REPUBLIC OF KOREA CHAIR

APRIL 2026

Toward a Trilateral Tech Framework

Connecting India, Japan, and South Korea in the Indo-Pacific

CSDR
COUNCIL FOR STRATEGIC AND DEFENSE RESEARCH

Recommended Citation:
Roy, Torunika. 2026. Toward a Trilateral Tech Framework: Connecting India, Japan, and South Korea in the Indo-Pacific. New Delhi: Council for Strategic and Defense Research.

ABOUT THIS REPORT

This report examines a conspicuous gap in Indo-Pacific architecture: the absence of a formalized mechanism for technology cooperation among three of Asia's leading democracies. Against the backdrop of intensifying US-China rivalry, erratic American trade policy under Trump 2.0, and China's weaponization of economic interdependence, the report makes a compelling case for a purpose-built minilateral that leverages complementary national strengths — India's digital economy and human capital, Japan's precision manufacturing and standards diplomacy, and South Korea's semiconductor and electronics leadership.
Drawing on middle-power theory and the logic of interest-driven minilateralism, the report argues that trilateral cooperation offers a viable middle path between great-power dependence and costly self-reliance. Anchored in concrete sectoral analysis and policy recommendations, it provides both a strategic rationale and a practical roadmap for institutionalizing what bilateral ties alone have failed to deliver.

COUNCIL FOR STRATEGIC AND DEFENSE RESEARCH

The Council for Strategic and Defense Research (CSDR) is an independent, New Delhi-based think tank providing strategic analysis and policy recommendations to governments, businesses, and institutions. It addresses critical global challenges through rigorous research and a deep understanding of regional dynamics.

CSDR integrates global perspectives with practical experience, ensuring its partners receive innovative, context-specific solutions. Its expertise spans foreign policy, geopolitical risk, connectivity and geoeconomics, defense and aerospace, military strategy, strategic technologies, conflict resolution, peacebuilding, climate change, energy security, and technology policy. It specializes in the Indian subcontinent, Eurasia, and the Indo-Pacific region.

ABOUT THE REPUBLIC OF KOREA CHAIR AT CSDR

The Republic of Korea Chair at CSDR aims to enhance the understanding and cooperation between India and the Republic of Korea through research and policy engagement. Launched in Jan 2025 with a grant from the Korea Foundation, the Chair aims to raise broader awareness and deepen understanding of the India-ROK relationship, which remains limited despite growing governmental engagement.

AUTHOR

Torunika Roy - Research Associate, CSDR

RESEARCH DIRECTION

Prof. C Raja Mohan - ROK Chair & Distinguished Fellow, CSDR
Dr. Gaurav Saini - Co-founder, CSDR

EXECUTIVE SUMMARY

The Indo-Pacific's technology architecture has a conspicuous gap: despite robust bilateral partnerships and convergent strategic interests, India, Japan, and South Korea have yet to establish a formalised trilateral framework for technology cooperation. This report argues that the moment to close that gap is now.

The geopolitical imperatives are acute. Intensifying US-China rivalry has transformed semiconductors, artificial intelligence, and critical minerals from commercial assets into instruments of statecraft. China's weaponisation of economic interdependence, through export controls on gallium, graphite, and rare earths, has exposed the vulnerabilities of overreliance on a single supplier. Washington's turn toward high tariffs and strategic unpredictability under the second Trump administration has further complicated the security calculus for US allies Tokyo and Seoul. In this environment, middle-power cooperation is no longer an optional supplement to great-power alignment. It is a strategic necessity.

India, Japan, and South Korea each embody a distinct but complementary profile within the global technology ecosystem. India contributes demographic scale, a deep engineering talent pool, and a rapidly expanding digital infrastructure. Japan brings precision manufacturing, advanced materials expertise, and decades of experience in international standard-setting. South Korea offers world-leading capabilities in semiconductors, electronics, and industrial production. These are not overlapping strengths. They are interlocking ones, forming the basis of a genuinely resilient trilateral architecture.

The report identifies four priority sectors for structured cooperation: Semiconductors, Artificial Intelligence and Cybersecurity; Critical Minerals; Shipbuilding; and Clean Energy. Across each, the three countries face shared vulnerabilities that trilateral cooperation is uniquely positioned to address. In semiconductors, India's design talent can offset the workforce constraints of Japan and South Korea. In critical minerals, aligning KABIL, JOGMEC, and KOMIR offers a credible counter to Chinese processing dominance. In shipbuilding, Indian yards, paired with Japanese design and Korean systems integration, can begin to contest China's near-total control of the global orderbook.

The report also confronts real obstacles: historical mistrust between Tokyo and Seoul, Seoul's strategic ambiguity toward Beijing, and the absence of a formal institutional anchor. These are manageable, but only through deliberate institutional design, not goodwill alone. The report recommends a phased roadmap, moving from a Trilateral Track Task Force and think tank-led sectoral frameworks in the near term, toward a standing minilateral secretariat and co-financed supply chain infrastructure over the medium and long term.

The India-Japan-South Korea trilateral is not a hedge against great-power competition. It is a durable contribution to a rules-based Indo-Pacific order, built by the region's leading democracies, on their own terms.

INTRODUCTION

Tech-based cooperation among countries has increasingly become a question of economic security, as access to semiconductors, data infrastructure, and other critical technologies now shapes national power, strategic autonomy, and resilience. Securing the economy was first formalized at the 2023 G7 Summit in Hiroshima, where the leaders stated "Economic Resilience and Economic Security."[1] In the statement, the G7 countries prioritized fostering mutually beneficial partnerships to support resilient value chains, thereby setting a standard for middle powers to reduce risk to their economies.[2] This marked a transition from viewing markets as politically neutral spaces to recognizing them as strategic domains within great-power competition, as reflected in China's export controls and the US's turn toward high tariffs under the second Trump administration.

In the statement, the G7 countries prioritized fostering mutually beneficial partnerships to support resilient value chains, thereby setting a standard for middle powers to reduce risk to their economies.[2] This marked a transition from viewing markets as politically neutral spaces to recognizing them as strategic domains within great-power competition, as reflected in China's export controls and the US's turn toward high tariffs under the second Trump administration.

There are multiple forces that motivated this shift. First, the most important economic advantages are increasingly tied to a few key technologies (chips, AI, quantum, etc). Only a small number of countries dominate these arenas, prompting a global tech race. Second, countries deploy export controls, high reciprocal tariffs, screening, and sanctions as instruments of statecraft. Third, economic coercion by states highlights how economic interdependence can be weaponized for leverage. For instance, China curtailed the exports of critical minerals to Japan amid tensions over the Senkaku/Diaoyu Islands.[3] Fourth, the reversal of globalization after the COVID-19 pandemic and the fragility of supply chains exposed the vulnerability of highly concentrated production networks. Finally, new technologies present security threats. For example, AI can be misused to launch cyberattacks.

In response, many states started pursuing inward capacity building, including investments in R&D, scaled manufacturing, and critical infrastructure, while diversifying supply chains. These systemic responses are not devoid of great-power competition and distinct bilateral relationships. Essentially, the US-China competition has turned technology into a central arena of competition, with export controls, item screenings, and industrial policies, whose effects are felt differently across their partners. For instance, Japan and South Korea rely on the US for their security.

However, growing uncertainty in the regional security architecture, due to President Trump's stance on sharing the burden of security with allies or withdrawing troops, has reinforced concerns about overdependence. Simultaneously, China's strong economic and technological influence on both economies has created tensions of dual dependence. Against this backdrop, India emerges as an attractive partner due to its expanding market size and technological capabilities. India also has a relatively lower strategic vulnerability than both the US and China.

Bilateral relationships among middle powers such as India, Japan, and South Korea have also matured into robust strategic partnerships. Their cooperation has expanded across a wide range of sectors, including critical and emerging technologies, supply chain resilience, digital innovation, maritime security, and clean energy. For example, in 2025, Cochin Shipyard Limited (CSL) signed a comprehensive MoU with South Korea's HD Korea Shipbuilding & Offshore Engineering Co. Ltd. (KSOE). Similarly, India and Japan signed an MoU on Digital Partnership 2.0 to collaborate on digital public infrastructure, AI, IoT, and semiconductors. Both also signed an MoC to advance cooperation in mineral resources.[4] However, despite recurring discussions and evident synergies, there is no formal, institutionalized trilateral mechanism linking these three Asian democracies. The absence is particularly striking given the existence of other institutionalized groupings, such as the Japan-Korea-China trilateral summits and the Japan-Korea-United States security dialogue.

In this context, the cooperation among middle powers becomes an important variable. Middle powers occupy an intermediate position between great powers and small states in terms of material capabilities, influence, and status in the international system. They are not defined solely by size or economic strength, but by their foreign policy behaviour.[5] They seek to stabilize and reinforce the existing international order, favour multilateralism and rules-based approaches, and act as facilitators in global governance. Such behaviour is the outcome of deliberate policy choices shaped by domestic capacity, geopolitical location, and external constraints.[6]

Middle powers... are not defined solely by size or economic strength but by their foreign policy behaviour. They seek to stabilize and reinforce the existing international order, favour multilateralism and rules-based approaches, and act as facilitators in global governance. Such behaviour is the outcome of deliberate policy choices.

Especially in a "milieu of uncertainty" due to Chinese economic coercion and Trump 2.0 transactionalism, a technology cooperation framework among India, Japan, and South Korea can preserve strategic autonomy and provide economic security. Each embodies a behavioural conception of middle power diplomacy, yet in distinct ways. Each possesses distinct characteristics within the global technology ecosystem. India contributes to the scale of human capital and the digital economy. Japan brings advanced manufacturing capabilities, precision technologies, and experience in international standard-setting. South Korea offers world-leading expertise in semiconductors, electronics, and industrial production. These complementary strengths create the basis for cooperation that enhances resilience without diluting competitiveness.

This report highlights that the lack of a formal trilateral framework among India, Japan, and South Korea is a gap in the Indo-Pacific's evolving economic and security architecture. It argues that a tech cooperation among the three can provide a middle path between dependence on great-power leadership and self-reliance. The report also addresses questions such as why no formalized mechanism has emerged among the three countries, despite strong bilateral ties. Which sectors offer the greatest potential for trilateral cooperation? And how can trilateral cooperation help mitigate risks arising from unpredictable shifts in global trade?

The report is organized into four sections. Section I conceptualises middle power diplomacy and minilateralism. Section II provides the geopolitical context, including China's dominance in manufacturing and technology, and US policy uncertainty. Section III presents an overview of the complementarities of India, Japan, and South Korea. Finally, section IV lists potential challenges and also suggests policy recommendations.

SECTION I: MIDDLE POWERS AND MINILATERALISM: INDIA, JAPAN, AND SOUTH KOREA

India, Japan, and South Korea share similar middle power traits but are shaped by distinct historical experiences, structural constraints, and priorities.

Japan's middle-power diplomacy has evolved as a pragmatic response to structural constraints imposed after 1945 and to the shifting balance of power in Asia. Constrained by a constitutional prohibition on the use of military force as a primary diplomatic tool, Japan recalibrated its foreign policy toward economic statecraft, multilateralism, and institution-building.[7] Over time, Japan translated its expanding economic strength into regional diplomacy. The Fukuda Doctrine marked a turning point by emphasising non-military engagement, mutual trust, and partnership with Southeast Asia.[8] In the 21st century, the intensifying US-China rivalry has forced Japan to adapt its middle-power diplomacy to a more contested strategic environment. Thus, Tokyo's response has been a hybrid approach combining hedging and engagement. While reinforcing the US-Japan alliance as the core of its security posture, Japan has simultaneously expanded partnerships with other middle powers through minilateral frameworks such as the Quad and regional trade architectures, such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP).

South Korea's middle power identity began to crystallize in the early 1990s, particularly under the Kim Young-sam administration, when Seoul's foreign policy discourse shifted toward internationalism, multilateralism, and global engagement.[9] Seoul has since pursued a normatively driven and institution-centred diplomacy, actively participating in global and regional forums such as the G20, ASEAN-led mechanisms (ASEAN Plus Three, ARF, ADMM-Plus, EAS), APEC, the UN, and issue-specific initiatives on development effectiveness, nuclear security, and non-proliferation. Most importantly, it aims to carefully manage constraints arising from its security dependence on the US and its economic interdependence with China.

