



## INDIA AND THE RARE EARTH CONUNDRUM: NAVIGATING SECURITY, GEOECONOMICS AND GLOBAL SUPPLY CHAINS

Ratnadeep Maitra<sup>1</sup> Tapas Das<sup>2</sup>

Shiv Nadar University, Kandi Raj College, India.

### Abstract:

The post-pandemic multipolar world order has led to a 'decoupling' of supply chains, prioritising reliable collaboration and attempting to delimit and isolate China geopolitically. However, Sino-American rivalry has been particularly pronounced in the strategic semiconductor industry, where rising regional powers such as India assume tremendous importance given the recent Initiative on Critical and Emerging Technology (iCET) roadmap. This article examines the intersection of geoeconomics and security in the semiconductor industry, drawing on Buzan's concept of 'multi-dimensional security' and Keohane and Nye's idea of 'complex interdependence'. Finally, it considers how India might influence the emerging network of supply chains and the consequent implications for technological security.

**Keywords:** Rare earths, semiconductors, supply chain, critical technologies, geoeconomics, security, India, China-US rivalry.

**Titulo en Español:** *India y el dilema de las tierras raras: navegando entre la seguridad, la geoconomía y las cadenas de suministro globales*

### Resumen:

*El orden mundial multipolar posterior a la pandemia ha dado lugar a una «desconexión» de las cadenas de suministro, priorizando la colaboración fiable e intentando delimitar y aislar a China geopolíticamente. Sin embargo, la rivalidad entre China y Estados Unidos ha sido especialmente pronunciada en la estratégica industria de los semiconductores, donde potencias regionales en ascenso como la India adquieren una enorme importancia dada la reciente hoja de ruta de la Iniciativa sobre Tecnologías Críticas y Emergentes (iCET). Este artículo examina la intersección entre la geoconomía y la seguridad en la industria de los semiconductores, basándose en el concepto de «seguridad multidimensional» de Buzan y la idea de «interdependencia compleja» de Keohane y Nye. Por último, analiza cómo la India podría influir en la red emergente de cadenas de suministro y las consiguientes implicaciones para la seguridad tecnológica.*

**Palabras Clave:** *Tierras raras, semiconductores, cadena de suministros, tecnologías críticas, geoconomía, seguridad, India, rivalidad China-Estados Unidos.*

Copyright © UNISCI, 2026.

Las opiniones expresadas en estos artículos son propias de sus autores, y no reflejan necesariamente la opinión de UNISCI. *The views expressed in these articles are those of the authors, and do not necessarily reflect the views of UNISCI*

<sup>1</sup> Ratnadeep Maitra is an early-career researcher at the Department of International Relations and Governance Studies at Shiv Nadar University, Delhi-NCR E-mail: <rm774@snu.edu.in>

<sup>2</sup> Tapas Das is an Assistant Professor of Political Science at Kandi Raj College, Murshidabad, Kalyani University India. E-mail:<dtapas319@gmail.com>  
DOI: <http://dx.doi.org/10.31439/UNISCI-256>



## 1. Introduction

The geo-strategic interregnum around the Covid-19 pandemic marked a tectonic shift at the systemic level. The imminent tensions within a “hyper-globalized” world order were evinced through the crisis-driven interventions pursuing a *nation-first* logic. Although the adversity created a “power vacuum<sup>3</sup>”, there was a conspicuous absence of any popular global mandate for Washington to serve as the usual crisis manager. Equally pertinent, the rupture exposed the frailties of global governance structures, thereby eroding their credibility.

At an intra-state level, there was a resurgence of “populist nationalism<sup>4</sup>” with a concomitant democratic deficit. The locational immobility stemming from stringent lockdowns culminated in a “virtual civilization”. Moreover, the de-globalizing proclivities received significant ballast from a confrontational posture towards immigration. Most importantly, the ramifications mentioned above reoriented the conception of security in transformative terms, diluting mutual engagement in favour of a strategy of self-sufficiency.

The most overt manifestation of such a transition is observable at the intersection of geo-economics and security. The post-pandemic consensus holds that established global supply chains align with extant geopolitical calculations, thereby trumping the normative logic of comparative advantage as conceptualized by David Ricardo.

This reconfiguration has been further intensified by the growing strategic salience of critical minerals such as lithium, cobalt, nickel, copper, and rare earth elements, which are indispensable to advanced manufacturing, clean energy transitions, and next-generation technologies. The resulting imbalance between rapidly expanding demand and structurally constrained supply has generated price volatility and geopolitical contestation, rendering mineral supply chains a central arena of geo-economic competition rather than mere commercial exchange<sup>5</sup>.

## 2. Theoretical Framework

It is instructive to situate the erstwhile integrationist dimension of global supply chains within the theoretical framework of “complex interdependence” conceptualized by Keohane and Nye. It was presciently posited that a “multi-centric” world order would usher in a new paradigm of interdependence among conventional state-actors as well as “non-territorial” actors, with a multiplicity of communication conduits at different levels of analysis. Moreover, the arrangement would entail a non-hierarchical set of issue-areas, coupled with a merely tangential purpose of military security<sup>6</sup>.

