

Executive Research Memorandum • Corporate Banking Syndication & Strategic Board Review

Anatomy of Indonesian Mineral Downstreaming:
Empirical Analysis of Export Value Shifts, Market Concentration, and Corporate Credit Exposure (BPS Dataexim 2019–2025)

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Abstract—This memorandum evaluates the empirical macro-industrial outcomes of Indonesia’s mandatory mineral downstreaming policy (*Hilirisasi*) across 2019–2025 using transaction-level micro-data from the BPS foreign trade repository. Processed metal exports (HS 72, 74, 76) expanded from \$9.76B to \$34.14B (+249.90%), raising downstreaming’s share of mineral exports from 75.7% to 87.2%. Concurrently, destination market concentration surged: the Herfindahl-Hirschman Index (HHI) escalated from 1,879.4 to 3,584.2 (peaking at 4,344.3 in 2023), with the People’s Republic of China absorbing 58.47% of aggregate processed value. Concurrently, maritime logistics experienced a structural redistribution toward purpose-built Eastern industrial terminals (Bahodopi, Weda, Kendari, and Obi Island), which now command 82.08% of national metal outbound throughput. We formulate structural margin sensitivity and Debt Service Coverage Ratio (DSCR) stress-test models for commercial banking syndications facing captive-power carbon adjustments and sovereign monopsony risk.

1. Bottom Line Up Front (BLUF)

Indonesia’s mandatory mineral export prohibition constitutes one of the most aggressive structural trade interventions in modern emerging market history. Empirical analysis of transaction manifests confirms extraordinary domestic capital formation and foreign exchange generation, counterbalanced by acute sovereign monopsony concentration:

1. **Explosive Value-Add Expansion:** Processed metal export revenues (HS 72 Iron/Steel, HS 74 Copper, HS 76 Aluminium) reached **\$34.14 Billion** in 2025, representing a **+249.90%** net expansion against the pre-ban baseline of \$9.76B in 2019.
2. **Severe Sovereign Concentration (HHI 3,584.2):** Downstream exports exhibit high destination concentration. Mainland China’s absorption share expanded by **+20.70 percentage points** (from 37.77% to 58.47%), introducing elevated structural beta to Chinese real estate and industrial fixed investment.
3. **Maritime Logistical Realignment (82.08% Eastern Share):** Traditional Western multi-purpose ports (Tanjung Priok, Tanjung Perak) lost 14.34 percentage points of volume share. Smelter-adjacent private enclave terminals in Central Sulawesi and North Maluku now dominate outbound mineral clearance.
4. **Corporate Credit Vulnerability:** While historical EBITDA margins remain solid (24–32%), project debt service coverage ratios (DSCR) face acute compression under rising captive coal power costs, softening benchmark metal spreads, and European Carbon Border Adjustment Mechanism (CBAM) liabilities.

Macro-Industrial Metric	2019	2025
Processed Metal Exports (HS 72, 74, 76)	\$9.76B	\$34.14B
Raw Mineral Ore Exports (HS 26)	\$3.13B	\$5.02B
Downstream Processing Ratio (%)	75.7%	87.2%
Destination Concentration (HHI Index)	1,879.4	3,584.2
Dominant Sovereign Share (China, P.R.)	37.77%	58.47%
Eastern Smelter Port Market Share (%)	57.88%	82.08%
Western Commercial Gateway Share (%)	37.20%	17.82%
Total Mineral Trade Realization	\$12.89B	\$39.16B

Table 1: Macro-Industrial Empirical Dashboard (2019 vs 2025)

2. Institutional Background & Policy Shock

The legislative genesis of mineral downstreaming rests upon **Law No. 4/2009** on Mineral and Coal Mining (*UU Minerba*), which mandated that mining concession holders (*IUP/KK*) purify raw ores domestically. Following judicial validation by the Constitutional Court (Decision No. 10/PUU-XII/2014), the regulatory mandate was reinforced

by **Law No. 3/2020** and the Omnibus Job Creation Law (**Law No. 11/2020**, reaffirmed Law No. 6/2023).

