THE India Japan FORUM

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ananta centre

The India-Japan Forum presents a platform for fostering dialogue and advancing the bilateral and strategic partnership between India and Japan to leverage opportunities, exchange ideas and develop a joint agenda for future cooperation. The forum is convened by Ananta Centre and Ministry of External Affairs, Government of India. All discussions are held under Chatham House rules and participation is limited to select invitees from both sides.

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EXECUTIVE SUMMARY

This report examines the multifaceted relationship between India and Japan, set against the backdrop of a rapidly evolving geopolitical landscape in the Indo-Pacific region. It explores the key areas of development, existing challenges, and future potential of this strategic partnership. Amidst shifting global dynamics, the study emphasizes the increasing importance of collaboration between these two nations for regional stability and economic growth.

The primary objective of this study is to provide an in-depth analysis of the strategic, economic, and technological dimensions of the India-Japan partnership. It examines how this relationship is being reshaped by factors such as:

- **ASIA'S ASCENDANCE:** Asia's growing economic and strategic influence and its role in reshaping global geopolitics.
- **SUPPLY CHAIN RESILIENCE:** The imperative to forge resilient and competitive supply chains, particularly in critical technologies.
- **INDIA'S ECONOMIC TRANSFORMATION:** The growth of India's economy and the changes in its investment landscape.
- **THE CHINA FACTOR:** The implications of China's assertive policies for India, Japan, and the wider Indo-Pacific region.
- **DECARBONIZATION:** The transition to a sustainable energy future and the collaborative efforts required to achieve decarbonization goals.

The analysis of the current state of bilateral relations shows a partnership with significant potential for growth. Existing challenges include translating intentions into action and overcoming an over-reliance on governmental initiatives without sufficient societal engagement.

Challenges and Opportunities in Bilateral Relations

The India-Japan partnership is a critical pillar of security, economic resilience, and technological collaboration in the Indo-Pacific. While the relationship has expanded across multiple domains, key structural and strategic challenges must be addressed to realize its full potential.

Welcome remarks delivered by **Rajan Navani,** Chairman, Ananta Centre, CMD. Jetline Group of companies, Founder CEO, Jetsynthesys.

1. HUMAN RESOURCES

A strong and adaptable workforce is essential for fostering a resilient economy. Efforts to enhance talent mobility, adaptability, and language proficiency are underway but are yet to reach their full potential. Developing a dynamic industry ecosystem requires greater cultural integration, flexibility, and a supportive, hands-on approach to workforce development.

2. STRATEGIC AND GEOPOLITICAL IMPERETIVES

REGIONAL STABILITY: As maritime democracies with shared commitments to a rules-based international order, India and Japan play a pivotal role in ensuring regional security. However, effectively responding to geopolitical uncertainties—particularly in the face of China's growing assertiveness—necessitates deeper defence and security cooperation.

MULTILATERAL ENGAGEMENT: While both nations actively engage in platforms such as the Quad and the Indo-Pacific Economic Framework (IPEF), their alignment in broader multilateral initiatives remains a work in progress, requiring greater strategic coordination.

3. ECONOMIC AND TRADE COLLABORATION

INVESTMENT AND MARKET ACCESS: Japan remains a key investor in India, particularly in the infrastructure and technology sectors. However, bureaucratic hurdles, regulatory mismatches, and the need for policy reforms continue to pose challenges to seamless investment flows and trade expansion.

SUPPLY CHAIN RESILIENCE: Strengthening supply chains, especially in high-tech sectors such as semiconductors and advanced manufacturing, presents both a challenge and an opportunity. India and Japan must navigate policy alignment and capacity-building efforts to enhance competitiveness in critical industries.

4. TECHNOLOGICAL INNOVATION AND SUSTAINABILITY

ADVANCING CRITICAL TECHNOLOGIES: While collaboration in AI, 5G, and robotics is growing, bridging gaps in research and development ecosystems will be essential for India and Japan to emerge as global innovation leaders.

DECARBONIZATION AND GREEN ENERGY: Both nations are committed to sustainability, yet achieving ambitious climate goals requires stronger partnerships in green hydrogen, battery storage, and circular economy initiatives. Addressing financing constraints and technology transfer mechanisms will be crucial.

5. SOCIETAL ENGAGEMENT

BEYOND GOVERNMENTAL TIES: While governmental initiatives have driven much of the bilateral engagement, deeper people-to-people connections, academic collaborations, and private-sector participation remain underdeveloped. Broadening societal involvement will be key to fostering long-term strategic trust.

Conclusion

This report presents an in-depth analysis of these challenges and opportunities, offering insights into the evolving India-Japan relationship. By identifying areas for deeper collaboration and addressing structural barriers, it provides a strategic framework for policymakers, businesses, and researchers seeking to enhance bilateral cooperation in an era of shifting global dynamics.

INTRODUCTION

The India-Japan Forum is a premier annual event that brings together senior leaders, policymakers, and private sector representatives from India and Japan to strengthen bilateral cooperation, explore emerging opportunities, and foster strategic dialogue. Convened by the Ananta Centre in collaboration with the Ministry of External Affairs, Government of India, the Forum serves as a high-level engagement platform to enhance mutual trust and develop a shared vision for future collaboration.

Discussions at the Forum are conducted under Chatham House Rules, ensuring a candid exchange of ideas in a confidential setting. Participation is by invitation only and includes ministers from the government, parliamentarians, business leaders, academics, media representatives, and experts from leading think tanks.

The 3rd India-Japan Forum took place on 6–7 December 2024 in New Delhi. The forum focused on several critical areas of collaboration, including defence cooperation in the Indo-Pacific, the semiconductor industry, AI governance, alternative energy sources, supply chains, high-tech geopolitics, and enhancing trust within the bilateral relationship.

Dr. S. Jaishankar, India's External Affairs Minister, addressed the inaugural session, and Mr. Takeshi Iwaya, the Japanese Foreign Minister, delivered a video message. Ms. Nirmala Sitharaman, Finance Minister of India, along with several experts, participated in discussions across the Forum.

The following chapters reflect on key themes identified during the discussions at the Forum. Each short essay highlights the context, challenges, opportunities, and points of convergence in the relationship.

Participants from both countries emphasized on growth and stability and underscored the need to strengthen security cooperation and foster technological autonomy to navigate strategic vulnerabilities.

Amidst the rise of regional powers and intensifying competition in the Indo-Pacific, the discussions reflected the deep trust between India and Japan and reinforced their strategic partnership.

Anchored in shared democratic values and accountability, the dialogue reaffirmed a commitment to sustainable development and a transparent rules-based international order.

CHAPTER 1

India-Japan: Strategic Partners in an Uncertain World

The current state of India-Japan bilateral relations reveals a multifaceted partnership with significant potential for growth, along with some challenges that need to be addressed. Some of the major areas of development are working towards a robust human resource base for talent and mobility, deepening trust and technology coproduction in defence and security cooperation, scaling up business ties, collaborating on semiconductors, building digital infrastructure, and strengthening the relationship further. Amidst a thriving partnership, there are critical areas where more efforts are required, such as translating good intentions into practical actions, addressing the lack of supporting activities such as education, tourism, etc., and recognizing the overreliance on government action without sufficient societal engagement. The following sections provide a kaleidoscopic view of the current state of the bilateral relationship.

Kicking off the Forum ON SCREEN: Takeshi Iwaya, Minister of Foreign Affairs, Government of Japan. **(L-R): S. Jaishankar,** Minister of External Affairs, Government of India; **Indrani Bagchi,** CEO, Ananta Centre.

Towards a Robust Human Resource Base

A crucial aspect of strengthening India-Japan relations involves the development of a robust human resource base to foster a cohort of adept professionals conversant with each other's cultures and systems. This is being pursued through initiatives such as student exchanges, talent mobility programs, corporate internships, and tailored training.

> ***A key element of this human-resource base strategy is 'mobile talent' training and leveraging the Specified Skilled Worker (SSW) program to create pathways for professionals to work and gain experience in both countries.***

Efforts are underway to enhance student mobility by encouraging collaborative academic environments and promoting study-abroad opportunities. Beyond academics, there is a strong focus on practical training to provide real-world experience in each other's professional settings. A key element of this human resource base strategy is 'mobile talent' training and leveraging the Specified Skilled Worker (SSW) program to create pathways for professionals to work and gain experience in both countries. This is expected to address the shortage of skilled individuals with expertise in India-Japan dynamics. However, the SSW which is focused on skill development for employment opportunities and global workforce integration, is yet to see significant progress.

Cultural, lifestyle, and dietary differences pose challenges for Japanese newcomers, but the Japan Bank for International Cooperation (JBIC) is working to provide information and support. Creating a supportive ecosystem that helps in acclimatizing, handholding on ease of doing business, dispelling stereotypes about the other country, setting up industrial parks as per the taste of the visitor, and showcasing success stories are among the ways to enhance the human resource base. Corporate internships and training initiatives are being expanded to boost cultural awareness and professional competence in these areas.

These human resource initiatives also seek to deepen mutual understanding and strengthen societal connections. Addressing challenges such as the shortage of Japanese language programs and tutors in India is crucial, especially as demand for language learning continues to rise. Developing human resources is a fundamental pillar of the India-Japan partnership, vital for its sustained growth and long-term stability.

Advancing Defence and Security Cooperation

Cooperation in defence and security is a cornerstone of the India-Japan partnership, marked by advancements in joint projects and a focus on technology and product development.

The Unified Complex Radio Antenna (UNICORN) system for the Navy is an important example of progress in this area. UNICORN is a collaborative initiative designed to enhance the stealth and communication capabilities of Indian naval ships. By integrating multiple antenna functions into a single structure, the system reduces the radar signature of ships while improving operational efficiency and communication reliability. Formalized through a Memorandum of Implementation (MoI) signed between Bharat Electronics Limited (BEL) and Japanese partners in November 2024, the project combines Japan's design expertise with India's co-production capabilities.[1]

Already operational on Japan's Mogami-class frigates, the UNICORN system exemplifies cutting-edge innovation and marks a significant step in bilateral defence collaboration. The project also highlights a strategic shift in Japan's arms export policy, involving the transfer of finished defence equipment to India.

Joint military exercises further underscore the deepening ties between the two nations. The participation of Japanese military personnel in India shows the evolution from policy discussions to hands-on cooperation, deepening trust and mutual understanding.

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1 Ministry of External Affairs. 2023. Joint statement: Third India-Japan 2+2 foreign and defence ministerial meeting. Government of India. Retrieved from https://www.mea.gov.in/bilateral-documents.htm?dtl/38190/Joint_Statement_Third_IndiaJapan_22_Foreign_and_Defence_Ministerial_Meeting.

The evolution of defence collaboration is significant because it is not usually the first area of collaboration between two countries, given that technology co-development with tangible outcomes requires a high degree of trust. This progress demonstrates the maturity of the India-Japan relationship.

The evolution of defence collaboration is significant because it is not usually the first area of collaboration between two countries, given that technology co-development with tangible outcomes requires a high degree of trust. This progress demonstrates the maturity of the India-Japan relationship, which has advanced to a stage of practical engagement in sensitive and strategic domains, reinforcing their shared vision of a rules-based international order, good governance, promotion and consolidation of democratisation, respect for basic human rights, regional stability, and a just social and economic development of the Indo-Pacific region.

Scaling Up Business and Trade Ties

The business relationship between India and Japan reflects a deepening economic partnership through the expansion of existing projects and exploration of emerging sectors. Long-standing collaborations such as Toyota-Kirloskar in the automotive industry and Nippon Steel-ArcelorMittal, are scaling up. The Toyota-Kirloskar cooperation shows a commitment to electric automobiles, and the Nippon Steel-ArcelorMittal collaboration aims to increase steel production from 9 million tonnes to 15 million tonnes annually by 2026, demonstrating increased confidence in India's growth potential. This also highlights the willingness of established Japanese companies to expand their presence and investments in India.

Japan's advanced expertise in semiconductor equipment and materials complements India's growing demand and workforce potential, supported by the India Semiconductor Mission.

A key area of growth is semiconductor collaboration, which seeks to leverage the individual strengths of each nation. Japan's advanced expertise in semiconductor equipment and materials complements India's growing demand and workforce potential, supported by the India Semiconductor Mission. Joint investments can create resilient supply chains, reducing dependence on dominant players like China. High-tech partnerships, including in R&D and chip design, could drive innovation, with collaboration extending to Taiwan, adding strategic depth aligned with shared Indo-Pacific goals. However, addressing

challenges such as infrastructure gaps, talent development, and geopolitical sensitivities will be vital to establishing a robust and successful semiconductor ecosystem.

While India's business climate has improved, challenges like labour regulations persist, requiring continuous engagement between the Indian government and Japanese businesses. There is significant potential for growth, drawing from Japan's success in shaping conditions in other markets. Strengthening investment and collaboration in technology sectors remains key to advancing the India-Japan economic relationship.

Trade and Investment Partnerships

Trade between India and Japan is evolving with a strong focus on investment, supply chains, and critical tech cooperation. Japan has been a major investor in India's infrastructure and manufacturing sectors, contributing more than $30 billion since 2000 to projects in smart cities, railways, and renewable energy. Both nations are working to enhance supply chain resilience, especially in light of recent global disruptions. Key areas of collaboration include semiconductors, AI, 5G, and cybersecurity, with Japan playing a pivotal role in supporting India's digital mission. However, the trade imbalance persists—in 2023, India's exports to Japan were at $7 billion, and imports at $13 billion. Regulatory barriers and tariff issues continue to hinder growth, and focused efforts are required to optimize trade and enhance tech cooperation.

The India-Japan Fund will target investments in green technologies in India, including renewable energy, e-mobility, and waste-to-energy, while also fostering collaboration between Indian and Japanese companies.

Against this backdrop, the establishment of the India-Japan Fund in October 2023, with a target corpus of $600 million, marks a significant commitment to sustainable growth. The National Investment and Infrastructure Fund Limited (NIIFL), backed by the Government of India, will contribute 49 per cent to the corpus, and the JBIC, a Japanese government-owned policy institution, will contribute the remaining 51 per cent. The India-Japan Fund will target investments in green technologies in India, including renewable energy, e-mobility, and waste-to-energy, while also fostering collaboration between Indian and Japanese companies.