It was captured how complex independence would “operate in a democratic zone of peace”, with an amplified voice for influential transnational organizations that have penetrative potential across different intra-state levels, through “domestic constituencies”. Such a demilitarization of policy instruments vis-à-vis areas of interdependence would have positive spillovers to geo-economic and geo-strategic realms. Keohane and Nye maintained that

---

<sup>3</sup> Duran, Burhanuddin: “The Future of Global Great Power Competition after the Coronavirus”, *Insight Turkey*, Vol 22, n° 2 (July 2020), pp. 79-92, at <https://www.insightturkey.com/articles/the-future-of-global-great-power-competition-after-the-coronavirus>.

<sup>4</sup> Mishra, Sitakanta. “Pandemic Geopolitics and India”, *Indian Foreign Affairs Journal*, Vol.15, n° 2 (April-June2020), pp. 155–171, at <https://www.jstor.org/stable/48630172>.

<sup>5</sup> Xu, Deyi, Shiquan Dou, Yongguang Zhu, and Jinhua Cheng: “Resource nationalism: the intersection of politics and economics”, *Humanities and Social Sciences Communications* 11, n° 1423 (October 2024), at <https://www.nature.com/articles/s41599-024-03949-8#citeas>

<sup>6</sup> Keohane, Robert O. & Nye Joseph S (2012): *Power and Interdependence*, Boston, Longman.



knowledge societies would be organized around “loosely structured networks” that facilitate the flow of different categories of information – “free”, “commercial”, and “strategic”.<sup>7</sup>

It is equally imperative to revisit the multi-dimensional understanding of security as conceptualized by Barry Buzan. At the same time, the dominant discourse on security had a militaristic overtone, with the category conceived as a form of “freedom from threat,” the sustenance of an “independent identity,” and “functional integrity” against aggressive advances. However, Buzan expanded the ambit of security by de-centering the site of sovereign power and disaggregating its very nature, relating to the larger logic of interdependence. Here, the framework of “complex interdependence” must be read in tandem with Buzan’s conceptualization of the post-Cold War paradigm as a consensual and dialogic “international society” premised on a “security community”<sup>8</sup>.

Such a “security community” even encompassed “societal security” from fault-lines undermining markers of identity and cultural registers, through “migration” and “civilizational” confrontations, “economic security” of feasible welfare and accessibility to financial arrangements, and finally “environmental security” of planetary support systems<sup>9</sup>.

Within this expanded security framework, rare earth elements increasingly function as sources of structural power rather than conventional commodities. Control over their production and circulation confers not only industrial advantage but also diplomatic and economic leverage, allowing states to shape the conditions under which others access critical technologies. Rare earths thus exemplify how material infrastructures have become central to contemporary security, operating at the intersection of economic capability, technological control, and strategic influence<sup>10</sup>.

Crucially, such power does not derive from geological endowments alone but from control over the entire value chain—from surveying and separation chemistry to magnet fabrication, component integration, and end-of-life recovery. States that dominate these nodes capture disproportionate value and leverage, while those confined to raw material extraction risk structural subordination within global production networks. This distinction helps explain persistent patterns of dependence even among resource-rich economies<sup>11</sup>.

This expanded conception of security also allows for an engagement with the political economy of resource nationalism. Historically cyclical in nature, resource nationalism has resurfaced in periods of heightened demand and price volatility, as states seek to recalibrate control over strategically vital natural resources. Such impulses are often shaped not merely by economic rationality but by ideological claims of national ownership, populist politics, electoral incentives, and concerns over distributive justice. In this sense, critical minerals increasingly fall within Buzan’s domain of economic and societal security, wherein access, control, and ownership become markers of national resilience<sup>12</sup>.

---

<sup>7</sup> *Ibid*

<sup>8</sup> Buzan, Barry: “New Patterns of Global Security in the Twenty-First Century”, *International Affairs*, Vol. 67, n° 3 (July 1991), pp 431–451, at <https://doi.org/10.2307/2621945>.

<sup>9</sup> *Ibid*

<sup>10</sup> Amir, Syed Raiyan: “Rare earth elements are the new drivers of global power”, *The Daily Star*, 1 November 2025, at <https://www.thedailystar.net/opinion/views/news/rare-earth-elements-are-the-new-drivers-global-power-4023951>.

<sup>11</sup> *Ibid*.

<sup>12</sup> Rao, Swasti: “No country built rare earths resilience alone. India must take lessons from Japan and Taiwan”, *The Print*, 28 November 2025, at <https://theprint.in/opinion/no-country-built-rare-earths-resilience-alone-india-must-take-lessons-from-japan-taiwan/2794150/>.