2.1 Chronology of Export Bans and Fiscal Covenants

The structural policy break unfolded in three coordinated administrative phases:

- **January 1, 2020 (Nickel Ban):** Ministry of Energy and Mineral Resources (ESDM) Regulation 11/2019 accelerated the total export ban on nickel ore (< 1.7% Ni and ≥ 1.7% Ni, HS 2604), advancing the previous 2022 deadline.
- **June 10, 2023 (Bauxite Ban):** Full export prohibition on washed bauxite ore (HS 2606), compelling capital deployment into domestic refinery lines for smelter-grade alumina.
- **2023–2024 (Copper Intermediate Regime):** Escalating export duties on copper concentrates (HS 2603) from 5% to 15%, conditioning export permits on physical construction milestones at Manyar (Gresik) and Sumbawa Barat.

2.2 International Trade Law: WTO Dispute DS592

In November 2019, the European Union filed a formal dispute at the World Trade Organization (*DS592: Indonesia – Measures Relating to Raw Materials*), alleging violations of GATT 1994 Article XI:1 (elimination of quantitative restrictions). In November 2022, the WTO panel ruled against Indonesia, rejecting defense arguments anchored on GATT Article XX(d) (enforcing domestic law) and Article XX(g) (conservation of exhaustible resources).

Indonesia appealed the panel report in December 2022. Due to the prolonged vacancy crisis in the WTO Appellate Body, the appeal entered an indefinite procedural moratorium (appealed into the void). This legal impasse allowed Indonesia to maintain its export prohibition, securing a regulatory shield for ongoing capital formation.

2.3 FDI Inflows and Fiscal Subsidies

The industrial response was spearheaded by foreign direct investment (FDI) inflows, primarily from Chinese industrial consortia (Tsingshan Holding Group, Delong Holdings, Zhejiang Huayou Cobalt, and Harita Nickel).

Capital formation was catalyzed by aggressive sovereign incentives: Corporate Income Tax (*PPh Badan*) holidays of up to 20 years under Finance Ministry Regulation PMK 130/2020, exemption of import tariffs on capital machinery (BKPM Masterlist), and zero export duties on intermediate ferroalloys (FeNi, NPI).

3. Time-Series Dynamics of HS 26 vs. HS 72, 74, 76

To quantify the macro-industrial shift, we extracted 6,461 transaction manifests across 2019–2025 from the BPS dataexim repository. Trade flows are classified into raw ores (HS 26) and processed metals (HS 72 Iron/Steel, HS 74 Copper, HS 76 Aluminium).

Year	HS 26 (Raw)	HS 72–76	Total Trade	Downstr.%
2019	\$3.13B	\$9.76B	\$12.89B	75.7%
2020	\$3.24B	\$13.37B	\$16.60B	80.5%
2021	\$6.35B	\$24.76B	\$31.11B	79.6%
2022	\$10.30B	\$31.48B	\$41.78B	75.3%
2023	\$8.72B	\$29.82B	\$38.54B	77.4%
2024	\$8.23B	\$30.93B	\$39.16B	79.0%
2025	\$5.02B	\$34.14B	\$39.16B	87.2%
Δ Net Growth	+\$1.89B +60.4%	+\$24.38B +249.9%	+\$26.27B +203.8%	+11.5 pp

Table 2: Annual Mineral Export Trajectory (Customs Value in USD)

The empirical time-series exhibits three structural phases:

1. Phase I: Supply Shock & Gestation (2019–2020):
Raw nickel ore shipments ceased abruptly in January 2020. Smelted metal exports grew from \$9.76B to \$13.37B (+37.0%), as initial Rotary Kiln-Electric Furnace (RKEF) lines at Indonesia Morowali Industrial Park (IMIP) came online.
2. Phase II: Commodity Supercycle Peak (2021–2022):
Post-pandemic fiscal stimulus drove LME metal prices to historical highs. Processed exports surged to \$31.48B. Raw ore exports (HS 26) temporarily expanded to \$10.30B solely due to price appreciation in copper concentrates from Grasberg and Batu Hijau, which continued under temporary export waivers.
3. Phase III: Maturation & Structural Dominance (2023–2025):
With High-Pressure Acid Leach (HPAL) plants commissioned and bauxite exports barred, processed metal exports achieved an unprecedented \$34.14B, representing 87.2% of aggregate mineral revenues. Concurrently, raw ore exports contracted by 51.3% from their 2022 peak to \$5.02B as domestic copper flash smelters entered testing.

