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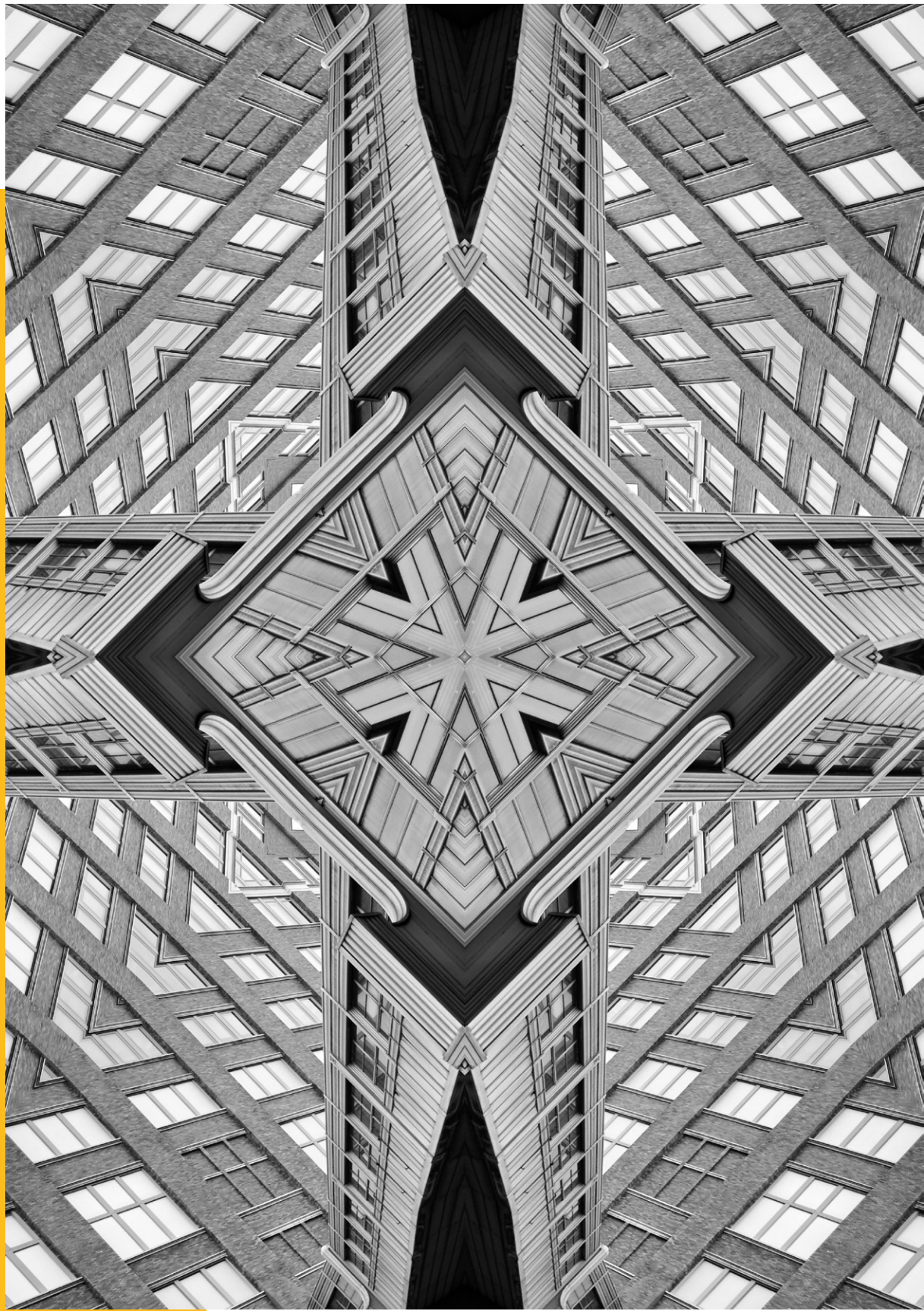

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Securing India's Midstream Capacity by Processing Critical Minerals Overseas

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Abstract

Global demand for critical minerals is predicted to increase manifold in the coming years, but India's midstream capacity is underprepared. Despite some overseas projects, India's partnerships have not progressed beyond the exploration phase, and it is still exposed to single-source supply disruptions. This paper argues that India must move beyond upstream collaborations to building capacity for overseas midstream processing through joint ventures, offtake-backed agreements, and strategic partnerships. Drawing from the Japan Oil, Gas and Metals National Corporation (JOGMEC) model and Australia's critical minerals framework, the paper proposes four recommendations to increase India's midstream capacity—establishing a sovereign-backed Critical Minerals Finance Fund, reforming Khanij Bidesh India Limited (KABIL) into a focused midstream facilitation body, converting bilateral partnerships into processing commitments, and building the human capital needed to sustain them.