JBIC is investing in the National Industrial Corridor Development Corporation (NICDC) in areas near Mumbai, Bangalore, and Chennai. JBIC is also interested in investing in semiconductors. The agency has launched the DiGi Framework to support digital infrastructure

Special address by (L-R): **Nirmala Sitharaman,** Minister of Finance, Government of India in conversation with **N K Singh**, President, Institute of Economic Growth & Chairman, 15th Finance Commission.

in India, partnering with the US International Development Finance Corporation and the Export-Import Bank of Korea. JBIC mobilised more than $4 billion for India between 2020 and 2024.

People-to-People Connections

Enhancing people-to-people connections is a vital aspect of the India-Japan partnership, aiming to foster a deeper, more organic, and self-sustaining relationship beyond government and business interactions.

TOURISM: Despite a surge in Indian outbound travel, Japan has not witnessed a significant increase in Indian tourists. This gap represents a missed opportunity for cultural exchange and mutual understanding.

EDUCATION AND INTERNSHIPS: Expanding educational and internship exchanges is critical for fostering familiarity and long-term engagement. The demand for learning Japanese far exceeds the availability of seats at language schools, indicating untapped potential in academic and cultural collaboration.

SOCIETAL INVOLVEMENT: A robust bilateral relationship requires broader societal backing. Public interest, cultural understanding, and interaction are vital for sustaining and enriching the partnership.

ADDRESSING THE LANGUAGE BARRIER: Overcoming language challenges by leveraging the existing interest to learn is necessary to facilitate stronger engagement. Investment in higher education collaboration, enhancing mobility programs, and training the trainers are important.

LEARNING FROM OTHER MODELS: Japan's successful people-to-people ties with Southeast Asia offer lessons, particularly in boosting tourism, student exchanges, expertise, and mobility supported by

infrastructure like flights and accommodation.

Goodwill to Action: Best Practices

Translating good intentions into practical action is a significant challenge in the India-Japan relationship. Positive sentiments are not always reflected in tangible outcomes. There is a need to move beyond goodwill and create a detailed plan of action. Programs like the SSW must gain traction, and leverage opportunities in areas like health, AI, and technology. There is a need to adopt best practices that can enhance mobility and talent exchange to foster deeper ties. Japan's Southeast Asian experience can offer valuable lessons.

In 2017, the Japanese Farmers' Cooperative Association in Kagawa Prefecture started a project for developing agricultural production in Xieng Khouang province in Lao PDR in Southeast Asia. This project involved imparting technical guidance and supplies to farmers to enable them earn a stable income and sell in the international market in the near future. The project was made possible because Japan had been receiving technical intern trainees from Asia since 2008 and learned about the difficult conditions of farmers in Xieng Khouang through people-to-people interactions.[2]

In another case in the area of health, in 2011, the Japanese public enterprise Ajinomoto Co. Inc. launched the Vietnam Nutrition System Establishment Project to train dieticians for four years. This still-continuing project involved the governments of both countries and universities in Japan. It led to the development of a national nutrition policy in Vietnam, and to the recognizing of dietician as a civil service profession.[3]

> ***The Indian Technical and Economic Cooperation (ITEC) program of the Ministry of External Affairs, Government of India, offers an opportunity for both the countries can explore the identified sites of priority and their respective capabilities for collaborative efforts to build a resilient and sustainable future.***

The Indian Technical and Economic Cooperation (ITEC) program of the Ministry of External Affairs, Government of India, offers an opportunity for both countries to explore identified sites of priority and their respective capabilities for collaborative efforts to build a resilient and sustainable future. According to NITI Aayog, India's strengths in AI lie in its large pool of skilled engineers, its strong focus on healthcare

2 Ministry of Foreign Affairs, Japan [MFA, Japan]. 2021. White Paper on Development Cooperation 2020: Japan's International Cooperation. March 2021, The Government of Japan. p. 88.

3 MFA, Japan. 2021. p. 89.

Commencing the Forum- In conversation with (L-R): S. Jaishankar, Minister of External Affairs, Government of India; **Indrani Bagchi,** CEO, Ananta Centre.

and education, and its growing adoption of digital technologies.[4] This resonates with Japan's focus on "quality growth" and the willingness to cooperate with stakeholders willing to take advantage of its strengths.[5]

Balancing Government Action with Societal Participation

A significant challenge in the India-Japan relationship is the overreliance on government action, without sufficient societal engagement. The relationship has been largely shaped by government-led initiatives, but for it to truly deepen, broader societal involvement is needed. This means fostering connections at the people-to-people level, including increased tourism, educational exchanges, and other forms of interaction. There is considerable focus on G2G and G2B to strengthen bilateral ties, such as the Comprehensive Economic Partnership Agreement (CEPA), India-Japan Fund, and JBIC for Small and Medium-sized Enterprises (SMEs). However, governments alone cannot build this relationship. While governmental support is essential for providing a framework for collaboration, it is critical to have public buy-in and active participation from the citizens of both countries. The relationship requires a shift towards organic and self-sustaining interactions beyond government and business deals. The goal is to create a more robust relationship that is not solely dependent on governmental support.

4 NITI Aayog. 2018. National strategy for artificial intelligence. NITI Aayog. Government of India. https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf.

5 Ministry of Foreign Affairs, Japan [MFA, Japan]. 2021. p.187

CHAPTER 2

Asia Ascendant: Reshaping Global Geopolitics

Asia's geopolitical landscape is undergoing a profound transformation, redefining global power dynamics in ways unparalleled since the Cold War. As the world's most populous continent and home to three of the five largest economies, Asia is no longer a peripheral player in international affairs but a principal stage setter. This evolution has been driven by a complex interplay of economic ambition, military modernization, and shifting alliances, with implications around the world. At the heart of this transformation is the Indo-Pacific region, where the interests of major powers converge and where security challenges and economic opportunities define the strategic calculus of countries like India, Japan, China, and the US.

Ideas in exchange (L-R): Nobumitsu HAYASHI, Governor, Japan Bank for International Cooperation; **Deepa Gopalan Wadhwa,** Former Indian Ambassador to Japan.

Asia as the Economic Engine of the World

Asia's economic prowess is indisputable. The Asian Development Bank (ADB) projects that the region will account for more than 50 per cent of global GDP in the next decade.[6] China and India, the region's economic heavyweights, are at the forefront of this surge. Despite some recent slowing of its growth, China remains a $18 trillion economic giant[7], driving global supply chains and competitive infrastructure development through initiatives like the Belt and Road Initiative (BRI). Meanwhile, India, the fastest-growing major economy, is set to surpass Germany as the world's third-largest economy by 2027,[8] with its emphasis on digital infrastructure, manufacturing, and green technologies.

> ***Asia will account for over 50 per cent of global GDP growth in the next decade, driven by the twin engines of China and India, with Southeast Asia occupying a pivotal niche.***

Southeast Asia is also playing an increasingly significant role. The Association of Southeast Asian Nations (ASEAN) bloc, with its integrated markets and a young, dynamic workforce, has emerged as a hub for supply chain diversification, particularly as companies seek alternatives to China amid intensifying US-China tensions.

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6 Asian Development Bank. (n.d.). Asia 2050: Executive summary. Retrieved from https://www.adb.org/sites/default/files/publication/28608/asia2050-executive-summary.pdf

7 National Bureau of Statistics of China. (2025, January 17). Statistical release. Retrieved from https://web.archive.org/web/20250117035516/https://www.stats.gov.cn/sj/zxfb/202501/t20250117_1958332.html

8 World Bank. (n.d.). Global economic prospects. Retrieved from https://www.worldbank.org/en/publication/global-economic-prospects

Regional trade pacts like the Indo-Pacific Economic Framework for Prosperity (IPEF),[9] Comprehensive and Progressive Agreement for Trans-Pacific Partnershi (CPTPP),[10] and the Regional Comprehensive Economic Partnership (RCEP)[11] showcase Asia's appetite for economic integration.

Japan and South Korea, renowned for their technological capabilities, continue to increase their economic relevance. Japan, the world's fourth-largest economy[12], is driving innovation in semiconductors and green energy, while South Korea is a global leader in advanced manufacturing and digital technologies.

The Indo-Pacific as a Strategic Focal Point

Geopolitical Significance of the Indo-Pacific

The Indo-Pacific is a theatre of intense geopolitical competition, with major powers vying for influence and control over critical sea lanes and strategic chokepoints. Approximately 60 per cent of global maritime trade passes through the Indo-Pacific[13], including vital routes like the Malacca Strait and the South China Sea. This is key to the region's strategic importance and makes it a focal point for security considerations.

> ***With approximately 60 per cent of global maritime trade passing through its waters, the Indo-Pacific has become the fulcrum of the global economy and a critical security priority.***

Major Powers and their Interests

China's assertiveness in the South and East China Seas has drawn widespread attention. Beijing's militarization of artificial islands, its expansive maritime claims, and frequent incursions into neighbours' waters have escalated tensions with countries like the Philippines, Vietnam, and Japan. The US, as part of its Indo-Pacific strategy, has

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9 U.S. Department of Commerce. n.d. Indo-Pacific Economic Framework (IPEF). Retrieved from https://www.commerce.gov/ipef

10 Australian Government, Department of Foreign Affairs and Trade. n.d. Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) official documents. Retrieved from https://www.dfat.gov.au/trade/agreements/in-force/cptpp/official-documents

11 Association of Southeast Asian Nations (ASEAN). n.d. Regional Comprehensive Economic Partnership (RCEP). Retrieved from https://asean.org/our-communities/economic-community/integration-with-global-economy/regional-comprehensive-economic-partnership-rcep/; India is not part of CPTPP or RCEP. It has an observer status in one of the four pillars.

12 Associated Press. 2023. Japan economy GDP report 2023. Retrieved from https://apnews.com/article/japan-economy-2023-gdp-893d53deba654c4924e4924f0b321cc5

13 Air University. 2023. Intersecting tides: Climate change and maritime trade in the Indo-Pacific 2040. Retrieved from https://www.airuniversity.af.edu/JIPA/Display/Article/3703872/intersecting-tides-climate-change-and-maritime-trade-in-indo-pacific-2040/

Diplomatic reflections by **Keiichi Ono,** Ambassador of Japan to India.

responded with freedom-of-navigation operations (FONOPs)[14] and strengthened alliances with regional partners.

India, as a key maritime power, plays a critical role in safeguarding the Indian Ocean Region (IOR). It has expanded its naval capabilities, focusing on aircraft carriers, submarines, and long-range maritime surveillance platforms. Through forums like the Quad—comprising India, Japan, the US, and Australia—New Delhi engages with like-minded partners to enhance maritime security and ensure a balance of power in the region. Japan, too, has taken a more assertive stance in regional security. The recent increase in Japan's defence spending, the highest[15] since World War II, reflects its resolve to counter China's growing military power.

Japan's partnerships with India and the US, alongside its leadership in the Quad, underscore its commitment to a stable and secure Indo-Pacific. The AUKUS, an alliance between Australia, the UK, and the US, has been formed to strengthen the ability of each partner to support the security and defence interests of the others. These frameworks aim to enhance interoperability among allies, strengthen maritime domain awareness, and counterbalance China's influence.

Taiwan: The Flashpoint

Taiwan remains a critical flashpoint in the Indo-Pacific. As the world's leading producer of advanced semiconductors, it is a lynchpin of the

14 U.S. Department of Defense. n.d. Freedom of Navigation (FON) program. Retrieved from https://policy.defense.gov/OUSDP-Offices/FON/

15 Japan Ministry of Defense. 2024. Defense budget report 2024. Retrieved from https://www.mod.go.jp/en/d_act/d_budget/pdf/20241126a.pdf

Insightful remarks by **Sibi George,** Ambassador of India to Japan.

global economy, even as its strategic location makes it a geopolitical hotspot. China views Taiwan as a "core interest" that must be ultimately brought under Beijing's control, and periodically escalates military activities around the island, including large-scale drills and airspace incursions[16].

> ***Taiwan, the world's leading manufacturer of semiconductor chips is both a linchpin of the global economy and a geopolitical hotspot, with Beijing's claims on the island.***

Many US allies, including Japan and India, have made varying gestures of support for Taiwan. However, the US has consistently played the leading role in supporting Taipei through arms sales, high-level diplomatic visits, and military exercises. These actions signal a commitment to deterring Chinese aggression and maintaining stability in the region.

India-Japan Partnership: A Model for Cooperation

India and Japan share a common vision for a free, open, and inclusive Indo-Pacific, as outlined in their respective overarching strategic cooperation frameworks. India's Act East Policy[17] and Japan's Free and Open Indo-Pacific (FOIP) strategy[18] are aligned in their objectives

16 Ministry of National Defense (Japan). 2024. Official announcement. Retrieved from https://x.com/MoNDefense/status/1874623895967338863?mx=2

17 Ministry of External Affairs (India). n.d. Distinguished lectures. Retrieved from https://www.mea.gov.in/distinguished-lectures-detail.htm?840

18 Ministry of Foreign Affairs (Japan). n.d. Official report. Retrieved from https://www.mofa.go.jp/files/100056243.pdf

of enhancing connectivity, promoting sustainable development, and countering coercive behaviours in the region. The collaboration between Tokyo and New Delhi is underpinned by shared democratic values and a commitment to the rules-based order and has become a cornerstone of regional security and economic stability.

> ***The India-Japan partnership reflects shared democratic values and commitment to a rules-based Indo-Pacific, blending connectivity and security in a common strategic vision.***

Plans for multilateral economic cooperation projects like the Asia-Africa Growth Corridor (AAGC)[19] demonstrates the collaboration between Tokyo and New Delhi, along with other partners, to offer an alternative to China's BRI. The two nations are also strengthening their bilateral defence relationship, conducting joint military exercises, and have signed agreements for technology transfers and co-production of defence equipment such as the UNICORN (Unified Complex Radio Antenna) mast for the Indian Navy.[20]

The defence relationship centres on the 2020 Reciprocal Provision of Supplies and Services Agreement between the Armed Forces of India and the Self-Defense Forces of Japan,[21] enabling the two militaries to share resources during joint exercises and humanitarian operations. The agreement also bolsters maritime domain awareness cooperation by increased information-sharing between the maritime forces of the two countries.

On the economic front, Japan has made substantial commitments to the Indian market. Tokyo pledged ¥5 trillion ($42 billion) in investments over five years during the 2022 annual bilateral summit,[22] building on the foundation of their 2011 Comprehensive Economic Partnership Agreement (CEPA).[23] The CEPA aims to eliminate tariffs on 94 per cent of bilateral trade goods.

