IJMRRS

International Journal for Multidisciplinary
Research, Review and Studies

ISSN: 3049-124X (Online)

VOLUME 2 - ISSUE 1

2024

India-Japan Semiconductor Partnership: A Strategic Response to Supply Chain Vulnerabilities and China Dependency

Ms. Riya Wagle, Dr. Bidisha Bhattacharya

Abstract

This study examines the India-Japan Semiconductor Partnership as a strategic response to India's critical dependency on Chinese semiconductor imports. With China supplying 70-75 percent of India's computer imports and contributing to an $87.48 billion trade deficit in 2022, India faces acute economic, strategic, and technological vulnerabilities requiring urgent diversification. The partnership, formalized through a July 2023 Memorandum of Cooperation, combines Japan's semiconductor manufacturing expertise with India's large domestic market through institutional mechanisms including JBIC financing, IJICP industrial corridors, and technology transfer initiatives. Employing qualitative case study methodology with comparative analysis, this research examines the partnership's strategic rationale, institutional architecture, implementation challenges, and potential outcomes.

Findings reveal sophisticated institutional design addressing financial support, infrastructure development, and workforce development simultaneously. However, formidable challenges emerge: capital requirements exceeding tens of billions, workforce skill gaps requiring 5-10 years to remedy, paradoxical dependence on Chinese rare earth materials, and infrastructure deficits. Unlike US partnerships with Taiwan and South Korea leveraging existing manufacturing excellence, India-Japan must build capabilities from scratch. The partnership represents a critical test case for bilateral cooperation as pathway to technological sovereignty in emerging economies, with implications for Indo-Pacific supply chain resilience and friendshoring viability in critical technology sectors.

Keywords: semiconductor partnership, India-Japan relations, supply chain resilience, technology transfer, strategic dependencies, emerging economies

1. Introduction

The semiconductor industry has emerged as critical strategic infrastructure for modern economies, underpinning technologies from artificial intelligence to defense systems. With around 75% of the world's semiconductor production capacity located in China and East Asia, the COVID-19 pandemic revealed serious weaknesses in these highly concentrated global supply chains. In order to increase supply chain resilience, these disruptions and rising geopolitical tensions have forced countries to reevaluate their reliance and seek strategic alliances.

Particularly serious vulnerabilities exist for India. According to trade data, 70–75% of India's computer imports come from China, with electronic integrated circuits worth $4 billion in 2020–21. India's ongoing trade deficit with China, which was $87.48 billion in 2022 and reflects a structural imbalance where the country exports mostly low-value agricultural items and imports high-value manufactured goods, is a result of these dependencies. The battle in the Galwan Valley in June 2020 brought to light the ways in which geopolitical conflicts might jeopardize economic ties by generating strategic (risks of supply disruption), technological (limited indigenous capabilities), and economic (chronic deficits) vulnerabilities that call for immediate diversification.

A critical case for determining whether bilateral cooperation can successfully handle strategic dependencies is the India-Japan Semiconductor Partnership, which was established in July 2023 through a Memorandum of Cooperation. In contrast to alliances between well-established semiconductor powers (such as the US and Taiwan or the US and South Korea), this relationship aims to develop capabilities from the ground up, which makes it especially pertinent to comprehending the options open to developing nations pursuing technical autonomy. Through a thorough case study analysis, this article explores the partnership's institutional procedures, implementation obstacles, strategic justification, and possible outcomes, evaluating the likelihood of lowering reliance on imports while promoting domestic technological capabilities.

The success or failure of the cooperation has ramifications for the viability of "friendshoring" approaches to crucial technological industries as well as for larger Indo-Pacific supply chain resilience measures, which go beyond India-Japan relations. Understanding whether this partnership can achieve meaningful semiconductor capability development has important policy and strategic implications for emerging economy development strategies worldwide, especially considering India's status as the world's fifth-largest economy with aspirations for global technological leadership.