4. Maritime Logistical Realignment

Mineral downstreaming engineered a total geographic transformation in Indonesian freight logistics. Export clearance shifted away from conventional multi-purpose container terminals in Java toward specialized private deep-water ports in Eastern Indonesia.

Port (POD)	Industrial Cluster		'19	'25	Δpp
Bahodopi	Central	Sulawesi	0.0%	33.1%	+33.1%
Weda	North	Maluku	0.0%	19.1%	+19.1%
Kendari	SE	Sulawesi	9.8%	10.2%	+0.4%
	(VDNI/OSS)				
Tanjung Perak	East Java	(Public	17.8%	9.2%	-8.6%
	Gateway)				
Obi Island	South	Halmahera	3.4%	7.0%	+3.6%
	(Harita)				
Tanjung Priok	Jakarta	(National	12.0%	6.3%	-5.7%
	Gateway)				
Morowali	Central	Sulawesi	0.0%	4.9%	+4.9%
	(Bungku)				
Kolonedale	North Morowali	(PT	44.7%	3.5%	-41.3%
	GNI)				
Cigading	Banten	(West Java	7.4%	2.3%	-5.0%
	Cluster)				
Kolonodale	North	Morowali	0.0%	2.1%	+2.1%
	(Sub-entry)				

Table 3: Outbound Port Redistribution (Share of Processed Value)

4.1 The Rise of Specialized Enclave Terminals

In 2019, commercial container gateways (Tanjung Perak and Tanjung Priok) processed 29.82% of outbound processed metals. By 2025, their combined footprint contracted to 15.48%.

Conversely, the integrated industrial estates at Bahodopi (IMIP, Morowali) and Weda Bay (IWIP, Central Halmahera) captured 52.25% of national outbound trade in 2025. Adding Kendari (10.20%) and Obi Island (7.00%), Eastern industrial complexes command 82.08% of outbound metal traffic.

4.2 Regulatory Logistics: The Enclave Model

This spatial concentration demonstrates that downstream value addition in Indonesia is structurally embedded in private industrial enclaves:

- **Special Terminal Status (*Terminal Khusus / TERSUS*):** Regulated under Transportation Ministry Regulation PM 20/2017, these captive deep-water berths operate outside standard public port authorities, clearing direct international bulk carriers (up to 50,000 DWT) directly to foreign ports.
- **Direct Shipping Corridors:** Mineral shipments bypass domestic hub-and-spoke cabotage routes entirely, charting direct navigational routes from Weda Bay and Bahodopi to Ningbo-Zhoushan, Qingdao, and Tianjin.
- **Infrastructure Integration:** Port handling facilities are physically integrated via automated heavy conveyor belts to mine-mouth captive coal power stations and RKEF/HPAL tapholes, minimizing inland logistics costs.

4.3 Cabotage Exemptions & Direct Navigation Economics

Under Law No. 17/2008 on Shipping, cabotage restrictions mandate Indonesian-flagged vessels for domestic carriage. However, by designating smelter jetties as international export clearance points, industrial operators utilize foreign-flagged Supramax and Capesize bulkers directly at the mine gate. This yields substantial ocean freight cost savings (\$12–\$18 per metric ton compared to transshipping via Surabaya or Jakarta), entrenching direct trans-Pacific and South China Sea maritime trunk lines.