India, by contrast, occupies a distinctive position among middle powers.[10] Prof. C Raja Mohan argues that "India's fast-growing economy and expanding comprehensive national power make it more than a middle power."[11] With a distinctive position in the international system, nuclear weapons, an aggregate GDP approaching $4 trillion, and sustained growth of 6%-7%, India's material capabilities give it global salience. However, its low per capita income, large population, and unfinished nation-building tasks continue to constrain its great-power ambitions. Such a structural gap between aggregate power and domestic capacity shapes India's foreign policy choices.[12] India's middle-power behaviour reflects strategic autonomy stemming from non-alignment and an aversion to external interference, alongside selective alignment driven by its geopolitical rivalry with China and its economic partnership with the US.

India, by contrast, occupies a distinctive position among middle powers. Prof. C Raja Mohan argues that "India's fast-growing economy and expanding comprehensive national power make it more than a middle power." With a distinctive position in the international system, nuclear weapons, an aggregate GDP approaching $4 trillion, and sustained growth of 6%-7%, India's material capabilities give it global salience.

Despite divergent historical trajectories and strategic priorities, India, Japan, and South Korea converge on the need for selective, issue-based cooperation in an uncertain and contested geopolitical environment. Their differences create incentives to form a minilateral framework rather than obstruct it. Japan and South Korea, as US allies, seek to diversify partnerships and build trusted supply chains to mitigate risks arising from deep economic dependence on China. India seeks technological and economic partners to accelerate domestic capacity, diversify risk, and sustain multilateralism. Against this backdrop, the logic of a minilateral becomes relevant as minilaterals are not ideologically uniform but rather interest-driven and situational, allowing middle powers to pursue selective cooperation without shared grand visions.[13] Minilaterals allow states to work together on specific issues without requiring convergence on a shared grand strategy. They are not "geared to addressing global challenges given their focus on a limited agenda, narrow geographical scope, and interest in issues that align with the shared interests of their partners."[14]

For India, minilateral are pathways to multipolarity and reformed multilateralism. For Japan, there is a mechanism to reinforce norms and trusted supply chains. For South Korea, they are tools to avoid binary choices in a polarised Indo-Pacific. In this way, minilateralism provides a flexible architecture to accommodate their differences.

SECTION II: GEOPOLITICAL CONTEXT

Tech sovereignty, which has become a top priority for governments worldwide, is about "maintaining control over the foundational tech stack that underpins modern economies, from semiconductors to 5G networks."[15] Control over critical technologies like semiconductors, AI systems, cloud infrastructure, and data governance shapes a country's ability to protect sensitive sectors, including defense, finance, energy, and public health. Recent shocks, from pandemic-era chip shortages to Russia's invasion of Ukraine, have exposed the vulnerabilities of overreliance on global supply chains. For instance, the recent AI agreement[16] between the US and the UAE enables the UAE to accelerate its ambitions to become an AI hub by providing access to advanced Nvidia chips. However, it also raises concerns in Washington about offshoring critical technologies to China, given the UAE's close economic ties with China (its largest trading partner).

At the same time, the pursuit of tech sovereignty cannot be equated with isolation or digital protectionism. Modern technology ecosystems are deeply interdependent, spanning human capital, research institutions, supply chains, and regulatory frameworks. Even advanced economies struggle to achieve full self-sufficiency, given the high costs and complexity of semiconductor manufacturing and the dominance of a few global firms.[17] As a result, strategic autonomy increasingly depends on trusted international partnerships alongside strong domestic innovation systems.

The pursuit of tech sovereignty cannot be equated with isolation or digital protectionism. Modern technology ecosystems are deeply interdependent, spanning human capital, research institutions, supply chains, and regulatory frameworks. Even advanced economies struggle to achieve full self-sufficiency, given the high costs and complexity of semiconductor manufacturing and the dominance of a few global firms. As a result, strategic autonomy increasingly depends on trusted international partnerships alongside strong domestic innovation systems.

China's Rising Tech Dominance and Weaponization of Interdependence

China's current technological breakthroughs highlight a structural shift in the global innovation landscape, challenging long-held assumptions about Western technological primacy. At the core of Beijing's approach is the concept of "New Quality Productive Forces," which emphasizes integrating emerging technologies such as AI, automation, green energy, and advanced manufacturing to enhance productivity while retaining China's manufacturing base.[18]

Rare earth minerals, comprising 17 elements such as lanthanides, scandium, and yttrium, are foundational to both civilian and military technologies.[19] Since the 1980s, China has come to dominate the industry due to lower costs, laxer environmental standards, and decades of government support. As per the report by Reuters, "China accounts for about 60% of global mine production and 90% or more of refined production and rare earth magnet output."[20] In 2025, China tightened export restrictions on rare earth elements, which forced exporters to apply for licences.[21] Earlier in 2025, export controls caused shortages of rare-earth magnets, leading car plants around the world to pause operations. A similar pattern is visible in the semiconductor industry. Often described as the "new oil," semiconductors are crucial for "driving technological innovation and global competitiveness" in sectors like electronics, automotive, telecommunications, and beyond.[22] In 2024, China established a $48 billion investment fund for its semiconductor sector to reduce dependence on foreign suppliers. China has also "surpassed South Korea in foundational capabilities across nearly all semiconductor technology areas, including the memory sector," where South Korean firms like Samsung and SK Hynix have traditionally been global leaders.[23] Also, China has moved beyond imitation to ecosystem leadership. By April 2025, its core AI industry was valued at nearly $83.45 billion, supported by over 400 specialised firms and more than 1.5 million AI patent applications, around 40% of the global total.[24] Apart from AI, China's dominance extends into energy and industrial technologies. BloombergNEF's 2025 Global Lithium-Ion Battery Supply Chain Ranking ranks China first for its superior infrastructure, low electricity costs, and concentration of refining and manufacturing capacity across the battery value chain.[25] China's AI battery advantage is reinforced by its early and aggressive move into next-generation clean fuels. China now hosts three times as many commercial-scale clean industrial projects as the US, including large-scale green ammonia and methanol plants backed by low-cost, state-backed renewable financing and coordinated industrial planning.[26]

China has moved beyond imitation to ecosystem leadership. By April 2025, its core AI industry was valued at nearly $83.45 billion, supported by over 400 specialised firms and more than 1.5 million AI patent applications, around 40% of the global total. Apart from AI, China's dominance extends into energy and industrial technologies.

ASPI's Critical Technology Tracker

Lead country and technology monopoly risk

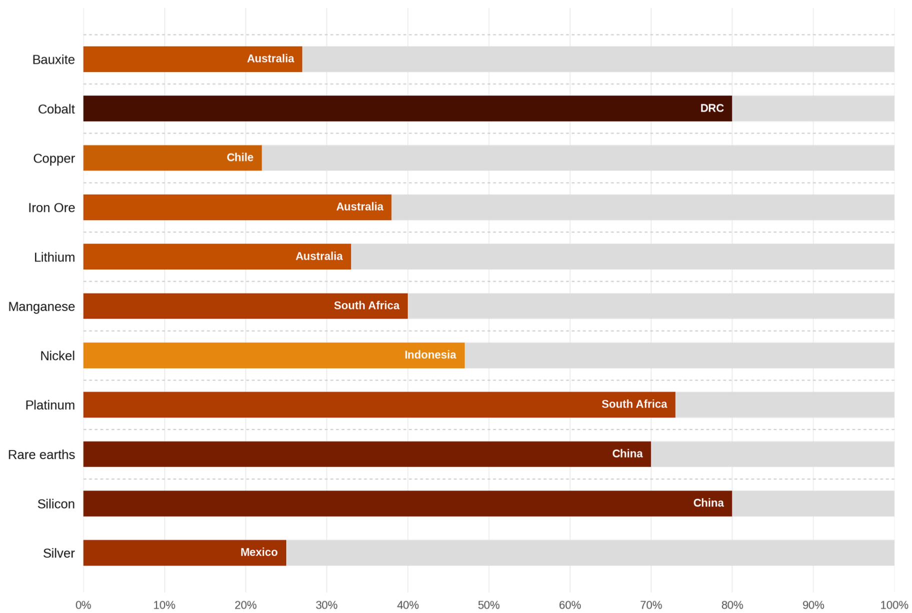
Technology monopoly risk: High Medium Low | **Lead country:** China USA

Technology	Lead country	Technology monopoly risk
Advanced materials and manufacturing		
1. Nanoscale materials and manufacturing	China	high
2. Coatings	China	high
3. Smart materials	China	medium
4. Advanced composite materials	China	medium
5. Novel metamaterials	China	medium
6. High-specification machining processes	China	medium
7. Advanced explosives and energetic materials	China	medium
8. Critical minerals extraction and processing	China	low
9. Advanced magnets and superconductors	China	low
10. Advanced protection	China	low
11. Continuous flow chemical synthesis	China	low
12. Additive manufacturing (incl. 3D printing)	China	low
Artificial intelligence, computing and communications		
13. Advanced radiofrequency communications (incl. 5G and 6G)	China	high
14. Advanced optical communications	China	medium
15. Artificial intelligence (AI) algorithms and hardware accelerators	China	medium
16. Distributed ledgers	China	medium
17. Advanced data analytics	China	medium
18. Machine learning (incl. neural networks and deep learning)	China	low
19. Protective cybersecurity technologies	China	low
20. High performance computing	USA	low
21. Advanced integrated circuit design and fabrication	USA	low
22. Natural language processing (incl. speech and text recognition and analysis)	USA	low
Energy and environment		
23. Hydrogen and ammonia for power	China	high
24. Supercapacitors	China	high
25. Electric batteries	China	high
26. Photovoltaics	China	medium
27. Nuclear waste management and recycling	China	medium
28. Directed energy technologies	China	medium
29. Biofuels	China	low
30. Nuclear energy	China	low
Quantum		
31. Quantum computing	USA	medium
32. Post-quantum cryptography	China	low
33. Quantum communications (incl. quantum key distribution)	China	low
34. Quantum sensors	China	low
Biotechnology, gene technology and vaccines		
35. Synthetic biology	China	high
36. Biological manufacturing	China	medium
37. Vaccines and medical countermeasures	USA	medium
Sensing, timing and navigation		
38. Photonic sensors	China	high
Defence, space, robotics and transportation		
39. Advanced aircraft engines (incl. hypersonics)	China	medium
40. Drones, swarming and collaborative robots	China	medium
41. Small satellites	USA	low
42. Autonomous systems operation technology	China	low
43. Advanced robotics	China	low
44. Space launch systems	USA	low

Source: ASPI's Critical Technology Tracker — The global race for future power[27]

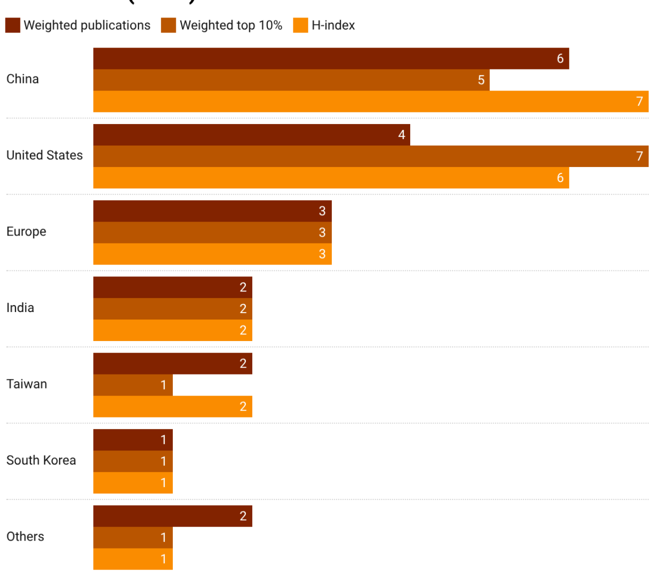
Seven countries dominate mining of critical minerals [28]

Share of global mine production by dominant country



Source: USGS Mineral Commodity Summaries 2024 · Compiled by CSDR

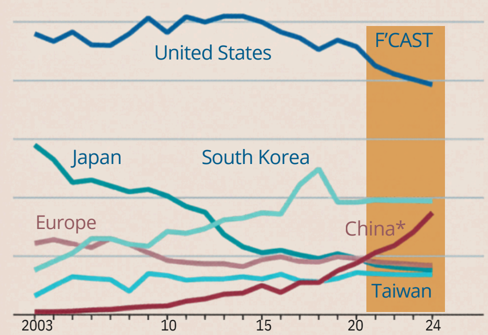
Number of research institutions globally for their volume and quality of publication in advanced IC design and fabrication (2023) [29]



Source: Ezell, Stephen. "How Innovative Is China in Semiconductors?" ITIF, 25 Nov. 2024 • Created with Datawrapper

China rising [30]

Semiconductor sales, global market share, %



Source: Semiconductor Industry Association

*Annual average increase of 30%, 2021-24

China's technological ascent has direct implications for tech sovereignty, increasingly understood as a strategic imperative rather than an economic preference. The concentration of critical minerals processing, manufacturing capacity, and technology diffusion within China exposes vulnerabilities in global supply chains. Robert Atkinson writes that if China leads innovation, then the outcome could be "potentially catastrophic."[31] China will become self-sufficient in advanced industries, which would lessen the value of US trade sanctions, including export controls. China would gain the upper hand by threatening to cut off supplies of essential goods to nations that do not comply with its wishes.