The partnership has also expanded into emerging technologies. A 2023 semiconductor supply chain agreement[24] signals a push by both nations

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19 Economic Research Institute for ASEAN and East Asia (ERIA). n.d. Asia-Africa Growth Corridor: Partnership for Sustainable and Innovative Development. Retrieved from https://www.eria.org/Asia-Africa-Growth-Corridor-Document.pdf

20 Press Information Bureau (India). 2024. Official press release. Retrieved from https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2073843

21 Press Information Bureau (India). 2023. Government policy announcement. Retrieved from https://pib.gov.in/PressReleseDetail.aspx?PRID=1652911&reg=3&lang=1

22 Embassy of India, Tokyo. n.d. Economic and trade relations. Retrieved from https://www.indembassy-tokyo.gov.in/eoityo_pages/MTE

23 Ministry of Commerce and Industry (India). n.d. India-Japan Comprehensive Economic Partnership Agreement (CEPA). Retrieved from https://www.commerce.gov.in/international-trade/trade-agreements/india-japan-cepa/

24 Press Information Bureau (India). 2024. Official government release. Retrieved from https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1970784

to develop critical technology infrastructure. The semiconductor supply agreement builds on the 2018 digital partnership, which aligns India's Digital India program[25] with Japan's Society 5.0 initiative.[26] Tokyo and New Delhi are also jointly pursuing clean energy development under a 2022 India-Japan Clean Energy Partnership (CEP) agreement[27] focused on clean and sustainable technologies.

Joint military exercises such as Dharma Guardian for land forces, JIMEX for maritime forces, and the Veer Guardian for air exercise, also underscore deepening interoperability and joint operational capabilities between Indian and Japanese forces.

Strategic Concerns in Asia's Military Modernization

The Indo-Pacific's strategic environment is characterized by rapid military modernization. Asia and Oceania, the two sub-regions that mainly makeup the Indo-Pacific littoral region, include countries that account for over 20 per cent of global defence expenditure[28], driven by the ambitions of regional powers to safeguard their interests and project influence.

Accounting for over 20 per cent of global defence expenditure, Indo-Pacific littoral states' rapid military modernization is reshaping the balance of power in the region.

China's People's Liberation Army Navy (PLAN) has become the world's largest naval force[29], supported by advanced missile systems, aircraft carriers, and submarines. Beijing's investments in hypersonic technology and artificial intelligence also underscore its desire to dominate future battlefields.

India, in response, has significantly ramped up its defence capabilities. Indigenous platforms like INS Vikrant, India's first home-grown aircraft

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25 Ministry of Electronics and Information Technology (India). n.d. Digital India initiative. Retrieved from https://www.meity.gov.in/sites/upload_files/dit/files/Digital%20India.pdf

26 Cabinet Office, Government of Japan. n.d. Society 5.0 initiative. Retrieved from https://www8.cao.go.jp/cstp/english/society5_0/index.html

27 Ministry of External Affairs (India). n.d. India-Japan Clean Energy Partnership. Retrieved from https://www.mea.gov.in/incoming-visit-detail.htm?34992/IndiaJapan+Clean+Energy+Partnership

28 Stockholm International Peace Research Institute (SIPRI). 2024. Global military expenditure report 2023. Retrieved from https://www.sipri.org/sites/default/files/2024-04/2404_fs_milex_2023.pdf

29 U.S. Naval Institute News. 2021, November 3. China has the world's largest navy with 355 ships and counting, says Pentagon. Retrieved from https://news.usni.org/2021/11/03/china-has-worlds-largest-navy-with-355-ships-and-counting-says-pentagon

A focused conversation on India's semiconductor capabilities between (L-R): S, Krishnan, Secretary, Ministry of Electronics and Information Technology(MeitY), and **Pramit Pal Chaudhuri,** India Practice Head, Eurasia Group, Distinguished Visiting Fellow, Ananta Aspen Centre.

carrier, and the Agni-V intercontinental ballistic missile highlight New Delhi's focus on securing its strategic defence interests first. Defence partnerships with nations like Japan, France, and Israel have further bolstered India's military capabilities.

India's Hypersonic Missile Tests: Bolstering Deterrence

> ***India's successful hypersonic missile tests are important steps to develop effective deterrence and ensure strategic parity with regional powers such as China.***

India's strides in hypersonic missile technology are reshaping its defence strategy, providing a significant boost to its deterrence capabilities. The Defence Research and Development Organization (DRDO) successfully tested the Hypersonic Technology Demonstrator Vehicle (HSTDV) in 2020[30] and a long-range hypersonic missile in 2024.[31] These breakthroughs have paved the way for the development of more sophisticated hypersonic ballistic and cruise missiles capable of travelling at speeds exceeding Mach 5. Such capabilities are essential for maintaining strategic parity with regional competitors like China, which has already operationalized hypersonic systems such as the

30 Press Information Bureau (India). 2023. Defense policy announcement. Retrieved from https://www.pib.gov.in/PressReleasePage.aspx?PRID=1651956

31 Press Information Bureau (India). 2024. Government press release. Retrieved from https://pib.gov.in/PressReleasePage.aspx?PRID=2073994

DF-17.[32] The ability of hypersonic missiles to evade traditional missile defence systems makes them a game-changer in modern warfare, enhancing India's ability to respond to evolving threats effectively.

Japan is Modernising its Self Defense Forces (SDF) Capabilities

As threats from both China and North Korea proliferate, the modernization of Japan's SDF is proportionately gaining momentum. Tokyo's acquisition of advanced fighter jets including the Lockheed Martin F-35,[33] missile defence systems such as the ship-based Aegis SAM systems,[34] and maritime patrol aircraft such as the Kawasaki P-1[35] demonstrates its readiness to address evolving threats.

Japan's collaboration with the US on advanced radar and interceptor technologies[36] also underscores the importance of allied coordination in addressing these emerging challenges. As India and Japan deepen their defence partnership, their combined focus on leveraging cutting-edge technologies—whether in space or missile defence—reinforces their shared vision for a secure and stable Indo-Pacific. These advancements signal a commitment to not only national security but also regional stability in an increasingly multipolar world.

Advancements in Space Exploration: Expanding Frontiers of Cooperation

India and Japan have emerged as key players in the rapidly evolving 21st century space race, leveraging their technological expertise to drive advancements that extend beyond national pride to strategic imperatives. The Indian Space Research Organization (ISRO) has achieved milestones such as the Chandrayaan-3 mission[37], which marked a historic soft landing on the Moon's south pole in 2023, the satellite docking experiment (SpaDeX) which was successfully conducted in January 2025,[38] and the planned human space flight

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32 Center for Strategic and International Studies (CSIS). n.d. DF-17 missile profile. Retrieved from https://missilethreat.csis.org/missile/df-17/

33 Lockheed Martin. n.d. F-35 global enterprise: Japan. Retrieved from https://www.f35.com/f35/global-enterprise/japan.html

34 U.S. Naval Institute News. 2023, December 20. Japan locks in funding for 2 new Aegis destroyers. Retrieved from https://news.usni.org/2023/12/20/japan-locks-in-funding-for-2-new-aegis-destroyers

35 Japan Maritime Self-Defense Force. n.d. P-1 aircraft specifications. Retrieved from https://www.mod.go.jp/msdf/equipment/aircraft/patrol/p-1/

36 Kyodo News. 2023, March. U.S. to use Japanese radar to improve space domain awareness. Retrieved from https://english.kyodonews.net/news/2023/03/58d498b791e7-us-to-use-japanese-radar-to-improve-space-domain-awareness.html

37 Indian Space Research Organization (ISRO). n.d. Chandrayaan-3 mission details. Retrieved from https://www.isro.gov.in/Chandrayaan3_Details.html

38 Indian Space Research Organisation (ISRO). n.d. Space Docking Experiment (SpaDEx). Retrieved from https://www.isro.gov.in/mission_SpaDeX.html

missions under the Gaganyaan programme[39]. These achievements and plans have positioned India alongside the US, Russia, and China as an elite space faring nation.

> ***From India's Chandrayaan and Gaganyaan missions to JAXA's Hayabusa asteroid missions, India and Japan are leveraging space technologies to bolster strategic capabilities and foster regional cooperation.***

The Japanese Aerospace Exploration Agency (JAXA) has been at the forefront of space innovation. Its Hayabusa missions[40], which brought back asteroid samples to Earth[41] in June 2010, demonstrate technological sophistication and scientific ambition. Japan has increasingly aligned its space programme with national security objectives, exemplified by the establishment of its Space Operations Group in 2020[42]. Tokyo's partnership with Washington on satellite constellations for missile defence[43] underscores the growing militarization of space. Collaboration between India and Japan in this domain is gaining momentum, particularly in areas such as satellite development, lunar exploration, and data sharing for maritime surveillance in the Indo-Pacific. Both nations recognise the dual-use nature of space technologies and the need to safeguard space assets from threats, including those posed by anti-satellite weapons. Their collective efforts not only enhance their capabilities but also contribute to a rules-based order in outer space.

Technological Endeavours and Economic Integration

Asia is at the forefront of the technological revolution, with innovations in artificial intelligence, 5G, and advanced manufacturing reshaping global industries. China, through its Made in China 2025 initiative[44], aims to dominate the high-tech sectors. However, US-led decoupling efforts, alongside export controls on critical technologies, are challenging Beijing's ambitions.

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39 Indian Space Research Organisation (ISRO). n.d. Gaganyaan human spaceflight program. Retrieved from https://www.isro.gov.in/Gaganyaan.html

40 Japan Aerospace Exploration Agency (JAXA). n.d. Hayabusa mission overview. Retrieved from https://www.isas.jaxa.jp/en/missions/spacecraft/past/hayabusa.html

41 Japan Aerospace Exploration Agency (JAXA). n.d. Mission updates. Retrieved from https://www.isas.jaxa.jp/en/topics/002154.html

42 Japan Air Self-Defense Force. n.d. Space situational awareness (SSA) initiatives. Retrieved from https://www.mod.go.jp/asdf/ssa/index.html

43 U.S. Indo-Pacific Command. 2024. U.S. Space Forces and Japan launch first bilateral space effort. Retrieved from https://www.pacom.mil/Media/News/News-Article-View/Article/4055500/us-space-forces-space-systems-command-and-japan-launch-first-bilateral-space-ef/

44 Government of China. 2015. Latest policy releases. Retrieved from https://english.www.gov.cn/policies/latest_releases/2015/05/19/content_281475110703534.htm

Perspectives on strategic partnerships by **Takehiko MATSUO,** Vice Minister, International Affairs of METI, Japan.

With India's digital revolution and China's high-tech ambitions, Asia is not only a participant in the tech race but a leader in reshaping the global innovation landscape.

India, leveraging its burgeoning digital infrastructure, is emerging as a leader in technology-driven growth. Initiatives like the National Mission for Artificial Intelligence are likely to become the foundations for India to be competitive in the exponentially growing emergent and critical technologies sector.

Japan and India have also signed several bilateral agreements for cooperation on most pivotal technologies and initiatives such as 5G, wide spectrum telecom security, submarine optical fibre cables, startup incubation,[45] and smart cities.

Japan and South Korea remain at the cutting edge of semiconductor innovation, with their companies playing critical roles in global supply chains. Collaboration among Quad nations on emerging technologies further underscores the strategic importance of technology in shaping the future of the Indo-Pacific.

Challenges and Opportunities in a Multipolar Context

The Indo-Pacific is fraught with territorial disputes involving both

45 Ministry of External Affairs (India). n.d. Legal treaties document JP18B3389. Retrieved from https://www.mea.gov.in/Portal/LegalTreatiesDoc/JP18B3389.pdf

small nations and heavyweights like China, India, Japan, and Russia, which have a defining impact on the regional security of the entire littoral area. The South China sea is a major flashpoint between China and several Southeast Asia nations such as Vietnam, Philippines, Malaysia, and Indonesia. India and China have also been at odds along the Line of Actual Control. China also disputes the ownership of the Senkaku islands which are controlled by Japan. Japan in turn claims four islands in the Northern territories (Chishima/Kuril Island) chain which have been controlled by Russia since WWII.

While conflict and grey zone warfare has mostly defined the region's security dynamics, Humanitarian Assistance and Disaster Relief (HADR) are also a dimension of civic-military cooperation between nations in the region. Since at least the 2004 Tsunami, India has been a key HADR partner for countries in the Indo-Pacific littoral region, which serves as a major soft power tool in its foreign policy arsenal.[46]

Conclusion

India-Japan bilateral relations are likely to evolve and improve as their security, economic, and technological interests continue to converge. Furthermore, both countries are likely to continue cooperating with Australia and the US who are their security and economic partners in forums like the Quad. With expanded military cooperation the Indian armed forces and the Japanese Self-Defense Forces are also likely to increasingly raise their levels of interoperability with some level of similarity in the subsystems if not platforms in their respective arsenals.

46 Press Information Bureau (India). 2024. Press release. Retrieved from https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1879788

CHAPTER 3

Resilient and Diversified Supply Chains, Trade, and Critical Tech

The Indo-Pacific region stands at a pivotal crossroads, navigating a complex web of supply chain vulnerabilities, geopolitical crosscurrents, and the weaponization of trade and technology. In this era of uncertainty, building resilient supply chains and fostering technological prowess are no longer mere economic objectives, but have become strategic imperatives for national security and regional stability. India and Japan, two regional powerhouses, are forging a dynamic partnership to strengthen their competitive edge, particularly in supply chain and critical technologies like semiconductors and artificial intelligence. Their collaboration includes the essential components of modern industry and technology, from rare earth minerals to multi-level advanced chip manufacturing. This strategic alliance and its innovative solutions illuminate the path toward a more stable, secure, and prosperous Indo-Pacific, where economic and technological leadership serve as anchors of regional resilience and growth. Through their joint efforts, India and Japan aim to transform supply chains from potential vulnerabilities into foundations of strength, ensuring the region remains at the cutting edge of global progress.

Insights on diplomatic priorities by **Dammu Ravi,** Secretary, Economic Relations, Ministry of External Affairs.

The Evolving Landscape of Supply Chains in the Indo-Pacific

Post-COVID Disruptions and Geopolitical Tensions

The COVID-19 pandemic and the subsequent geopolitical tensions have fundamentally altered the landscape of trade and economic cooperation. There is a growing trend of nations prioritizing their national interests, sometimes at the expense of multilateral rules and regulations. This has manifested in measures like "vaccine nationalism"[47] during the pandemic and a general willingness to sacrifice efficiency for reliability. There are also phenomena such as ever-increasing protectionist measures with marked rise in tariffs and other barriers, often justified under the guise of industrial policy. These unfolding changes have exposed vulnerabilities in existing supply chains, prompting a re-evaluation of how nations approach trade and economic partnerships.