2. Literature Review

The corpus of prior research on semiconductor supply chains, bilateral trade relations, and strategic alliances provides essential context for understanding the India-Japan relationship in addition to pointing out significant gaps that this study addresses.
Research on global semiconductor supply chains highlights strategic shortcomings and geographic concentration dangers. While the Semiconductor Industry Association (2024) states that 75% of manufacturing capacity is in East Asia, (Ernst, 2016) looks at China's state-driven semiconductor strategy. According to (Khan et al., 2024), resilience difficulties arise as the industry approaches the trillion-dollar threshold. This research illustrates why nations want supply chain diversification, despite the fact that it primarily concentrates on current semiconductor powers rather than creating market plans for capabilities expansion.

India's technology trade stance has fundamental disadvantages, according to studies. While (Veeramani et al., 2018) report India's poorer export performance in comparison to China in manufactured products, (Pohit and Basu, 2011) point out India's limited high-tech competitiveness beyond pharmaceuticals. In their analysis of India's reliance on Chinese active pharmaceutical ingredients, (Chaudhari, 2021) and (Bjerke, 2022) show trends of strategic vulnerability across industries. However, rather than examining partnership mechanisms or strategic measures to reduce dependency, these studies mostly concentrate on diagnosing them.

Research on Japan's semiconductor sector documents both historical breakdown and current attempts at resuscitation. The Brookings Institution (2024) examines Japan's current strategy, which blends domestic investments (Rapidus Corporation) with international partnerships (TSMC Kumamoto factory). The literature on US-EU semiconductor cooperation serves as an example of Japan's multidirectional cooperative approach. Research specifically examining Japan's role in semiconductor development in developing nations like India is still lacking, though.
The disputes surrounding the Quad framework and the broader Indo-Pacific strategic conflict are linked to semiconductor cooperation in (Gokhale, 2021) and (Modern Diplomacy, 2025) geopolitical analysis. This literature offers geopolitical motivations for partnerships while often considering economic and technological concerns superficially, despite its concentration on high-level strategy rather than implementation mechanisms and real-world issues.

Despite a wealth of research on the geopolitics of semiconductors, India's trade dependencies, and Japan's semiconductor strategy, a comprehensive analysis of the India-Japan Semiconductor Partnership in particular is still lacking. Whether the partnership model can be replicated by other countries seeking strategic autonomy in critical technologies, how the partnership resolves the conflict between reducing its reliance on China and continuing to use Chinese materials inputs for semiconductor manufacturing, what implementation issues distinguish this new market collaboration from alliances between established semiconductor powers, or how the institutional mechanisms of this partnership fill India's specific capability gaps have not been examined in previous research.

By carefully analyzing the India-Japan partnership's structure, workings, obstacles, and future, this paper closes these gaps. The research offers unique insights into bilateral cooperation as a strategy for technological sovereignty and supply chain resilience in emerging economies by placing the partnership within the context of India's documented trade dependencies on China and contrasting it with other semiconductor collaborations worldwide.

3. Research Methodology

This study employs qualitative case study methodology to analyze the India-Japan Semiconductor Partnership. Using an explanatory-descriptive design, the study combines an in-depth account of the partnership's structure with a critical analysis of its strategic justification, obstacles, and possible results. For thorough coverage and triangulation, the analysis uses a variety of sources, including secondary sources (academic literature, industry reports, and policy analyses from think tanks), primary sources (July 2023 Memorandum of Cooperation, PLI scheme frameworks, JBIC and IJICP statements), and bilateral trade statistics at HS6 classification from the Observatory of Economic Complexity, WTO Stats, and India's Ministry of Commerce.

The study incorporates several analytical viewpoints: comparative analysis placing India-Japan in relation to other semiconductor partnerships (US-Taiwan, US-South Korea, Japan-EU), institutional analysis assessing organizational mechanisms and policy frameworks, and strategic trade analysis looking at documented dependencies measured through trade data. A SWOT framework evaluates opportunities (technological transfer, regional cooperation), threats (global competitiveness, geopolitical uncertainties), weaknesses (capital limits, talent gaps), and strengths (India's market, Japan's knowledge) in a methodical manner.