### **3. Unpacking the Semiconductor Industry – Synthesizing Geoeconomics and Security**

It is imperative to note that, before the pandemic, such value chain disruptions could be attributable to natural calamities such as earthquakes or floods, de-skilling, outsourcing discrepancies, logistical fallacies, among other causal factors. However, the pandemic singularly conflated most such technical breakdowns arising from the twin developments of unforeseen demand and a paucity of supply. Consequently, the cascading effects entailed that two pressing dimensions of supply chains had been glossed over – an adaptability in their capacity and a diversification in their distribution, especially to preclude spatially concentrated technological hotspots. The legitimate apprehension of a probable Chinese weaponization of their critical minerals as bargaining chips on the geopolitical table against their challengers fostered a sense of techno-nationalism amongst the major powers.

The article would now scrutinize the global semiconductor industry and its inter-linkages with a more multi-dimensional conception of security. As a form of “integrated circuit”, semiconductors remain essential to strategic sectors such as “quantum computing”, “artificial intelligence”, and high-end jet carriers. Despite a robust American design and manufacturing prowess in the post-Second World War era, the former was outshone entirely by Taiwan, an East Asian nation. A coherent reason for the shift could be the cost-effective offshoring of manufacturing activities – a process of “fragmentation by default<sup>13</sup>”.

At the other end of the spectrum, under a revanchist leadership, the “Guiding Chinese Dream” remains contingent on a shift from exogenous technology to “indigenous innovation-driven” development – vindicating its renewed interest in the semiconductor industry. Notwithstanding its rapid strides in facial recognition technology and artificial intelligence, Beijing’s inability to produce advanced semiconductors could be attributable to specific determinants – an underwhelming level of “relative knowledge intensity”, myopic investments in undeserving technology startups, and overreliance on subsidies within a party-state structure<sup>14</sup>. These causal factors have led Beijing to continue producing generic chips on a disappointing scale, while making wasteful research expenditures and being steeped in graft.

As a crucial dimension of American techno-nationalism, the Creating Helpful Incentives for Producing Semiconductors (CHIPS) and Science Act was enacted, providing ballast for the formation of technological capital and supply chain resilience while curbing the commercial outflow of critical technologies and advanced chips to Beijing. Washington was even instrumental in persuading the Netherlands and Japan to clamp down on similar exports<sup>15</sup>. The “civil-military fusion” in Beijing, which had hitherto facilitated the impeded permeation of critical technology from commercial-domestic to national-militaristic purposes, received a setback, with critics decrying the decision as a “Cold War mentality”. Thus, a geo-economic posture got intrinsically tied to a new security architecture, reflecting how global interdependence and local self-reliance went hand in hand in great power competition.

Rare earth elements have emerged as a particularly acute choke point within this evolving architecture, given their indispensable role in advanced weapons systems, electronics, and semiconductor manufacturing. Beijing’s near-monopoly over processing and refining has enabled it to leverage access to supply as a political instrument, transforming mineral interdependence into a strategic vulnerability for its competitors. In the broader context of the

<sup>13</sup> Bhandari, Konark: “Ready” for Semiconductor Manufacturing?”, Carnegie India, 23 May 2023, at <https://carnegieindia.org/2023/05/23/is-india-ready-for-semiconductor-manufacturing-pub-89814>.

<sup>14</sup> Cronin, Richard: “Semiconductors and Taiwan’s “Silicon Shield”, Issue Brief, 16 August 2022, at <https://www.stimson.org/2022/semiconductors-and-taiwans-silicon-shield/>.

<sup>15</sup> Li, Zhuoran: “The Future of the China-US Chip War”, The Diplomat, 2 March 2023, at <https://thediplomat.com/2023/03/the-future-of-the-china-us-chip-war/>.



U.S.–China rivalry, rare earths exemplify how material dependencies can be deliberately weaponized within global supply chains<sup>16</sup>.

The securitization of semiconductor supply chains must also be understood alongside the geo-economics of critical minerals that underpin chip manufacturing. Host governments face an enduring dilemma between attracting foreign investment and retaining greater control over resource rents, particularly as minerals transition from commodities to strategic assets. As global interdependence deepens, this tension has become more pronounced, transforming investment regimes and reinforcing state intervention as a legitimate instrument of technological security<sup>17</sup>.

Herein, Taiwan’s “strategic dominance” emerges at the intersection of a Sino-American competition. While the Sino-Taipei relation has been deemed as “weaponized interdependence” creating new “waves of competition”, an inward-looking American tech policy would seriously undermine Taipei’s “silicon shield<sup>18</sup>” – a techno-military security, owing to its increased power resources in the “issue area” of critical technology. This had previously entailed a form of deterrence against potential Sino aggression, which might lose much of its heft due to American “decoupling by design”.

This vulnerability is compounded by Taiwan’s dependence on critical minerals, particularly rare-earth elements, which underpin advanced semiconductor manufacturing. For a technology-intensive economy such as Taiwan, rare-earth security is not merely ancillary but existential to its industrial competitiveness and techno-strategic relevance. Consequently, Taipei has long treated mineral access, recycling, and diversification as integral components of semiconductor security, underscoring how material dependencies can undermine even the most sophisticated technological ecosystems<sup>19</sup>.