Concentration and Over-dependence

The dangers of over-reliance on specific countries or suppliers for critical goods, especially in sectors like semiconductors and critical minerals, have become an area of major concern as over-dependence and lack of alternatives and redundancies create significant economic and security risks. Consequently, the imperative of diversification arises. Diversifying supply sources has become a priority to mitigate risks. This involves not only finding new suppliers but also fostering

47 Bollyky, T. J., & Bown, C. P. 2020. The tragedy of vaccine nationalism. Foreign Affairs, 99(5), 96–105. https://www.wto.org/english/tratop_e/trips_e/techsymp_290621/bown_pres2.pdf

domestic production capabilities.

The Weaponization of Trade and Technology

The risk of trade and technology being leveraged has become increasingly apparent, with nations becoming more nationalistic and prioritizing self-reliance. This has resulted in talks of decoupling and a focus on de-risking supply chains, which in turn impacts established trade dynamics. Several trends such as the China Plus One Strategy has exemplified this approach whereby entities not owned by Beijing have over the past decade sought to introduce redundancies and alternatives for several stages in their supply chains.[48]

From Globalization to De-Risking

The disruptions in supply chains, the weaponization of trade, and the rise of nationalism have triggered a shift away from globalization towards strategies that prioritize de-risking. The focus is no longer solely on efficiency and low costs, but on creating resilient supply chains that can withstand shocks and disruptions.

Rules of Origin and Supply Chain Complexity

As supply chains become more complex and geographically dispersed, issues related to "rules of origin" have also become more significant. There is a growing concern that countries may attempt to circumvent tariffs and other trade restrictions by routing goods through third countries with minimal value addition. Many so called manufacturers, frequently engage in "label washing"—a practice where companies merely assemble knocked-down product kits[49] while falsely claiming to meet higher local value-addition requirements under domestic regulations.[50] This situation underscores the need for increased transparency and cooperation on "rules of origin" to ensure that trade policies are effective and fair.

Strategic Cooperation Between India and Japan

India and Japan are deepening economic cooperation to fortify supply chain resilience, a key pillar of their "Japan and India Vision 2025 Special Strategic and Global Partnership Working Together for Peace and

48 Bansal, V. (2023, July 19). India should cash in on 'China plus one' strategy - World Bank chief. Reuters. https://www.reuters.com/world/india/india-should-cash-china-plus-one-strategy-world-bank-chief-2023-07-19/

49 HAL's import, assemble, supply 'model'. n.d. The Hindu. https://www.thehindu.com/news/national/HAL%E2%80%99s-import-assemble-supply-%E2%80%98model%E2%80%99/article60516661.ece

50 Swaminomics. (2014, October 26). Make in India and manufacture in India are two different things. The Times of India. https://timesofindia.indiatimes.com/blogs/Swaminomics/make-in-india-and-manufacture-in-india-are-two-different-things/

Prosperity of the Indo-Pacific Region and the World." With geopolitical tensions and pandemic-induced disruptions exposing vulnerabilities in global trade, the two nations are pushing for diversified and secured supply networks. Their collaboration extends beyond bilateral trade to multilateral frameworks such as the Supply Chain Resilience Initiative (SCRI) and the Indo-Pacific Economic Framework (IPEF), reinforcing their strategic importance in Asia's economic realignment.

Multilateral Engagements

SCRI, a trilateral agreement launched by India, Japan, and Australia in April 2021, aims to reduce dependence on single-country supply chains, particularly for critical minerals, semiconductors, and pharmaceuticals,[51] and promote economic security. The initiative aims foster cross-border investments and supply-chain mapping to prevent future disruptions.

India and Japan are also actively engaged in the IPEF which was launched by the US in 2022 in Tokyo with 14 founding member countries of the Indo-Pacific region reinforcing their strategic importance in Asia's economic realignment. The aim is to strengthen supply chain resilience, trade, and clean energy initiatives. India has joined Pillars II to IV (Supply Chains, Clean Economy, and Fair Economy) and has an observer status for Pillar I (Trade), assuming a leadership [for playing a significant role in]role in formulating resilient trade networks.[52]

While India is not a member of Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), its economic strategists argue for participation in trade blocs to expand market access.[53] Japan, as a CPTPP founding member, could play a role in facilitating India's entry if New Delhi chooses to join.

Japan's Expanding Investment in India

Economic ties between India and Japan continue to grow, with bilateral trade reaching $21.96 billion in FY23. Japan is among India's largest investors, with $42.55 billions of FDI spanning key sectors such as automobiles, electronics, and semiconductors.[54] Toyota and Suzuki, both deeply entrenched in India, are strengthening their supply chains through joint ventures. Suzuki's Indian venture, Maruti Suzuki,

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51 Government of India, Press Information Bureau. (2021, April 27). The Trade Ministers of India, Japan and Australia formally launched the Supply Chain Resilience initiative in a Trilateral Ministerial Meeting held virtually on 27.04.2021. Press Information Bureau, Government of India. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1714362

52 Government of India, Press Information Bureau. 2024, December 21. Supply Chain Resilience. Press Information Bureau, Government of India. https://pib.gov.in/PressReleasePage.aspx?PRID=2080247

53 Jha, N. (2023, October 27). India should be part of RCEP, CPTPP: Niti Aayog CEO BVR Subrahmanyam. The Economic Times. https://economictimes.indiatimes.com/news/economy/policy/india-should-be-part-of-rcep-cptpp-niti-aayog-ceo-bvr-subrahmanyam/articleshow/115052609.cms?from=mdr

54 Embassy of India, Tokyo. 2024, June. India-Japan Bilateral Economic Relations. https://www.indembassy-tokyo.gov.in/eoityo_pages/NjQw

Charting maritime synergy **Krishna Swaminathan,** Vice Chief of Naval Staff, Indian Navy.

will launch its first electric vehicle (EV) in Gujarat in 2025, supplying to Toyota for global markets, including Japan and Europe.[55] Japanese firms are also increasing their semiconductor investments in India, as they seek to reduce reliance on China and Taiwan. India and Japan signed a Memorandum of Cooperation (MoC) on the Japan-India Semiconductor Supply Chain Partnership in 2023. Japan's Renesas Electronics and Tokyo Electron[56] has partnered with India's Tata Group to co-develop semiconductor solutions,[57] aligning with New Delhi's $10 billion incentive program to boost domestic chip production.[58]

Enhancing Competitiveness and Innovation

In the context of supply chains, while resilience focuses on enduring disruptions, competitiveness integrates agility, cost-efficiency, and innovation, providing a sustainable strategic edge. While joint ventures like Maruti Suzuki evolved and later thrived in a different geopolitical environment, it serves as a template for success to be replicated in other sectors such as batteries and semiconductors in the present era.

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55 Jha, N. (2024, October 30). Maruti Suzuki to make first EV for Toyota in India, production starts ... CNBCTV18. https://www.cnbctv18.com/auto/maruti-suzuki-to-make-first-ev-for-toyota-in-india-production-starts-2025-in-gujarat-19501351.htm3

56 Tokyo Electron. (2024, September 10). Tokyo Electron and TATA Electronics Private Limited Announce Strategic Partnership to Grow Semiconductor Ecosystem in India. https://www.tel.com/news/topics/2024/20240910_001.html

57 Matsumoto, K. (2022, June 29). Japan's Renesas, India's Tata Motors partner to develop chip solutions. Reuters. https://www.reuters.com/technology/japans-renesas-indias-tata-motors-partner-develop-chip-solutions-2022-06-29/

58 Shah, S. (2021, December 15). India outlines $10 bn plan to woo global chip makers. Reuters. https://www.reuters.com/world/china/india-unveils-10-bln-plan-woo-semiconductor-display-makers-2021-12-15/

Resilient supply chains: Trading in a more protectionist world (L-R): Takehiko Matsuo, Vice Minister, International Affairs of METI, Japan; **Dammu Ravi,** Secretary, Economic Relations, Ministry of External Affairs; **Susumu Kataoka,** President, Japan External Trade Organization; **Jayant Sinha,** Former Minister of Finance of India and former Member of Parliament, Lok Sabha; **Trinh Nguyen,** Senior Economist, Emerging Asia, Natixis; **Amita Batra,** Professor of Economics, Centre for South Asian Studies, JNU; **Baijayant Panda,** Member of Parliament, Lok Sabha.

Collaboration on Critical Technology and Minerals

India's semiconductor manufacturing ambitions is supported by the technological expertise of Japan and South Korea. The partnership is focused on establishing local fabrication facilities. Tata electronics entered a partnership with Taiwan's Powerchip Semiconductor Manufacturing Corporation (PSMC) in 2024 to establish India's first semiconductor fabrication plant in Dholera, Gujarat, marking a milestone in this journey[59]. Japan's advanced materials and manufacturing processes, coupled with India's growing talent pool, are driving joint research and development initiatives aimed at fostering collaboration and strengthening the semiconductor value chain.

Semiconductors lie at the heart of modern technology, enabling advancements in sectors from renewable energy to national defence. The partnership between India and Japan in this domain addresses critical challenges in infrastructure, talent development, and supply chain security. India's strides in semiconductor manufacturing, marked by projects like the Dholera fab in Gujrat and Outsourced Semiconductor Assembly and Test (OSAT) facility in Assam,[60] highlight its ambitions to become a global player in this industry.

Critical mineral bottlenecks pose another challenge. Rare earth elements, cobalt, and lithium—essential for semiconductor production—are largely controlled by China. India and Japan are working together to reduce this dependency by co-investing in sustainable mining and refining technologies. These initiatives align with their shared vision for a resilient and self-reliant Indo-Pacific.

Additionally, clean energy technologies form a critical component of this partnership. Both the countries are collaborating on green

59 Tata Electronics. (2024, February 29). First Indian fab semiconductor Dholera. Tata. https://www.tata.com/newsroom/business/first-indian-fab-semiconductor-dholera

60 Tata Electronics. (2024, February 29). First Indian semiconductor assembly test facility. Tata. https://www.tata.com/newsroom/business/first-indian-semiconductor-assembly-test-facility

hydrogen projects and advanced battery production, leveraging Japan's leadership in recycling and India's prospective Production Linked Incentive (PLI) schemes[61] to boost investment in renewable energy solutions.

India has approved a National Critical Mineral Mission (NCMM) initiative, allocating INR 163 billion to enhance domestic mineral exploration and processing, alongside an expected INR 180 billion investment from state-run firms.[62] The initiative which is part of India's broader policy push towards self-reliance in critical sectors, aims to fast-track regulatory approvals, incentivize mining, and promote mineral recycling. The initiative also incorporates provisions such as duty waivers, overseas acquisition, and cooperation with like-minded international partners such as Japan.

Addressing Challenges and Building a Secure Future

With the return of President Donald Trump for his second term as president, Washington has already begun to pivot to a more protectionist approach in trade and also impose high tariffs on various countries. While India and Japan have no choice but to navigate the new complexities to continue their robust relationship with the US in the Indo-Pacific, it will only be possible with significant improvements in decision making and bureaucratic apparatuses. In the new economic landscape of rising US protectionism and supply chain vulnerabilities in the post-pandemic world, it is imperative that New Delhi and Tokyo create a conducive environment for investment and innovation.

Harnessing the Potential of AI: Governance Framework and Innovation

Artificial intelligence (AI) is a force redefining industries, governance, and societal structures. For India and Japan, AI represents an opportunity to drive economic growth while addressing ethical and governance challenges.

India's extensive talent pool and digital infrastructure complement Japan's expertise in robotics and computational research. Together, the two nations are advancing collaborative projects in areas like healthcare, cybersecurity, and supply chain optimization. Ethical AI

61 National Green Hydrogen Mission. May 25, 2024. Supply Incentives [Archived website]. Internet Archive. https://web.archive.org/web/20240525191535/https://nghm.mnre.gov.in/supply-incentives

62 Government of India, Press Information Bureau. 2025, February 14. Union Cabinet approves launch of National Critical Mineral Mission. Press Information Bureau, Government of India. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2097309

Critical Chips: How semiconductors and critical minerals bring India and Japan together (L-R): **Bin Fan,** Representative Director, CEO, Optorun Co Ltd; **Randhir Thakur,** CEO, TATA Electronics; **Malini Narayanmoorthi,** Country Head, Renesas India; **Rishabh Jain,** Senior Programme Lead, Council on Energy, Environment and Water; **Toshihiko Kurihara,** Chief Representative, Japan Bank for International Cooperation.

governance is central to their efforts, with an emphasis on harmonizing standards to ensure data privacy, fairness, and inclusivity.

Building a skilled workforce capable of navigating AI-driven transformations is also a priority. Joint education programmes and research collaborations are fostering talent development, ensuring scalability and adaptability in AI applications. These initiatives align with broader regional goals, such as those outlined by the Quad, which emphasize the importance of ethical and transparent AI deployment.

India and Japan play pivotal roles in the Global Partnership on AI (GPAI),[63] a multilateral initiative advancing responsible AI development. India, a founding member, assumed the 2023 Chair for the initiative and hosted the GPAI Summit in New Delhi. In 2022, Japan had hosted the Summit in Tokyo and like India, it had been instrumental in shaping AI policy and fostering international cooperation.

> ***India and Japan are shaping an ethical AI future through harmonized standards and collaborative innovation at the bilateral level and at multilateral forums such as IPEF and GPAI.***

Conclusion

The trend to seek alternatives and decoupling away from China has led to several changes in regional and global trade relations. These changes have in turn created new opportunities for India and Japan

63 Government of India, Press Information Bureau. 2023, December 11. India to Lead Global Partnership on Artificial Intelligence (GPAI) in 2024; to Host GPAI Summit from 12th to 14th December 2023. Press Information Bureau, Government of India. https://pib.gov.in/PressReleasePage.aspx?PRID=1985143

to position themselves as key players in global supply chains across sectors.

By aligning their efforts with multilateral frameworks like the IPEF and GPAI, India and Japan are fostering a transparent and competitive trade and regulatory environment that counters the risks posed by the protectionist trade policies expected from the US and the regional trend to decouple from China.

India and Japan's strategic partnership represents a holistic model to counter the challenges and capitalize on the opportunities emerging in the Indo-Pacific. By addressing supply chain vulnerabilities, advancing AI governance, and fostering collaboration in critical technologies, the two countries are not only securing their economic futures but also contributing to regional and global stability.