As a recently announced initiative (MoC, signed July 2023), measurable outcomes remain uncertain, necessitating reliance on tactical documents rather than demonstrated results. Therefore, rather than evaluating demonstrated efficacy, the study evaluates design quality and potential. While the case study method restricts generalizability, the restricted public availability of comprehensive specifications and proprietary agreements limits depth in some areas. Comparative analysis, on the other hand, finds patterns that are more broadly applicable, which helps to overcome this limitation.

4. The India-Japan Semiconductor Partnership: Structure, Mechanisms, and Challenges

4.1 Background and Strategic Context

4.1.1 India's Semiconductor Dependency Crisis

India's dependence on Chinese semiconductors constitutes a significant risk across economic and strategic dimensions. Bilateral trade statistics show that 70 to 75 percent of India's computer imports are sourced from China, which is also a major supplier of critical electronic subassemblies and finished goods. In the 2020–21 period alone, India imported approximately $4 billion in electronic integrated circuits from China. These dependencies extend beyond finished products to essential components for domestic manufacturing.

This reliance reflects and reinforces a broader structural imbalance. In 2023, the total value of bilateral trade with China reached $115.82 billion, but India's trade deficit with China remained persistently high at $83.36 billion, with the gap peaking at $87.48 billion in 2022. India's exports are predominantly low-value goods—mainly agricultural products—while high-value imports such as electronics, machinery, and chemical products dominate inflows from China.

The COVID-19 pandemic briefly disrupted these patterns, causing a temporary 14 percent drop in imports from China in 2020. However, as India's economy recovered and domestic manufacturers resumed production, imports rebounded rapidly, increasing by nearly 50 percent in 2021. The digital transformation within India, accelerated by work-from-home demand, further boosted the import of smartphones and communication equipment.

These patterns of reliance heighten several vulnerabilities. Large trade deficits continually strain foreign exchange reserves and introduce macroeconomic imbalances. Supply disruptions, whether due to global shocks, geopolitical tension, or targeted restrictions, remain a constant risk. Furthermore, India's limited domestic capabilities in key industries hamper its prospects for innovation and technological advancement. The Galwan Valley border dispute in 2020 underscored how geopolitical and economic risks can intersect, reinforcing the necessity for diversification strategies.

4.1.2 Japan's Semiconductor Resurgence and Strategic Interests

Japan was once a dominant force in global memory chip production, achieving a 50 percent market share in the 1980s. However, intensifying competition from Taiwan's TSMC and South Korea's Samsung drove this figure down to 10 percent by 2020, with Japanese firms specializing further in materials and equipment. The shock of supply chain disruptions during the COVID-19 pandemic, combined with growing US-China technological competition and concerns over Taiwan's geopolitical stability, prompted a strategic reassessment. Japan subsequently elevated semiconductors to a national priority sector, critical for future technologies such as artificial intelligence and robotics.

This policy pivot materialized in state-supported initiatives like the founding of Rapidus Corporation in 2022—formed with the explicit aim to reach advanced chip production through partnerships with global companies such as IBM. Meanwhile, Japan also succeeded in attracting major international investments, notably TSMC's new production plant in Kumamoto, expected to become operational in 2024. To protect its own investments, diversify risks, and secure reliable export destinations, Japan is now proactively engaging with India, whose chip consumption is projected to surpass $100 billion by 2030.

4.1.3 Convergence of Strategic Interests

The India-Japan Semiconductor Partnership is grounded in complementary national strengths and objectives. India brings to the table a rapidly growing market, an extensive pool of engineers, and targeted government support through policy initiatives including the Production-Linked Incentive scheme. Japan contributes critical financial resources—primarily via JBIC—along with decades of industrial experience and a well-developed knowledge base in semiconductor manufacturing and supply chain management.