China's technological ascent has direct implications for tech sovereignty, increasingly understood as a strategic imperative rather than an economic preference. The concentration of critical minerals processing, manufacturing capacity, and technology diffusion within China exposes vulnerabilities in global supply chains.

The first China Shock, triggered by Beijing's accession to the WTO in 2001, reshaped global manufacturing through low-cost labor and export-led growth, hollowing out industrial bases across the West. Two decades later, a more consequential transformation is underway. Toys, textiles, or furniture no longer drive China shock 2.0, but by technologically intensive areas such as electric vehicles, lithium-ion batteries, solar panels, semiconductors, and advanced manufacturing equipment.

Unlike the earlier phase, this shock intersects with what scholars describe as the weaponization of interdependence. China's centrality within global production networks enables it to shape market access, pricing, and technological pathways, generating asymmetric dependencies. China dominates 85-90% of the global solar module market, 60% of electric vehicle battery manufacturing, 70% of lithium processing capacity, 70% of the civilian drone market, and 80% of rare-earth element refining.[32] This gives Beijing structural leverage over downstream industries worldwide. China's overwhelming scale further amplifies these dynamics. Its factory output in sectors such as EVs and renewable energy equipment now exceeds that of the US, Germany, Japan, South Korea, and the United Kingdom.[33] China Shock 2.0 thus poses a deeper challenge than its predecessor. It threatens not only employment and industrial competitiveness, but also technological leadership and national security. As competition increasingly centers on semiconductors, AI, clean energy, and dual-use technologies, China's concentration of production capacity heightens vulnerabilities for other states. This has prompted a growing push for de-risking, supply chain diversification, and industrial policy response across the US, Europe, and Asia.

China's Economic Coercion in Practice

According to the Mercator Institute for China Studies, "China engages in 123 cases of economic coercion worldwide between February 2010 and March 2022."[34] India, Japan, and South Korea have also been victims of China's coercive economic measures. In many cases, China weaponized its concentrated control over critical resources for diplomatic spats, treating them as strategic assets rather than commercial goods.

In 2010, Beijing abruptly halted exports of rare earth elements to Tokyo amid a diplomatic dispute over the detention of a Chinese fishing trawler captain. China already dominates global supply, mining about 93% of rare earths and supplying more than 99% of some key elements.[35] Thus, the embargo instantly threatened supply chains for technologies ranging from hybrid-car motors and wind turbine components to solar-panel glass to military systems (guidance motors, rangefinders, sonar, etc.).

The most emblematic case was China's retaliation against South Korea following Seoul's decision to deploy the US-made THAAD missile defence system in 2016. The Lotte Group, which provided land for the THAAD site, bore the brunt of Beijing's response. Chinese authorities imposed regulatory suspensions and inspections on Lotte's retail operations, resulting in massive losses of over $0.86 billion and the eventual exit of its department store business from China by 2018.[36]

Beijing has continued to weaponize economic interdependence through targeted coercion, including restricting the movements of Chinese engineers critical to India's electronics manufacturing, delaying fertilizer exports on which India's agriculture heavily depends, and slowing shipments of rare earths vital to India's EVs and automotive sectors.[37] Simultaneously, China's diplomatic, military, and intelligence backing of Pakistan during the May 2025 India-Pakistan conflict underscores Beijing's reliance on proxy strategies to constrain India. Taken together, these actions show that China views India through a competitive lens, seeking to curb its industrial rise despite diplomatic engagement. For New Delhi, this reinforces the need to diversify supply chains to safeguard strategic autonomy.

Beijing has continued to weaponize economic interdependence through targeted coercion, including restricting the movements of Chinese engineers critical to India's electronics manufacturing, delaying fertilizer exports on which India's agriculture heavily depends, and slowing shipments of rare earths vital to India's EVs and automotive sectors.

U.S. Policy Uncertainty

Under the Biden administration, Washington pursued a strategy of de-risking rather than decoupling, building resilient, trusted supply chains with allies (friend-shoring) and mobilizing massive domestic support for the CHIPS and Science Act.[38] The US proposed a Chip 4 Alliance to institutionalize cooperation among the most indispensable nodes of the global semiconductor ecosystem. In the alliance, the US aimed at bringing advanced chip design and electronic design automation software, Taiwan (led by TSMC) offered advanced logic chip fabrication, South Korea intended to help with memory semiconductors and foundry services, and Japan, with critical upstream inputs such as semiconductor materials, precision manufacturing equipment, and components. By grouping these, Biden sought to reduce strategic vulnerabilities and diversify supply chains away from China.

However, the second Trump administration replaced multilateral de-risking with blunt economic nationalism and aggressive onshoring. Large, tariff-led measures and sudden trade actions have raised the costs and uncertainty of cross-border production, even as Washington continues to emphasize maintaining a domestic high-tech advantage. The result is a mixed signal for partners: on one hand, the US is doubling down on domestic capacity and export controls; on the other, it is using tariffs and unilateral measures that push allies and partners to hedge or diversify away from the US. In April 2025, the White House circulated a chart listing elevated tariff rates for India (26%), Japan (24%), and South Korea (25%), among others.[39] This signaled that even longstanding allies could no longer assume stable economic relations with the United States. Partners began to ponder how to replace the economic guarantees and access to technology that the US was now less likely to provide.

In May 2022, President Biden and Prime Minister Modi launched the US-iCET partnership to deepen high-tech cooperation in semiconductors, AI, quantum, and related areas.[40] Later, under President Trump, the iCET initiative was changed into Transforming Relations Utilising Strategic Technologies (TRUST) in 2025. However, Trump's transactional politics overshadow the foundations of India-US relations. In August 2025, the US administration moved to double tariffs on many Indian imports to 50% in response to New Delhi's purchases of discounted Russian oil.[41]

Trump's transactionalism and unpredictability were also prevalent among the US's traditional allies. With South Korea, Trump sought[42] to reduce the US military presence on Korean soil.[43]

The second Trump administration replaced multilateral de-risking with blunt economic nationalism and aggressive onshoring... The result is a mixed signal for partners: the US is doubling down on domestic capacity and export controls; & using tariffs and unilateral measures that push allies and partners to hedge or diversify away from the US.

In September 2025, South Korea felt 'betrayed' after the US immigration authorities conducted a raid on a Hyundai-LG battery factory in Georgia that "ensnared hundreds of South Korean workers."[44] The authorities detained South Koreans with handcuffs and chains around their ankles. Many South Koreans began to doubt if the US really considered them as an ally. Simultaneously, Japan has expressed disappointment that the US did not support Prime Minister Sanae Takaichi during a row with Beijing over Taiwan. PM Takaichi stated that "Chinese armed intervention against Taiwan would be an 'existential threat' to Japan, which could require a response from Japan's self-defense forces."[45] In response, China acted aggressively on the economic and cultural fronts. Also, Japan felt "less assured when [President Trump] asked PM Takaichi not to "provoke" Beijing."[46]

Both South Korea and Japan were already unhappy with Trump's demand for $350 billion[47] and $550 billion investments, respectively.[48] Both later reached a trade deal with the US, which will reduce tariffs to 15%.

U.S. Regulating Tech

In general, the US has begun to treat advanced technology as a strategic asset instead of a shared resource. Recently, the US policies on tech have shifted from open technology sharing to tighter strategic control. The 2026 semiconductor proclamation[49] framed chips, AI hardware, and semiconductor manufacturing equipment as essential to military strength, critical infrastructure, and industrial reliance, justifying tariffs, supply chain reshoring, and stricter export controls. This also builds on former President Joe Biden's "Framework for Artificial Intelligence Diffusion," which created a tiered system of access. It only provided unrestricted access to close allies such as Japan and South Korea, while countries like India faced security-related limits.[50]

In Japan's and South Korea's cases, the US deployed tariffs as a bargaining instrument to renegotiate the terms of technological and economic cooperation. Elevated tariffs created urgency in Tokyo and Seoul, pushing both to propose investments in the US's critical sectors, after which Washington offered calibrated tariff reductions with controlled technology sharing.

In Japan's and South Korea's cases, the US deployed tariffs as a bargaining instrument to renegotiate the terms of technological and economic cooperation. Elevated tariffs created urgency in Tokyo and Seoul, pushing both to propose investments in the US's critical sectors, after which Washington offered calibrated tariff reductions with controlled technology sharing. The US-Japan Trade deal brought tariffs from 24% to 15% after Japan agreed to invest $550 billion in American industries. Both also signed a cooperation on critical minerals.[51] Similarly, under the 2025 US-ROK trade deal, President Trump agreed to cut American import duties on South Korean products from 25% to 15%, while Seoul committed to invest $350 billion in the American shipbuilding industry. Washington also approved South Korea's pursuit of (conventionally-armed) nuclear-powered submarines (SSNs) and agreed to cooperate on fuel-sourcing pathways.[52]

SECTION III: BRINGING TOGETHER INDIA, JAPAN, AND SOUTH KOREA

Until now, there has been no single, shared, urgent strategic driver or political leadership to push for summit-level institution-building. India's more balanced Indo-Pacific stance and Japan-Korea historical tension create divergent threat perceptions and weak, uneven domestic incentives for trilateral architecture.[53] Also, cooperation on chip, critical minerals, and supply chain largely flowed through US-led or bilateral friend-shoring incentives and ad hoc working groups (such as Chip 4 alliance, Pax Silica, iCET/TRUST initiative, US-India-ROK Trilateral Technology initiative), reducing the immediate institutional case for a separate India-Japan-South Korea framework.[54]

However, the growing risk of China Shock 2.0, combined with Washington's shift from coalition-based friend-shoring to increasingly unilateral onshoring, is eroding the reliability of these arrangements and making regionally anchored, issue-specific Asian minilaterals (technology supply pacts, chip cluster cooperation, critical-minerals partnerships) more attractive.

The proposal of an India-Japan-South Korea trilateral framework reflects a convergence of strategic interests among three major Indo-Pacific stakeholders navigating an increasingly volatile regional order. As middle powers with deep economic integration and growing security responsibilities, all three face heightened vulnerabilities arising from geopolitical competition, supply chain disruptions, and coercive economic practices.

A key enabling factor is the recalibration of Japan-South Korea relations, especially under President Yoon Suk-yeol (now impeached). Under Yoon, Seoul's "future-oriented" approach, including resolving the forced labor dispute and resuming high-level dialogues, unlocked space for functional cooperation on economic security, technology protection, and regional deterrence. The lifting of Japan's export controls on critical semiconductor materials and the revival of shuttle diplomacy directly strengthened trilateral potential, particularly in managing supply chain resilience and sensitive technologies, where Japan and South Korea lead.[55] The urgency to engage with Japan was also reflected in the new Lee administration. In 2025, the newly inaugurated South Korean president, Lee Jae Myung, prioritized visiting Japan over the United States.[56]

Although geographically isolated from both Japan and South Korea, India's role in the trilateral would be complementary. India's Look East Policy, initiated in 1992, was designed to deepen engagement with Southeast Asia by boosting trade, investment, and economic cooperation. In the post-liberation phase, this catalyzed into deeper engagement with key East Asian economies, particularly Japan and South Korea, laying the groundwork for today's Special Strategic Partnerships.[57] South Korea's Indo-Pacific Strategy identifies India as a leading regional partner,[58] while Japan views India as indispensable to its Free and Open Indo-Pacific vision. India brings scale, market depth, maritime reach, and growing technological capabilities, especially in IT, space, and advanced manufacturing. Bilateral mechanisms such as the India-ROK Special Strategic Partnership, the India-Japan Special Strategic and Global Partnership, CEPA frameworks, and sectoral dialogues on defense, infrastructure, and supply chains provide a strong institutional base for layering trilateral cooperation.