4.4 Regional Growth Disparities & Dutch Disease

The spatial concentration of mineral processing has driven acute regional GDP divergence. Central Sulawesi and North Maluku recorded annualized GRDP growth rates exceeding 15–22% across 2021–2024, far outpacing the national average (5.05%). However, input-output tables indicate low backward linkages to local agricultural and service sectors, producing enclave economies characterized by elevated capital intensity, imported capital goods, and localized price inflation.

5. Econometric Concentration Modeling

To quantify sovereign exposure risks, we model the Herfindahl-Hirschman Index (HHI_t) across all N export destinations:

$$HHI_t = \sum_{i=1}^N s_{it}^2 = \sum_{i=1}^N \left(\frac{X_{it}}{\sum_{j=1}^N X_{jt}} \times 100 \right)^2 \quad (1)$$

where X_{it} represents customs export value to sovereign partner i in year t , and s_{it} is the percentage market share.

Destination Sovereign	2019 Share	2025 Share	Net Shift
China, P.R.	37.77%	58.47%	+20.70 pp
Viet Nam	6.25%	7.12%	+0.87 pp
Taiwan, POC	10.90%	6.17%	-4.73 pp
India	9.21%	5.19%	-4.02 pp
Malaysia	10.49%	4.59%	-5.90 pp
Thailand	4.10%	2.73%	-1.37 pp
Korea, Rep.	7.90%	2.70%	-5.20 pp
Italy	3.29%	2.55%	-0.74 pp
Turkey	0.35%	1.46%	+1.11 pp
Spain	0.68%	1.23%	+0.55 pp
All Other Partners	9.06%	7.79%	-1.27 pp

Table 4: Sovereign Export Market Share Realization (Processed Metals)

5.1 Antitrust Benchmarks and Structural Surge

Under standard regulatory antitrust and sovereign exposure guidelines (U.S. DOJ / Federal Reserve):

- $HHI < 1,500$: Unconcentrated Portfolio
- $1,500 \leq HHI \leq 2,500$: Moderately Concentrated
- $HHI > 2,500$: Highly Concentrated / Monopsony Vulnerability

In 2019, Indonesia's processed metal portfolio exhibited moderate diversification ($HHI = 1,879.4$). Following the nickel ban, the index spiked into extreme concentration territory:

- **2020:** $HHI = 4,302.9$ (Immediate post-ban offload)
- **2021–2022:** $HHI = 3,369.1 \rightarrow 4,093.1$
- **2023 Peak:** $HHI = 4,344.3$ (Chinese absorption reached 64.2%)
- **2024–2025:** $HHI = 3,512.9 \rightarrow 3,584.2$

5.2 Monopsonistic Elasticity and Macroeconomic Beta

The empirical consequence of $HHI = 3,584.2$ is an acute *monopsonistic transmission elasticity*:

$$\varepsilon_{\text{IDN,CHN}} = \frac{\partial \ln X_{\text{processed},t}}{\partial \ln Y_{\text{CHN},t}^{\text{ind}}} \approx 0.78 \quad (2)$$

A 1.0% exogenous shock to Chinese industrial production or property investment induces an estimated **0.78%** contraction in Indonesian total mineral export revenues. The policy effectively dismantled multi-jurisdiction raw ore shipments to establish single-buyer intermediate dependency.

6. Smelter Margin Sensitivity & DSCR Modeling

For corporate banking syndicates, credit risk is governed by conversion spreads between metal prices and input operating costs:

$$\text{Spread}_t = P_{\text{metal},t} - (\alpha P_{\text{ore},t} + \beta P_{\text{coal},t} + \gamma P_{\text{flux},t} + \delta P_{\text{labor},t}) \quad (3)$$

where β captures energy intensity (2.5–3.2 tons of thermal coal per ton of Nickel Pig Iron in RKEF processing).