These economic and technical complementarities are reinforced by a shared geopolitical outlook. Both countries seek to reduce strategic vulnerabilities arising from high dependence on China and aspire to strengthen their own positions in the global value chain. Active participation in frameworks such as the Quad, as well as alignment on democratic values and the international rules-based order, further underpin this partnership and are expected to ensure consistency through political cycles. The present climate, marked by heightened supply chain risk and a global push for diversification, makes conditions especially conducive for new entrants and innovative collaborations. The evolution of chip technologies and emerging architectures offer India and Japan opportunities to develop competitive advantage without requiring direct confrontation with established leaders in mature segments.

4.2 Key Partnership Mechanisms and Institutional Arrangements

4.2.1 Memorandum of Cooperation Framework

In July 2023, India's Ministry of Electronics and Information Technology and Japan's Ministry of Economy, Trade, and Industry signed a Memorandum of Cooperation, establishing the official structure for bilateral semiconductor collaboration. This agreement creates business-to-business and government-to-government links, with a strong emphasis on supply chain resilience and institutionalized coordination. Joint working groups, composed of representatives from government, industry, and regulatory bodies, meet regularly to assess progress, identify bottlenecks, and suggest new initiatives. The MoC mandates the sharing of manufacturing expertise and technology, enabling Indian engineers and researchers to benefit from Japanese training and experience, while also fostering joint academic and R&D projects. Harmonization of regulations, fast-tracking venture approvals, and mutual recognition of standards aim to streamline cross-border cooperation. The MoC is set for an initial five-year term, subject to renewal, and includes regular progress reviews to ensure accountability and strategic alignment.

4.2.2 Japan Bank for International Cooperation (JBIC) Financial Support

The Japan Bank for International Cooperation plays a critical role in the India-Japan partnership by supplying much-needed capital and financial expertise. Given the capital-intensive nature of semiconductor fabrication, JBIC provides direct financing, co-finances joint ventures with Indian partners, and extends credit for technology acquisition. Crucially, the bank offers political risk insurance, reducing the uncertainty faced by private investors and encouraging longer-term commitments. JBIC's involvement is not limited to funding; it also conducts feasibility studies and due diligence, ensuring that investment decisions are robust and sustainable. This level of institutional support demonstrates Japanese government commitment and provides both Indian and Japanese private actors the confidence required to invest in large-scale semiconductor ventures.

4.2.3 India-Japan Industrial Competitiveness Partnership (IJICP)

The India-Japan Industrial Competitiveness Partnership serves as the broader framework underpinning advanced manufacturing cooperation. IJICP supports the creation of industrial corridors and special economic zones, focusing on core infrastructure required for high-tech production—including stable power, pure water systems, waste management, and logistics. Japanese experts, collaborating closely with central and state authorities, transfer operational knowledge across industrial policy, supplier ecosystem design, and business management. The partnership is particularly valuable for connecting potential Indian and

Japanese business partners, reducing information barriers, and fostering joint ventures. Business missions and promotional events organized under this framework help accelerate relationship-building critical for complex supply chains, ultimately contributing to the formation of a robust semiconductor ecosystem.

4.2.4 Technology Transfer and Skill Development Initiatives

Both nations treat the development of domestic capabilities as a priority, with special attention given to talent and knowledge transfer. Partnerships are established between leading educational and research institutions in India and Japan, enabling faculty exchanges, joint research, and curriculum enhancement. Japanese semiconductor firms initiate hands-on corporate training programs in India, providing direct exposure to manufacturing, equipment operation, and quality control practices. These efforts are complemented by research collaborations that place Indian engineers in Japanese facilities, accelerating experiential learning. The Japan International Cooperation Agency contributes to technical capacity-building by deploying experienced experts to teach, consult, and help establish vocational training centers, supporting workforce development at both technician and advanced engineering levels.