The idea of trilateral cooperation among India, Japan, and South Korea emerged in 2012, when think tanks from the three countries convened a trilateral dialogue in New Delhi, involving IDSA, KNDA, and the Tokyo Foundation.[59] Through Track 2, the dialogue reflected growing convergence in strategic outlooks, particularly on maritime security, regional order, and China's rising influence. It also underscored that early recognition of overlapping bilateral ties could be leveraged to form a minilateral format without formal alliances. Almost a decade later, External Affairs Minister S. Jaishankar's back-to-back visits to Seoul and Tokyo in 2024 highlighted India's intent to align its Indo-Pacific partnerships more closely.[60] Now, amid growing uncertainty and the risk of economic coercion, a trilateral technology partnership is more essential than ever.

The idea of trilateral cooperation among India, Japan, and South Korea emerged in 2012, when think tanks from the three countries convened a trilateral dialogue in New Delhi, involving IDSA, KNDA, and the Tokyo Foundation.[59] Through Track 2, the dialogue reflected growing convergence in strategic outlooks, particularly on maritime security, regional order, and China's rising influence.

The following table shows a focused bilateral push with both Japan and South Korea across semiconductors, AI/digital, displays, defense R&D, and wider S&T cooperation.

India's tech agreements with Japan and South Korea

Partner	Agreement / Initiative	Year	Area(s)	Purpose
Japan	**India–Japan Semiconductor** Supply Chain Partnership (MoC between MeitY and METI)	2023	Semiconductor / supply-chain resilience	Deepen cooperation on semiconductor supply chains, boost investment, joint R&D, talent/skilling and industrial linkages.
Japan	**Japan–India Digital Partnership** 2.0 & Japan–India AI Cooperation Initiative (Launched at leaders' summit)	2025	Digital tech, AI, startups, talent exchange	Elevates digital ties; promotes joint R&D in AI, talent exchange, startup linkages and corporate partnerships.
Japan	**Corporate / industry pacts** (Renesas–IIT Hyderabad; Tokyo Electron–TATA Electronics) Toyota Tsusho – Indian Rare Earths Limited (IREL)	2024–25 2012	VLSI, semiconductor equipment, manufacturing Rare Earth Elements	Industry MoUs for VLSI research, equipment/automation and semiconductor ecosystem building in India. Processes Indian rare oxides and purifies them for export to Japan.
Japan	**Japan–India Maritime /** Shipbuilding Cooperation & private deals (Mitsui OSK, maritime fund, investment pledges)	2025	Shipbuilding, maritime tech, maritime financing	Japan private investment pledges; discussions on shipbuilding collaboration and maritime financing to scale India's ambitions.
South Korea	**India–ROK Bilateral Science &** Innovation / Tech Cooperation MoUs	2018	AI, IoT, biotech, semiconductors, defence R&D	Series of government and research MoUs linking CSIR/IITs and Korean research bodies.
South Korea	**IESA – KDIA (Korea Display** Industry Association) MoU	2023	Display, semiconductors, R&D, skills	Industry-to-industry MoU to share know-how on display technologies, R&D, standards, skilling and business linkages.
South Korea	**Vedanta – multiple Korean** display firms MoUs (~20 Korean display glass companies)	2023	Display manufacturing / electronics hubs	Vedanta signed MoUs with ~20 Korean display glass companies to develop an electronics/display manufacturing hub in India.
South Korea	**Cochin Shipyard (CSL) – HD** KSOE MoU BEML – HD KSOE & HD Hyundai Samho Heavy Industries (HSHI) MoUs	2025	Shipbuilding technology transfer, joint projects, workforce upskilling	Long-term strategic cooperation for joint newbuilds, technology sharing, capacity-building and upskilling.

Framing a Trilateral Framework

The strongest glue for the framework is the alignment of the three nations' interests: India needs technology and capital, while Japan and South Korea need markets, manufacturing bases, and human resources. The India-Japan-Korea trilateral represents a form of "cooperative balancing," securing against geopolitical uncertainties.[61] Unlike military alliances such as NATO, cooperative balancing focuses on economic insulation, norm-setting, and institutional thickness.

Economic insulation reduces exposure to Chinese economic coercion by building alternative supply chains for critical technologies and resources.[62] Norm setting establishes transparent standards for digital governance, infrastructure financing, and green energy to counter the opaque practices associated with the BRI.[63] Lastly, institutional thickness provides layers of diplomatic engagement that make the regional order more resilient to shocks, such as a US withdrawal or a Chinese blockade.[64]

India-Japan-Korea trilateral cooperation can be organized around four pillars: Semiconductor Value Chain, Critical Minerals, Clean Energy, and Shipbuilding.

Pillar I: Managing the Semiconductors, AI, and Cybersecurity Value Chain

Japan and South Korea represent two distinct yet complementary models within the global semiconductor ecosystem. Japan, once the world's leading semiconductor power in the 1980s, has since ceded dominance in chip fabrication but retains an unrivalled position in upstream segments such as semiconductor equipment, materials, and precision manufacturing.[65] Its near-monopoly in critical inputs, including photoresists, silicon wafers, EUV-related equipment, and advanced materials, makes Japan indispensable to the global chip supply chain.

South Korea, by contrast, has emerged as a manufacturing heavyweight, particularly in memory semiconductors, where it dominates global DRAM and NAND markets, and plays a significant role in advanced front-end fabrication and foundry services. While Japan anchors the supply chain through materials and tools, South Korea drives scale and production, especially in memory and logic manufacturing, making the two economically structurally interdependent rather than competitive.[66]

India enters this landscape from a fundamentally different position. Unlike Japan and South Korea, which are technologically mature but demographically constrained, India is still in the early stages of building semiconductor manufacturing capacity. Although India is not yet a major node in global semiconductor value chains, its large and growing working-age population offers a critical comparative advantage at a time when Japan and South Korea face acute labor shortages due to ageing societies and declining fertility rates.[67] This asymmetry creates a strong rationale for trilateral cooperation, in which Japan's materials and equipment expertise and South Korea's manufacturing capabilities can be complemented by India's labor pool, market scale, and emerging ambitions in fabrication.

Unlike Japan and South Korea, which are technologically mature but demographically constrained, India is still in the early stages of building semiconductor manufacturing capacity. Although India is not yet a major node in global semiconductor value chains, its large and growing working-age population offers a critical comparative advantage.

***Mapping the Complementarities*[68]**

UPSTREAM — Japan

Core Strength

Materials & Equipment

Japan produces ~90% of fluorinated polyamide, ~90% of photoresists, and ~70% of etching gas worldwide.

Key Companies

Tokyo Electron · Shin-Etsu · JSR

Government Push

- **METI Semiconductor Revitalisation Strategy**
  Industrial policy to restore domestic chip manufacturing through subsidies, R&D support, and supply-chain resilience.
- **Large-scale fab subsidies (incl. TSMC project)**
  Direct government funding to attract and expand advanced semiconductor manufacturing in Japan.
- **Targeted production & R&D grants**
  Support for materials, equipment makers and next-generation semiconductor research.

Role in Trilateral

Supplying the critical machinery and chemicals required for fabrication.

→ Materials & Equipment

MIDSTREAM — South Korea

Core Strength

Memory Manufacturing

South Korea dominates the production of DRAM and NAND memory chips, holding a global market share of over 60%.

Key Companies

Samsung Electronics · SK Hynix

Government Push

- **K-Semiconductor (K-Chips) Strategy**
  National strategy to build a global semiconductor cluster with public funding and incentives.
- **Enhanced tax credits & investment incentives**
  Higher tax breaks to accelerate domestic chip manufacturing and R&D.
- **Large fiscal support packages**
  State-backed funding to sustain memory, logic leadership, and ecosystem resilience.
- **Cluster facilitation & regulatory easing**
  Measures to smooth permitting and develop semiconductor industrial zones.

Role in Trilateral

Mass production of memory chips and advanced logic fabrication know-how.

→ Manufacturing Capability

DOWNSTREAM — India

Core Strength

Design & Assembly

Home to nearly 20% of the world's chip design engineers. Emerging hub for Assembly, Testing, Marking, and Packaging (ATMP).

Key Companies

Tata Electronics · HCL Technologies

Government Push

- **India Semiconductor Mission (ISM)**
  Central framework providing fiscal support for fabs, OSAT/ATMP, display and design ecosystem.
- **Semiconductor PLI & capital support schemes**
  Investment-linked incentives to attract fabrication, packaging, and upstream component manufacturing.
- **Semiconductor cluster development**
  Dedicated clusters such as Gujarat's Dholera/Sanand hubs and Assam's OSAT/ATMP cluster with land, utilities and single-window clearances.
- **Electronics & component ecosystem incentives**
  Complementary PLIs to strengthen PCBs and other electronics components.

Role in Trilateral

Providing human capital and a scalable manufacturing base.

Trilateral Complementarity:
Japan's materials & equipment expertise + South Korea's memory manufacturing scale + India's design talent & scalable assembly base = A resilient trilateral semiconductor value chain

Source: METI; ISM; K-Chips Strategy; Ezell, ITIF (2024) · CSDR (2025)

Securing Digital Infrastructure with AI & Cybersecurity

India, South Korea, and Japan represent three complementary nodes in AI and cybersecurity resilience. India commands a talent pool of 1.2 billion internet users, 200,000+ AI-literate professionals, and $110 million USD (approx.) in national AI investment.[69] However, India lacks advanced semiconductor infrastructure and post-quantum cryptography capabilities.[70] Japan provides ethical AI governance frameworks (the Hiroshima AI Process),[71] systems integration expertise, and research in quantum-resistant cryptography. But Japan suffers from severe workforce shortages and a cultural reluctance to the rapid adoption of security technology. South Korea is a semiconductor powerhouse with the third-largest number of global AI patents[72] and $2.76 billion in private AI investment.[73] Yet it faces institutional gaps, such as the AI Basic Act, which excludes national defense, leading to regulatory fragmentation.[74]

Threat Landscape

The Indo-Pacific faces synchronized AI-amplified cyber threats. North Korean state-sponsored actors (APT45)[75] conduct 1.3 million cyberattacks daily in South Korea alone,[76] increasingly using AI for automated reconnaissance, deepfake-enabled infiltration, and polymorphic malware. In 2019, a North Korean hacker group hacked India's Kundakulam nuclear power plant.[77] In 2024, North Korean hackers stole $308 million in cryptocurrency from DMM Bitcoin, a Japan-based cryptocurrency exchange. The company, unable to recover from the hack, ceased operation in December 2024.[78] In 2025, North Korea stole $2 billion in cryptocurrency to fund nuclear weapons programs.[79] Also, during the May 2025 conflict between India and Pakistan, Pakistan-linked state actors deployed 1.5 million cyberattacks on India with 150 successful breaches targeting defense personnel via Crimson RAT malware.[80]

AI and Cybersecurity Comparison among India, Japan, and South Korea

	India	Japan	South Korea
AI Policy	National Strategy for Artificial Intelligence (NITI Aayog)	National AI Plan (Ministry of Economy, Trade and Industry)	AI Basic Act (Ministry of Science and ICT)
AI Strengths	Large talent pool, software, startups, global IT services	Industrial AI, robotics, R&D	Corporate AI, semiconductors
AI Ecosystem	Growing startups and global IT services (TCS, Wipro, HCL Tech)	Startups and firms (Fujitsu, NEC, SoftBank)	Innovation led by big firms (Samsung, Naver, LG)
Challenges	Less domestic compute and hardware	Slower scale-up, high costs	Concentration in large companies
Cybersecurity Standing	ITU GCI Tier 1 (top tier)	ITU GCI Tier 1	ITU GCI Tier 1
Cyber Institutions	Indian Computer Emergency Response Team (CERT-In)	National Center of Incident Readiness and Strategy for Cybersecurity (NISC)	Korea Internet & Security Agency (KISA)
Overall Profile	Software-led AI Power	Industry-led AI Power	Hardware and corporate AI Power

Pillar II: Looking for Critical Minerals

India, Japan, and South Korea, or "The Buyers Club," depend on other countries for their critical minerals needs.

South Korea is the world's leading producer of EV batteries. It is existentially dependent on imported lithium and precursors, heavily sourced from Chinese refineries. China provides "96.6% of Korea's precursor cathode materials, 93.7% of its synthetic graphite, and 80.4% of its lithium hydroxide."[81] South Korea's critical minerals strategy is explicitly geared toward securing a stable feedstock for its high-tech industries. Seoul has prioritized 33 critical minerals,[82] flagging 10 as strategic for sectors such as EVs and batteries, set a target to cut import dependence to 50% by 2030, and is expanding physical stockpiles alongside an eight-day rapid-response distribution system to blunt supply shocks.[83] The state combines demand-side measures (public loans, insurance, tax benefits, and other financial support for private overseas mining ventures) with supply-side innovation in substitute materials, recycling and reuse, and institutional backing for domestic processing. This reflects South Korea's structural constraint of limited domestic resources, which Seoul emphasizes by emphasizing import risk mitigation.