6.1 Cash-Flow Available for Debt Service (CFADS)

$$DSCR_t = \frac{\text{CFADS}_t}{\text{Debt Service}_t} = \frac{\text{EBITDA}_t - \Delta \text{WC}_t - \text{Tax}_t}{\text{Principal}_t + \text{Interest}_t} \quad (4)$$

Stress Scenario	EBITDA	Base	Stressed
Base Case (Ni \$17.5k/t, Coal \$65/t)	\$100.0M	2.15x	2.15x
Scenario A: Ni Price Drop (-20%)	\$62.0M	2.15x	1.33x
Scenario B: Coal Tariff Surge (+40%)	\$78.0M	2.15x	1.68x
Scenario C: Combined Stagflation	\$41.0M	2.15x	0.88x
Scenario D: EU CBAM Carbon Levy (\$75/t)	\$53.0M	2.15x	1.14x

Table 5: DSCR Stress-Test Sensitivity Matrix for 40kt RKEF Smelter

6.2 Covenant Breach Dynamics & Syndication Covenants

Under combined stagflation (Scenario C: LME nickel softening to \$14,000/t coupled with captive power tariff escalation), DSCR drops to **0.88x**, breaching typical syndication covenant floors (1.25x) and triggering mandatory cash sweeps and dividend lock-ups.

6.3 Captive Coal Sensitivity & DMO Exposure

Thermal coal represents 32–38% of RKEF operating expenditures. Indonesian smelters currently benefit from the Domestic Market Obligation (DMO) price ceiling of \$90/t for industrial power generation (ESDM Decree 58/2022). If regulatory authorities align captive power coal prices with international export benchmarks (ICI 3 or Newcastle index), operating EBITDA margins would contract by 420–650 basis points.

6.4 HPAL Payable Elasticity & Chemical Reagents

Hydrometallurgical (HPAL) cashflows exhibit differing sensitivities: revenue is tied to MHP payables (75–82% of LME nickel plus cobalt credits). Cost volatility is primarily driven by imported sulfur (1.1–1.3 tons sulfur per ton MHP) and limestone flux, exposing projects to global chemical freight cycles.

6.5 Refinancing Cliff & Currency Risk

Over 68% of outstanding project debt in Indonesian smelting assets was structured with 3- to 5-year mini-perm bullet maturities denominated in USD. With project revenues pegged to LME/SHFE dollar prices but debt held by international bank consortia, tightening offshore interest rates have elevated refinancing hurdle rates by 220–340 bps.

6.6 Collateral Quality & Liquidation Recovery

Specialized pyrometallurgical assets have virtually zero secondary market liquidity. Upon technical default, salvage value is estimated at $\leq 15\%$ of initial EPC capex due to localized enclave isolation. Consequently, syndicates must establish legal perfection over offshore escrow accounts and offtake cash flows rather than relying on asset foreclosure.

7. Implications for Banking Syndications

Commercial banks and international syndicates underwriting downstream mineral facilities across 2026–2030 face a sharply diverging credit landscape across processing technologies:

7.1 Pyrometallurgical (RKEF) Credit Downgrade

Rotary Kiln-Electric Furnace (RKEF) smelters producing Class 2 nickel (NPI/FeNi) face secular margin compression:

- **Global Market Saturation:** Unprecedented Indonesian capacity additions have pushed global nickel supply into sustained surplus, collapsing the historical NPI-to-LME margin.
- **Captive Coal Carbon Liabilities:** RKEF lines consume 2.8–3.2 MWh of electricity per ton of FeNi, emitting 45–60 tons of CO₂ equivalent per ton of nickel. Smelters face escalating liabilities under Indonesia's carbon tax (Law No. 7/2021) and border carbon taxes in Western export destinations.
- **Recommendation:** Compress debt tenors on standalone RKEF assets to ≤ 5 years and impose debt-sizing limits capped at 55% Loan-to-Value (LTV).

7.2 Hydrometallurgical (HPAL) Underwriting Criteria

High-Pressure Acid Leach (HPAL) plants producing Mixed Hydroxide Precipitate (MHP) and nickel cathode for EV batteries offer superior margin resilience, but pose severe engineering and environmental risks:

- **Elevated Capital Intensity:** HPAL CAPEX ranges from \$25,000 to \$35,000 per ton of annual capacity, compared to \$12,000–\$16,000 for RKEF.
- **Tailings Governance (DSTP vs. Dry Stacking):** Deep Sea Tailings Placement (DSTP) faces stringent ESG exclusion by European and North American institutional capital. Lenders should prioritize dry stacking facilities despite higher initial land and CAPEX requirements.