CHAPTER 4

India's Economic Transformation

India is being increasingly recognized as a key driver of global economic growth, supported by stable macroeconomic policies and ongoing structural reforms. According to the International Monetary Fund (IMF), India's GDP growth for FY2025–26 is projected at 6.5%, positioning it as one of the fastest-growing major economies globally[64]. This transformation is reflected in robust foreign direct investment (FDI) inflows, which has reached $1 trillion since April 2000[65], demonstrating investor confidence in India's economic prospects. Amid global economic uncertainties, India's strategic initiatives, supported by forex reserves of more than $586.9 billion (as of December 2023), underscore its resilience and commitment to sustainable growth[66]. Against the backdrop of these positive strides, this chapter primarily examines the emergent prospects for the semiconductor and electronics industries in India.

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64 International Monetary Fund. 2024. World Economic Outlook: October 2024. Retrieved from https://www.imf.org/external/datamapper/profile/IND.

65 Ministry of Commerce and Industry. (2024). India's FDI Journey Hits $1 trillion. Dec 12, 2024. PIB. Government of India. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2083683

66 Reserve Bank of India. 2023. Weekly Statistical Supplement: December 2023. Retrieved from https://www.rbi.org.in.

Economic Growth: Opportunities and Challenges

India's economic growth presents a mix of opportunities and challenges. On the one hand, the country benefits from a growing domestic market, driven by rising GDP and increasing purchasing power. On the other hand, global demand for exports, particularly from developed nations, is plateauing, impacting India's export-dependent industries. For instance, India's exports goods and services accounts for 22.45% of its GDP as of 2022 data,[67] and it has been observed that merchandise exports declined by 3.5% in 2023, reflecting a slowdown in global consumption patterns.[68] Climate change complicates economic stability by affecting agriculture, which remains a critical sector for employment and livelihoods. Traditional labour-intensive export sectors, such as textiles, are experiencing reduced global demand, posing challenges to value addition and job creation.

Additionally, electoral cycles can lead to temporary slowdowns in public expenditure and governance-related activities,[69] which may affect economic growth in specific quarters. Despite these hurdles, India's economy demonstrates resilience and potential for sustained growth. The optimism from the IMF on India's growth is bolstered by continued structural reforms and a focus on fostering innovation, infrastructure, and investments.

Foreign investments contributed around 21.8% of India's GDP in 2021.[70] While India's growth heavily depends on its internal market, FDI plays a significant role in modernizing and developing the economy. Even as several top investors showed a decline, Japan, which was among the top five sources of foreign investment, showed an upward trend, marking $3.17 billion in 2023–24.[71] Japan alone contributed 6.1% of the total FDI to India from April 2000 to March 2024.[72] Strengthening bilateral relations with an economic powerhouse and a committed,

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67 World Bank. n.d. India trade statistics: Exports, Imports, Products, Tariffs, GDP and related Development Indicator. World Integrated Trade Solution. https://wits.worldbank.org/CountryProfile/en/IND#:~:text=GDP%20of%20India%20is%203%2C385%2C089%2C881%2C935.39,percentage%20of%20GDP%20is%2026.92%25.

68 Ministry of Commerce and Industry. 2023. Monthly export-import data. Retrieved from https://commerce.gov.in.

69 Shameer, K. M., & Durai, S. R. S. 2024. The Political Budget Cycle: Evidence from Indian Municipal Corporation Elections. Review of Development and Change, 29(1), 86–105. https://doi.org/10.1177/09722661241256713. On the contrary, Lok Sabha elections also lead to significant increases in public expenditure.

70 Enright, M. 2024. The impact of foreign investment on India's economy. Oct 15, 2024. Hinrich Foundation. https://www.hinrichfoundation.com/research/wp/fdi/the-impact-of-foreign-investment-on-india-economy/.

71 PTI. 2024. India receives highest FDI from Singapore in 2023–24; Mauritius second biggest investor: Government data. June 02, 2024. The Hindu. https://www.thehindu.com/business/Economy/india-receives-highest-fdi-from-singapore-in-2023-24-mauritius-second-biggest-investor-government-data/article68242434.ece.

72 Embassy of India, Tokyo. 2024. India-Japan Bilateral Economic Relations. Government of India. https://www.indembassy-tokyo.gov.in/eoityo_pages/NjQw.

Asia in a Multipolar World: Views from Japan, India, Philippines and Vietnam (L-R): **Maiko Ichihara,** Professor, Graduate School of Law and School of International and Public Policy, Hitotsubashi University; **Richard Heydarian,** Chairholder in Geopolitics, Polytechnic University of the Philippines; **Nguyen Thai Yen Huong,** Representative of Vietnam to the AICHR; **Ernest Z. Bower,** President and CEO, BowerGroupAsia Inc.; **Kenji Hiramatsu,** Chairman, Institute for International Strategy of the Japan Research Institute Ltd.; **C. Raja Mohan,** Foreign Policy Commentator, Professor at the Institute of South Asian Studies, National University of Singapore.

friendly country such as Japan promises high value addition to India's economic growth. A testament to Japan's commitment was the Japan International Cooperation Agency's (JICA's) largest ever single infrastructure project loan of 300 billion yen for the construction of the high-speed railway corridor in India. Japan also is the largest bilateral ODA (Official Development Assistance) investor for India. With 1,490 Japanese companies registered in India as of October 2022, the Japan Bank of International Cooperation (JBIC), in its Overseas Business Operations Survey Report 2023, highlighted India as the top promising country replacing China.[73]

Key Sectors and Reforms

Semiconductor Industry

India's semiconductor industry is undergoing a significant expansion, driven by government initiatives, increasing demand, and global collaborations. In the fiscal year 2023–24, India imported approximately 18.43 billion semiconductor chips, valued at ₹1.71 lakh crore, marking an 18.5% increase from the previous year.[74] To reduce import dependence

73 Embassy of India, Tokyo. 2024.

74 PTI. 2024. Semiconductor chip import increased 18.5% to ₹1.71 lakh crore in FY24. December 6, 2024. Economic Times. https://economictimes.indiatimes.com/tech/technology/semiconductor-chip-import-increased-18-5-to-rs-1-71-lakh-crore-in-fy24/articleshow/116047484.cms?from=mdr.

and strengthen domestic manufacturing, the Indian government launched the ₹76,000 crore Semicon India Program.[75] The government is providing substantial incentives, covering up to 75% of the cost of establishing new plants, to foster the growth of this critical sector.[76]

Major global companies are investing in India's semiconductor sector, including those from Japan. For instance, Tokyo Electron (TEL) signed a memorandum of understanding with India's Tata Electronics Private Limited, a leading player in the global electronics manufacturing industry.[77] The two companies will collaborate to accelerate semiconductor equipment deployment for India's first semiconductor fabrication unit being built by Tata Electronics in Dholera, Gujarat, and for its assembly and test facility in Jagiroad, Assam. This partnership will focus on training Tata Electronics' workforce on TEL equipment and support ongoing R&D initiatives. It aims to leverage the strengths of both companies to establish a robust semiconductor manufacturing ecosystem in India. In addition, since 2022, Vedanta has signed agreements with 30 Japanese technology firms to develop India's semiconductor manufacturing ecosystem.[78]

Alongside Japan, several other companies from the USA,[79] the Netherlands,[80] and Israel[81] are investing in India's semiconductor ecosystem. These strategic investments and partnerships underscore India's potential to become a key player in the global semiconductor supply chain.

The semiconductor industry is focused on creating a comprehensive ecosystem that includes equipment makers, material suppliers, and testing facilities. There is also simultaneous investment in skills development in both semiconductor design and manufacturing.

The semiconductor industry is focused on creating a comprehensive

75 PTI. 2024.

76 Ministry of Electronics and Information Technology [MeitY]. 2023. India Semiconductor Mission. Retrieved from https://www.meity.gov.in.

77 Tokyo Electron. 2024. Tokyo Electron and TATA Electronics Private Limited Announce Strategic Partnership to Grow Semiconductor Ecosystem in India. September 10, 2024. Tokyo Electron. https://www.tel.com/news/topics/2024/20240910_001.html; PTI. 2025. Tata Electronics acquires 60 pc stake in Pegatron Technology India. January 24, 2025. The Economic Times. Retrieved from https://manufacturing.economictimes.indiatimes.com/news/hi-tech/tata-electronics-acquires-60-pc-stake-in-pegatron-technology-india/117526192.

78 PTI. 2022. Vedanta inks pacts with 30 Japanese firms to develop Indian semiconductor manufacturing ecosystem. December 13, 2022. The Hindu. https://www.thehindu.com/business/vedanta-inks-pacts-with-30-japanese-firms-to-develop-indian-semiconductor-manufacturing-ecosystem/article66259400.ece?utm_source=chatgpt.com.

79 Reuters. 2024. Analog Devices, Tata Group in talks to make semiconductors in India. September 19, 2024. Reuters. https://goto.now/2I7Cx.

80 Bajwa, A. 2024. NXP Semiconductors to invest more than $1 billion in India as it boosts R&D efforts. September 11, 2024. Reuters. https://goto.now/TckjT.

81 Mehta, T. 2024. Israel's Tower Semiconductor ties up with Adani Group for $10 billion chip project in India. September 6, 2024. Reuters. https://goto.now/JXZzP.

Making space for AI: Possibilities and Governance (L-R): Debjani Ghosh, Distinguished Fellow, NITI Aayog; **Shigehiro Tanaka,** Corporate Senior Executive Vice President (Executive Officer), NEC Corporation; **Rajan Navani,** Chairman, Ananta Centre; CMD, Jetline Group of Companies; Founder & CEO, Jetsynthesys; **Daisuke Kawai,** Deputy Director, Economic Security Program, Research Centre for Advanced Science; **Prakash Chellam,** Managing Director, Premji Invest; **Nihal Chauhan,** CEO & Founder, Indo-Pacific Advisory.

ecosystem that includes equipment makers, material suppliers, and testing facilities. There is also simultaneous investment in skills development in both semiconductor design and manufacturing, with international collaborations playing a key role in providing training. To ensure a conducive environment, the government plans to establish clusters equipped with the necessary social and physical infrastructure.

Electronics Industry

Running parallel to the semiconductor industry, India's electronics sector is expanding with the goal of moving up the value chain from assembly to component manufacturing. The sector witnessed a 22% boost in FY24 from the previous turnover of approximately $22.7 billion in export in 2022–23.[82] The government aims to increase India's domestic value addition in the electronics component from the current 15-18% to 35-40% in the next few[always good to specify the specific time period] years.[83] To align with India's plan of becoming a $5 trillion economy by 2027-28, the government is targeting $300 billion in electronics production and $100 billion in exports.

To bolster India's electronics manufacturing and export capabilities,

82 Sharma, Y. 2024. $100 billion: How can India hit its lofty electronics export target? February 13, 2024. The Economic Times. https://economictimes.indiatimes.com/industry/cons-products/electronics/100-billion-how-can-india-hit-its-lofty-electronics-export-target/articleshow/107664128.cms?from=mdr.

83 Khan, D. 2025. India's electronics market largely assembly-focused; represents just 4% of the global share: Economic Survey. Jan 31, 2025. Money Control. https://www.moneycontrol.com/technology/india-s-electronics-market-largely-assembly-focused-represents-just-4-of-the-global-share-economic-survey-article-12925620.html.

China's Ambitions: Implications for India and Japan (L-R): Y. K. Joshi, Director General, Centre for Contemporary China Studies; **Shyam Saran,** President, India International Centre; **Ken Jimbo,** Professor, Faculty of Policy Management, Keio University; **Chisako T. Masuo,** Professor, Graduate School of Social and Cultural Studies, Kyushu University; **Jabin T. Jacob,** Director, Centre of Excellence for Himalayan Studies, Shiv Nadar University; **Dhruva Jaishankar,** Executive Director, Observer Research Foundation America.

the government has implemented several key initiatives. The Phased Manufacturing Programme (PMP), launched in May 2017, promoted domestic mobile-handset production, fostering a robust local manufacturing ecosystem. Building on this foundation, the Production Linked Incentive (PLI) scheme was introduced across multiple sectors, including electronics, to enhance global competitiveness, attract investments, boost exports, integrate India into the global supply chain, and reduce import dependence.[84] Complementary measures such as the Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS), the Modified Electronics Manufacturing Clusters (EMC 2.0) under the National Policy on Electronics 2019, and the Electronics System Design and Manufacturing (ESDM) initiative further contributed to the government's roadmap aiming for $100 billion in exports and $300 billion in total electronics manufacturing.[85]

Japanese companies and financial institutions are playing a significant role in advancing India's electronics sector. For instance, apart from Tokyo Electron in semiconductor, Nidec Motor Corporation, a 100% owned subsidiary of Nidec Corporation, signed a supply-partnership agreement with Ashok Leyland, the Indian flagship of the Hinduja Group, to provide an electric motor-controller system as vehicle electrification gains momentum globally. With $55 million investment in September 2023 at Orchard Hub in Hubli, Karnataka, commercial

84 Ministry of Electronics and Information Technology. 2020. Production Linked Incentive (PLI) Scheme for Large Scale Mobile and Component Manufacturing. MeitY, Government of India. https://www.meity.gov.in/writereaddata/files/booklet_pli_scheme_for_large_scale_electronics_manufacturing_english.pdf.

85 Sharma, Y. 2024.

electric-vehicles production are expected to roll out in late 2025.[86] Likewise, the Japanese Panasonic Energy announced a joint venture with the state-run Indian Oil Corporation Ltd. (IOCL) in 2024 to manufacture cylindrical lithium-ion cells in India.[87] This strategic initiative was taken to capitalize on anticipated increase in demand for batteries for two- and three-wheel vehicles and energy storage systems in the Indian market. These collaborations underscore Japan's commitment to supporting the growth of India's electronics industry enabling its participation in the global supply chain.

Other Reforms

Complementing these sector-specific initiatives, the government has introduced significant reforms, particularly during the COVID-19 pandemic, to stimulate private sector participation. Since 2020, structural reforms have been announced in sectors such as defence, energy, aviation, space, and mining.[88] Efforts have been made to streamline regulatory processes, and collaboration between the central and state governments has been strengthened to attract and facilitate investments, laying the groundwork for sustainable economic growth.[89]

Investment Landscape and Opportunities

With its focus on streamlining processes and creating a conducive environment for business, India presents a promising investment landscape for foreign investors. While there is significant potential for Japanese foreign direct investment, it is recognized that further encouragement is needed.