Following China's 2010 rare-earth embargo, Japan pioneered diversification strategies through JOGMEC (Japan Organization for Metals and Energy Security), but it remains vulnerable in midstream processing.[84] Japan's critical minerals strategy is shaped by past supply shocks and thus emphasizes resilience through diversification, domestic capacity building, and international partnerships. Institutional measures center on empowering JOGMEC to invest directly in overseas mines and offtake arrangements, building strategic stockpiles, and using public-private financial tools to help Japanese firms acquire upstream assets. Domestically, Tokyo is accelerating the development of recycling and substitution technologies, promoting processing and separation capabilities, and exploring seabed and other non-traditional resources.[85] Japan seeks to reduce concentration risk while retaining openness to trusted partners.

Comparison of Korea and Japan's Import Dependence by Critical Mineral Resources (2023)[87]

Mineral Resource	South Korea				Japan			
	Largest Import Partner	WGI (2022)[1]	Import Dep. Rate (%)[2]	Import Amount (1,000 tons)	Largest Import Partner	WGI (2022)[1]	Import Dep. Rate (%)[2]	Import Amount (1,000 tons)
Natural graphite	China	-0.44	98.7	49.4	China	-0.44	91.2	48.9
Cobalt	Congo (DRC)	-1.98	31.9	12.4	Finland	0.89	34.1	6.5
Lithium	China	-0.44	54.9	29.3	China	-0.44	59.7	9.5
Manganese	South Africa	-0.72	39.6	335.1	South Africa	-0.72	39.5	485.4
Nickel	New Caledonia	NA	36.4	150.9	Philippines	-0.71	29.0	250.2
Rare earths	China	-0.44	62.1	2.6	China	-0.44	69.9	16.4

[1] WGI: World Governance Index — political stability indicator of supplier country
[2] Import dependence rate: share of total consumption met by imports

India's National Critical Mineral Mission (NCMM) sets out a comprehensive, supply-security-oriented strategy that links intensified domestic exploration, overseas asset acquisition, value-chain development, and circularity. Key pillars include 1,200 GSI exploration projects between 2024-25 and 2030-32; facilitation of roughly 26 PSU and 24 private foreign mining ventures; the creation of mineral processing parks and three Centres of Excellence; and explicit targets for recycling, patenting, and skilling.[88] NCMM is pragmatic and forward-looking, attempting to convert India's geological limitations into strategic gains through upstream deals, downstream processing capacity, and recycling.

India's reliance on other countries for Critical Minerals (2020)[89]

Critical Mineral	Import Dependence (%)	Major Import Sources (2020)
Lithium	100%	Chile, Russia, China, Ireland, Belgium
Cobalt	100%	China, Belgium, Netherlands, US, Japan
Nickel	100%	Sweden, China, Indonesia, Japan, Philippines
Niobium	100%	Kuwait, Germany, South Africa, Brazil, Thailand
Niobium (ferro)	100%	Brazil, Australia, Canada, South Africa, Indonesia
Germanium	100%	China, South Africa, Australia, France, US
Rhenium	100%	Russia, UK, Netherlands, South Africa, China
Beryllium	100%	Russia, UK, Netherlands, South Africa, China
Tantalum	100%	Australia, Indonesia, South Africa, Malaysia, US
Strontium	100%	China, US, Russia, Estonia, Slovenia
Zirconium (Zircon)	80%	Australia, Indonesia, South Africa, Malaysia, US
Graphite (natural)	60%	China, Madagascar, Mozambique, Vietnam, Tanzania
Manganese	50%	South Africa, Gabon, Australia, Brazil, China
Chromium	2.5%	South Africa, Mozambique, Oman, Switzerland, Turkey
Silicon	<1%	China, Malaysia, Norway, Bhutan, Netherlands

India has also identified 30 critical minerals and established KABIL (Khanij Bidesh India Ltd)[90] to acquire overseas assets. KABIL is seeking to collaborate with overseas partners to achieve shared goals in critical minerals market security.[91]

Critical Minerals on India, Japan,[92] and Korea's Lists (As of June 2025)[93]

Mineral	India	Japan	South Korea
Aluminium			✓
Antimony	✓	✓	✓
Beryllium	✓	✓	
Bismuth	✓	✓	✓
Cadmium	✓		
Chromium			✓
Cobalt	✓	✓	✓
Copper	✓	✓	✓
Gallium	✓	✓	✓
Germanium	✓	✓	
Graphite	✓	✓	✓
Hafnium	✓	✓	
Indium	✓	✓	✓
Lead			✓
Lithium	✓	✓	✓
Magnesium			✓
Manganese			✓
Molybdenum	✓	✓	✓
Nickel	✓	✓	✓
Niobium	✓	✓	✓
Phosphorous	✓	✓	
Platinum Group Elements (PGE)	✓	✓	✓
Potash	✓		
Rare Earth Elements (REE)	✓	✓	✓
Rhenium	✓	✓	
Selenium	✓		✓
Silicon	✓	✓	✓
Strontium	✓	✓	✓
Tantalum	✓	✓	✓
Tellurium	✓		
Tin	✓	✓	✓
Titanium	✓	✓	✓
Tungsten	✓	✓	✓
Uranium		✓	
Vanadium	✓	✓	✓
Zinc			✓
Zirconium	✓	✓	✓

Pillar III: Powering Economy with Clean Energy

Clean energy strengthens both energy and economic security by reducing dependence on imported fuels, stabilizing long-term energy costs, decentralizing supply, and creating domestic jobs and industries. Producing power from domestic solar, wind, hydro, and biomass reduces exposure to volatile global fuel markets (e.g., the 2022 Energy crisis due to the Russia-Ukraine War)[94] and geopolitical supply shocks, making the national energy system less vulnerable to international crises.[95]

Because solar and wind have very low operating costs once built, they help lock in predictable power prices and reduce price shocks for households and industry compared with fossil fuels.[96] Batteries, pumped hydro, and green hydrogen add storage and flexibility to intermittent renewables, enabling them to reliably meet demand over hours, days, or seasons, further strengthening supply resilience.[97]

Economically, the renewables transition creates manufacturing, construction, operations, and maintenance jobs and builds local supply chains for panels, turbines, batteries, and electrolysers, keeping investment and wages inside the country while opening new export opportunities in green technologies and fuels.[98]

India's large solar and wind resource base, along with its National Green Hydrogen Mission, provides a practical route to improve energy security by replacing imported fuels with domestically produced clean electricity and hydrogen.[99] Japan's limited domestic fossil resources make energy security a central concern. Scaling offshore wind, improving grid flexibility, and using hydrogen and ammonia as low-carbon fuels are core parts of Japan's Green Growth Strategy and recent hydrogen policies.[100] South Korea's industrial structure makes cheap, reliable power and low-carbon feedstocks essential for competitiveness. The national hydrogen roadmap and recent energy plans focus on expanding renewables, offshore wind, storage, and hydrogen to reduce reliance on fuel imports, support the decarbonization of heavy industry, and foster new domestic supply chains for electrolysers and batteries.[101]

Clean Energy Comparison: India, Japan, and South Korea

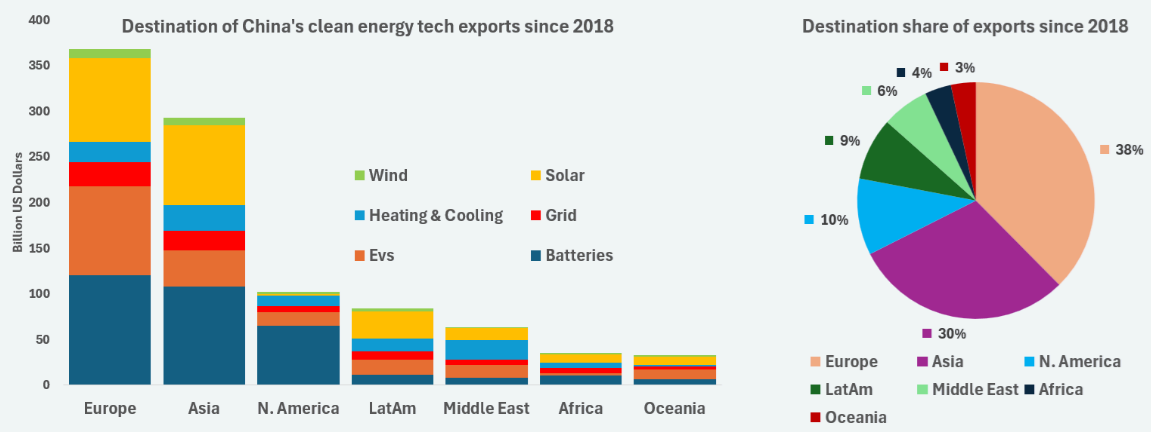
Metric	India	Japan	South Korea
Net-zero target	2070 (announced 2021)	2050 (announced 2020)	2050 (announced 2020)
Installed renewable capacity	~204 GW excl. large hydro (2025); ~44.5 GW added in 2025	~158 GW (2025 base for renewables market)	~10.5% of electricity from renewables (2024); low absolute capacity vs peers
Solar (approx.)	132.85 GW (Nov 2025); 3rd globally in solar generation	~91 GW (2024)	35.1 GW (2025); focus on offshore wind planned
Wind (onshore + offshore)	~50 GW (wind portion of renewables)	5.84 GW (2024); expanding	4 GW (Dec 2025); offshore wind expansion planned
Green Hydrogen target	5 MMT per annum by 2030	3 million tonnes annually by 2030	3.9 MTPA
Hydrogen R&D / Policy	National Green Hydrogen Mission	Basic Hydrogen Strategy	Korea Hydrogen Economy Roadmap
EV Market	Rapid two-wheeler electrification; passenger EVs still small but rising	Passenger EV uptake accelerating; growing hybrid fleet	High EV adoption among new car sales; strong domestic EV supply chain
Grid Integration	Major challenge: uneven T&D, DISCOM financial stress, distribution losses	Highly reliable grid; ageing assets but strong investment in smart grid and storage	Modern grid; heavy centralised generation mix creates integration challenges for variable renewables
Heating & Cooling	Cooling demand rising fast; clean-heat focus on green hydrogen, electrification and heat pumps still early	High cooling penetration; policy attention to heat-pump rollout and industrial heat decarbonisation	Increasing cooling demand; growing interest in electrified heat and hydrogen for industry
Clean Energy Focus Areas	Solar PV expansion, wind, green hydrogen mission, battery storage support	Offshore wind growth, solar PV deployment, hydrogen strategy & GX (green transformation)	Renewable share increase, phasing out coal, expanding offshore wind, nuclear backup

Metric	India	Japan	South Korea
Industrial Strengths	Very large market and labour pool; fast-growing solar manufacturing; growing green-H2 policy & PLI	World leading in upstream equipment and materials (photoresists, wafer tech, precision equipment); strong advanced materials R&D	World leader in batteries & cell manufacturing; strong shipbuilding (offshore wind platforms); large electronics industry
Role in Clean Supply Chains	Demand market + future H2 exporter	Supplier of advanced materials, equipment, R&D	Battery & hydrogen tech partner; shipping/logistics integration
Strategic Cooperation Examples	India–Japan hydrogen R&D; India–Korea green hydrogen talks	Japan–India JCM & hydrogen agreements	Korea–India hydrogen industrial partnerships; KPI Green Hydrogen with Jeonbuk Province

Clean energy is inseparable from industrial competitiveness, trade balances, and supply chain power. As shown below, China's dominance in clean energy manufacturing has resulted in nearly USD 1 trillion in exports since 2018, spanning batteries, solar components, EVs, wind systems, grid equipment, and heating and cooling technologies. Batteries have emerged as the single largest export category, followed by solar components and EVs, underscoring China's central role across the clean-tech value chain rather than in power generation alone.

