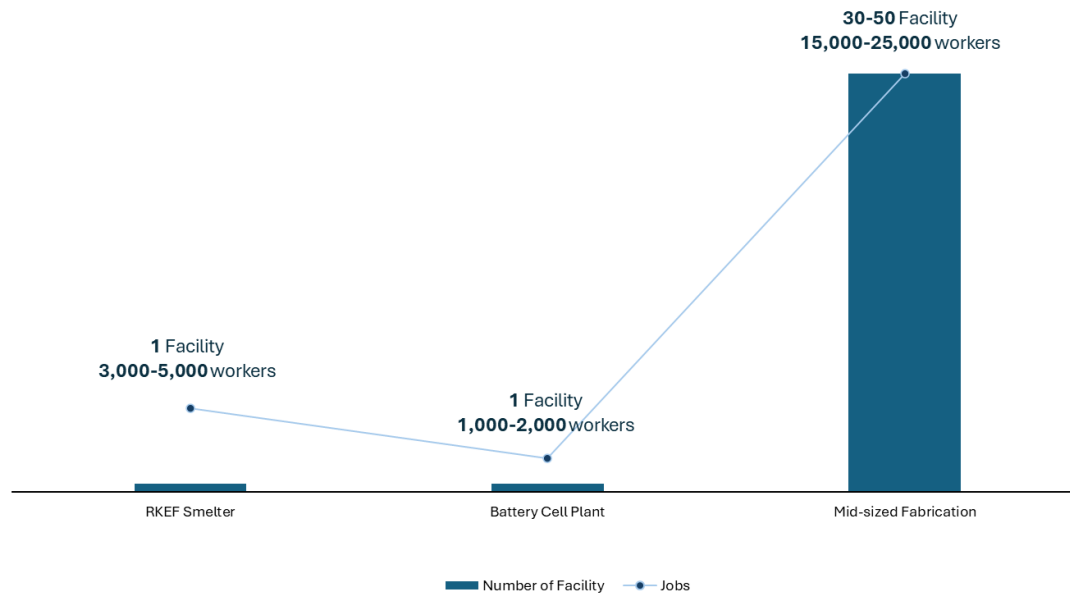
The third pillar develops domestic champions in tiers 2 and 1 and restructures JV terms to maximise technological transfer, knowledge localisation and domestic equity participation.

1. First, build domestic champions from the ground up by developing SMEs that broad-based industrialisation requires. At the same time, leverage existing large domestic firms as multi-tier anchors that catalyse the wider ecosystem, with explicit mandates to develop Indonesian SMEs as their tier-2 supplier base.
2. All new nickel JVs above a specified investment threshold should set up co-located research and development facilities staffed by Indonesian engineers, mandatory secondment programmes for Indonesian technical personnel to learn about partner-country operations, and contractual obligations to develop Indonesian-owned intellectual property in processing technologies. India's Jamshedpur model illustrates the long-term potential: Tata Steel's integrated cluster progressed from basic smelting to train engine and commercial vehicle manufacturing within a single urban ecosystem, supported by on-site research institutions (CSIR-National Metallurgical Laboratory) and management education (XLRI) that built a specialised local workforce. Indonesia could adapt this model by establishing metallurgical research centres next to Morowali and Weda Bay and linked to domestic universities, and by requiring industry co-funding in order to grant SEZ fiscal benefits.
3. Deploy Indonesia's bank credit guarantees specifically for tier-2 fabrication investments in stainless steel-intensive product families, which would derisk the entry of domestic mid-market firms into conversion activities that commercial banks now consider unbankable.

4.2 Why one layer deeper changes everything

The difference between Indonesia's current investment model and the alternative this report proposes is not merely technical – it is structural, and it determines whether the nickel economy generates enclave revenue or broad-based industrial development. Two contrasts make this difference concrete.

Figure 4.2. What Can Indonesia Build with USD1.5 –2 Billion?