4.3 Implementation Challenges and Obstacles

4.3.1 Capital Requirements and Limited Private Sector Participation

The capital requirements for building an advanced semiconductor fabrication facility in India are substantial, typically ranging from $10 billion to $20 billion for a single major project, with total outlay increasing further when research and infrastructure are included. India's Production-Linked Incentive (PLI) scheme, as well as state-level policies, have moved decisively toward subsidizing up to 50 percent of project costs, covering expenditures such as procurement of building and process equipment, cleanroom installation, utilities, workforce training, and in-house R&D. Nevertheless, attracting and sustaining the remaining investment—especially from the private sector—remains a core challenge. Investors are cautious about the long timeframes for return on investment, the rapid evolution of semiconductor manufacturing technology, and the intense competition presented by long-established global leaders.

In practical terms, the largest share of investment is absorbed by the purchase and installation of sophisticated process machinery and support equipment, followed by the construction and outfitting of cleanrooms, core utilities, and site infrastructure. Additional significant expenditures go toward personnel recruitment, skill development, routine site operations, and regulatory compliance. As a result, the unit economics of operating a fab in India are shaped not only by the upfront capital commitment, but by recurring costs for materials, high-grade inputs, electricity, facility maintenance, and continuous technological upgrades. Because India's ecosystem for these supplies and services is still developing, initial projects often incur higher costs and face greater risk compared to fabs in countries with mature local supplier networks and specialized logistics. The long-term economic viability of India's semiconductor endeavours will depend on sustained ecosystem development—fostering domestic suppliers, workforce capabilities, and supportive service providers to gradually align with international cost benchmarks and operational best practices.

To address these concerns, a combination of policy innovations—public-private partnerships, dedicated infrastructure funds, and careful regulatory simplification—will likely be necessary to provide both financial assurance and operational clarity for investors. The success of the India-Japan partnership in particular will hinge on how effectively these elements are coordinated to reduce risk, build confidence among private capital providers, and establish the conditions for a sustainable, competitive semiconductor sector.

4.3.2 Skilled Workforce Shortage

India confronts a formidable shortage of personnel with the specialized skills required for semiconductor manufacturing, despite producing upwards of one million engineering graduates each year. The fabrication sector requires distinct and highly technical competencies spanning chip architecture, process engineering, materials science, automated manufacturing, and quality control. Existing engineering curricula, however, tend to emphasize software over hardware skills, with only a handful of universities offering state-of-the-art laboratory and cleanroom training as part of undergraduate or postgraduate programs. Enrollment in these specialized courses remains well below industry needs, and compensation in semiconductor manufacturing has generally lagged behind more popular professional options like IT services, further exacerbating talent attraction and retention problems.

Compounding the situation is the active recruitment of Indian talent by established global players, which has led to significant brain drain. Flexible work arrangements typical of IT sectors are also less feasible in this field, where the demands of shift work and operational continuity are non-negotiable. Addressing these challenges will require sustained curriculum reform, expansion of hands-on training, and partnership with global leaders in industrial apprenticeships. Scholarships, industry-led training, and joint ventures in education—with dedicated investment in infrastructure—are necessary to build a substantial workforce over the next decade. Failure to resolve these bottlenecks risks the paradoxical outcome of underutilized facilities due to unaddressed skills gaps.

4.3.3 Rare Earth Materials and Supply Chain Dependencies

The ambition to reduce reliance on China for finished semiconductors is undermined by India's and Japan's continued dependence on China for rare earth elements and other critical materials essential to chipmaking. China dominates more than two-thirds of global rare earth extraction and over 85 percent of advanced processing capacity, meaning that the current partnership could merely substitute one type of supply chain vulnerability for another. Beyond rare earths, the industry depends on a tightly concentrated global supplier base for chemicals, photoresists, gases, and ultra-pure silicon, making any local production highly susceptible to international disruptions.