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Introduction

The global requirement for critical minerals is expected to triple by 2030 and quadruple by 2040, driven by clean energy expansion, electric mobility, and advanced manufacturing.[1] In India, the demand for minerals such as lithium, cobalt, nickel, and manganese is expected to exceed 250 kilotonnes by 2030.[2] Demand for copper from the power sector alone will grow approximately 5.4 times by 2025, and for nickel, 10.7 times by 2047.[3] This growth reflects India's climate and industrial ambitions, including achieving 50 percent of cumulative installed electric power capacity from non-fossil-fuel sources by 2030,[4] 30 percent electric vehicle penetration by 2030,[5] and net-zero greenhouse gas emissions by 2070.[6]

Recognising the importance of these minerals, the Government of India launched the National Critical Mineral Mission in January 2025.[7] It has also expanded international engagement through multilateral platforms such as the Minerals Security Partnership (MSP) and established Khanij Bidesh India Limited (KABIL) to secure overseas mining and processing assets. Despite these initiatives, however, India's midstream capacity remains limited. Most overseas projects are at an early stage. Financing and technology gaps exist, and weak domestic demand for refined materials continues to constrain the development of a processing ecosystem. Further, critical mineral supply chains across the world are capital-intensive and characterised by a midstream chokepoint that cannot be replicated quickly.

This paper argues that India must move beyond upstream acquisition to investing in overseas midstream processing capacity. Processing in partner countries—through joint ventures, offtake-backed investments, and midstream collaborations—offers three advantages. First, it enables access to refined minerals in regions where mining and processing are co-located. Second, it aligns with host countries' demand to hold a greater share of the value addition. Third, it allows Indian firms to build operational and technological capabilities.

Drawing on Japanese and Australian models, India can explore strategies for offshoring, financing, and incentivising private investment. This paper maps India's current institutional landscape, identifies factors impeding the domestic processing industry, and proposes recommendations to strengthen the country's participation in overseas processing projects.

The 2024–25 Economic Survey, tabled in Parliament in January 2025, notes that of the 33 minerals vital to India's economic security, 24 face a high risk of supply disruptions.[8] India is entirely import-dependent for 10 critical minerals: lithium, cobalt, nickel, vanadium, niobium, germanium, rhenium, beryllium, tantalum, and strontium.[9] Import dependence is also considerable for other minerals, including zirconium (80 percent), graphite (60 percent), and manganese (50 percent).[10]

The midstream segment of the critical minerals value chain is a global chokepoint. Table 1 shows the processing and refining activities of select critical minerals. China dominates the value chain for minerals such as graphite, manganese, and rare earth elements (REEs). For others, including lithium, copper, nickel, silicon, and graphite, it holds a high share of global processing, reinforcing its influence over supply chains.

Table 1: Critical Mineral Processing and Refining Concentration (Global)

Mineral	China's Global Share	Others
Lithium	36% smelting and 35% refining	Chile and the Democratic Republic of Congo (DRC)
Copper	60% processing	Chile (29%) and Argentina (10%)
Manganese	90% refining	Japan and Belgium
Nickel	>50% with Indonesia and Japan	
REEs	90% refining	Malaysia and Vietnam
Silicon	70% processing	Russia, Norway, and Brazil
Graphite	100% processing	
Cobalt	75% processing	Europe, Australia, and Japan

Source: State of the Sector: Critical Energy Transition Minerals for India[11] and Global Critical Minerals Outlook 2024, International Energy Agency.[12]

India's vulnerability is compounded by micro-level impediments. Flaws in the mine auction system have constrained private investment in exploration and mining. The composite licence scheme, introduced in 2015, replaced the 'first come, first served' system but is largely limited to brownfield blocks, which require high capital expenditure to be viable.[13] Mine auctions have also seen either limited participation or irrationally high bids. As of May 2025, five tranches of critical mineral blocks (totalling 55) had been launched, of which only 34 were successfully auctioned.[14] Some auctions recorded premiums as high as 752 percent above the reserve price, leading to instances of leaseholders surrendering blocks due to weak financial viability.[15] The high capital intensity and long gestation period of projects, combined with price volatility, have made it difficult to attract private capital without de-risking instruments. These structural impediments imply that India's reliance on China's dominance is also a product of its own policy design.