Sources: ESI's estimation

Consider first the difference between a tier-3 smelter and a tier-2 conversion ecosystem. A USD1.5 billion RKEF smelter in Morowali employs 3,000 to 5,000 workers in capital-intensive, continuous-process operations. It buys the vast majority of equipment, electrodes and refractories from Chinese suppliers. Its output – NPI or ferronickel – is sold on commodity spot markets to Chinese stainless steel mills at globally determined prices. The smelter generates foreign exchange and fiscal revenue, but its supply chain linkages to the domestic economy are minimal: local procurement is concentrated in low-value services such as catering, security and basic logistics, while the surrounding community gains employment but not industrial capabilities. When nickel prices fall, the smelter's margins compress and it has no domestic demand buffer.

Now consider what the same capital could catalyse in tier-2 conversion. Deploy the same USD1.5 billion across 30 to 50 mid-sized fabrication firms – tube mills, stamping operations, fastener producers, metal service centres, precision engineering workshops – and it would generate an estimated 15,000 to 25,000 jobs across a far broader skill spectrum: machine operators, quality inspectors, process engineers, tooling specialists, and sales and logistics professionals. These firms would buy stainless steel coil from domestic tier-3 producers, creating forward linkage demand that currently does not exist. They would source tooling, maintenance and calibration services from local SMEs, creating backward linkages. And they would sell specification-grade components to domestic construction, food processing, car and infrastructure buyers, creating the demand anchoring that insulates the system from global commodity cycles. The employment per dollar invested is higher, the supply chain is wider, skill formation is deeper, and resilience is greater.

A parallel contrast applies to the two downstream pathways competing for policy attention: EV batteries versus metallurgical tier-2 usage. Indonesia's EV battery ambition has attracted significant public

investment and political capital, and the Hyundai-LG and CATL partnerships are genuine strategic milestones. But a battery cell plant is a single, highly capital-intensive facility spending USD1 billion to USD2 billion to generate 10GWh and employing 1,000 to 2,000 workers in cleanroom conditions with advanced automation. Its supply chain is globally sourced and technology-gated: cathode materials, electrolytes, separators and cell assembly equipment are procured from a small number of specialised international suppliers. The scope for domestic SME participation at Indonesia's current capabilities is limited to packaging, logistics and facility services. The foreign JV partner has proprietary rights over the technology, and the end product enters a global market dominated by Chinese, South Korean and Japanese incumbents.

Metallurgical tier-2 development presents a fundamentally different industrial profile. Tubes, fittings, fasteners, stamped components, kitchen equipment and structural brackets are made across many stainless steel conversion firms in a network rather than concentrated in one. Entry costs are moderate: USD5 million to USD50 million per firm, not USD1 billion to USD2 billion. The technology is mature and transferable, not proprietary. The supply chain is anchorable domestically: feedstock comes from Indonesian tier-3 mills, and output serves Indonesian construction, infrastructure, food processing and consumer goods markets. Employment is labour-intensive and skill-building. And every product manufactured domestically rather than imported represents a permanent reduction in Indonesian dependence on foreign finished goods – a structural gain that will persist regardless of commodity prices.

This is not an either/or choice. Indonesia should pursue both pathways. But policy attention, fiscal incentives and institutional support should reflect the scale of opportunity. The metallurgical tier-2 route meets 70% of global nickel demand, serves a domestic market of 280 million consumers, and can begin generating returns within three to five years using existing materials and accessible technologies. The EV battery route, while strategically important for long-term positioning, absorbs less than 1% of Indonesian nickel output and requires a decade or more to build competitive domestic capabilities. Current policy architecture does not account for this arithmetic.

Correcting the imbalance – by directing at least equal institutional support, fiscal incentives and political attention to the metallurgical conversion pathway – is not a retreat from ambition. It is a recognition that industrial depth is built one layer at a time, and the next layer is already within reach.