Such a geopolitical contingency has necessitated that the diffuse nature of supply chains incorporates a security dimension. Such a security conception must be hinged on financial transparency, relational integrity, and transactional commitment. It is in this regard that New Delhi’s pitch for the most reliable destination for facilitating supply chains might be factored in – marking a deft synthesis of spatial advantages with policy stability.

Recent initiatives such as U.S.–India cooperation on critical mineral supply chains, including discussions under the iCET framework and India’s participation in the Minerals Security Partnership, reflect a growing strategic convergence. These platforms aim to diversify supply, reduce overdependence on China, and align trusted partners across mineral ecosystems. However, such external partnerships can only reinforce—rather than substitute for—domestic capabilities in mining, processing, and technological upgrading.

#### **4. Understanding the Domestic Space**

If we take a look at the domestic factors shaping India’s role in the global semiconductor supply chain, two things become apparent: Firstly, India’s ability to emerge as a producer of rare earths.

---

<sup>16</sup> Seth, Nayan: “Rare Earths, Rare Opportunity: India's Potential in Easing China's Chokehold – South Asian Voices”, *South Asian Voices*, 23 October 2024, at <https://southasianvoices.org/ec-m-in-n-us-india-rare-earth-10-23-2024/>.

<sup>17</sup> Xu, Deyi, Shiquan Dou, Yongguang Zhu, and Jinhua Cheng: “Resource nationalism: the intersection of politics and economics”, *Humanities and Social Sciences Communications* 11, n° 1423 (October 2024), at <https://www.nature.com/articles/s41599-024-03949-8#citeas>

<sup>18</sup> Hill, Andrew: “The great chip war — and the challenge for global diplomacy”, *Financial Times*, 7 December 2022, at <https://www.ft.com/content/7de40326-58a9-457b-a828-edf86031883e>.

<sup>19</sup> Rao, Swasti: “No country built rare earths resilience alone. India must take lessons from Japan and Taiwan”, *The Print*, 28 November 2025, at <https://theprint.in/opinion/no-country-built-rare-earth-resilience-alone-india-must-take-lessons-from-japan-taiwan/2794150/>.



Secondly, India's outlook towards the semiconductor industry in general. Both aspects must be understood within the institutional and economic discourse regarding their respective positions in the Indian economy.

India's rare-earth challenge mirrors this broader pattern of institutional constraints. Despite substantial reserves in coastal and beach sand deposits, India lacks technological depth across mining, separation, refining, and magnet production. High energy requirements, environmental clearance hurdles, waste management concerns, and limited private-sector participation have collectively inhibited capacity formation. As a result, India continues to import a significant proportion of its rare-earth requirements from China, underscoring that resource endowments alone do not translate into strategic autonomy<sup>20</sup>.

Despite possessing one of the world's largest rare earth reserves, India currently lacks capabilities across the entire value chain—from extraction and separation to processing and magnet manufacturing. This disjuncture between geological potential and industrial capacity constrains India's ability to translate resource endowments into strategic leverage, underscoring the need to view rare earth development as an institutional and technological challenge rather than merely a geological one.

If we look at some of the schemes underpinning the semiconductor industry in India, the 'Make in India' initiative is at the center. The Production Linked Incentive (PLI), the Design Linked Incentive (DLI), and the Chips to Startup (C2P) schemes provide an incentive package for establishing semiconductor industries in India. In terms of budgetary allocation, the Ministry of Electronics and IT (MeitY) has earmarked \$10 billion for the Indian Semiconductor Mission (ISM)<sup>21</sup>. In the following section, we examine key debates and policy inconsistencies in this field.

Resource governance in this context operates as a two-level game, wherein domestic political coalitions, fiscal imperatives, and institutional design constrain international negotiations over investment and supply chains. The feasibility of India's integration into resilient semiconductor supply chains thus depends not only on external partnerships but also on the internal ordering of resource rents, regulatory coherence, and political commitment to long-term industrial upgrading.

## **5. Interrogating the Mining Space**

In the case of rare earths, several government corporations, such as the Indian Rare Earths Limited (IREL), hold a monopoly on the extraction of these Rare Earth Elements (REEs). However, the IREL is primarily engaged in the extraction of Rare Earth Oxides (REOs), which are considered low-cost and low-profit emanating from "upstream processes". It sells these to foreign firms, who in turn engage themselves in the extraction of these metals and manufacture end products as well<sup>22</sup>.

These are the so-called high-cost and high-profit generating "downstream processes". This allows India to contribute only a tiny fraction to global production, while domestic manufacturers are forced to import a wide range of REE derivatives from China.

---

<sup>20</sup>Behera, Col Sudhir R.: "Rare Earth Elements: The Achilles' heel of international Geopolitics", Centre for Joint Warfare Studies, May 2025, at <https://cenjows.in/rare-earth-elements-the-achilles-heel-of-international-geopolitics/>.

<sup>21</sup> Pandey, Shubhra: "India's Emerging Prominence as a Semiconductor Superpower", Invest India, 6 July 2023, at <https://www.investindia.gov.in/team-india-blogs/indias-emerging-prominence-semiconductor-superpower>.