The recent rare-earth magnet export restriction from China revealed India's vulnerability to supply disruptions. In April 2025, China enacted export restrictions on seven heavy and medium REEs and magnets used in automotive and defence technologies.[16] This disrupted India's supply chains, as dependence on Chinese permanent magnets was 81.3 percent in 2024–25.[17] China accounted for 73 percent of India's imports in 2024 for REEs such as scandium and yttrium—also covered under the export restriction.[18] This reflects a broader reliance on Chinese midstream output, as minerals mined elsewhere are often processed in China before entering global markets. The restrictions place Indian automakers in a dilemma, causing magnet shortages, production bottlenecks, and cost escalation.[19] The lack of domestic or international alternatives adds to the crisis.[20]

India's limited midstream capacity exacerbates these vulnerabilities. The country lacks commercial-scale processing facilities for key lithium-ion battery precursor materials, including lithium carbonate,[21] spherical graphite, and nickel and cobalt sulphate.[22] Midstream processing requires advanced technological capabilities, high capital and operational expenditure, and stringent environmental controls—capabilities that countries like China have developed over decades. Without the ability to convert raw ores into battery-grade or high-purity chemicals, India will remain dependent on single-source suppliers for its growing domestic demand.

Why Domestic Processing Is Limited

India's limited domestic processing capacity stems from three structural challenges: restricted access to raw material, weak domestic demand, and underdeveloped technological capabilities. Together, these factors have prevented the emergence of a viable critical mineral midstream industry.

A. Restricted Access to Raw Material

Reliable and cost-effective access to raw material is essential for mineral processing. In India, only a limited set of critical minerals is produced (see Table 2), and even where domestic production exists, access remains constrained due to policy design.

For REEs, India holds about 6 percent of global deposits,[23] yet production remains stagnant at around 1,700 tonnes of rare earth oxides annually.[24] Historically, the sector has been tightly regulated due to environmental and safety concerns linked to the radioactive properties of certain minerals, with extraction and processing reserved for the public sector.[25] As a result, the REE landscape continues to be dominated by IREL (India) Ltd and Kerala Minerals and Metals Limited. The monopolistic nature of the industry for so many decades has caused detriment to the REE industry in India. While IREL undertook exploration of REEs, its operations have largely shifted towards more easily extractable beach sand minerals, which generate most of its revenues.[26] At present, IREL operates India's only samarium–cobalt magnet processing facility,[27] while the country lacks both the required technology and a secure domestic cobalt supply.[28] Amendments to the Mines and Minerals (Development and Regulation) Act in 2023 opened REE exploration and mining to the private sector; however, investment remains limited due to stringent environmental regulations and the absence of enabling infrastructure.[29]

For copper, the constraints differ. India produces around 570,000 tonnes annually but faces obstacles in supplying copper concentrates to domestic smelters.[30] Hindustan Copper Limited (HCL), a public sector company, is the only integrated copper producer, while private players such as Hindalco and Sterlite Copper Industries rely on imported copper concentrates.[31] Earlier policies restricted mining licences to public sector undertakings,[32] resulting in HCL controlling around 80 percent of domestic reserves and limiting entry.[33] Consequently, Hindalco and Sterlite have acquired overseas mining assets to secure concentrate supply.[34]

Selenium and gallium, produced as by-products of copper and alumina refining, are restricted by the limited scale of their host industries. Gallium production in India has been sporadic, with only Hindalco and National Aluminium Company Limited (NALCO) producing it in the past.[35] Similarly, the absence of domestic nickel mining limits the availability of selenium.[36]

Table 2: Status of Critical Mineral Production and Processing in India

Mineral	Mineral Production (Tonnes)	Status of Processing	Key Companies
Copper	570,000	Net importer of refined copper since 2018[37]	HCL (integrated), Hindalco, and Sterlite Copper Industries Limited
REE	1,700	No commercial-scale facility to refine and separate minerals to high-purity levels[38]	IREL (India) Ltd, Kerala Minerals and Metals Limited
Selenium	164	No consistent domestic production	HCL and Hindalco (intermittent)
Tin	7,989	Limited capacity	Chhattisgarh Mineral Development Corporation Limited, Precious Minerals and Smelting Limited
Zirconium	30,000	N/A	N/A
Gallium	N/A	Recovered in the past, current processing is negligible	Hindalco Industries Limited and NALCO
Graphite	89,645	N/A	Tamil Nadu Minerals Limited and Pradhan Industries

Source: Indian Mines Yearbook 2023;[39] Mineral Economies;[40] Industry Press.

Note: All production numbers are the latest available from the Indian Bureau of Mines Mineral Yearbook 2023; N/A implies data not available.

B. Downstream Demand Yet to Materialise

Critical minerals' processing capacity expands when strong demand from downstream manufacturing industries creates a sustained market for its products.[41] In India, clean energy and advanced manufacturing sectors remain largely at the assembly stage, relying on imported components rather than generating demand for locally refined materials.