7.3 Covenant Structuring & Collateral Protections

Syndication facility agreements must incorporate structural mitigants:

1. **Offtake Concentration Penalties:** Enforce covenants triggering higher Debt Service Reserve Accounts (DSRA from 3 to 6 months) if sales to a single sovereign jurisdiction exceed 65%.
2. **Mandatory Price Hedging:** Enforce minimum 40–50% rolling forward hedging of conversion margins on the London Metal Exchange (LME) or Shanghai Futures Exchange (SHFE).
3. **Parent Corporate Guarantees:** Mandate unconditional parent guarantees covering debt service until 12 months after achieving Commercial Operation Date (COD) and verified 85% continuous nameplate capacity.

8. Strategic Recommendations for Value-Chain Deepening

To insulate national balance-of-payments from commodity cyclicity, industrial policy must transition from *Phase 1 Smelting* to *Phase 2 Complex Manufacturing*:

1. **Reallocating Pioneer Tax Holidays:** Terminate Corporate Income Tax holidays for basic RKEF lines. Reallocate fiscal incentives exclusively toward tertiary downstream applications: cold-rolled stainless sheet, automotive fasteners, copper wire rod, and transformer winding fabrication.

2. **Decarbonizing Captive Power Grids:** Facilitate grid-interconnection between state utility PLN and private industrial complexes (IMIP/IWIP), transitioning power mix from sub-critical captive coal to regional hydro, geothermal, and utility-scale solar PV.

3. **Establishing Liquid Onshore Price Benchmarks:** Accelerate the development of physically settled nickel, copper, and tin contracts on the Jakarta Futures Exchange (JFX) and ICDX. Pricing domestic mineral benchmarks (*Harga Patokan Mineral* / HPM) against domestic liquid contracts eliminates transfer pricing leakage to offshore trading entities.

4. **Developing Battery Precursor Ecosystems:** Accelerate domestic refining of technical-grade lithium, battery-grade cobalt sulphate, and synthetic graphite to enable end-to-end domestic battery cell production.

8.1 Tertiary Deepening Architecture

The transition matrix for Indonesian mineral assets requires shifting domestic value-retention from basic primary smelting (NPI, matte, MHP with 15–25% domestic value retention) to tertiary engineering goods (stainless tube, cathode foil, EV packs with 65–80% retention). This necessitates establishing domestic consumption quotas and differentiated royalty tariffs on semi-finished intermediate exports.

8.2 Credit Committee Underwriting Checklist

Syndication underwriting teams evaluating mineral assets must verify:

- Minimum DSCR under LME -20% stress $\geq 1.30\times$.
- Fully permitted dry-stack tailings storage facility (TSF).
- Minimum 3 tier-1 offtakers across at least 2 sovereign jurisdictions.
- Executed PLN renewable power purchase agreement (PPA) roadmap.

Methodological Footnotes & Selected References

Data Source: Republic of Indonesia Central Statistics Agency (Badan Pusat Statistik - BPS) Web API v2. **Extraction Protocol:** Programmatic queries against *dataexim* engine (source=1, period=2, jenishs=1) covering 2-digit Harmonized System chapters: HS 26 (*Ores, slag and ash*), HS 72 (*Iron and steel, including FeNi and NPI*), HS 74 (*Copper and articles thereof*), and HS 76 (*Aluminium and articles thereof*). **Concordance:** Harmonized against BPS 8-digit Master HS Nomenclature and UN Comtrade mirrors. **HHI Computation:** Destination market shares calculated based on free-on-board (FOB) customs valuation in USD. All econometric estimations and stress-test matrices produced using Python *scipy*, *statsmodels*, and *pandas* analytical toolkits.

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