<sup>22</sup> Kanisetti, Anirudh: "Here's how India can end Chinese dominance in rare earths", *Business Insider*, 13 February 2021, at <https://www.businessinsider.in/policy/economy/news/heres-how-india-can-end-chinese-dominance-in-rare-earths/articleshow/80883001.cms>.



China's dominance in rare-earth supply chains persists not solely because of its resource base, but also because of long-standing institutional lock-ins across mining, processing, and downstream manufacturing. Western economies, despite recognizing the national security implications of such dependence, have struggled to exit China-centric supply chains, reinforcing Beijing's capacity to deploy export restrictions as a strategic lever—as evidenced by the 2010 embargo against Japan. India's current predicament reflects similar structural constraints rather than an absence of strategic intent<sup>23</sup>.

The IREL itself is devoid of any economic incentive, with its primary function being the supply of thorium as extracted from monazite to the Department of Atomic Energy (DEA). India thus needs to open up this sector substantially to foster competition whilst guaranteeing innovation<sup>24</sup>.

Comparative experiences from East Asia suggest that securing rare earths cannot be reduced to upstream extraction alone. Japan's response to the 2010 supply disruption demonstrated that meaningful resilience emerges only when downstream capabilities in separation, refining, magnet manufacturing, and recycling complement mining. Similarly, South Korea has focused on diversifying supply through regional partnerships while simultaneously investing in recycling technologies and alternative materials. These trajectories highlight that resource security today is rooted in full-spectrum control of the value chain rather than mere ownership of mineral reserves<sup>25</sup>.

The structural constraints are further exacerbated by the global resurgence of resource nationalism, wherein states increasingly deploy policy instruments such as export restrictions, royalty revisions, state equity participation, and local content requirements to maximize resource rents. While these measures are often justified in the name of strategic autonomy, their effectiveness hinges on institutional capacity and technological depth. In the absence of downstream capabilities, rent-maximization strategies risk reinforcing dependency rather than mitigating it<sup>26</sup>.

## **6. From Design to Manufacturing**

There is a significant puzzle regarding the semiconductor industry in India: while India remains firmly embedded in the design segment, it lags in manufacturing. This places India in an enviable position when it comes to global 'standard setting'. However, an overemphasis on design hampers the creation of 'clusters' in the long run.

Japan's post-2010 industrial strategy offers an instructive contrast in this regard. Rather than privileging any single segment of the value chain, Tokyo pursued coordinated investments linking materials, manufacturing, and technological upgrading, backed by sustained public funding and precise industrial sequencing. This alignment enabled Japan to rebuild capabilities

---

<sup>23</sup> Seth, Nayan: "Rare Earths, Rare Opportunity: India's Potential in Easing China's Chokehold", *South Asian Voices*, 23 October 2024, at <https://southasianvoices.org/ec-m-in-n-us-india-rare-earths-10-23-2024/>.

<sup>24</sup> *Ibid*

<sup>25</sup> Rao, Swasti: "No country built rare earths resilience alone. India must take lessons from Japan and Taiwan", *The Print*, 28 November 2025, at <https://theprint.in/opinion/no-country-built-rare-earths-resilience-alone-india-must-take-lessons-from-japan-taiwan/2794150/>.

<sup>26</sup> Xu, Deyi, Shiquan Dou, Yongguang Zhu, and Jinhua Cheng: "Resource nationalism: the intersection of politics and economics", *Humanities and Social Sciences Communications* 11, n° 1423 (October 2024), at <https://www.nature.com/articles/s41599-024-03949-8#citeas>



in high-end magnet production and advanced materials, illustrating that design leadership yields durable gains only when embedded within a broader manufacturing and materials ecosystem<sup>27</sup>.

Many ancillary industries can benefit from India's semiconductor industry's growth<sup>28</sup>. This also ties into the prospect of attracting Foreign Institutional Investors (FIIs) to relocate their operations to India. Subsidies tend to provide only a fleeting economic incentive because they can be withdrawn at any time.

Such an imbalance has much to do with the Indian economy's makeup, which tends to prioritize services over manufacturing. There are many Massive Open Online Courses (MOOCs) on semiconductors on the Indian e-learning platform SWAYAM. Despite a vast knowledge pool, most engineering graduates tend to opt for jobs in the software and IT industry. However, the need of the hour is to invest in semiconductor fabrication facilities or 'fabs'. These are large-scale enterprises requiring a continuous supply of clean water and electricity. Alongside this, they also need to continually upgrade their technology<sup>29</sup> continually. The Semiconductor Laboratory, established in 1976 in Mohali, Punjab, is currently India's sole 'fab'. It is currently undergoing modernization<sup>30</sup>.

## **7. Institutional and Policy Reforms**

However, there is much to learn from the experiences of other states, as well as from examining our institutions when it comes to manufacturing semiconductors.