In the electric vehicle (EV) and battery industry, production relies on assembly and imported components such as cathodes, anodes, and electrolytes.[42] Many manufacturers import lithium-ion batteries and assemble them into finished products.[43] Several gigafactory projects have been announced, but remain at the pilot stage, delaying large-scale demand for lithium, nickel, cobalt, manganese, and graphite.[44] Going forward, strengthening the upstream value chain will require domestic manufacturing of cell components to increase demand for processed materials.[45] India's wind energy sector shows a similar assembly-led pattern. While India has emerged as the second-largest hub in the Asia-Pacific for onshore wind turbine assembly,[46] the production of blades and gearboxes—requiring minerals such as chromium, manganese, nickel, and molybdenum—remains limited, with continued reliance on imports.[47] Other components, such as permanent magnets, are also sourced from abroad.[48] Cutting-edge technology industries, such as semiconductors, cannot satisfy the demand from the Indian mineral processing industry due to strict purity requirements.[49]

These constraints limit the ability of downstream industries to generate sustained market pull for processed critical minerals. India has yet to stimulate robust demand for these minerals.

C. Nascent Technological Base

India lacks the commercial-scale facilities and technological capabilities required to transform raw ore into high-purity refined outputs for sectors such as batteries, EVs, and renewable energy components.

In downstream processing, India faces steep technical barriers.[50] First, it lacks commercial-scale plants for processing technologies such as solvent extraction electrowinning (SX-EW) and high-pressure acid leach (HPAL),[51] which are essential for extracting minerals such as copper, lithium, and nickel from complex ores. Second, hazardous waste handling remains inadequate.[52] For example, India lacks the containment systems required for the safe disposal of radioactive waste generated during the mining and processing of minerals such as uranium and thorium.[53] Third, facilities capable of achieving ultra-high purity—such as battery-grade lithium or rare earth magnet precursors—are absent.[54]

Further, homegrown research infrastructure for process development, pilot testing, and innovation remains minimal. There are only seven Centres of Excellence for advancing research in critical minerals, comprising four Indian Institutes of Technology and three research and development (R&D) laboratories.[55] There is a need to expand pilot-plant and demonstration-scale R&D.

India's limited processing base is a consequence of resource scarcity and institutional bottlenecks. Restricted access to raw material, low demand from downstream sectors, and the absence of advanced processing technologies have together prevented the emergence of a robust midstream industry. These limitations make the case for pursuing overseas processing partnerships as a complement to domestic initiatives, to build India's capability gap and support its industrial ambitions.

The Role of Overseas Processing

The case for India to invest in overseas midstream processing capacity rests on three rationales: the economic logic of co-locating processing with mining, the political realities of mineral-rich countries, and the strategic opportunity for Indian firms to build operational capabilities in global supply chains. At the same time, these expectations must be tempered by existing limitations and designed to leverage market mechanisms alongside state support. Each of these considerations is discussed below.

The Economic Logic of Co-Location

For mining and metals companies, transport is one of the highest operational costs. Ore is often moved over substantial distances—sometimes hundreds of kilometres—from mine to mill, consuming significant time and energy. In some cases, transport can constitute more than 50 percent of the total delivered cost.[56] Establishing processing sites close to mines can therefore yield significant operational and economic advantages, improving efficiency and strengthening firm competitiveness.

Recent studies support the economic and environmental benefits of co-location. Co-location reduces freight and inventory holding costs as well as carbon emissions associated with transport.[57] These efficiencies arise from shorter logistics chains and more synchronised extraction and processing. In the mining sector, minimising transport distances through co-location lowers operational costs, haulage volumes, and fuel consumption, while supporting low-carbon supply chains and broader industrial goals.

Despite these advantages, setting up processing capacity abroad has not been straightforward for Indian firms. Geopolitical instability in resource-rich countries, such as the DRC, which is a prominent supplier of cobalt,[58] has disincentivised private firms from investment without state backing. More importantly, new projects outside China face higher costs and slower deployment due to complex permitting, financing constraints, and a lack of offtake agreements.[59] By contrast, Chinese firms enjoy state support and more established supply chains. This cost asymmetry is a challenge for India. Its overseas strategy should therefore focus on minerals where Chinese dominance is less entrenched, such as lithium carbonate in South America and REEs in Australia, and on supply chains where domestic downstream demand can generate market pull.

The Role of Market Mechanisms

State-led interventions alone are insufficient to build a resilient midstream supply chain. Market mechanisms, such as long-term offtake agreements and private trading houses, play an important role in managing project risk. Long-term offtake agreements have become an industry norm, with companies investing in the critical minerals value chain through such agreements.[60]

Japan has utilised offtake agreements to secure supply without direct state ownership or operation of processing facilities. Sojitz Corporation, in collaboration with Japan Oil, Gas and Metals National Corporation (JOGMEC), created Japan Australia Rare Earths (JARE) in 2011.[61] JARE functioned as a financing vehicle, extending loans and financing to Lynas Rare Earths Limited—an Australian rare earth mining and processing company—and securing an offtake agreement for 65 percent of its heavy rare earth output for the Japanese market.[62]

Market transparency of commodities such as cobalt, lithium, and REE remains limited, discouraging investment and constraining risk assessments.[63] For India, a deeper engagement with global commodity markets should form part of its critical minerals' strategy. This includes supporting firms in accessing futures markets and negotiating long-term supply contracts.