China's clean energy exports by destination since 2018

Europe has been the top market for China's clean tech exports, followed by Asia and North America



Source: Ember

Pillar IV: Sailing the Shipbuilding Industry

India's shipbuilding ambitions are now anchored in both domestic cluster-building and strategic engagement with powerhouse partners such as Japan and South Korea. Under Maritime Vision 2030 and Amrit Kaal Maritime Vision 2047, New Delhi aims to boost indigenous shipbuilding capacity and increase India's share in global ship output, with targets to enter the top 10 by 2030 and top 5 by 2047. The central government has announced a comprehensive support framework, including the Maritime Development Fund, totalling $9 billion. Coastal states are also active, with clusters planned across Maharashtra, Andhra Pradesh, Gujarat, Odisha, Kerala, and others.[102]

However, India's shipbuilding sector trails global leaders by a wide margin. China overtook Japan in ship output by 2008 and South Korea by 2010, realizing expansion goals years ahead of schedule and steadily capturing the largest share of global orders and deliveries.[103]

To accelerate this transformation, India has pursued bilateral industrial partnerships with Japan and South Korea. In 2024-25, Cochin Shipyard Ltd (CSL) signed a strategic MoU with South Korea's HD Korea Shipbuilding & Offshore Engineering (KSOR) to share technical expertise, workforce skilling, and jointly pursue shipbuilding and repair projects.[104] Japanese firms are also exploring ties, with Mitsui O.S.K. Lines (MOL) and others examining investments and joint ventures in Indian yards, aligning with India's broader infrastructure push.[105]

These partnerships make economic and strategic sense for all parties. India benefits from technology transfer, quality standards, and foreign investment that help its coastal clusters become globally competitive. Japan and South Korea secure new markets and production bases, helping diversify their industrial footprints.

Largest Shipbuilding Countries in the World (2024)

Rank	Country	Gross Tonnage (GT)	Global Share (%)
1	**China**	39,118,358	55.1%
2	**South Korea**	20,090,872	28.3%
3	**Japan**	9,002,442	12.7%
4	Vietnam	720,884	1.0%
5	Philippines	668,207	0.9%
6	Italy	455,590	0.6%
7	France	289,196	0.4%
8	Germany	189,970	0.3%
9	Finland	162,177	0.2%
10	Singapore	160,460	0.2%
11	Netherlands	142,935	0.2%
12	Indonesia	99,345	0.1%
13	Russia	97,695	0.1%
14	Türkiye	83,437	0.1%
15	Spain	64,327	0.1%

■ China, South Korea and Japan together account for ~96% of global shipbuilding output.

Shipbuilding Clusters planned in India

Indian State	Shipbuilding Clusters (Expected)	Initiatives
Maharashtra	Vijaydurg (Sindhudurg) — 1,371 acres; Nandgaon (Palghar) — 2,666 acres; Dighi (Raigad) — 2,550 acres (identified in first phase)	Shipbuilding, Ship Repair & Ship Recycling Policy 2025: 15% capital subsidy, INR 25 cr for R&D, INR 1 cr for skill development, 30-year renewable land lease
Andhra Pradesh	Dugarajapatnam — 2,000 acres (1,000 for shipbuilding, 1,000 for downstream industries); Machilipatnam (500 acres) and Bhavanapadu (300 acres) as potential locations	Andhra Maritime Policy 2024: holistic shipyard and cluster development; Special Purpose Vehicle to attract investment in shipbuilding
Kerala	Cherthala (Alapuzha District) — 15 acres	Setting up testing facility; short-term courses for engineers and financiers
Odisha	Exploring Ship Recycling Hub near Paradip Port	—
Gujarat	Shipbuilding yards expected at Hazira, Kutch, Amreli, and Bhavnagar	Gujarat Maritime Policy (pending approval): interest subsidies, tax exemption, wave land lease, promote internal design and R&D

Shipbuilding Tech Comparison (2025)

Technology / Capability	India	Japan	South Korea
Global Shipbuilding Rank (output)	16th	3rd	2nd
Share of global ship output	<1%	~15%	~20%
Core Technological Strength	Hull fabrication, basic commercial vessels, naval ships	Precision engineering, fuel-efficient designs, automation	High-end complex vessels, scale manufacturing
High-end vessels (LNG, VLCC, FPSO)	Limited (mostly repair and defence)	Strong in LNG design and fuel efficiency	Leader in LNG carriers, FPSOs
LNG Carrier Tech	Nascent	Advanced, Efficient	World Leader
Ship automation & smart yards	Low–medium	High (robotics, digital, etc.)	Advanced (developing AI-assisted yards)
Green ship tech (methanol and ammonia)	Pilot Stage	Advanced R&D	Commercial-scale
Naval & Defence Shipbuilding	Strong (indigenous focus)	Moderate	Moderate
Ship repair and MRO	Growing (CSL, L&T, etc.)	High-quality	Strong but secondary to new-builds
Labour Cost Advantage	High	Low	Medium
Key Companies	Cochin Shipyard, Mazagon Dock, L&T	Mitsubishi Heavy, Imabari, JMUC	HD KSOE, Samsung HI, Hanwha Ocean
Current Challenges	Scale, technology, quality	Ageing workforce, labour cost	Competition from China

SECTION IV: CHALLENGES AND POLICY RECOMMENDATIONS

Key Challenges

Several constraints shape the design of trilateral cooperation, including political, institutional, and capacity-related issues.

Political challenges include membership size, agenda trade-offs, changes in domestic politics, and historical mistrust. While minilaterals often facilitate trust-building, challenges arise when members face commitment issues. For example, past efforts, such as the first Quad (US-Japan-India-Australia), lost momentum in 2007 due to changes in political leadership.[106] As changes in government or priorities can derail progress, institutional backing and long-term frameworks are required to maintain consistency. Furthermore, historical issues between Japan and South Korea (trade disputes, comfort women, colonial trauma) have long strained their relations, complicating confidence-building needed for trilateral cooperation.[107] Lastly, Seoul often hedges between China and the US, which may occasionally change the scope and clarity of its engagement in trilateral settings.[108]

Operationally, the flexible and informal nature of minilaterals may serve as both an advantage and a limitation. While minilaterals involve issue-based cooperation, the absence of formal institutional structures may impact continuity and coordination.[109] Moreover, the disconnect between academia and bureaucracy complicates operationalization. Policy is often shaped by bureaucrats rather than academic networks. The lack of institutional academic teams (joint research cells or think tanks embedded within governments) weakens continuity and technical depth.[110]

Divergences in strategic priorities and threat perception may further erode cooperation. Without clearly defined goals and objectives, trilateral cooperation may become reactive, convening only when prompted by crises. Also, Tokyo and New Delhi may prioritize balancing China, whereas Seoul's economic ties to Beijing can temper its public stance, leading to misalignment in threat priorities.[111]

Finally, differences in industrial capacity, resource availability, and coordination may affect the pace of implementation.[112] Participation in multiple regional and functional groupings, such as QUAD, BIMSTEC, and IPEF, can stretch diplomatic bandwidth.[113]

Sector-Specific Challenges

Sector	India	Japan	South Korea
Semiconductor	Strong talent pool but inadequate physical infrastructure for fabs. IP protection concerns.	Advanced manufacturing but acute labour shortages due to ageing population. Heavy fiscal burden of subsidies.	Severe skilled-labour shortages despite global leadership. Projected shortfall of ~50,000 semiconductor workers by early 2030s.
Critical Minerals	High import dependence for lithium, cobalt, REEs. Weak domestic extraction due to regulatory rigidity and limited private participation. Underdeveloped processing and recycling capacity.	Strong diversification strategy through JOGMEC, but limited domestic resources and continued reliance on overseas assets. India–Japan cooperation heavy on MoUs, light on co-financed mines.	Near-total import dependence, heavy reliance on China. Domestic stockpiling insufficient.
AI & Cybersecurity	Rapid digitalisation but fragmented AI governance and rising cyber vulnerabilities.	Preference for voluntary AI governance leads to ambiguity in enforcement; cautious adoption of binding AI rules.	AI Basic Act introduces strict compliance for high-risk AI, raising costs for collaboration.
Shipbuilding	Less than 1% share of global shipbuilding; high capital costs, import-dependent inputs, low productivity.	Loss of competitiveness to China; high labour costs, limited land base and ageing workforce affect scaling. Strong tech base but shrinking market share.	Technologically advanced but squeezed by China's price competitiveness and rising domestic costs. Labour shortages persist.
Clean Energy	Rapid renewable capacity growth but chronic grid congestion and curtailment. PLI schemes favour assembly over upstream value addition. EV adoption needs massive charging and battery supply growth.	Slow renewable deployment due to grid constraints, utility dominance, and weak enforcement of targets. High solar curtailment in Kyushu.	Capacity expansion outpaces grid upgrades; regulatory bottlenecks and KEPCO's financial stress delay transmission. Offshore wind faces local resistance.

To move from dialogue to delivery, the trilateral can consider the following points:

Phase	Area	Recommendations	Key Stakeholders
SHORT TERM (0-2 years) Building Trust	**Political & Institutional**	· Establish Trilateral Track Task Force with diplomats, sectoral bureaucrats and scholars, structured around priority tech sectors. · Mandate think tanks and research institutions to draft sectoral frameworks before formal government negotiations. · Begin with non-sensitive, economically relevant sectors (semiconductors, rare earths, clean energy, digital economy) to avoid hesitation related to China.	MEAs, METI, MOTIE, Ministry of Mines (India), leading think tanks, industry associations

Phase	Area	Recommendations	Key Stakeholders
	Critical Minerals	· Launch a Trilateral Mineral Stockpiling Dialogue for lithium, nickel, rare earths, gallium and graphite, aligning stockpile thresholds and transparency norms. · Develop India–Japan–Korea feasibility studies for mineral processing and recycling in India. · Align KABIL/IREL (India), JOGMEC (Japan), and KOMIR (Korea) on shared projects.	KABIL, IREL, JOGMEC, KOMIR
	Semiconductors	· Fast-track visas, joint certification and short-term placement of Indian engineers in Japanese and Korean fabs. · Define Trusted IP corridors with clear safeguards to reduce risk aversion among Japanese and Korean corporations.	METI, MeitY, ISM, fab industry
	Clean Energy & Shipbuilding	· Pilot green shipbuilding cooperation for LNG, hydrogen carriers and offshore wind vessels, pairing Indian yards with Japanese design and Korean systems integration. · Coordinate grid modernisation dialogues, focusing on storage, transmission and standards alignment.	JBIC, KEXIM, CSL, port authorities
MEDIUM TERM (3-5 years) Institutionalise & Scale	**Political & Institutional**	· Formalise a Trilateral Working Group Secretariat with rotating leadership to mitigate leadership change risks. · Develop sector-specific roadmaps with milestones, financing plans and delivery benchmarks.	PM offices, foreign ministries
	Critical Minerals	· Launch co-financed mining and processing hubs in India and third countries (Africa, Australia, Southeast Asia) supported by export credit and insurance. · Expand urban mining and recycling clusters in India for EV batteries and e-waste using Japanese and Korean technologies.	JBIC, KEXIM, KABIL, JOGMEC
	Semiconductors	· Establish joint design–fabrication–assembly ecosystems, leveraging India's design talent and Japan–Korea fabrication expertise. · Anchor fabs near industrial clusters with guaranteed water, power and logistics support.	ISM, METI, K-Chips Secretariat
	AI & Cybersecurity	· Align AI governance principles to enable joint R&D while respecting Korea's compliance regime and Japan's voluntary approach. · Expand real-time sharing of cyber threat intelligence, especially against state-sponsored attacks.	CERT-In, NISC, KISA, NITI Aayog
	Shipbuilding & Clean Energy	· Develop joint standards for green vessels, offshore wind platforms and hydrogen logistics. · Coordinate financing for grid upgrades, storage and EV supply chains to reduce bottlenecks.	POSCO, Samsung, Mitsubishi, L&T, Adani; national grid operators, JBIC, KEXIM

Phase	Area	Recommendations	Key Stakeholders
LONG TERM (5-10 years) Strategic Convergence	**Political & Strategic**	· Transition from ad hoc coordination to a standing minilateral framework with defined scope and review mechanisms. · Use the trilateral as a platform for third-country cooperation, particularly in Africa and the Indo-Pacific.	Cabinet-level coordination bodies, QUAD partners
	Economic & Technological	· Build end-to-end resilient supply chains across minerals, chips, clean energy and maritime technology to reduce overreliance on single suppliers. · Position the trilateral as a rule-setter in green shipping, critical minerals ESG standards and trusted AI.	Multilateral development banks, standard-setting organisations
	Human Capital & Legitimacy	· Institutionalise labour mobility, joint degrees and PhD programmes to address demographic decline in Japan and Korea while absorbing India's workforce surplus. · Embed academia into policymaking to ensure continuity beyond electoral cycles.	Universities, research councils, standard-setting organisations

CONCLUSION

India, Japan, and South Korea emerge as essential middle powers in shaping the economic security in the Indo-Pacific. All three of them stand as “consequential players” as together, they possess the economic, technological, security, and institutional levers required to reshape supply chains, defense postures, and governance in the region. As technological competition, supply-chain risks, and geoeconomic pressures intensify, reliance on a single superpower gradually becomes unfeasible. Consequently, countries move toward a more networked and diversified form of cooperation, blending their complementary industrial strengths with their comparative advantages. In this context, a trilateral framework is necessary to pool complementary capabilities to enhance resilience, autonomy, and economic security. Differences, rather than commonalities, are more significant and can be leveraged as complementary strengths when combined. For instance, South Korea and Japan bring semiconductor and display technologies, as well as high-end manufacturing know-how. India adds scale (large domestic markets, workforce capacity, and design and assembly ecosystems).