Addressing materials security requires a multi-pronged approach, including building strategic partnerships with producers in Australia, Vietnam, and Mongolia, promoting commercial-scale recycling technologies for rare earth elements, and developing national and multilateral strategic reserves. Dedicated R&D for materials substitution and joint procurement arrangements with likeminded partner countries, such as the United States and the European Union, are equally important. Placing material security at the center of the India-Japan collaboration will strengthen resilience and prevent the mere transfer of vulnerabilities from one node of the supply chain to another.

4.3.4 Infrastructure and Ecosystem Deficits

A comprehensive and reliable infrastructure, extending far beyond the factory floor, is vital for globally competitive semiconductor manufacturing. India has created special economic zones and planned corridors, but major deficiencies persist, particularly in electricity, water, and logistics. Power reliability remains an acute concern, as even the briefest failure can result in catastrophic financial losses by halting wafer production. Despite progress, many sites require backup systems and additional quality control hardware. Water intensity represents another challenge: modern fabrication facilities may consume several million litres per day of ultra-pure water, necessitating state-of-the-art purification and recycling systems, and intensifying competition with other users in water-scarce regions.

India's absence of a dense, localized network of suppliers and service providers means that what in Taiwan or South Korea would be routine maintenance, component supply, or packaging operations remains a significant cost and risk factor in India. While isolated pilot projects exist, multinational manufacturers typically require strong supplier clusters and logistics corridors before making large investments. Furthermore, the frequent movement of sensitive goods—often in and out of India—requires reliable customs, airport, and port handling, with current limitations contributing to delays and higher costs. Addressing these constraints will require integrated planning, ongoing public-private investment, and policies designed to catalyse a self-sustaining ecosystem, not just isolated investment in fabrication facilities.

Additionally, it is crucial to recognize that semiconductor plants are only as resilient and cost-effective as the local supply chains available to support their operations. A semiconductor ecosystem demands an intricate web of high-purity chemical suppliers, specialty gas providers, testing and packaging services, cleanroom maintenance vendors, ultra-pure water plants, logistics specialists, and equipment servicing firms—just-in-time and operating at globally competitive standards. In India, such supporting industries remain in their infancy, and their absence poses an immediate risk of operational delays, higher costs, and chronic import dependence for essential inputs and services. Without deliberate state and industry action to nurture local capacity—through supplier incentives, capacity-building funds, and support for specialized SMEs—fabs risk functioning as costly islands, perpetually exposed to global price swings, trade disruptions, and long lead times. Building this upstream and downstream supplier base is thus a true bottleneck and must become a central priority for Indian industrial and innovation policy if the country is to realize the full promise of large-scale semiconductor manufacturing.

5. Discussion

5.1 Comparative Analysis with Other Semiconductor Partnerships

The India-Japan partnership stands apart from most major global semiconductor alliances. Whereas US-Korea and US-Taiwan collaborations leverage strong incumbent firms and seek to mitigate regional concentration, India and Japan must build core manufacturing and ecosystem capacity nearly from scratch. Horizon Europe's partnership with Japan focuses on fundamental research and technology over immediate production, while India-Japan must simultaneously invest in immediate capability, future R&D, and system-wide industrial coordination. Managing delicate economic ties with China adds to the complexity, as both India and Japan advance strategic autonomy by navigating rather than severing such relationships. This underscores the partnership's uniqueness as a pathway for capability-building, not just capacity expansion, in the semiconductor sector.

5.2 Critical Success Factors and Prospects

Success will hinge on the ability to marshal long-term private capital by presenting sufficiently robust business cases, not just relying on public subsidies. Workforce development is a multi-year process, requiring persistent educational investment before a critical mass of technical specialists can be reached.

Materials security remains a potential vulnerability; supply diversification, stockpiling, and recycling innovation are essential to avoid substituting one dependency for another. Political and policy consistency across cycles, building broad institutional buy-in, and embedding the partnership in India's evolving innovation ecosystem are crucial for resilience.