Shift in Host Country Expectations

At the same time, political realities in resource-rich countries are shifting towards greater state control over mineral wealth. Resource-rich countries are enforcing restrictions in the form of export bans and increased royalties on upstream raw material to protect and develop their processing and downstream industries. Several countries have imposed outright bans on the export of unprocessed minerals. Indonesia imposed a ban on nickel ore exports in 2013 and 2020, and similarly, Zimbabwe imposed one on chromium in 2021.[64] Namibia imposed a ban on lithium ore, cobalt, manganese, graphite, and REEs in 2025.[65]

For some countries, these measures go beyond export bans. In the DRC, which supplies more than two-thirds of the world's cobalt, a revised Mining Code in 2018 increased the fiscal burden on mining firms. Royalties rose from 2 percent to 3.5 percent for copper and from 2 percent to 10 percent for cobalt.[66] Additionally, a new 50 percent tax rate on income realised when commodity prices rise by 25 percent above levels in the project's feasibility study was imposed.[67] These measures aim to curb 'super profits' and increase government revenue from the mining sector.

Several countries engaging with India on critical minerals are pursuing similar strategies. Chile, for example, is moving towards partial nationalisation through its National Lithium Strategy announced in 2023.[68] This strategy is expected to increase state oversight in lithium projects and push the domestic industry to higher value-added activities.[69] For India, these developments may imply tighter regulatory oversight and a commitment to invest in local industries. Similarly, Australia has adopted measures to retain a greater share of value creation through joint ventures and co-investment strategies. The Critical Minerals Strategy 2023–2030 calls for attracting international investments to develop downstream processing opportunities.[70] For Indian companies, this implies participation in refining and material production within Australia, rather than relying solely on raw material offtake.

These policy shifts reflect growing expectations among resource-rich countries to capture a larger share of value addition. A lot of these countries—often lower-income economies with expanding mining sectors—rely heavily on minerals exports. Minerals and metals account for over 30 percent of total exports in 23 African countries, exceeding 75 percent in countries such as the DRC, Botswana, and Zambia.[71] Mineral projects are also a source of income for the governments, where they can collect revenues through royalties, corporate income tax, and sometimes even a stake in the ownership of the projects. Additionally, a lot of these minerals are important inputs to industries such as steel and clean energy, with high downstream value-addition. Many of the resource-rich countries face sluggish economic growth. There is a disparity between where critical minerals are mined and the location of higher value addition steps, such as processing and downstream industries. Through these policies, resource-rich countries aim to break existing global production patterns and increase the economic dividend of their wealth by keeping a higher share of value addition within their domestic borders.[72]

Trade Policy as an Instrument

Trade liberalisation and predictable trade rules are essential enablers of India's overseas strategy. The elimination of tariffs on critical minerals under the Australia–India Economic Cooperation and Trade Agreement (ECTA)[73] boosts Indian imports of Australian critical minerals and encourages investment in Australian mining projects, as offtake agreements will become more viable.

Additionally, India and Chile are negotiating a Comprehensive Economic Partnership Agreement (CEPA), which is expected to deepen critical mineral cooperation.[74] Once concluded, it could reduce the cost of importing lithium carbonate and copper products, diversifying supply away from China, a leading global producer. Such predictable trade frameworks reduce the risk premium on overseas investments and make long-term contracts easier to negotiate.

India's Private Sector Capabilities

Many Indian firms have demonstrated the capacity to operate internationally and manage complex supply chains. For example, Altmin is establishing a US$250 million greenfield lithium refining project in Brazil to process ore into lithium carbonate for lithium-ion batteries.[75] Epsilon Advanced Materials is investing US$650 million in an EV battery manufacturing facility in North Carolina, US,[76] and is exploring a public–private partnership with Finnish Minerals Group to establish an anode production facility.[77] In metals, Deccan Gold Mines Limited is developing a gold production facility in Kyrgyzstan, holding a 60 percent stake in the operating company.[78] Indian firms are also active in recycling; Attero is expanding operations in Poland with a 100,000-ton-per-year lithium-ion recycling plant.[79]

These examples show that Indian firms can manage value chains abroad. These capabilities are crucial for building capabilities in critical sectors beyond the country's national boundaries. Given the push for resource nationalism and the need for locating higher-value-added industries in host countries, India's pursuit of diversified and sustainable critical minerals supply chains should extend beyond domestic initiatives.

India's institutional response to securing critical minerals has strengthened in recent years through targeted policies and agreements.