Nonetheless, there are several challenges to the trilateral. Each of them has different priorities, with varying levels of economic dependence on external powers. Additionally, institutional and coordination challenges can affect the pace and scope of the cooperation. Furthermore, the domestic political environment and industrial capacity gaps can delay the materialization of trilateral initiatives. To manage such constraints, countries must pursue calibrated and sector-specific approaches.

If planned effectively, a trilateral arrangement may generate shared gains in multiple domains for India, Japan, and South Korea. For all of them, the opportunity provides a platform for diversifying supply chains, strengthening technological resilience, and expanding industrial collaboration in critical minerals, semiconductors, AI, clean energy, and shipbuilding, among many other sectors. At a broader level, the trilateral cooperation can contribute to diversifying regional production networks, safeguarding against external economic coercion, and reinforcing middle-power agency to strengthen economic security in the Indo-Pacific.

ENDNOTES

[1] Goodman, Matthew P. “G7 Gives First Definition to ‘Economic Security.’” CSIS, 28 Oct. 2024, www.csis.org/analysis/g7-gives-first-definition-economic-security.
[2] “G7 Leaders’ Statement on Economic Resilience and Economic Security.” Consilium, 20 May 2023, www.consilium.europa.eu/en/press/press-releases/2023/05/20/g7-leaders-statement-on-economic-resilience-and-economic-security.
[3] Xue, Patrick. “China’s Rare Earth Strategy May Need Recalibration.” East Asia Forum, 24 Nov. 2025, eastasiaforum.org/2025/11/24/chinas-rare-earth-strategy-may-need-recalibration.
[4] “List of Outcomes: Prime Minister’s Visit to Japan (August 29 – 30, 2025).” Ministry of External Affairs, Government of India, www.mea.gov.in/bilateral-documents.htm?dtl/40061/List+of+Outcomes+Prime+Ministers+Visit+to+Japan+August+29++30+2025.
[5]Jordaan, Eduard. “The Concept of a Middle Power in International Relations: Distinguishing between Emerging and Traditional Middle Powers.” Politikon: South African Journal of Political Studies, vol. 30, no. 1, 2003, pp. 165–181, ink.library.smu.edu.sg/soss_research/394.
[6] Ibid.
[7] Soeya, Yoshihide. “Japan’s Middle Power Diplomacy: Evolution and New Challenges.” India’s World, 27 Nov. 2025, indiasworld.in/japans-middle-power-diplomacy-evolution-and-new-challenges.
[8]“Fukuda Doctrine.” Asia Japan Alumni International, 8 June 2022, asja.gr.jp/en/asja/fukuda.html#:~:text=First%2C%20Japan%2C%20a%20nation%20committed,summit%20meeting%20with%20ASEAN%20leaders.
[9] Huynh, Tam-Sang. “Bolstering Middle Power Standing: South Korea’s Response to U.S. Indo-Pacific Strategy from Trump to Biden.” The Pacific Review, vol. 36, no. 1, 2023, pp. 32–60, doi:10.1080/09512748.2021.1928737.
[10]Rubiolo, Florencia, et al. “India as an Asian Middle Power: Between Pragmatism and Regional Balance.” Global Affairs ~ Annual Review, Nov. 2024, pp. 331–33. cari.org.ar/uploads/articles/India%20as%20an%20Asian%20Middle%20Power:%20Between%20Pragmatism%20and%20Regional%20Balance.pdf?r=2.
[11] Mohan, C. Raja. “India: Leaning to One Side (Cautiously).” MIDDLE POWERS PROJECT, 2025, www.belfercenter.org/sites/default/files/2025-11/India_MiddlePowers-CountryReport_2.2.pdf.
[12] Ibid.
[13] Jacob, Happymon. “Grand Strategy | How Minilateralism Is Reshaping Global Order | Hindustan Times.” Hindustan Times, 8 Dec. 2024, www.hindustantimes.com/opinion/grand-strategy-how-minilateralism-is-reshaping-global-order-101733676306904.html.
[14] Ibid.
[15] Simmonds, Nii. “The Quest for Tech and Manufacturing Sovereignty.” Project Syndicate, 18 Aug. 2025, www.project-syndicate.org/commentary/tech-sovereignty-cannot-be-achieved-in-isolation-by-nii-simmonds-2025-07.

ENDNOTES

[16] Maccioni, Federico, et al. “UAE to Build Biggest AI Campus Outside US in Trump Deal, Bypassing Past China Worries.” Reuters, 15 May 2025, www.reuters.com/world/china/uae-set-deepen-ai-links-with-united-states-after-past-curbs-over-china-2025-05-15.
[17] Simmonds, “The Quest for Tech and Manufacturing Sovereignty.”
[18] Briefing, China. “China’s New Quality Productive Forces: An Explainer.” China Briefing News, 10 Sept. 2024, www.china-briefing.com/news/chinas-new-quality-productive-forces-an-explainer.
[19] Reuters. “What Are Rare Earths and Why Are They so Important?” Reuters, 30 Oct. 2025, www.reuters.com/markets/commodities/what-are-rare-earth-metals-why-are-they-demand-2025-02-26.
[20] Ibid.
[21] Jackson, Lewis. “How China’s New Rare Earth Export Controls Work.” Reuters, 10 Oct. 2025, www.reuters.com/world/china/how-chinas-new-rare-earth-export-controls-work-2025-10-10.
[22] Hashmi, Sana. “China Leads Semiconductor Race Despite US Sanctions. Still Relying on Foreign Tech Though.” ThePrint, 7 Jan. 2025, theprint.in/opinion/eye-on-china/china-semiconductor-industry-us-sanctions-relying-on-foreign-tech/2435527.
[23] Kaur, Dashveenjit. “Global Chip Race: China Semiconductor Sector Surpasses South Korea.” TechWire Asia, 10 Sept. 2025, techwireasia.com/2025/03/global-chip-race-china-semiconductor-sector-surpasses-south-korea.
[24] Helou, Elias Al. “China’s Artificial Intelligence Industry Reaches Nearly $83.45 Billion by April 2025.” Economy Middle East, 30 May 2025, economymiddleeast.com/news/china-artificial-intelligence-industry-reaches-nearly-83-45-billion-by-april-2025.
[25] BloombergNEF. “China Regains Number One Spot in BloombergNEF’s Global Lithium-Ion Battery Supply Chain Ranking.” BloombergNEF, 22 May 2025, about.bnef.com/insights/clean-energy/china-regains-number-one-spot-in-bloombergnefs-global-lithium-ion-battery-supply-chain-ranking.
[26] White, Edward. “China Uses Green Tech Dominance to Take Early Lead in Clean Fuels Race.” Financial Times, 22 Dec. 2025, www.ft.com/content/77283ccf-5a50-41e1-b6b9-9741ac3e7309.
[27] Gaida, Jamie, et al. “ASPI’s Critical Technology Tracker the Global Race for Future Power.” ASPI, Feb. 2023, ad-aspi.s3.ap-southeast-2.amazonaws.com/2023-08/ASPIs%20Critical%20Technology%20Tracker.pdf?VersionId=nVmWySgLSX2FMaS1U.uQVgQvvd_W427G.
[28] Gurzu, Anca. “How China dominates critical minerals in three charts.” Ciper, 30 Apr. 2025, www.ciphernews.com/articles/how-china-dominates-critical-minerals-in-three-charts.
[29] Ezell, Stephen. “How Innovative Is China in Semiconductors?” ITIF, 25 Nov. 2024, itif.org/publications/2024/08/19/how-innovative-is-china-in-semiconductors.
[30] The Economist. “Will China Dominate the World of Semiconductors?” The Economist, 29 Jan. 2022, www.economist.com/international/2022/01/29/will-china-dominate-the-world-of-semiconductors.
[31] Atkinson, Robert. “How to Win Techno-Economic Competition With China.” The National Interest, 25 Nov. 2024, nationalinterest.org/blog/techland/how-win-techno-economic-competition-china-213136.

ENDNOTES

[32] Ibid.
[33] Us, Week. “How 'China Shock 2.0' Will Roil Global Markets.” The Week, 21 Apr. 2025, theweek.com/politics/china-shock-2-0-roil-global-markets.
[34] Lee, Christy. “South Korea Seeks to Join Efforts to Counter China’s Economic Coercion.” Voice of America, 25 May 2023, www.voanews.com/a/south-korea-seeks-to-join-efforts-to-counter-china-s-economic-coercion-/7109606.html.
[35] Bradsher, Keith. “China Bans Rare Earth Exports to Japan Amid Tension.” CNBC, 23 Sept. 2010, www.cnbc.com/2010/09/23/china-bans-rare-earth-exports-to-japan-amid-tension.html.
[36] He, Baogang, et al. “South Korea Pushes Back Against Chinese Economic Coercion.” East Asia Forum, 7 Dec. 2023, eastasiaforum.org/2023/05/05/south-korea-pushes-back-against-chinese-economic-coercion.
[37] Roy-Chaudhury, Shantanu. “The Limits of an India-China Détente.” South Asian Voices, 17 July 2025, southasianvoices.org/geo-m-in-n-limits-india-china-detente-07-17-2025.
[38] Gargeyas, Arjun. “The Chip 4 Alliance Might Work on Paper, but Problems Will Persist.” The Diplomat, 27 Aug. 2022, thediplomat.com/2022/08/the-chip4-alliance-might-work-on-paper-but-problems-will-persist.
[39] Breuninger, Kevin. “See Trump’s List: More Than 180 Countries and Territories Facing Reciprocal Tariffs.” CNBC, 3 Apr. 2025, www.cnbc.com/2025/04/02/trump-reciprocal-tariffs-countries-chart-imports-united-states.html.
[40] House, White. “FACT SHEET: United States and India Elevate Strategic Partnership With the Initiative on Critical and Emerging Technology (iCET).” The White House, 31 Jan. 2023, bidenwhitehouse.archives.gov/briefing-room/statements-releases/2023/01/31/fact-sheet-united-states-and-india-elevate-strategic-partnership-with-the-initiative-on-critical-and-emerging-technology-icet.
[41] Jazeera, Al. “US Raises India Tariffs to 50 Percent Over Russian Oil Purchases.” Al Jazeera, 27 Aug. 2025, www.aljazeera.com/news/2025/8/27/us-imposes-50-percent-tariff-on-india-over-russian-oil-purchases.
[42] Trump singed an annual defense policy bill that includes a measure to restrict the government from unilaterally reducing the current troop level of the 28,500-strong U.S. Forces Korea in Dec 2025.
[43] Cha, Victor. “South Korea’s Response to U.S. Demands: Minimize Risk, Maximize Reward.” CSIS, 7 Oct. 2025, www.csis.org/analysis/south-koreas-response-us-demands-minimize-risk-maximize-reward.
[44] Agence France-Presse. “South Korea Feels &Amp;#039;Betrayed&Amp;#039; by US Immigration Raid at Hyundai-LG Factory.” NDTV, 8 Sept. 2025, www.ndtv.com/world-news/betrayed-south-korea-shaken-by-us-immigration-raid-9235706.
[45] Ryall, Julian. “Trump’s Transactional Diplomacy Alarms Japan, South Korea.” dw.com, 4 Dec. 2025, www.dw.com/en/trumps-transactional-diplomacy-alarms-japan-south-korea/a-75018312.
[46] Ibid.
[47] A further $150 billion shipbuilding cooperation from South Korea.
[48] Ryall, Julian. “Trump’s Transactional Diplomacy Alarms Japan, South Korea.”