> ***Critical factors for attracting Japanese investors include the easing of regulatory processes, cooperation between central and state governments, and establishing a sense of familiarity.***

Critical factors for attracting Japanese investors include the easing of regulatory processes, cooperation between central and state governments, and establishing a sense of familiarity. The Indian

86 Nidec Corporation. 2024. Nidec accelerates Commercial Vehicle electrification in India with Ashok Leyland partnership, Indian footprint investments. October 3, 2024. Nidec Corporation. https://www.nidec.com/en/corporate/news/2024/news1003-01/.

87 Baruah, R. 2024. IOCL, Panasonic to form joint venture to make lithium-ion cells. March 31, 2024. Live Mint. https://goto.now/HH9b8.

88 APN. 2020. Govt announces reforms in 8 key sectors; FDI in defence production hiked, coal & mineral mining opened for private players. May 17, 2020. APN News. Retrieved from https://www.apnnews.com/govt-announces-reforms-in-8-key-sectors-fdi-in-defence-production-hiked-coal-mineral-mining-opened-for-private-players/?utm_source=chatgpt.com

89 NITI Aayog. 2018. Strategy for New India @ 75. Government of India. Retrieved from https://www.niti.gov.in/sites/default/files/2019-01/Strategy_for_New_India_2.pdf.

government is actively addressing these issues by working to remove hurdles and streamline regulatory controls, moving towards a system of facilitation rather than control.

> ***There is an attempt to develop complete industry ecosystems, which include both physical infrastructure such as land and roads, and social infrastructure such as housing, schools, medical facilities, and recreational facilities.***

To incentivize investment, the Indian government provides generous financial incentives, and these are often supplemented by additional incentives from state governments. These incentives are designed to significantly reduce the costs of investment, making India an attractive destination for businesses. Beyond financial incentives, the government is focused on developing complete ecosystems for industries, not just individual factories. Complete industry ecosystems include both physical infrastructure such as land and roads, and social infrastructure such as housing, schools, medical facilities, and recreational facilities such as golf courses. This comprehensive development approach aims to create an environment in which businesses can thrive.

> ***The goal is to create a plug-and-play environment for companies of all sizes, enabling them to quickly establish themselves and begin operations.***

The government recognizes the vital role of small and medium-sized enterprises (SMEs) in value chains and is working to attract them by building the necessary infrastructure and support systems. The goal is to create a plug-and-play environment for companies of all sizes, enabling them to quickly establish themselves and begin operations. In the semiconductor sector, the government is developing industrial clusters where equipment manufacturers, material suppliers, and other ancillary companies can set up base. Since many SMEs lack the resources to make large investments, the government is collaborating with parent companies to make it comfortable for them to move to India. The aim is to attract a broader array of foreign investors to create a robust and diverse business ecosystem.

Global Role and Partnerships

India's commitment to representing the Global South was evident through its G20 presidency, during which it actively consulted and addressed the concerns of these nations. Central to this effort has been India's growing strategic alignment with Japan, fostering a

Geopolitics of Hi-tech: New opportunities between India, ROK & Japan (L-R): Arvind Gupta, Head, Digital India Foundation; **Hiroyuki Akita,** Commentator, Nikkei; **Chi Ung Song,** Senior Research Fellow & Director, Centre for Asia-Pacific Strategy on the Frontier Technology, STEPI, Republic of Korea; **Arun P. Golaya,** Commodore (Retd), VSM; **Anirudh Suri,** Non-Resident Scholar, Carnegie India.

partnership aimed at leveraging technology for mutual growth and addressing global challenges. This collaboration seeks to enhance trade, bring advanced technology to the Global South, and ensure stability in shared global commons, such as the Indo-Pacific, through which approximately 40% of global trade flows.

> ***With 20% of global design engineers based in India, the country is well-positioned to contribute significantly to the Indo-Japanese technological alignment in electronics.***

Both India and Japan recognize the importance of aligning their approaches to meet future technology requirements. India's ambition to double its share in the global electronics value chain is indicative of this shared vision. With 20% of global design engineers based in India, the country is well-positioned to contribute significantly to the technological alignment in electronics. Japan, as a vital G7 member, complements these efforts by championing aligned causes, including the reform of international financial systems and multilateral development banks.

A notable example of this partnership is their work together in forums such as the World Bank and the International Monetary Fund (IMF). India and Japan collaborated to address pressing issues like the Sri Lankan crisis, underscoring their shared commitment to global stability. India's G20 presidency emphasized the need to reform multilateral development banks for 21st-century challenges. This effort yielded tangible results, with a high-level expert committee proposing 30 recommendations, 27 of which were accepted by the World Bank.

India's semiconductor mission is another example of its partnership with Japan, and the growing global interest in India's role. The initiative underscores the Indian government's commitment to leverage the mutual goal of creating a robust semiconductor manufacturing ecosystem, which is crucial for technological self-reliance and global

(L-R): **Rajan Navani,** Chairman, Ananta Centre, CMD. Jetline Group of companies, Founder CEO, Jetsynthesys; **Jaishankar,** Minister of External Affairs, Government of India.

supply chain resilience.

The India-Japan collaboration is underpinned by shared objectives to foster technological innovation and promote sustainable growth, positioning the two nations as pivotal players in shaping the global economic and technological landscape.

CHAPTER 5

Implications of China's Posture for India, Japan and Indo-Pacific

The evolving power dynamics in the Indo-Pacific, driven by China's assertive policies and growing influence, are reshaping regional strategies and alliances. China's pursuit of a diplomatic ceasefire and its simultaneous military expansionism have created a complex environment that demands careful evaluation. For India and Japan, China's actions pose both challenges and opportunities, compelling both countries to recalibrate their strategic, economic, and technological approaches. Understanding the dynamics of this situation is crucial for fostering a resilient and cooperative relationship between India and Japan.

The Strategic Challenge

Diplomatic Ceasefire

China has shown a desire for a "diplomatic ceasefire," particularly with Japan. This is evidenced by the meeting between Prime Minister Shigeru Ishiba and President Xi Jinping, which occurred unusually soon after Ishiba took office[90]. Historically, China has been reluctant to hold summits with Japanese prime ministers lacking relatively strong domestic political backing. This suggests a tactical shift, possibly influenced by China's domestic economic challenges and unfavourable international standing. However, this apparent eagerness for improved relations does not necessarily indicate a fundamental change in China's long-term objectives.

China's interest in a temporary improvement in relations with Japan may be driven by several factors including its need to stabilise its international relations amidst economic difficulties and concerns over the potential for a more confrontational-US approach under a new administration led by Donal Trump. China may also want to counter the perception that it is isolated and that a united front is forming against it in the Indo-Pacific region.

Confronting Assertiveness

> ***China's actions reflect a consistent pattern of assertive behaviour, posing challenges to sovereignty and stability in the Indo-Pacific.***

China's military expansion and territorial claims have caused widespread unease in the Indo-Pacific. From the Himalayas, where skirmishes between India and China persist, to the East China Sea, where Japan contends with Chinese naval activity, the region faces a consistent pattern of assertive behaviour. Observations from key stakeholders indicate that China's actions often reflect a zero-sum worldview, complicating engagement while necessitating cautious counterbalancing strategies.

For India, the Ladakh standoff remains a critical barrier to normalizing ties with Beijing. Restoration of the status quo ante is viewed as a precondition for meaningful dialogue. Japan, meanwhile, continues to strengthen its defences in response to Chinese incursions near the Senkaku Islands, reflecting shared concerns over regional stability. Both India and Japan increasingly align their efforts through joint military exercises, intelligence-sharing initiatives, and security dialogues.

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90 Ministry of Foreign Affairs of the People's Republic of China. 2024, December 17. President Xi Jinping Meets with Japanese Prime Minister Shigeru Ishiba. https://www.fmprc.gov.cn/eng/zy/jj/xjpcxapec2g20/202412/t20241217_11495800.html

Following Japan's decision to discharge treated water from the Fukushima nuclear plant in 2021, China imposed a unilateral embargo on Japanese seafood imports. The ban is likely an act of economic coercion as the International Atomic Energy Agency (IAEA) has found that the water's release adheres to applicable safety standards.[91]

China has increased its military activities in the East China Sea, including in the vicinity of the Senkaku Islands, which are claimed by China but administered by Japan. These actions are seen as an attempt to assert control over disputed territories. Russia has also conducted military flights and warship transit in conjunction with Chinese vessels and aircraft near the Northern territories (Chishima/Kuril Island) over which Japan claims sovereignty, likely signalling to Tokyo that in response to its close military-technical cooperation with the US, China and Russia may present a joint front against it in their respective territorial disputes against Japan.[92]

China's coast guard vessels have also started patrolling near Taiwan-controlled Kinmen Island,[93] a move by Beijing towards adopting a "Senkaku model" to expand control. This is likely to be a part of a broader strategy of asserting dominance in the region and even a harbinger of a military conflict involving an attack on Taiwan.

In a series of moves since 2015, which are most consistent with a pattern of hybrid warfare activity, China has weaponized migration against Japan. The detention of around 17 Japanese nationals under China's anti-espionage laws not only highlights the risks for Japanese citizens in China but also limits the number of experts willing to travel to China.[94] China has also been accused of stoking anti-US sentiments in Okinawa island which hosts American troops critical for Taiwan's defence, fuelling a local separatist movement, and of spreading disinformation over the Internet.[95] These actions are consistent with deliberate cognitive warfare likely aimed at undermining Japan's unity and sowing discord within its society.

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91 International Atomic Energy Agency. 2023, July 4. IAEA finds Japan's plans to release treated water into the sea at Fukushima consistent with international safety standards. https://www.iaea.org/newscenter/pressreleases/iaea-finds-japans-plans-to-release-treated-water-into-the-sea-at-fukushima-consistent-with-international-safety-standards

92 Japan Ministry of Defense. 2024, October. China: Military activities in waters and airspace surrounding Japan. https://www.mod.go.jp/en/d_act/sec_env/pdf/ch_d-act_a.pdf

93 Xinhua. 2024, October 14. China coast guard patrols around Taiwan island. Global Times. https://www.globaltimes.cn/page/202410/1321159.shtml

94 Reuters. 2023, November 29. China arranges for Japanese officials to visit detained Japanese citizen. https://www.reuters.com/world/asia-pacific/china-arranges-japanese-officials-visit-detained-japanese-citizen-2023-11-29/

95 Taipei Times. 2025, January 27. Beijing sowing divisions in Okinawa: report. Taipei Times. https://www.taipeitimes.com/News/front/archives/2025/01/27/2003830897

China's Worldview and Hegemonic Ambitions

China's perspective on the international order is based on a zero-sum worldview, where one country's gain is seen as another's loss. China views India and Japan as being aligned with the US, and not as independent actors, and ascribes no agency to either country. This perception leads China to discount the strategic autonomy of both countries and view their actions through the lens of US influence alone.

This worldview even more broadly informs China's interactions with other nations, where cooperation is often seen as a strategic tool to advance its own interests whereby Beijing's focus is primarily on expanding its own power and influence, often at the expense of others.

China's long-term goal appears to be to establish itself as not only the dominant power in Asia but likely also the world. This ambition is reflected in its actions in the South and East China Seas and the Indian Ocean, its border disputes, and its overall economic and military expansion including in projects like the Belt and Road initiative (BRI) and the China-Pakistan Economic Corridor (CPEC).

China seeks to reshape the existing regional order to reflect its own priorities and objectives. Beijing views the participation of India and Japan in alliances or groupings as efforts to contain or target China. This is because China perceives these alliances as a threat to its regional ambitions. And despite current tensions, the possibility of a G2 relationship between the US and China remains a concern for both India and Japan. Such an understanding could lead to the US playing an offshore balancing role, allowing China to dominate Asia, a scenario neither India nor Japan would accept.

Economic Dependency vs Diversification

> ***The Indo-Pacific is moving from reliance on Chinese trade towards diversification and resilient supply chains.***

China's role as a significant trading partner presents a paradox for India and Japan. Despite concerns over security, economic interdependence remains substantial. China is the largest trading partner of both India[96] and Japan.[97] However, rising trade nationalism in China[98] and supply-chain vulnerabilities exposed during the COVID-19 pandemic

96 Japan Ministry of Foreign Affairs. n.d. Japan-China Economic Relationship and China's Economy. Retrieved February 18, 2025, from https://www.mofa.go.jp/a_o/c_m2/page23e_000652.html

97 Japan Ministry of Foreign Affairs. n.d. Japan-China Economic Relationship and China's Economy. Retrieved February 18, 2025, from https://www.mofa.go.jp/a_o/c_m2/page23e_000652.html

98 University of Michigan News. 2024, June 11. Nationalism forces Chinese multinationals to reclaim home-country identity. University of Michigan News. https://news.umich.edu/nationalism-forces-chinese-multinationals-to-reclaim-home-country-identity/

have amplified calls for diversification in India and Japan as well as the rest of the world.

Efforts are underway to reduce reliance on Chinese exports by fostering resilient supply chains. For example, the Comprehensive Economic Partnership Agreement (CEPA)[99] and bilateral trade initiatives aim to integrate Indian and Japanese industries into global value chains. Japan's investments in India's manufacturing and infrastructure sectors, including its pledge of investing 5 trillion yen by 2027,[100] signify a long-term commitment to economic collaboration. These initiatives also align with India's "Make in India" and "Make for the World"[101] goals, leveraging Japanese expertise to develop itself as an export hub.

The Semiconductor Race

> ***India and Japan are building semiconductor capabilities to counter China's dominance in the sector.***

The race to secure semiconductor supply chains highlights the strategic importance of technology in the Indo-Pacific. China's dominance in chip manufacturing has prompted India and Japan to strengthen collaboration in this critical sector. India's Semiconductor Mission, supported by Japanese investments in materials and equipment, reflects a shared commitment to reducing dependency on Chinese supply chains.

Japan's advanced capabilities in semiconductor materials and India's growing talent pool in design and assembly create opportunities for co-development. Collaborative initiatives in research and development (R&D), skill training, and ecosystem-building are essential to counter China's dominance. Moreover, partnerships with Taiwan and other regional players like Vietnam adds strategic depth to these efforts, reinforcing shared Indo-Pacific objectives.

The Role of the QUAD

The Quad provides a unified platform for countering China's influence while fostering regional stability.