It should be noted, however, that this analysis has not mapped supply chain bottlenecks at the operational (shop-floor or supplier network) level, nor does it provide granular capex and opex data at the project level—a limitation dictated by nascent progress in India's domestic sector and a lack of plant-level financial transparency. Future empirical work should trace the on-the-ground development of supplier networks, analyse fab performance benchmarks, and detail the cost-competitiveness journey relative to world standards. A nuanced understanding of sequenced policy interventions, timing, and coordination between skills, supply chains, and anchor investments would advance both academic debates and practical strategy.

5.3 Strategic Implications for Regional Supply Chain Resilience

The Indo-Japan model offers broader implications for regional value chain resilience. If successful, it could anchor Quad or Indo-Pacific multilateral supply strategies, allow other emerging economies to pursue sovereignty without cornering themselves politically, and serve as an experimental laboratory for bilateral partner-driven innovation in critical industries. The onus now lies on stakeholders to draw from these early lessons—and to further investigate, through empirical research, where persistent bottlenecks or inflection points genuinely occur so as to update and refine policy responses as the sector matures.

6. Conclusion

The India-Japan Semiconductor Partnership represents a strategically significant initiative designed to address India's acute dependence on Chinese semiconductor imports—a dependence that underpins considerable trade imbalances and exposes the country to both economic and technological vulnerabilities. The alliance, formalized through the 2023 Memorandum of Cooperation, leverages Japan's demonstrated expertise in semiconductor technology and India's sizeable market and engineering workforce. Together, both partners employ mechanisms such as dedicated financing, institutional frameworks, and industrial corridors to lay the groundwork for technology transfer and domestic capability building. In a global landscape increasingly defined by technological sovereignty and resilient supply chains, this collaboration stands as an ambitious yet necessary response.

Unlike partnerships involving established manufacturing leaders, the India-Japan venture confronts the unique challenge of building vital manufacturing capacity, a skilled labor base, advanced R&D, and a complete supplier ecosystem essentially from scratch. Infrastructure gaps, continued reliance on Chinese rare earths, long lead times for talent development, and capital demands in the tens of billions of dollars remain the most formidable obstacles. Success will depend on persistent policy attention from both governments, patient capital mobilization, and a commitment to scaling up high-quality workforce development at unprecedented rates. Concrete policy instruments—ranging from extended tax incentives and focused university-industry collaborations to targeted programs for supply chain security—will be indispensable as the partnership matures.

At the same time, it must be acknowledged that this study cannot yet offer a granular mapping of all operational supply chain bottlenecks or detailed plant-level benchmarks for cost and performance. The evolving nature of India's domestic value chain and the limited transparency on early-stage financial outcomes present intrinsic empirical limitations. Future research should therefore prioritize systematic data collection on supplier landscapes, public-private project structuring, and operational benchmarking to guide both academic debate and policy design. A clearer understanding of the ideal sequence, timing, and policy mix for ecosystem development would further strengthen the evidence base for this and similar alliances.

Ultimately, the trajectory of the India-Japan Semiconductor Partnership will serve as a test case of whether friendshoring, bilateral institution-building, and joint innovation can deliver technological sovereignty and resilient value chains for an emerging economy. Its outcomes will hold important implications not only for Indo-Pacific geoeconomics, but also for nations worldwide attempting to restructure their strategic industries in the pursuit of security, autonomy, and sustainable growth.