National Critical Mineral Mission (NCMM)

Approved in January 2025, the NCMM aims to secure critical mineral supplies and strengthen domestic value chains.[80] The government has earmarked INR 16,300 crore (approximately US$1.9 billion) and covers all stages of the mineral value chain.[81] The mission focuses on:[82]

- Increasing domestic mineral production
- Acquiring mineral assets abroad
- Expanding recycling
- Investing in human resources and scientific research
- Developing funding, financing, and fiscal incentives

A key initiative is the establishment of Mineral Processing Parks to host processing and refining facilities.[83] The Ministry of Mines is also expected to roll out smaller schemes to support stockpiling and processing through the National Mineral Exploration Trust.[84] However, updates on these parks and midstream facilities remain limited, and the budget allocation timeline extends to 2030–31.[85] This raises the risk that processing capacity may not emerge in the near term, prolonging reliance on imports for fast-growing sectors.

KABIL

KABIL was established in 2019 as a joint venture between NALCO, HCL, and Mineral Exploration Corporation Limited (MECL).[86] It functions as the designated institutional arm for securing critical minerals abroad. Its mandate is to identify, acquire, explore, develop, mine, and process strategic minerals abroad to meet both commercial and domestic demands.

In Australia, five shortlisted projects are at the due diligence stage.[87] In Argentina, KABIL formalised an agreement in February 2023 to explore and develop five lithium blocks in Catamarca Province.[88] In Chile, engagement is at the Non-Disclosure Agreement (NDA) stage with ENAMI, a state-owned mining company.[89]

KABIL's institutional design imposes constraints that restrict progress beyond exploration. First, it lacks independent financing capacity and relies on equity contributions from its parent public sector undertakings, which have limited midstream experience. Second, it lacks systematic mechanisms to co-invest alongside Indian private firms. JOGMEC, by comparison, provides financial support to Japanese private companies to reduce risk for private firms.[90] Reforming KABIL to address these two gaps is essential for its expansion to be meaningful.

Mineral Security Partnership (MSP)

India's decision to join the MSP in 2023 marks an important step in securing critical mineral supply chains. The MSP brings together like-minded countries to foster resilient supply chains, promote sustainable and responsible mining practices, and reduce dependence on single-source suppliers. It integrates development finance institutions and export credit agencies to create synergies and increase impact.[91] India's partnership in the MSP signals its willingness to align with other MSP countries[92] and provide access to a broader pool of technical, financial, market, and scientific expertise. Indian overseas investments may also benefit from MSP-backed financing for projects that undergo rigorous vetting.[93] For Indian firms seeking to operate globally in the critical minerals supply chain, MSP participation can enhance credibility. Altmin's lithium refinery in Brazil is the first Indian project to be included in the MSP.[94] The project will produce 32,000 tonnes of lithium carbonate annually, helping to reduce India's reliance on processed lithium imports.[95]

Bilateral Partnerships

Recognising the importance of international collaborations, India has entered several bilateral agreements with partner countries:

A. Australia

Australia is India's strongest partner in critical minerals. From India's perspective, it offers abundant mineral resources, advanced mining and processing expertise, and established trade ties. In 2020, India and Australia signed a Memorandum of Understanding (MoU) to increase trade and investment in Australia's mining industry and enhance research and development (R&D) cooperation.[96] In 2023, both countries announced five mining projects—two focused on lithium and three on cobalt.[97] The ECTA also includes provisions to reduce tariffs. However, the partnership has yet to translate into joint processing projects, despite Australia's push to attract

foreign investment under its Critical Minerals Strategy 2023–2030.[98] For this to happen, India will need to bring financial and processing expertise; the proposed Critical Minerals Finance Fund recommended in this paper can enable the shift.

B. Kazakhstan

IREL and Kazakhstan's Ust-Kamenogorsk Titanium and Magnesium Plant JSC (UKTMP) have signed an agreement to establish IREUK Titanium Limited for the production of Titanium slag in India.[99] The joint venture will utilise IREL's raw minerals and UKTMP's technology, with agreed offtake supplied to UKTMP's titanium sponge plant.[100]

C. Latin America

India has moved to secure lithium resources in Latin America. In February 2025, it signed an MoU with Argentina to explore and mine lithium in Catamarca Province.[101] Engagements with Chile and Brazil remain at an early stage but are strategically important. India has renewed its partnership with Chile on copper, lithium, and rare earths through an MoU on geology and mineral resources.[102] India and Chile have ongoing negotiations for a Comprehensive Economic Partnership Agreement (CEPA) that is expected to deepen critical mineral cooperation.[103] With Brazil, India has expressed the desire to explore opportunities to invest in mining, processing, and refining projects in minerals such as lithium, copper, and rare earths.[104]

D. The United States (US) and the United Kingdom (UK)

India has also deepened collaboration with advanced economies. With the US, it signed an MoU to 'Expand and Diversify Critical Mineral Supply Chains' through collaboration in exploration, processing, and recycling.[105] India and the UK launched the Technology Security Initiative in 2024 to support R&D and share best practices on Environment, Social, and Governance (ESG) standards in critical minerals.[106]

India's multilateral and bilateral partnerships have remained in the exploration and early-stage mining phases. There is limited progress in midstream processing, which is a vulnerability in India's critical minerals supply chain. India is yet to secure meaningful stakes in refining capacity abroad, establish joint venture processing ventures or formulate offtake agreements for processed minerals. Further, the integration of overseas midstream activities with India's industrial goals is also missing. Fully integrating these aspects into its critical minerals overseas engagement will deliver a credible pathway to securing resilient supply chains and reducing exposure to single-source suppliers.