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99 Department of Commerce, Ministry of Commerce and Industry, Government of India. 2020, February 14. India Japan CEPA. https://www.commerce.gov.in/international-trade/trade-agreements/india-japan-cepa/

100 Ministry of External Affairs. (2024, December 4). External Affairs Minister Dr. S Jaishankar's remarks at the 7th India- Japan Indo-Pacific Forum and 10th India-Japan Track 1.5 Dialogue. Government of India. https://www.mea.gov.in/Speeches-Statements.htm?dtl/38544/External_Affairs_Minister_Dr_S_Jaishankars_remarks_at_the_7th_India__Japan_Indo__Pacific_Forum_and_10th_India__Japan_Track_15_Dialogue

101 Prime Minister of India. n.d. Make in India. Retrieved February 18, 2025, from https://www.pmindia.gov.in/en/major_initiatives/make-in-india/ Modi, N. [@narendramodi]. 2023, October 18. India is committed to promoting peace and stability in the Indo-Pacific region [Tweet]. Twitter. https://x.com/narendramodi/status/1714269509304127914

Energy Alternatives: Decarbonising Core Industries (L-R): Nobuo Okochi, Managing Executive Officer, India & ASEAN, Nippon Steel Corporation; **Hiren Mehta,** Chief Commercial Officer & EVP, Business Development, ACME Group; **Sanjiv Aggarwal,** CEO & Managing Director, National Investment and Infrastructure Fund; **Arunabha Ghosh,** CEO, Council on Energy, Environment and Water; **R. K. Misra,** Class 2 Fellow, Kamalnayan Bajaj Fellowship & Founder, YULU. Ulka Kelkar, Executive Director, Climate, World Resources Institute India; **Masahisa Ikeda,** Asia Managing Partner, Shearman & Sterling and Director of Asia Pacific, Trilateral Commission.

The Quadrilateral Security Dialogue (QUAD) has emerged as a pivotal framework for countering China's influence in the Indo-Pacific. Comprising India, Japan, Australia, and the US, the QUAD underscores a commitment to a free, open, and rules-based regional order. The first Trump administration (2017–21) played a significant role in elevating the QUAD's profile, fostering equitable burden-sharing among its members. As apparent from initiatives aimed at high-tech cooperation such as AUKUS[102] and iCET[103] emerging amongst its members, it appears that maintaining this momentum remains a priority for all stakeholders.

Japan and India see the QUAD as a platform to deepen security cooperation, especially in enhancing regional maritime security, and promote economic resilience. Initiatives such as the Indo-Pacific Economic Framework (IPEF) which was launched jointly by the US and 14 partner countries of the Indo-Pacific in 2022 complement these efforts, addressing trade, digital infrastructure, and supply chain stability. The IPEF partners represent 40 percent of the global GDP and 28 percent of global goods and services trade. However, greater emphasis on the QUAD's economic dimension is necessary to ensure its long-term relevance and efficacy.

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102 U.S. Department of Defense. n.d.. AUKUS. Retrieved February 18, 2025, from https://www.defense.gov/Spotlights/AUKUS/

103 Ministry of External Affairs. (2024, June 18). Review meeting of the India-U.S. initiative on critical and emerging technology (iCET). Government of India. https://www.mea.gov.in/press-releases.htm?dtl/37881/Review_Meeting_of_the_IndiaUS_initiative_on_Critical_and_Emerging_Technology_iCE

Balancing China: Defence and Security Cooperation

Joint military exercises and co-production efforts solidify India and Japan's defence collaboration in response to China.

China's growing assertiveness has accelerated defence collaboration between India and Japan. Joint military exercises, such as the Malabar naval drills[104] involving QUAD members, and bilateral defence technology transfers have deepened trust and operational readiness. Japan's increase in defence spending in January 2025 and India's focus on capability-building underscore their commitment to regional stability.

The Unified Complex Radio Antenna (UNICORN) for naval communications is an example of tech-transfer initiatives between Japan and India that blend Japanese innovation with Indian manufacturing. These efforts not only enhance bilateral ties but also reinforce the broader Indo-Pacific strategy to deter aggression.

People-to-People Connections

Expanding cultural and professional exchanges is vital to deepen the India-Japan relationship.

The long-term stability of India-Japan relations hinges on fostering people-to-people connections. Despite strong governmental ties, societal engagement remains limited, with barriers such as language, cultural differences, and insufficient educational exchanges posing challenges. Expanding programmes for skilled workers, students, and professionals between the two nations is essential for creating a more inclusive partnership.

Japanese investments in industrial corridors and infrastructure projects in India are opportunities to bridge these gaps. By integrating local communities and promoting cultural exchanges, these initiatives can enhance mutual understanding and support the broader goals of the India-Japan partnership.

104 Government of India, Press Information Bureau. 2021, February 8. Malabar Naval Exercise. Press Information Bureau, Government of India. https://pib.gov.in/Pressreleaseshare.aspx?PRID=1696140

Broader Implications for the Indo-Pacific

> ***The Indo-Pacific's future depends on balancing economic integration with strategic autonomy amid China's rise.***

The China factor extends beyond India and Japan, influencing the strategic calculus of Association of Southeast Asia Nations (ASEAN), the US, and other regional actors. Multilateral agreements such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and Regional Comprehensive Economic Partnership (RCEP) are redefining trade dynamics, while alliances like the AUKUS have introduced new dimensions to defense cooperation. The Indo-Pacific's future will depend on the ability of nations to balance economic integration with strategic autonomy, ensuring a stable and equitable regional order.

Conclusion

The evolving strategic landscape in the Indo-Pacific presents both opportunities and challenges for India and Japan. As regional powers committed to stability and a rules-based international order, both nations recognize the importance of strengthening their partnership across diplomatic, economic, and technological domains. While China's expanding influence shapes regional dynamics, India and Japan remain focused on fostering inclusive growth, sustainable development, and equitable economic partnerships.

Rather than viewing competition in zero-sum terms, India and Japan continue to advance a vision for a free, open, and multipolar Asia, emphasizing cooperation, connectivity, and shared prosperity. Their collaboration extends beyond security concerns, encompassing critical areas such as supply chain resilience, digital transformation, and sustainable infrastructure, particularly in the Global South. By reinforcing strategic ties and aligning efforts with like-minded partners, India and Japan contribute to a balanced regional architecture that upholds sovereignty, transparency, and long-term stability.

CHAPTER 6

Journey to Net Zero

Rising carbon emissions make decarbonization the defining challenge of the 21st century. As global CO_2 levels continue to climb, achieving net-zero emissions—by 2050 for Japan and 2070 for India—has become a shared, urgent goal that necessitates unprecedented levels of innovation and cooperation. Both countries acknowledge the critical need for an affordable transition to renewable energy, underpinned by the principles of equity and the concept of common but differentiated responsibilities as outlined in the United Nations Framework Convention on Climate Change.

This shared commitment serves as the foundation for India's and Japan's decarbonization strategies, where their unique energy landscapes and socio-economic priorities converge in the pursuit of a sustainable future. For both countries, the decarbonization imperative offers a dual opportunity: to reduce the environmental impact and to enhance energy security and strengthen economic resilience. The following sections discuss the current state of emissions, challenges, and collaborative efforts that are shaping the trajectories of their decarbonization pathways.

Current Status of Emissions and Decarbonization Efforts

Current Emission Levels

India ranks third in global CO_2 emissions from combustible fuels (accounting for 7.4% of the total), while Japan, at 2.9%, stands fifth (2022).[105] [Are more recent data available? Should replace footnote as well.] Addressing climate change has become a shared priority, particularly in energy-intensive and hard-to-abate sectors. Japan's power sector contributes 43% of its national CO_2 emissions, reflecting its continued reliance on fossil fuels, while India's power sector accounts for 37%, emphasizing the urgency of accelerating clean energy transitions. The transportation sector remains another major emitter in both countries, requiring comprehensive decarbonization strategies.

On a per capita basis, Japan's emissions (8.5 metric tonnes) ranked within the top 20% globally and were more than four times higher than India's (2.07 metric tonnes) as of 2022. While Japan is among the top five global emitters, its emissions are significantly lower compared to the largest emitters, China and the United States—only 8.7% of China's and 22.8% of the United States' emissions.[106] India's per capita emissions are less than half the global average (4.7 metric tonnes), underscoring its lower historical contribution to climate change.[107]

Challenges to Net-Zero Targets

Achieving net-zero emissions for Japan and India requires technological advancements, large-scale infrastructure investment, and substantial financial commitments to renewable and sustainable energy sources. A stable renewable energy supply, primarily from solar, wind, and low-carbon nuclear energy, is crucial by 2050, alongside the phased reduction of coal use in general industries by 2060 and in heavy industries by 2065.[108] With heavy industries accounting for 18% of India's CO_2 emissions, key challenges remain in innovative low-emission industrial systems—these include abating the high cost of green hydrogen and green steel, the absence of a sustainable critical minerals supply chain, and the necessity for a comprehensive policy framework with sectoral targets, including capacity-building in

105 IEA. 2022. How much CO2 does India emit? https://www.iea.org/countries/india/emissions; IEA. 2022. How much CO2 does Japan emit? https://www.iea.org/countries/japan/emissions.

106 Koons, E. 2023. Current State And Future Of Japan's Carbon Emissions. April 26, 2023. Energy Tracker Asia. https://energytracker.asia/current-state-and-future-of-japans-carbon-emissions/.

107 IEA. 2023. Co2 Emissions in 2023: The changing landscape of global emissions. International Energy Agency. https://www.iea.org/reports/co2-emissions-in-2023/the-changing-landscape-of-global-emissions

108 Vakkaleri, S. n.d. India's path to net zero. Flow. https://flow.db.com/more/esg/india-s-path-to-net-zero.i. India's path to net zero.

(L-R): S Jaishankar, Minister of External Affairs, Government of India; **Keiichi Ono**, Ambassador of Japan to India; **Nobumitsu HAYASHI,** Governor, Japan Bank for International Cooperation.

emerging clean technologies.[109] As of 2023, India imports over 40% of its primary energy requirements, costing more than $90 billion annually. Moreover, the mobility sector is mostly reliant on fossil fuels.[110]

> ***For both countries, accelerating the deployment of hydrogen, carbon capture, utilization, and storage (CCUS), and industrial decarbonization technologies are indispensable pathways for reducing emissions in hard-to-abate sectors pivotal to their economies.***

Japan has acknowledged the need to align its energy efficiency leadership in home appliances and automobiles with policies on the promotion of non-fossil energy, electrification, and energy rationalization.[111] For both countries, accelerating the deployment of hydrogen, carbon capture, utilization, and storage (CCUS), and industrial decarbonization technologies are indispensable pathways for reducing emissions in hard-to-abate sectors pivotal to their economies. Collaborative efforts between governments, industries, and financial institutions are essential to leveraging technology that drives cost reduction, accelerates commercialization, and establishes a sustainable low-carbon industrial ecosystem.

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109 India. 2022. India's Long-Term Low-Carbon Development Strategy. United Nations Framework Convention on Climate Change. https://moef.gov.in/uploads/2022/11/Indias-LT-LEDS.pdf.

110 Government of India. 2023. National Green Hydrogen Mission. Ministry of New & Renewable Energy.

111 Japan. 2021. Japan's eighth national communication and fifth biennial report (pp. 110–200). United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/resource/NC8_BR5-JPN-E%20(1).pdf.

Technological Approaches to Decarbonization

Hydrogen

Hydrogen is rapidly becoming a key pillar in industrial decarbonization, particularly in sectors like steel production. Japan has been at the forefront of integrating hydrogen into blast furnaces, with pilot projects demonstrating a 33% reduction in emissions within a year.[112] Additionally, advancements in high-performance steel, such as high-strength steel for automobiles and electrical steel for motors, are driving emissions reductions across downstream industries.

Green Hydrogen and Ammonia

Green hydrogen offers a versatile, zero-carbon energy source with applications across multiple industries. Ammonia, as a hydrogen carrier, enhances the feasibility of large-scale hydrogen adoption by simplifying storage and transportation. Japan's ongoing efforts in ammonia co-firing—achieving 20% ammonia substitution in power generation—demonstrate its potential as a next-generation fuel. Achieving this would require 20 million tonnes of ammonia annually (out of the annual global production of 200 million tonnes).[113]

While solar- and ammonia-based technologies are well established, electrolysis efficiency remains a challenge. Electrolysers currently operate at approximately 60% efficiency, but future advancements could raise this to 90%, significantly improving the economic viability of green hydrogen.[114]

India launched its National Green Hydrogen Mission (NGHM) in 2023 aiming to position itself as a global hub for green hydrogen production, targeting 5 million metric tonnes per year by 2030.[115]

The government supported production-linked incentives (PLI) for electrolyzer manufacturing, viability gap funding (VGF) for hydrogen production, and mandates for industries like refineries, fertilizers, cement, and steel to adopt green hydrogen. However, challenges such as water scarcity in arid areas, lack of access to rare earth minerals such as platinum for electrolysers, and inadequate storage and mobility infrastructure pose significant hurdles that complicate the decarbonizing of hard-to-abate sectors like steel and cement. Technologies such as direct iron ore reduction using hydrogen, and

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112 Nippon Steel Corporation. 2024. Verified the World's Highest Level of CO2 Emissions Reduction at 33% by Heated Hydrogen Injection in the Super COURSE50 Test Furnace. February 06, 2024. Nippon Steel Corporation Press Release. https://www.nipponsteel.com/en/news/20240206_100.html.

113 IHI. n.d. Using Ammonia as Fuel. Ishikawajima-Harima Heavy Industries (IHI) Corporation. https://www.ihi.co.jp/en/sustainable/environmental/climatechange/ammonia_energy/

114 International Energy Agency. n.d. Tracking Electrolysers. International Energy Agency. https://www.iea.org/energy-system/low-emission-fuels/electrolysers#tracking

115 Government of India. 2023. National Green Hydrogen Mission.

alternative cement production methods are still under development. Similarly, CCUS, while promising, requires substantial investment in innovation and R&D for widespread deployment. Despite these challenges, companies such as Reliance Industries, Adani Group, Indian Oil, and L&T are investing in electrolyzer technology and green hydrogen projects.[116]

India can benefit from Japanese expertise in hydrogen storage, transportation, and fuel-cell technology, as well as strategic partnerships for securing critical minerals and infrastructure development. Strengthening India-Japan collaboration in these areas will be essential to overcoming bottlenecks and accelerating India's green hydrogen ambitions.