If Indonesia continues on its current trajectory, scaling tier-3 capacity without building the tier-2 and tier-1 layers that convert throughput into industrial depth, the consequences are predictable and increasingly irreversible. First, commodity price exposure will intensify as global nickel supply continues to expand, with S&P Global projecting Indonesian output at nearly 5 million tonnes by 2035. Prices will remain structurally depressed, compressing margins for an export-dependent processing sector with no domestic demand buffer.⁷⁷

Second, the window for tier-2 development will narrow: as Chinese and Indian fabrication ecosystems mature and lock in global buyer relationships, the cost of entering conversion industries rises with each year of delay.

Third, the sustainability gate will close: the EU Battery Passport, operational from February 2027, and the CBAM will exclude high-carbon, low-traceability supply chains progressively from premium markets, stranding Indonesian intermediates in a limited pool of price-only buyers.

Fourth, the social contract will erode: communities in Sulawesi and Maluku, already bearing the environmental costs of rapid industrialisation, will see diminishing returns from an enclave model that

⁷⁷ S&P Global. [Indonesia – mining by the numbers, 2024](#). January 2026

generates export revenue but not the jobs, SME ecosystems or skill development that yield durable development dividends.

Indonesia has a finite window in which to leverage its resource advantage, scale and cost position to build genuine industrial depth. History will mark this moment as one where Indonesia chose to shape its own industrialisation destiny – or let others shape it instead. That window is closing and the time for action is now.

This paper is the second of a series of analyses on Indonesia's downstream mineral and industrial development. The Energy Shift Institute is publishing this series to highlight key developments, challenges and opportunities in the sector.

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TECHNICAL APPENDIX A

Anatomy of Indonesia's nickel downstreaming policy

This appendix sets out the detailed policy architecture analysis that underpins the two-paragraph diagnosis presented at the opening of Chapter 4.

The analysis examines two structural gaps: a policy stack imbalance between upstream push instruments and downstream pull instruments, and the enclave industrialisation pattern entrenched in Indonesia's nickel processing parks. The framework draws on coordination failure theory, which holds that individually rational investment decisions can settle into a suboptimal industrial equilibrium when complementary investments and enabling conditions are absent. In Indonesia's case, upstream policy instruments are strong, but the ecosystem of demand, standards, finance and shared services that tier-2 firms require is incomplete. The natural consequence is that each prospective investor rationally waits for others to move first, producing a classic coordination trap that policy intervention is best positioned to break.

A.1 Policy stack gap: Front-loaded downstreaming architecture

Indonesia's downstreaming policy is one of the most interventionist among major nickel producers. Yet its effectiveness is profoundly asymmetric: instruments at the mining and smelting stages are robust and coherent, and have demonstrably driven the upstream expansion documented in Chapter 2, while equivalent instruments at the manufacturing stage are weak, fragmented or absent. The Energy Shift Institute takes a look at the policy stack and analyses its incentive effects at each stage.

The push side: Mining and smelting instruments

At the mining stage, Indonesia deploys several powerful instruments. The 2014 raw ore export ban, combined with its iterative tightening through the revised Mining Law 3/2020 and subsequent government regulations, constitutes the foundational supply-push lever. By prohibiting unprocessed nickel laterite ore export, the policy forces mine operators to either invest in domestic processing or cease production. The RKAB governance framework about work plans and budgets provides operational control over mine production quotas, linking extraction rights to compliance with domestic processing obligations. These instruments are legally enforceable and have produced the intended outcome: a rapid shift of ore processing into Indonesia.^{78,79}

⁷⁸ Government of Indonesia. [Law 4/2009 on Mineral and Coal Mining](#). Jakarta. 2009

⁷⁹ Government of Indonesia. [Law 3/2020 \(Amendment to Mining Law\)](#). Jakarta. 2020