Japan and Australia offer blueprints and instructive examples for India's overseas processing strategy. Both faced supply vulnerabilities and responded by investing in midstream access abroad.

Japan: Public–Private Model

Japan's overseas critical minerals strategy intensified following acute vulnerability. In 2010, China banned rare earth exports to Japan, exposing vulnerabilities in the Japanese automotive industry, which relied heavily on magnets imported from China.[107] The export ban caused rare earth prices to increase tenfold, triggering a scramble among Japanese industries to secure supplies. In response, the Japanese government, through the Ministry of Economy, Trade and Industry (METI) and JOGMEC, developed a strategy to secure minerals from other sources abroad.

Three deals illustrate this strategy. First, JOGMEC's agreement with REAlloys Inc., signed in October 2025, facilitates the transfer of separation and magnet manufacturing technology to North American facilities[108] in exchange for supply commitments to Japan. Second, JARE, in partnership with Lynas Rare Earths Limited, follows a "three-country model," where ore is mined in Australia, processed abroad, and imported into Japan for downstream use.[109] This arrangement allows Japan to establish resilient midstream access without building a domestic processing capacity immediately. Third, JOGMEC and Iwatani have jointly invested up to US$120 million in a French rare earth refining project run by Caremag,[110] securing half of its output of dysprosium and terbium for use in EVs, wind turbines, and electronics.

This model combines sovereign-backed financing and risk mitigation with private sector execution. However, it is not without costs. It includes the possibility of expensive failures and projects that have spent many years in the red. Further, the diversification gains can erode without sustained institutional momentum. For example, Japan's rare earth imports from China fell from 93 percent in 2009 to 49 percent in 2020,[111] but increased to 63 percent by 2024.[112] For India, three lessons stand out from this case: state-backed de-risking paired with private-sector mobilisation and long-term institutional support.

Australia: Financing Ecosystem and Value Addition

Australia offers a different approach to building resilience in the critical minerals supply chains. Unlike Japan, which has retained significant downstream capacity, Australia has attracted countries for midstream processing projects. It has utilised its natural endowments to establish itself as a supplier of raw and semi-processed materials.

The Greenbushes lithium mine in Western Australia—the world's largest hard-rock lithium deposit—is co-owned by Tianqi Lithium Corporation (China), IGO Limited (Australia), and Albemarle (US).[113] The joint venture structure has enabled the pooling of resources and technology while ensuring that Australia retains a share of ownership and revenue. The Mount Holland Lithium Project is jointly owned by Wesfarmers (Australia) and Sociedad Quimica y Minera de Chile (SQM).[114] The project involves developing an open-pit lithium mine, a processing plant at Mount Holland, and a refining plant in Kwinana, Western Australia.

The approach is supported by a robust policy framework. Australia's Critical Minerals Strategy 2023–2030 promotes co-investment with international partners and end-to-end supply chains. The government has committed US$57.1 million to support these efforts.[115] Through the Critical Minerals Strategy, the Northern Australia Infrastructure Facility (NAIF) has earmarked US$500 million of funding to develop downstream processing projects in minerals such as rare earths, vanadium, and lithium hydroxide.[116] This initiative is important for de-risking large capital-investment projects. Export Finance Australia (EFA) has been funded with AUD 2 billion to provide financial support through loans, bonds, and working capital to help projects suffering from gaps in private finance overcome these gaps and get off the ground.[117]

This model, however, is not without risks. In such a situation, where state-backed finance is generous and conditions are attractive, it can displace competitive private investment and create long-term fiscal conditions that can outlast the strategic rationale for these projects. For India, which has less fiscal space than Australia, this drawback is relevant, and the financial instruments by the state work best when they crowd in private capital instead of substituting it.

Three lessons emerge for India's overseas processing strategy. First, institutional design matters a lot for the effectiveness of a state-backed entity. JOGMEC's ability to co-invest with private players and long-term orientation were essential for its success. Second, private sector participation is crucial; Japanese trading houses such as Sojitz were key to the success of its overseas processing strategy. India will have to identify and enable private sector champions and provide them with the de-risking instruments, market information, and offtake agreements needed to invest in overseas projects. Third, gains from diversification can erode without sustained commitment. Japan's experience shows that dependency on a single country can bounce back if the institutional momentum is not maintained. India's overseas strategy must be designed for the long term, to be able to sustain beyond immediate supply crises or geopolitical tensions.