In this context, multilateral frameworks such as the Quad and bilateral initiatives like the U.S.–India iCET offer essential opportunities for technology transfer, diversification, and strategic alignment. Nevertheless, their effectiveness ultimately hinges on India's ability to absorb external capabilities thro

ugh domestic institutional reform and capacity-building. Without parallel investments in processing infrastructure, regulatory streamlining, and skill formation, international partnerships risk remaining facilitative rather than transformative.

A critical lesson from global experiences is the importance of sequencing and prioritization in industrial policy. Rather than attempting to construct a comprehensive rare earth ecosystem simultaneously, states have succeeded by first consolidating strengths in mining and processing before expanding into more capital-intensive downstream segments. For India, a calibrated focus on scalable extraction, separation, and processing—supported by targeted R&D and regulatory reform—may offer a more credible pathway to supply chain integration than ecosystem-wide ambitions pursued in parallel.

Cross-national experiences also reveal that certain common institutional principles underpin successful resource and semiconductor strategies. These include time-bound implementation rather than open-ended policy intent, clarity in industrial sequencing from extraction to fabrication, and partnerships anchored in concrete production and technology-sharing arrangements rather than declaratory agreements. Taiwan's long-term international collaborations and Japan's sustained budgetary commitments demonstrate that credibility, not

---

<sup>27</sup> Rao, Swasti: "No country built rare earths resilience alone. India must take lessons from Japan and Taiwan", *The Print*, 28 November 2025, at <https://theprint.in/opinion/no-country-built-rare-earths-resilience-alone-india-must-take-lessons-from-japan-taiwan/2794150/>.

<sup>28</sup> Bhandari, Konark. "Ready" for Semiconductor Manufacturing?", *Carnegie India*, 23 May 2023, at <https://carnegieindia.org/2023/05/23/is-india-ready-for-semiconductor-manufacturing-pub-89814>.

<sup>29</sup> *Ibid*

<sup>30</sup> "Message from Moody's: Government must handhold the semiconductor industry", *The Indian Express*, 12 October 2023, at <https://indianexpress.com/article/opinion/editorials/message-moody-government-handhold-semi-conductor-industry-8978872/>.



ambition alone, determines whether supply chain diversification translates into strategic autonomy<sup>31</sup>.

Firstly, there is an argument for making the ISM a truly autonomous body. It should have the authority to prepare its own budget and remain accountable to the Parliament of India. Currently, the MeitY is undertaking legislation on a host of other issues, namely the Personal Data Protection Bill. Thus, there is an emergent need to separate a line agency from a staff agency<sup>32</sup>.

Secondly, there is a lack of integration between the ISM, which is housed under the Meit, Y, and other allied departments. This is not the case with the CHIPS Program Office (CPO) in the US, which has critical linkages with the Department of Defence, state, and homeland security, among others<sup>33</sup>.

Thirdly, there is a need to expedite the DLI's self-sufficiency in financing. For this to occur, the Centre for Development of Advanced Computing, which is the nodal agency for this scheme, needs to acquire equity in the recipient company. Such an approach was taken by the Industrial Technology Research Institute (ITRI) in Taiwan when it helped establish Taiwan Semiconductor Manufacturing Company (TSMC) and other enterprises<sup>34</sup>.

Fourthly, in the context of mining, some commentators have highlighted the need to establish a Department of Rare Earths (DRE). It would work under the Ministry of Petroleum and Natural Gas. The DRE can help secure access to strategic REEs by providing “viability gap funding” to interested enterprises<sup>35</sup>.

Fifthly, there is an additional need to create a Rare Earths Regulatory Authority of India (RERAI) to resolve commercial disputes and ensure compliance<sup>36</sup>. This is especially true since the mining of rare earths is an environmentally degrading process.

Moreover, the environmental externalities associated with rare earth extraction and refining introduce a critical political dimension to resource governance. Green transitions that rely heavily on rare earths risk becoming politically contentious if local communities bear the costs of pollution, displacement, and ecological degradation. This tension underscores how rare earth politics intertwine environmental security with industrial strategy, shaping regulatory choices and social consent in resource-producing regions. Global investors can thus be pensive about the ‘readiness assessment’ of India’s semiconductor sector lest it live up to specific standards<sup>37</sup>.

---

<sup>31</sup> Rao, Swasti: “No country built rare earths resilience alone. India must take lessons from Japan and Taiwan”, *The Print*, 28 November 2025, at <https://theprint.in/opinion/no-country-built-rare-earths-resilience-alone-india-must-take-lessons-from-japan-taiwan/2794150/>.

<sup>32</sup> Bhandari, Konark: “The Geopolitics of the Semiconductor Industry and India’s Place in It”, Carnegie Endowment for International Peace, 30 June 2023, pp. 1–48, at <https://carnegieendowment.org/research/2023/06/the-geopolitics-of-the-semiconductor-industry-and-indias-place-in-it?lang=en>.

<sup>33</sup> *Ibid*

<sup>34</sup> *Ibid*

<sup>35</sup> Kanisetti, Anirudh: “Here’s how India can end Chinese dominance in rare earths”, *Business Insider*, 13 February 2021, at <https://www.businessinsider.in/policy/economy/news/heres-how-india-can-end-chinese-dominance-in-rare-earths/articleshow/80883001.cms>.