Figure A.1. Coverage of Key Industrial-policy Instruments by Value-chain Stage

Instrument	Mining	Smelting/refining	Manufacturing
Hard constraints	Strong (ban/quota)	Medium (licensing)	Weak
Fiscal incentives	Limited	Strong (tax holiday etc.)	Patchy (EV-focused)
Demand engineering	N/A	N/A	Weak (e.g. TKDN for EV)
Quality infrastructure	N/A	Medium	Weak (e.g. lacking robust infrastructure to connect inputs with demand pulse)
Risk-sharing finance	N/A	Project finance	Weak (working capital)
Sustainability conditions	Growing (rehab)	Patchy	Weak/fragmented

Sources: ESI analysis; UNIDO; World Bank

At the smelting stage, industrial park policy and fiscal incentives have been equally decisive. Special economic zone (SEZ) and national strategic project (PSN) designations unlock tax holiday regimes under Government Regulation 12/2020, exempting investors from paying 10 to 25 years of income tax depending on investment scale and location. Facilitation of power, logistics and electricity system setup, combined with port-related infrastructure co-investment, reduces operating costs for capital-intensive rotary kiln-electric furnace (RKEF) and high-pressure acid leach (HPAL) smelters. All these conditions serve to streamline the permitting environment for foreign investors in approved industrial zones relative to general manufacturing.^{80,81}

The net effect of this push-side architecture is a powerful supply-forcing mechanism that has driven extraordinary capital into upstream and first-use production. In industrial policy theory, these instruments are “push” mechanisms: they force supply into domestic processing regardless of whether domestic demand for the output exists. Push mechanisms are said to be most effective when the target activity has clear scale economics and when the principal barrier is capital mobilisation rather than capability development. Both conditions hold for RKEF smelting; neither holds for tier-2 fabrication.^{82,83}

RKEF smelting fits the logic of push-side policy because it is scale-intensive, technologically more standardised and primarily constrained by capital, power and infrastructure. Once ore is forced into domestic processing, additional smelting capacity can be deployed through imported technology and established project models. Tier-2 fabrication is different. Its bottlenecks are not mainly financial, but organisational and technological: process know-how, tooling, standards, buyer qualification, and close integration with downstream users. In such activities, supply cannot simply be forced forward, because competitiveness depends on capabilities and demand.

The pull gap: Manufacturing-stage policy weakness

In contrast to the robustness of push-side instruments, Indonesia’s policy architecture at the manufacturing stage is conspicuously thin. Three dimensions of this gap are demand engineering, bankability infrastructure and standards ecosystem development.

Demand engineering refers to the deliberate creation of reliable, specification-defined domestic demand signals. In successful late-industrialisation cases – South Korea’s machinery sector, Taiwan’s electronic

⁸⁰ Government of Indonesia. [Government Regulation 12/2020](#). Jakarta. 2020

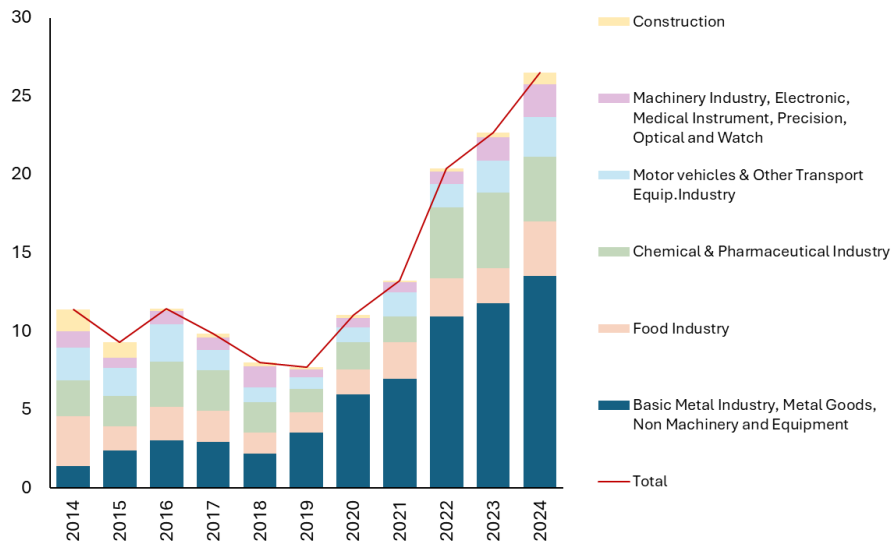
⁸¹ Patunru AA, Rahardja S. [Trade Protectionism in Indonesia: Bad Times and Bad Policy](#). Lowy Institute Analysis, July 2015