Battery Circularity

With global lithium-ion battery (LIB) demand projected to increase from 700 GWh in 2022 to 4,700 GWh by 2030,[117] sustainable supply chains and e-waste management are becoming critical. Circular economy strategies, including end-of-life (EoL) reuse and recycling, can reduce greenhouse gas emissions by 7-17% across the LIB lifecycle and significantly cut mining demand—55% for copper, 25% for lithium, and 35% for cobalt and nickel—by 2040.[118]

Japanese research projects that raw material demand for EVs will triple by 2050, emphasizing the importance of circularity measures.[119] A fully developed battery reuse and recycling ecosystem in Japan alone could create an ¥8 trillion market by 2050.[120] India, facing increasing demand for LIBs, must prioritize raw material security, reverse logistics, waste management laws, and capacity building for the informal sector.

Policy incentives for R&D in circular economy supply chains, pilot projects, and large-scale deployment of battery recycling technologies will be essential. Coordinated Indo-Japanese efforts in critical mineral security, recycling infrastructure, and financing mechanisms can accelerate industrial decarbonization while ensuring long-term resource sustainability.

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116 Pathak, K. 2024. H2GO: Reliance Industries, L&T, Adani and John Cockerill to manufacture electrolysers by 2025. July 10, 2024. The Economic Times. https://economictimes.indiatimes.com/industry/renewables/h2go-reliance-industries-lt-adani-and-john-cockerill-to-manufacture-by 2025/articleshow/111615431.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

117 Kumar, et al. 2024. Battery circularity and raw material security in India. Conference Proceedings. January 24, 2024. WRI India. https://wri-india.org/sites/default/files/uploads/Battery-circularity-and-raw-material-security-in-India-12th-July.pdf

118 Kumar. Battery circularity.

119 Kosai, S. 2024. Sustainable Electrification: Managing Resource Demands for Future Electric Vehicles. Ritsumeikan University.

120 Narahashi, D. & Sugimoto, K. 2024. Toyota, Other Japan Firms Speed Up Efforts to Reuse, Recycle EV Batteries; Keeping Key Mineral Resources in Japan Would Improve Economic Security. October 20, 2024. Yomiuri Shimbun. https://japannews.yomiuri.co.jp/business/companies/20241020-217522/

Policy Frameworks and Demand Creation

Effective policies are fundamental to decarbonization, serving three critical functions: setting a clear direction, injecting capital, and catalyzing market transformation. Achieving these goals requires a strategic blend of long-term vision and practical implementation.

Government policy plays a pivotal role in shaping the trajectory of industrial decarbonization. India's National Green Hydrogen Mission, the world's second-largest initiative of its kind, aims to produce 5 million tonnes of green hydrogen by 2030.

Government policy plays a pivotal role in shaping the trajectory of industrial decarbonization. India's National Green Hydrogen Mission, the world's second-largest initiative of its kind, aims to produce 5 million tonnes of green hydrogen by 2030. In addition, a Green Steel Mission is under development, signalling a commitment to decarbonizing heavy industries beyond renewable energy expansion. These initiatives establish a clear policy roadmap, providing businesses and investors with direction and certainty in pursuing sustainable practices.

However, market-driven demand is essential to make these initiatives effective. Green hydrogen and green steel remain significantly more expensive than conventional alternatives, necessitating targeted policy interventions to bridge the cost gap. One such approach is a ratcheting mechanism for green steel adoption, ensuring guaranteed offtake agreements for producers. This would create market confidence for steel manufacturers transitioning to low-carbon production while reassuring upstream hydrogen producers about sustained demand. India's introduction of a Green Steel Taxonomy further underlines its commitment to integrating green hydrogen into industrial processes.[121]

A balanced policy approach addressing both supply and demand is critical. Supply-side incentives alone will not drive adoption, particularly for early-stage, capital-intensive technologies. Public capital must be leveraged to stimulate demand, fostering both innovation and private-sector investment in green supply chains.

121 PIB. 2024. Union Minister of Steel and Heavy Industries, Shri H. D. Kumaraswamy, Releases India's Green Steel Taxonomy. December 12, 2024. PIB. Ministry of Steel, Government of India.

Successful models for demand aggregation already exist. For instance, bulk procurement of electric buses has driven cost reductions, making them commercially viable. Similar approaches could be applied to freight transportation, incentivizing commercial fleet electrification. Additionally, viability gap funding (VGF) mechanisms for electric buses have proven effective in de-risking investments in clean technologies.

Successful models for demand aggregation already exist. Bulk procurement of electric buses has driven cost reductions, making them commercially viable. A similar approach could be applied to freight transportation, incentivizing commercial fleet electrification. Additionally, viability gap funding (VGF) mechanisms for electric buses have proven effective in de-risking investments in clean technologies. However, challenges persist, particularly in smaller cities where payment delays hinder private investment. One potential solution is the establishment of payment security mechanisms, backed by international financial institutions such as Japanese banks, to improve investor confidence.

Carbon markets serve as a crucial mechanism for balancing economic growth with climate commitments, particularly in the context of differentiated responsibilities between developed and developing nations. Establishing aligned carbon trading standards can facilitate financial flows and technology transfers, supporting the deployment of low-carbon solutions like hydrogen and sustainable aviation fuels. As standardization is crucial, the Indian government is working toward a regulated carbon market that fosters an equitable trading mechanism among stakeholders. Collaboration with Japan can help mobilize investment while ensuring a fair distribution of climate responsibilities.

To accelerate industrial decarbonization, India and Japan must align policy frameworks, leverage financial instruments, and drive market-based demand for green technologies. By creating strong policy incentives and market mechanisms, both countries can ensure a sustainable, low-carbon industrial future while fostering innovation and investment at scale.

The Role of Funding and Investment

Decarbonization projects are inherently capital-intensive, requiring substantial investments due to their scale and complexity. India needs an estimated investment of $10.1 trillion to meet its 2070 target

as of 2022.[122] Securing adequate funding remains a critical challenge in achieving net-zero goals.

The Japan Innovation Fund serves as a model for financing technology-driven pilot projects, focusing on wind energy, green hydrogen transportation, and low-carbon cement production. By addressing technological bottlenecks and supporting innovation, this fund demonstrates a proactive approach to overcoming decarbonization barriers.

A key example of Indo-Japanese financial collaboration is the National Investment and Infrastructure Fund (NIIF), an alternative asset manager in India. In partnership with JBIC, NIIF has established a $600 million climate-focused fund, channelling investments into electric mobility and other decarbonization initiatives. This reflects a shared commitment to accelerate green transitions through strategic financing.

there is a growing need for a dedicated funding mechanism in India—similar to the Japan Innovation Fund—to support Indian entrepreneurs in developing and scaling decarbonization technologies. While private capital flows easily into mature sectors like renewable energy, early-stage clean technologies often struggle to secure investments due to higher risk and longer payback periods.

However, there is a growing need for a dedicated funding mechanism in India—similar to the Japan Innovation Fund—to support Indian entrepreneurs in developing and scaling decarbonization technologies. While private capital flows easily into mature sectors like renewable energy, early-stage clean technologies often struggle to secure investments due to higher risk and longer payback periods. The high cost of emerging green solutions, such as green steel, further discourages private investors. To illustrate, green steel production can cost up to seven times more than conventional methods, making policy support and innovative financing models essential for commercial viability.

The capital expenditure required to decarbonize critical industries such as steel and cement is estimated at half-a-trillion dollars, underscoring the urgent need for a well-structured investment strategy. This demands the creation of dedicated capital pools, including venture capital, early-stage R&D funds, and risk-mitigation mechanisms.

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122 Sharma, N. 2022. These are the challenges facing India's net-zero target. September 27, 2022. World Economic Forum & Quartz. https://www.weforum.org/stories/2022/09/net-zero-challenges-india-target/.

A notable example of Japan's investment in India's energy transition is Osaka Gas Co. Ltd., in collaboration with other Japanese firms, through AG&P LNG Marketing Pvt. Ltd.[123] This initiative is driving growth in City Gas Distribution (CGD) across a 320,000-square-kilometre area, covering 10% of India's land area, and nearly 90% of Japan's total landmass. The CGD network spans the transportation, residential, commercial, and industrial sectors, aligning with India's natural gas expansion strategy for low-carbon energy. Additionally, it creates business opportunities for Indian enterprises through a bidding process that grants exclusive gas distribution rights for defined geographic areas.

To successfully finance India's decarbonization, public and private capital must align through structured incentives, risk-sharing mechanisms, and policy-driven demand creation. A strengthened Indo-Japanese collaboration in investment and technology financing will be critical in driving large-scale industrial transformation and securing a sustainable, low-carbon future.

India-Japan Collaboration

India and Japan share a strong economic and strategic interest in decarbonizing core industries, making them natural partners in this effort. Their history of economic collaboration dates back to the 1950s, with Japanese companies playing a key role in India's industrial growth. Recognizing the need for a deeper cooperation, both nations are supporting technology co-development to drive innovation, alongside initiatives such as the India-Japan Fund, a $600-million fund of funds, which invests in Japanese enterprises.

Japan's industrial expertise is particularly strong in hydrogen-based reduction methods and carbon capture & storage (CCS). Nippon Steel, a leader in this field, is actively integrating environmental technologies into its operations in line with Japan's "Green Growth Strategy".[124] The company is pioneering hydrogen-based blast furnace technologies, a breakthrough with significant implications for global steel production. While these innovations are being developed in Japan, deployment plans in India are already underway, demonstrating the depth of Indo-Japanese collaboration.

This commitment is further reflected in the ArcelorMittal Nippon Steel India (AM/NS India) joint venture, which strengthens bilateral industrial ties. Nippon Steel's operations in Hazira, Gujarat, are set

123 Daigas Group. 2024. Osaka Gas, Sumitomo, and JOIN to Invest in Expanding City Gas Distribution Business in India. Daigas Group, April 8, 2024. https://www.osakagas.co.jp/en/whatsnew/icsFiles/afieldfile/2024/04/15/2404081.pdf

124 Kutty, N. & Tochibayashi, N. 2023. How Japan is accelerating efforts towards a carbon-neutral society. January 16, 2023. World Economic Forum. https://www.weforum.org/stories/2023/01/davos23-japan-accelerate-efforts-carbon-neutral-society/

for a major expansion to 50 million tonnes, backed by Rs 1.3 trillion in funding from Japanese financial institutions, including the Japan Bank for International Cooperation (JBIC). In addition to hydrogen-based solutions, the company is implementing near-term emission-reduction strategies, demonstrating the need for a comprehensive, multi-pronged approach to decarbonization.

India's push to generate 50% of its electricity from renewables by 2030 presents another major area for cooperation. A key example is the partnership between Sumitomo Corporation—one of Japan's largest trading firms—and AMPIN Energy Transition, a leading renewable energy developer in India.[125] India's corporate Power Purchase Agreement (PPA) market is expanding rapidly, and is projected to grow from 12 GW in 2023 to 100 GW by 2030, with solar power as the primary driver. Sumitomo's green energy platform will integrate AMPIN's 4 GW renewable portfolio and its global network to supply 1 GW of green power to industrial customers, particularly Japanese-affiliated firms.

The transportation sector presents further opportunities for Indo-Japanese cooperation. While Japan has been a leader in hybrid vehicle technology, India is rapidly adopting electric vehicles (EVs). Collaboration on knowledge-sharing, technology exchange, and financial mechanisms can accelerate green mobility adoption in both India and Japan. Financial institutions from both countries can work together to de-risk investments and support the scaling of EVs and other clean technologies.

A notable example of supply chain collaboration is the partnership between ACME Group, IHI Corporation, and Japanese shipping firms for the transport of green molecules, highlighting the potential for end-to-end cooperation across production, storage, and transportation of clean energy solutions. Expanding such partnerships will be critical in achieving long-term decarbonization goals.

> ***Both countries must maximize their complementary strengths—India's vast renewable energy potential in Rajasthan and Gujarat, and Japan's expertise in hydrogen production and electrolyser manufacturing.***

Moving forward, both countries must maximize their complementary strengths—India's vast renewable energy potential in Rajasthan and Gujarat, and Japan's expertise in hydrogen production and electrolyser manufacturing. Additionally, India's extensive grid infrastructure, which enables cost-free power transmission for 25 years after commissioning, presents a key advantage for scaling green hydrogen

125 Sumitomo Corporation. 2024. Sumitomo Corporation Establishes Renewable Energy Development and Supply Company in India. September 13, 2024. Sumitomo Corporation. https://www.sumitomocorp.com/en/europe/news/release/2024/group/18830.

production. By aligning their resources and capabilities, India and Japan can accelerate their energy transition while setting a global benchmark for sustainable industrial cooperation.

Conclusion

The path to decarbonization is a steep uphill journey, facing significant obstacles in technological readiness, capital availability, and policy uncertainty. Ambiguous and inconsistent policies for adopting critical technologies such as carbon capture and hydrogen-based steelmaking exacerbate this uncertainty. Additionally, the prohibitive cost of green technologies like green steel hinders private capital attraction. To foster foreign investment, harmonized regulatory frameworks and streamlined approval processes between India and Japan are essential. The shifting global political landscape, including shift in U.S. leadership, may impact international decarbonization initiatives, introducing both challenges and opportunities for climate policy and collaboration. A unified and strategic partnership between India and Japan, leveraging their respective strengths and capacities, is now imperative.

Priority areas for cooperation include the advancement and deployment of hydrogen technologies, investments in green infrastructure, and the creation of supportive policy environments. Joint efforts in developing technologies and stimulating demand for green products through government procurement and mandates will be crucial. Achieving a successful transition to a low-carbon economy demands robust policy support, strategic investments, and a commitment to technological innovation. This will require the establishment of dedicated capital pools, support for technological progress, and coherent regulatory frameworks. By working together, India and Japan can not only achieve their decarbonization targets but also set a powerful precedent for the global community.

AUTHOR'S NOTE

This report is written by Ananta's Dr. Shimreisa Chahongnao (Programme Executive | International Relations and Aditya Pareek (Programme Lead | International Relations. They encapsulate the rich discussions at the 3rd India Japan Forum where participants were tasked with identifying recommendations for Indian and Japanese policymakers to take this bilateral relationship forward. These recommendations fall largely in two buckets: how to face common geopolitical challenges and how to leverage mutually beneficial technologies. The authors have contextualised the recommendations by including the current approaches adopted by India and the Japan towards each issue.


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