<sup>36</sup> *Ibid*

<sup>37</sup> “Message from Moody’s: Government must handhold the semiconductor industry”, *The Indian Express*, 12 October 2023, at <https://indianexpress.com/article/opinion/editorials/message-moody-government-handhold-semi-conductor-industry-8978872/>.



## 8. Emerging Trends

Of late, several scholars have noted the transition of India's services sector into manufacturing. This is particularly true for a host of services startups, especially in the transport, procurement, and e-commerce sectors. India's slow growth has long been attributed to a moribund small to medium-scale tech manufacturing sector. Start-ups can help these smaller firms gain access to credit, raw materials, markets, warehousing, and logistics facilities, as well as quality checks<sup>38</sup>. Such a continuous stream of financing is essential for attracting venture capitalists, who always need to see whether the respective technology can be commercialized. In the present case, it is unclear what would happen if government funding were to dry up. Thus, this nascent trend will be of great significance to the Indian semiconductor industry in the years to come.

A further lesson from East Asian experiences lies in aligning industrial expansion with environmental responsibility and long-term research pathways. Advances in recycling, substitutes, and efficiency have enabled countries like Taiwan to reduce material vulnerability while maintaining global competitiveness. Such alignment is increasingly essential for attracting responsible global investors and embedding India within resilient and sustainable technology supply chains<sup>39</sup>.

Ultimately, rare earths sharpen rather than simplify contemporary geopolitics. The most acute risk is not merely the threat of sudden export cut-offs. Still, a gradual systemic fragmentation in which strategic mistrust multiplies transaction costs, disrupts technological diffusion, and hardens supply chain boundaries. As rare earths become a litmus test for twenty-first-century power, advantage will accrue to states that can construct resilient and environmentally credible value chains while managing the political and social consequences of extraction. Mastery over these "invisible materials," rather than territorial control alone, is likely to shape the contours of global power in the decades ahead<sup>40</sup>.

## 9. Conclusion

The article has examined the reconfiguration of global supply chains in the post-pandemic multipolar order, where geoeconomics and security have become deeply intertwined. Drawing on Keohane and Nye's concept of complex interdependence and Buzan's multidimensional understanding of security, it has been argued that rare earth elements have moved beyond the realm of commercial commodities to emerge as sources of structural power. Control over their production, processing, and circulation confers industrial, diplomatic, and technological leverage, particularly amid the securitization of semiconductor supply chains and the intensifying U.S.–China rivalry. Rare earths thus exemplify how material dependencies can be transformed into strategic vulnerabilities, reshaping global interdependence in hierarchical and asymmetrical ways.

Situating India within this evolving landscape, the article highlighted the disjuncture between geological endowments and industrial capacity that constrains its ability to translate resource potential into strategic autonomy. Institutional fragmentation, limited downstream capabilities, and regulatory and environmental constraints continue to inhibit India's integration into resilient rare-earth and semiconductor value chains. Comparative experiences from East

<sup>38</sup> Bhandari, Pranjul: "Building an India for manufacturers", *The Indian Express*, 9 October 2023, at <https://indianexpress.com/article/opinion/columns/the-rise-of-services-8973972/>.

<sup>39</sup> Rao, Swasti: "No country built rare earths resilience alone. India must take lessons from Japan and Taiwan", *The Print*, 28 November 2025, at <https://theprint.in/opinion/no-country-built-rare-earths-resilience-alone-india-must-take-lessons-from-japan-taiwan/2794150/>.

<sup>40</sup> Amir, Syed Raiyan: "Rare earth elements are the new drivers of global power", *The Daily Star*, 1 November 2025, at <https://www.thedailystar.net/opinion/views/news/rare-earth-elements-are-the-new-drivers-global-power-4023951>.



Asia demonstrate that resource security depends on coordinated investments across the entire value chain, supported by credible industrial sequencing and sustained institutional commitment. While emerging partnerships under frameworks such as the Quad and iCET offer essential avenues for diversification, their effectiveness ultimately hinges on domestic capacity-building. As rare earths increasingly become consequential in the twenty-first-century power, India's challenge lies in aligning economic security, environmental governance, and technological upgrading within an increasingly contested global order.

### **Bibliography**

Amir, Syed Raiyan: "Rare earth elements are the new drivers of global power", *The Daily Star*, 1 November.2025, at <https://www.thedailystar.net/opinion/views/news/rare-earth-elements-are-the-new-drivers-global-power-4023951>.

Arora, Neha, and Betty Han: "Exclusive: India explores rare-earth deal with Myanmar rebels after Chinese curbs", *Reuters*, 10 September 2025, at <https://www.reuters.com/world/china/india-explores-rare-earth-deal-with-myanmar-rebels-after-chinese-curbs-2025-09-10/>.