References

Bjerke, L. (2022). Antibiotic geographies and access to medicines: Tracing the role of India's pharmaceutical industry in global trade. Social Science & Medicine, 312, Article 115386. https://doi.org/10.1016/j.socscimed.2022.115386

Brookings Institution. (2024, June). The renaissance of the Japanese semiconductor industry. https://www.brookings.edu/articles/the-renaissance-of-the-japanese-semiconductor-industry

Chaudhari, S. (2021). India's import dependence on China in pharmaceuticals: Status, issues and policy options (RIS Discussion Paper Series No. 268). Research and Information System for Developing Countries. https://dx.doi.org/10.2139/ssrn.3906479

Deloitte. (2022). Semiconductor expansion may require smart capital spending. https://www.deloitte.com/us/en/Industries/tmt/articles/semiconductor-capital-spending.html

Ernst, D. (2016). China's bold strategy for semiconductors: Zero-sum game or catalyst for cooperation? East-West Center Working Paper (Innovation and Economic Growth Series). https://www.eastwestcenter.org/publications/chinas-bold-strategy-semiconductors-zero-sum-game-or-catalyst-cooperation

Gokhale, V. (2021, March). The road from Galwan: The future of India-China relations. Carnegie Endowment for International Peace. https://carnegieendowment.org/research/2021/03/the-road-from-galwan-the-future-of-india-china-relations

India Briefing. (2025, August 24). Semiconductor industry in India: Incentives and key players. https://www.india-briefing.com/news/setting-up-a-semiconductor-fabrication-plant-in-india-what-foreign-investors-should-know-22009.html

IMARC Group. (2025). Semiconductor Fabrication Manufacturing Plant Project Report 2025: Industry Trends, Plant Setup, Machinery, Raw Materials, Investment Opportunities, Cost and Revenue. https://www.imarcgroup.com/semiconductor-fabrication-manufacturing-plant-project-report

Khan, S. A. R., Yu, Z., Sharif, A., & Golpîra, H. (2024). Blockchain technology and supply chain resilience: A multi-method analysis of the pandemic impacts. International Journal of Production Economics, 270, Article 109168. https://doi.org/10.1016/j.ijpe.2024.109168

Ministry of Electronics and Information Technology (MeitY), Government of India & Ministry of Economy, Trade, and Industry (METI), Government of Japan. (2023, July). Memorandum of Cooperation on India-Japan Semiconductor Supply Chain Partnership. https://www.pib.gov.in/PressReleasePage.aspx?PRID=1970784

Ministry of External Affairs, Government of India. (2025, August 28). Fact sheet: India-Japan economic security cooperation. https://www.mea.gov.in/bilateral-documents.htm?dtl/40066/

Modern Diplomacy. (2025, March). The geopolitics of semiconductor supply chains. https://moderndiplomacy.eu/2025/03/24/the-geopolitics-of-semiconductor-supply-chains/

Observer Research Foundation. (2024, December). Evaluating India's PLI scheme for semiconductors. https://www.orfonline.org/expert-speak/evaluating-india-s-pli-scheme-for-semiconductors

Observatory of Economic Complexity. (2025). China (CHN) and India (IND) trade. Retrieved February 18, 2025, from https://oec.world/en/profile/bilateral-country/chn/partner/ind

Pohit, S., & Basu, S. (2011). High technology merchandise trade: Where do India stand? (MPRA Paper No. 32734). Munich Personal RePEc Archive. https://mpra.ub.uni-muenchen.de/32734

Semiconductor Industry Association & Boston Consulting Group. (2024, May). Emerging resilience in the semiconductor supply chain. https://www.semiconductors.org/

SolutionBuggy. (2025, April 14). Setting up a semiconductor fabrication plant: Cost, requirements, and opportunities in India. https://www.solutionbuggy.com/blog/semiconductor-fabrication-plant-setup

Veeramani, C., Aerath, L., & Gupta, P. (2018). Intensive and extensive margins of exports: What can India learn from China? The World Economy, 41(5), 1196–1222. https://doi.org/10.1111/twec.12592

Vision IAS. (2025, October 3). India-Japan partnership | Current Affairs. https://visionias.in/current-affairs/monthly-magazine/2025-10-04/international-relations/india-japan-partnership

World Trade Organization. (2025). WTO stats. Retrieved January 23, 2025, from https://stats.wto.org