Policy Recommendations

India has begun to build more resilient critical minerals supply chains, supported by rising private investment and state initiatives. However, persistent gaps in domestic mineral processing require a recalibration of policy towards deeper engagement in international processing projects. The following recommendations may be considered:

A. Establish a Critical Minerals Finance Fund

Indian companies require improved access to finance and better credit rates to invest in critical minerals projects ahead of the curve.[118] A sovereign-backed fund under the NCMM, modelled on Australia's EFA, can provide credit support for investments in higher-risk jurisdictions such as the DRC and Argentina. The fund must be structured to crowd in private capital, offering de-risking support in early stages while transitioning to commercial financing as projects mature. Export Import Bank of India (EXIM Bank) can be integrated to pool demand across Indian buyers.[119]

India should also explore a formal co-financing arrangement with EFA, which has demonstrated its openness to India through a US$171 million guarantee to Power Finance Corporation in 2025. Such collaboration could jointly de-risk Indian equity participation in Australian midstream projects.[120] Such a project will align with both countries' strategic interests; however, it would require negotiations, as no template for such an agreement currently exists between the two countries.

B. Reform KABIL

KABIL's mandate currently includes the acquisition of overseas mines and processing; however, its activities have focused on upstream activities, and it needs to pursue processing activities with greater intensity. Its strategic priority should shift towards midstream processing partnerships, which include entering offtake agreements, equity stakes in refineries and joint ventures. This shift should be reflected in its budget allocations and supported by a dedicated midstream division to establish technical and commercial expertise. It should also be able to act as a co-investor, alongside Indian private firms. Many private firms are exploring partnerships in critical minerals and advanced technologies, and KABIL can act as the matchmaker to connect these interests and provide credibility and de-risking support. There is also a need for greater transparency in the workings of the institution, publicly reporting the progress against specific milestones, and for ministerial oversight to be tied to the delivery.

C. Convert Bilateral Partnerships into Joint Processing Ventures

India's bilateral partnerships remain focused on exploration; advancing them to midstream partnerships will require financing, de-risking, and commercial execution, alongside trade liberalisation. While the ECTA with Australia reduces tariffs, completing Comprehensive Economic Cooperation Agreement (CECA) negotiations with Australia and the CEPA with Chile will further lower costs and improve project viability.[121]

Three partners stand out. With Japan, collaboration between KABIL and JOGMEC can support joint investments in third-country processing projects, combining Japan's technical expertise with India's growing downstream demand. Priority areas include REEs, dysprosium, terbium, and lithium carbonate.

With Australia, the existing trade framework and ongoing CECA negotiations provide a basis for deeper cooperation. Joint ventures, technology transfer, and long-term capital sharing—similar to JOGMEC's support to Lynas—will be essential. The proposed Critical Minerals Finance Fund can provide the financing backbone. Areas for collaboration can be minerals such as lithium hydroxide and REE projects, where Australia is seeking co-investment partners.

In Latin America, existing MoUs with Argentina and Chile should be converted into equity stakes in processing facilities before competition intensifies. Output such as lithium carbonate, cobalt sulphate, and REEs should be secured through offtake agreements for India's battery and EV sectors. India can also leverage the MSP framework to scale such projects.

D. Build Institutional Capabilities

India's overseas strategy will depend on specialised human capital to manage international midstream projects. The India–Australia Critical Minerals Research Partnership (IACMRP) should be extended beyond June 2026 and expanded to include commercial-scale pilot processing projects. Existing collaborations between CSIR–IMMT (Bhubaneswar, India) and Australian partners provides a foundation.

Additionally, a training institution should be established under the NCMM in partnership with the Indian Institutes of Technology (IITs) and industry partners to offer certification in hydrometallurgical processing, international project management, and ESG compliance. A similar programme exists under Australia's Critical Minerals Strategy, which has US$105.1 million earmarked for New Energy Apprenticeship and New Energy Skills Programs that will add 10,000 workers in the critical minerals sector.[122]

Conclusion

India's energy ambitions depend on secure access to critical minerals, particularly reliable midstream processing. Domestic initiatives—including the National Critical Mineral Mission, processing parks, and KABIL—mark an important beginning but remain insufficient to meet the demand created by India's surging industrial ambitions.

To meet this demand, India must complement domestic initiatives with overseas partnerships. Achieving this will require a stronger financial mechanism in the form of a sovereign-backed fund and a risk-mitigation mechanism that will allow Indian firms to invest in overseas projects. Deeper international partnerships, leveraging existing multilateral frameworks, can also help attract international investments. By integrating these interventions into its strategy, India can build a resilient supply chain that supports its clean energy transition, and position itself as a sustained partner.

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