⁸² Rodrik D. [Industrial policy for the twenty-first century](#). CEPR Discussion Paper No. 4767. 2004

⁸³ Rodrik D. [Coordination failures and government policy](#). Journal of International Economics. 1996;40(1-2):1-22

components, Malaysia’s palm oil downstream – governments used procurement mandates, domestic content requirements and SOE off-take obligations to create predictable demand for tier-2 nascent conversion industries. Indonesia lacks an equivalent mechanism for stainless steel conversion.^{84,85} TKDN rules about the degree of domestic content exist in principle but have limited effectiveness on intermediate industrial products whose quality and specification requirements are poorly defined.

Figure 4.2. FDI in Indonesia by Nickel-consuming Industry (USD bn)



Source: Ministry of Investment and Downstream Industry (BKPM), Indonesia. Processed by ESI

Bankability infrastructure is similarly underdeveloped – the financial instruments, risk guarantees and lending frameworks that allow tier-2 firms to access investment finance. RKEF smelter investments were bankable because they combined country-backed industrial park concessions, large foreign equity sponsors, and revenue projections that referenced commodity prices. Tier-2 fabrication investments such as tube mills, stamping shops and service centres are smaller and more credit-constrained; they

Push Instruments are necessary but not sufficient: forcing ore into processing creates a tier-3 base, but tier-2 requires pull from engineered demand, accessible finance and a functioning ecosystem that Indonesia’s downstream policy has not yet built

serve domestic markets whose demand volumes are uncertain. Commercial banks apply risk premiums that make marginal fabrication investments unfinanceable at competitive rates without credit enhancement or development finance.⁸⁶

The standards ecosystem gap is perhaps the most structurally consequential. Tier-2 conversion industries cannot function without a system of product standards, testing laboratories, certification bodies and metrology infrastructure that allows producers and buyers to verify product conformance.

Indonesia’s Badan Standardisasi Nasional (BSN) has developed SNI across a range of product categories, but coverage of stainless steel fabricated products is incomplete – pipes and fittings to ASTM A312/A403, fasteners to ISO 3506, service centre products to EN 10088 – and accredited testing laboratory capacity outside Java is extremely limited. Consequently, domestic tier-2 producers cannot prove product quality credibly to buyers operating under international

⁸⁴ Lee J, Gereffi G. [Innovation, upgrading, and governance in cross-SECTORAL global value chains: the case of smartphones](#). Industrial and Corporate Change 2021;30(1):215-231. DOI:10.1093/icc/dtaa062

⁸⁵ Pietrobelli C, Rabellotti R. [Upgrading to compete: GVCs, clusters, and SMEs](#). IDB; 2007

⁸⁶ Hausmann R, [Rodrik D. Economic development as self-discovery](#). Journal of Development Economics. 2003;72(2):603-633

procurement specifications, effectively eliminating them from large infrastructural and industrial projects that constitute the most stable demand anchors.

Table A.1. Indonesian Downstreaming Policy Stack: Strength Assessment by Value-chain Stage

Stage	Key Policy Instrument	Assessment
Mining (tier 3 upstream)	Ore export ban; RKAB quotas; Law No. 3 of 2020	Strong – binding supply-push; measurably effective
Smelting/first-use (tier 3)	SEZ/KEK ⁸⁷ tax holidays; PSN designation; PLN supply; permitting facilitation	Strong – attracted significant FDI; met capacity targets
Conversion/fabrication (tier 2)	TKDN (partial); selective import duties; limited SME credit schemes	Weak – demand engineering absent; bankability thin; standards incomplete
Final manufacturing (tier 1)	General FDI facilitation; some TKDN	Weak – no stainless-specific FDI targeting; supplier linkage programmes absent