Behera, Col Sudhir R.: "Rare Earth Elements: The Achilles' heel of international Geopolitics", Centre for Joint Warfare Studies, May 2025, at <https://cenjows.in/rare-earth-elements-the-achilles-heel-of-international-geopolitics/>.

Bhandari, Konark: "Ready" for Semiconductor Manufacturing?", Carnegie India, 23 May 2023, at <https://carnegieindia.org/2023/05/23/is-india-ready-for-semiconductor-manufacturing-pub-89814>.

Bhandari, Konark: "The Geopolitics of the Semiconductor Industry and India's Place in It", Carnegie Endowment for International Peace, 30 June 2023, pp. 1–48, at <https://carnegieendowment.org/research/2023/06/the-geopolitics-of-the-semiconductor-industry-and-indias-place-in-it?lang=en>.

Bhandari, Pranjul: "Building an India for manufacturers", *The Indian Express*, 9 October 2023, at <https://indianexpress.com/article/opinion/columns/the-rise-of-services-8973972/>.

Buzan, Barry: "New Patterns of Global Security in the Twenty-First Century", *International Affairs*, Vol. 67, n° 3 (July 1991), pp 431–451, at <https://doi.org/10.2307/2621945>.

Chandra, Amal: "Rare Earths Armistice: India's Shift from Mining to Processing", ORF, 12 November 2025, at <https://www.orfonline.org/english/expert-speak/rare-earths-armistice-india-s-shift-from-mining-to-processing>.

Cronin, Richard: "Semiconductors and Taiwan's "Silicon Shield", Issue Brief, 16 August 2022, at <https://www.stimson.org/2022/semiconductors-and-taiwans-silicon-shield/>.

Duran, Burhanuddin: "The Future of Global Great Power Competition after the Coronavirus", *Insight Turkey*, Vol 22, n° 2 (July 2020), pp. 79-92, at <https://www.insightturkey.com/articles/the-future-of-global-great-power-competition-after-the-coronavirus>.

Hill, Andrew: "The great chip war — and the challenge for global diplomacy", *Financial Times*, 7 December 2022, at <https://www.ft.com/content/7de40326-58a9-457b-a828-edf86031883e>.



Kanisetti, Anirudh: “Here’s how India can end Chinese dominance in rare earths”, *Business Insider*, 13 February 2021, at <https://www.businessinsider.in/policy/economy/news/heres-how-india-can-end-chinese-dominance-in-rare-earths/articleshow/80883001.cms>.

Keohane, Robert O., & Nye Joseph S (2012): *Power and Interdependence*, Boston, Longman.

Li, Zhuoran: “The Future of the China-US Chip War”, *The Diplomat*, 2 March 2023, at <https://thediplomat.com/2023/03/the-future-of-the-china-us-chip-war/>.

“Message from Moody’s: Government must handhold the semiconductor industry”, *The Indian Express*, 12 October 2023, at <https://indianexpress.com/article/opinion/editorials/message-moody-government-handhold-semi-conductor-industry-8978872/>.

Mishra, Sitakanta: “Pandemic Geopolitics and India”, *Indian Foreign Affairs Journal*, Vol.15, n° 2 (April-June 2020), pp. 155–171, at <https://www.jstor.org/stable/48630172>.

Pandey, Shubhra: “India's Emerging Prominence as a Semiconductor Superpower”, *Invest India*, 6 July 2023, at <https://www.investindia.gov.in/team-india-blogs/indias-emerging-prominence-semiconductor-superpower>.

Parashar, Shushant VC. (2025): “India’s Rare Earth Dilemma: Between Chinese Leverage and an Afghan Offer”, *The Diplomat*, 17 October 2025, at <https://thediplomat.com/2025/10/indias-rare-earth-dilemma-between-chinese-leverage-and-an-afghan-offer/>.

Rao, Swasti: “No country built rare earths resilience alone. India must take lessons from Japan and Taiwan”, *The Print*, 28 November 2025, at <https://theprint.in/opinion/no-country-built-rare-earths-resilience-alone-india-must-take-lessons-from-japan-taiwan/2794150/>.

Seth, Nayan: “Rare Earths, Rare Opportunity: India's Potential in Easing China's Chokehold”, *South Asian Voices*, 23 October 2024, at <https://southasianvoices.org/ec-m-in-n-us-india-rare-earths-10-23-2024/>.

Vaid, Manish: “Rare-earth realpolitik: How India turned scarcity to leverage”, *The Asia Times*, 22 August 2025, at <https://asiatimes.com/2025/08/rare-earth-realpolitik-how-india-turned-scarcity-to-leverage/>.

Xu, Deyi, Shiquan Dou, Yongguang Zhu, and Jinhua Cheng: “Resource nationalism: the intersection of politics and economics”, *Humanities and Social Sciences Communications* 11, n° 1423 (October 2024), at <https://www.nature.com/articles/s41599-024-03949-8#citeas>

Yagay and Sun: “Rare Earth Elements, China's Strategic Dominance, and India's Strategic Imperative: A Critical Crossroad for Economic and Geopolitical Aspirations”, *TaxTMI*, 11 June 2025.