Source: ESI analysis based on BKPM⁸⁸, World Bank⁸⁹, OECD⁹⁰ and BSN⁹¹

Economic consequences and the path to policy coherence

The economic consequences of this front-loaded architecture are predictable and observable. When supply-push instruments force ore into processing but pull-side instruments fail to create domestic absorption, the system settles into an equilibrium of export-heavy first-use production with limited domestic conversion. Tier-3 capacity expands faster than tier 2 can absorb, generating a structural orientation towards commodity export markets – primarily Chinese stainless mills – rather than domestic manufacturing networks.

This equilibrium carries three distinct economic vulnerabilities. The first is exposure to the global stainless steel demand cycle: with domestic absorption thin, Indonesian NPI and stainless steel producers are price-takers in commodity markets driven by Chinese construction and consumer cycles beyond Indonesian policy reach – illustrated sharply by the 2023-2024 NPI price decline. Second, persistent import leakage: because tiers 2 and 1 are underdeveloped, finished stainless goods and higher-specification mill products continue to be imported despite upstream scale.⁹² Third, policy shock sensitivity: the existing equilibrium depends on export restriction continuity; any relaxation under WTO dispute settlement pressure, such as the formal case brought by the EU in 2022 against Indonesia’s nickel

⁸⁷ An area with specific boundaries within the jurisdiction of the Unitary State of the Republic of Indonesia, designated to perform economic functions and to obtain certain facilities. This definition is primarily stipulated in Government Regulation No. 2 of 2011, Government Regulation No. 96 of 2015, and Law No. 39 of 2009.

⁸⁸ Government of Indonesia. [BKPM investment data](#). Jakarta. 2024

⁸⁹ World Bank. [Indonesia Economic Prospects](#). Washington: World Bank; 2024

⁹⁰ Warwick K. [Beyond industrial policy: Emerging issues and new trends](#). OECD STI Policy Papers No. 2. 2013

⁹¹ BSN. [Status of SNI coverage for stainless steel products](#). Jakarta. 2026

⁹² Badan Pusat Statistik (BPS), [Export-Import Data Portal](#). Jakarta. 2026

export ban, could undermine the processing investment rationale without a developed domestic market to absorb output.⁹³

A coherent policy stack can address all three vulnerabilities simultaneously. The success logic is simple: Push instruments ensure domestic material supply; pull instruments create predictable domestic demand, standards-backed bankability and shared services so tier 2 can scale into that supply. The strategy chapter that follows operationalises this logic into specific instrument recommendations.

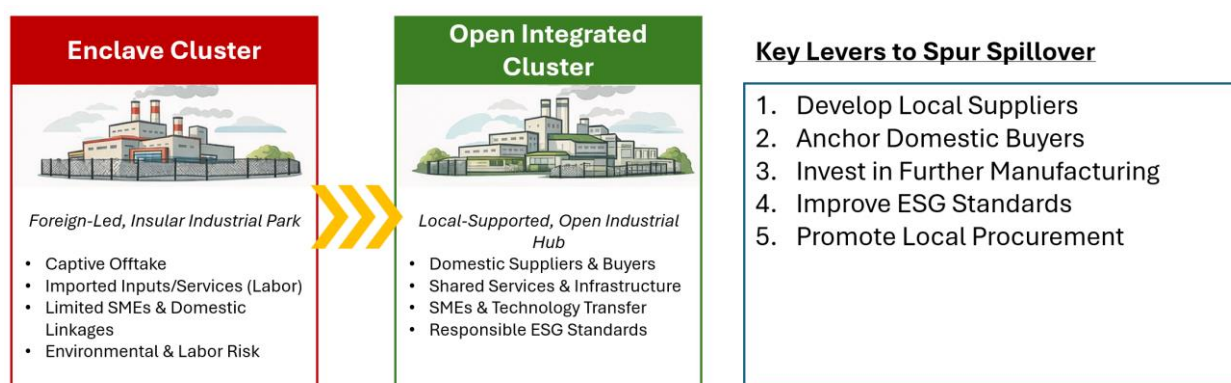
A.2 Enclave industrialisation: Why scale does not diffuse into tier 2 or 1

The second structural gap operates at the level of industrial geography and park governance rather than national policy. Indonesia’s nickel processing expansion is concentrated spatially in a small number of large industrial parks, principally Morowali and Weda Bay, that have been extraordinarily effective at attracting capital and generating export earnings. But their structure actively limits spillover into the broader domestic economy.

Defining enclave industrialisation in Indonesia’s nickel context

Enclave industrialisation, in development economics literature, refers to a pattern of industrial growth in which a spatially bounded cluster generates strong internal throughput but weak linkages to the surrounding economy. In export processing zones, enclaves can generate foreign exchange and formal employment without producing the technological spillovers, supplier development or domestic market integration that characterises successful industrial districts.^{94,95,96}

Figure 4.3. Transforming Enclave Clusters into Spillover Clusters



Source: ESI analysis

Indonesian nickel industrial parks exhibit classic enclave characteristics. They are optimised for export throughput: the entire logistical chain from ore yard to port is integrated vertically within or next to the park boundary, minimising engagement with domestic intermediate markets. Ownership is concentrated among a handful of large, vertically integrated anchor tenants, primarily Chinese-affiliated groups, that internalise supply chains rather than source externally. Technical and management workforces have historically included substantial Chinese national representation, limiting the domestic human capital spillovers that would otherwise form a primary capability transfer mechanism.⁹⁷

⁹³ European Commission. [Critical Raw Materials Act \(Regulation EU 2024/1252\)](#). 2024

⁹⁴ Myrdal G. [Economic theory and under-developed regions](#). Gerald Duckworth; 1957

⁹⁵ Fessehaie J, Morris M. [Value chain dynamics of Chinese copper mining in Zambia](#). Eur J Dev Res. 2013;25:537-556

⁹⁶ Rodriguez-Clare A. [Multinationals, linkages, and economic development](#). Am Econ Rev. 1996;86(4):852-873

⁹⁷ Public Citizen. [The deadly cost of nickel mining in Indonesia](#). Global Trade Watch. December 2025

Three mechanisms blocking spillovers

First: Buyer structure misalignment. Industrial parks export to commodity markets where scale and price dominate. Domestic buyers are fragmented and small relative to Chinese stainless steel mill off-take. For park tenants, investing in commercial infrastructure to serve domestic buyers is not rational when export channels offer larger volumes. This buyer-structure dynamic is a key determinant of whether processing industries develop domestic linkages or remain export-enclave bound.

Second: Supplier qualification barriers. Local SMEs face qualification thresholds, such as certification, insurance and track records, that few Indonesian SMEs outside Java can satisfy. Across industrial clusters in developing countries, qualification thresholds constitute effective entry barriers perpetuating import dependence even in resource-rich processing economies. In Latin American countries for example, the linkage potential of multinationals was found to depend critically on the absorptive capacity and qualification levels of local firms.⁹⁸

Third: Absence of shared services. Tier-2 industries depend on external services most individual SMEs cannot internalise: testing laboratories, tooling hubs, surface treatment facilities and service centres. In established industrial ecosystems such as Pohang city in South Korea and China's Pearl River Delta, these shared services exist as external economies reducing fixed costs for conversion firms. In Indonesia's nickel-adjacent regions, they are almost entirely absent.

The transformation logic follows directly: industrial parks can become linkage engines if governance frameworks require supplier development programmes, shared service infrastructure, domestic off-take structures and incentive designs tied to measurable linkage performance.

⁹⁸ Alfaro L, Rodriguez-Clare A. [Multinationals and linkages: An empirical investigation](#). *Economia*. 2004;4(2):113-169