ENDNOTES

[49] The White House. "ADJUSTING IMPORTS OF SEMICONDUCTORS, SEMICONDUCTOR MANUFACTURING EQUIPMENT, AND THEIR DERIVATIVE PRODUCTS INTO THE UNITED STATES." The White House, 14 Jan. 2026, www.whitehouse.gov/presidential-actions/2026/01/adjusting-imports-of-semiconductors-semiconductor-manufacturing-equipment-and-their-derivative-products-into-the-united-states.
[50] Barik, Soumyarendra. "New US AI Export Rule Excludes India From Benefits of Closest Allies. What Could Be the Impact?" The Indian Express, 16 Jan. 2025, indianexpress.com/article/explained/explained-sci-tech/us-ai-export-rule-india-9780103.
[51] Manak, Inu, and Allison J. Smith. "Tracking Trump's Trade Deals." Council on Foreign Relations, 5 Feb. 2026, www.cfr.org/articles/tracking-trumps-trade-deals.
[52] Park, Ju-Min, and Kanishka Singh. "US, South Korea Unveil Details on Shipbuilding Investment and Subs in Trade Deal." Reuters, 14 Nov. 2025, www.reuters.com/world/asia-pacific/us-south-korea-release-details-deal-including-korean-investment-shipbuilding-2025-11-14.
[53] Wong, Audrye. "Comparisons of the Alliance Thinking in Japan and South Korea as a Reflection of National Identity." Joint U.S.-Korea Academic Studies, pp. 144–45. keia.org/wp-content/uploads/2020/05/joint_us-korea_2016_-_alliance_thinking.pdf.
[54] Liu, Zongyuan Zoe. "How to Secure Critical Minerals for Clean Energy Without Alienating China." Council on Foreign Relations, 25 May 2023, www.cfr.org/blog/how-secure-critical-minerals-clean-energy-without-alienating-china.
[55] Langel, Tunchinmang. Japan-India-South Korea Trilateral for the Indo-Pacific - Indian Council of World Affairs (Government of India). 2023, www.icwa.in/show_content.php?lang=1&level=3&ls_id=9313&lid=6031.
[56] Mai, Le Nhu. "Lee's Historic Trip to Tokyo: A Calculated Rapprochement." The Diplomat, 23 Aug. 2025, thediplomat.com/2025/08/lees-historic-trip-to-tokyo-a-calculated-rapprochement.
[57] Panneerselvam, Prakash. Advancing India's Relationship With Japan and South Korea: Quest for Middle Power Cooperation | IPCS. Aug. 2016, www.ipcs.org/issue_select.php?recNo=603.
[58] Sharma, Abhishek. "South Korea's Evolving Indian Ocean Region Policy." orfonline.org, 21 July 2024, www.orfonline.org/research/south-korea-s-evolving-indian-ocean-region-policy.
[59] Panda, Rajaram. "Relevance of an India-Japan-South Korea Trilateral Dialogue." Jeju Peace Institute, 12 June 2020, jpi.or.kr/?p=10319.
[60] Pant, Harsh V. "Eastward Bound: Is an India-Japan-South Korea Trilateral in the Making?" orfonline.org, 18 Mar. 2024, www.orfonline.org/research/eastward-bound-is-an-india-japan-south-korea-trilateral-in-the-making.
[61] Panneerselvam, Prakash. Advancing India's Relationship With Japan and South Korea: Quest for Middle Power Cooperation | IPCS.
[62] Nagy, Stephen R. Middle Power Pragmatism in the Indo-Pacific: Japan's Free and Open Indo-Pacific Vision.
[63] Ibid.
[64] Kanodia, Kanishkh. "Securing the Future of US–Japan–South Korea Cooperation." Chatham House – International Affairs Think Tank, 10 Dec. 2025, www.chathamhouse.org/2025/12/securing-future-us-japan-south-korea-cooperation.

ENDNOTES

[65] Peng, Yuxin. “Japan and South Korea’s Engagement in the Chinese Market post-RCEP Implementation: A Case Study of the Semiconductor Industry.” Asia and the Global Economy, vol. 4, no. 2, June 2024, p. 100085. https://doi.org/10.1016/j.aglobe.2024.100085.
[66] Ibid.
[67] Tripathi, Prateek. “Semiconductors as the Spark for an India-Japan-South Korea Trilateral.” orfonline.org, 16 Oct. 2025, www.orfonline.org/expert-speak/semiconductors-as-the-spark-for-an-india-japan-south-korea-trilateral.
[68] Tripathi, Prateek. “Semiconductors as the Spark for an India-Japan-South Korea Trilateral.”
[69] Jeevanandam, Nivash. “India Leads Global AI Talent and Skill Penetration.” IndiaAI, 17 Dec. 2024, indiaai.gov.in/article/india-leads-global-ai-talent-and-skill-penetration.
[70] Joe, Sankalp. “Post-Quantum Cryptography: India’s Migration Strategy.” Medium, 17 Nov. 2025, medium.com/@sankalpj17/post-quantum-cryptography-indias-migration-strategy-5d406793604f.
[71] https://www.soumu.go.jp/hiroshimaaiprocess/en/index.html
[72] A-reum, Hong. “Korea Posts Third-largest Rise in Global Patent Filings.” CHOSUNBIZ, 30 Dec. 2025, biz.chosun.com/en/en-science/2025/12/30/PREKP34TQZAMVJSHYAZFQDLS3Q.
[73] McFaul, Cole, et al. Assessing South Korea’s AI Ecosystem. Center for Security and Emerging Technology, August 2023, cset.georgetown.edu/publication/assessing-south-koreas-ai-ecosystem/.
[74] Shivhare, Sakshi, and Kwang Bae Park. “South Korea’s New AI Framework Act: A Balancing Act Between Innovation and Regulation.” Future of Privacy Forum, 18 Apr. 2025, fpf.org/blog/south-koreas-new-ai-framework-act-a-balancing-act-between-innovation-and-regulation/
[75] Long, Taylor, et al. “APT45: North Korea’s Digital Military Machine.” Google Cloud Blog, 25 July 2024, cloud.google.com/blog/topics/threat-intelligence/apt45-north-korea-digital-military-machine.
[76] Wood, Natasha. “South Korea’s 2024 Cyber Strategy: A Primer.” Strategic Technologies Blog, Center for Strategic and International Studies, 2 Aug. 2024, www.csis.org/blogs/strategic-technologies-blog/south-koreas-2024-cyber-strategy-primer.
[77] Datta, Saikat, and Andrew Salmon. “North Koreans Behind Indian Nuclear Plant Hack.” Asia Times, 18 Feb. 2020, asiatimes.com/2019/11/north-koreans-behind-indian-nuclear-plant-hack.
[78] Beattie, Elizabeth. “North Korean Agents in Japan’s Anime Industry Part of Sophisticated Sanctions Evasion.” The Japan Times, 26 Oct. 2025, www.japantimes.co.jp/news/2025/10/23/world/crime-legal/north-korea-cyberattack-report.
[79] Tidy, Joe. North Korean Hackers Stealing Record Sums, Researchers Say. 7 Oct. 2025, www.bbc.com/news/articles/cwy8z7wxe03o.
[80] Patil, Sameer. “Operation Sindoor and India-Pakistan’s Escalated Rivalry in Cyberspace.” Royal United Services Institute (RUSI), 23 June 2025, www.rusi.org/explore-our-research/publications/commentary/operation-sindoor-and-india-pakistans-escalated-rivalry-cyberspace.

ENDNOTES

[81] Jones, Randall S. “South Korea’s Battery Industry Faces Challenges.” The Peninsula, Korea Economic Institute of America, 25 Aug. 2025, keia.org/the-peninsula/south-koreas-battery-industry-faces-challenges/.
[82] “The Strategy for Securing Reliable Critical Minerals Supply – Policies - IEA.” IEA, www.iea.org/policies/17942-the-strategy-for-securing-reliable-critical-minerals-supply.
[83] Cho, Hyun Soo, and Jane Nakano. “The Minerals Security Partnership Under the South Korean Leadership.” Center for Strategic and International Studies, 28 Jan. 2025, www.csis.org/analysis/minerals-security-partnership-under-south-korean-leadership.
[84] Moerenhout, Tom. “How the US–Japan Critical Minerals Partnership Is a Long-Overdue Step Toward Real Supply-Chain Security.” Center on Global Energy Policy, Columbia University, 29 Oct. 2025, www.energypolicy.columbia.edu/how-the-us-japan-critical-minerals-partnership-is-a-long-overdue-step-toward-real-supply-chain-security/.
[85] Sinh, Anindita. “Economic Security in the Indo-Pacific: India–Japan Cooperation in Critical Minerals.” CSEP Blog, Center for Security and Emerging Policy (CSEP), 13 Nov. 2025, csep.org/blog/economic-security-in-the-indo-pacific-india-japan-cooperation-in-critical-minerals/.
[86] The Importance of Critical Minerals Strategies in Our Clean Energy Future – ZERO NEXUS. zero.nexus/the-importance-of-critical-minerals-strategies-in-our-clean-energy-future.
[87] Kim, Gyupan. “Japan’s Critical Minerals Policy and Its Implications for South Korea.” SSRN Electronic Journal, Jan. 2025, https://doi.org/10.2139/ssrn.5897923.
[88] National Critical Mineral Mission. 2025, www.pib.gov.in/PressReleasePage.aspx?PRID=2120525®=3&lang=2.
[89] Ministry of Mines, Government of India. Report of the Committee on Identification of Critical Minerals. June 2023, mines.gov.in/admin/download/649d4212cceb01688027666.pdf.
[90] A joint venture company between National Aluminium Company Limited (NALCO), Hindustan Copper Limited (HCL) & Mineral Exploration & Consultancy Limited (MECL)
[91] Khanij Bidesh India Ltd. “KABIL Market Pitch.” Khanij Bidesh India Ltd., July 2023, kabilindia.in/public/storage/resources/KABIL%20Market%20Pitch.pdf.
[92] Sinh, Anindita. “Economic Security in the Indo-Pacific: India–Japan Cooperation in Critical Minerals.”
[93] “The Strategy for Securing Reliable Critical Minerals Supply – Policies - IEA.”
[94] “Gas Market Lessons From the 2022-2023 Energy Crisis – Analysis - IEA.” IEA, 1 Oct. 2025, www.iea.org/reports/gas-market-lessons-from-the-2022-2023-energy-crisis.
[95] “Energy Security – Topics - IEA.” IEA, www.iea.org/topics/energy-security.
[96] International Energy Agency. Renewables 2024: Analysis and Forecast to 2030. October 2024, iea.blob.core.windows.net/assets/17033b62-07a5-4144-8dd0-651cdb6caa24/Renewables2024.pdf.
[97] “Energy Storage - IEA.” IEA, www.iea.org/energy-system/electricity/grid-scale-storage.
[98] International Renewable Energy Agency. Renewable Energy and Jobs: Annual Review 2024. October 2024, iea.blob.core.windows.net/assets/17033b62-07a5-4144-8dd0-651cdb6caa24/Renewables2024.pdf.

ENDNOTES

[99] National Green Hydrogen Mission | MINISTRY OF NEW AND RENEWABLE ENERGY | India. mnre.gov.in/en/national-green-hydrogen-mission.
[100] Green Growth Strategy Through Achieving Carbon Neutrality in 2050 / METI Ministry of Economy, Trade and Industry. www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/index.html.
[101] International Energy Agency. Korea 2025: Energy Policy Review. November 2025, iea.blob.core.windows.net/assets/21b0a0d2-6b9a-435d-b591-c65fb76399d6/Korea2025.pdf.
[102] Sharma, Abhishek. "To Build Ships, India Must Look East." orfonline.org, 3 Sept. 2025, www.orfonline.org/expert-speak/to-build-ships-india-must-look-east.
[103] Potter, Brian. "How China Became the World's Biggest Shipbuilder." Construction Physics, 18 July 2025, www.construction-physics.com/p/how-china-became-the-worlds-biggest.
[104] Roy, Torunika. "CSL-KSOE Shipbuilding Alliance: A Turning Point for India-South Korea Cooperation - CSDR." CSDR, 11 July 2025, csdronline.com/blind-spot/csl-ksoe-shipbuilding-alliance-a-turning-point-for-india-south-korea-cooperation.
[105] Lerh, Jeslyn. "Japan's Mitsui OSK Eyes Shipbuilding Partnerships in India." Reuters, 9 Sept. 2025, www.reuters.com/world/india/japans-mitsui-osk-eyes-shipbuilding-partnerships-india-2025-09-09.
[106] Anuar, Amalina, and Nazia Hussain. Minilateralism for Multilateralism in the Post-COVID Age. S. Rajaratnam School of International Studies (RSIS), 19 Jan. 2021, www.rsis.edu.sg/wp-content/uploads/2021/01/PR210119_Minilateralism-For-Multilateralism-in-the-Post-COVID-Age.pdf.
[107] BBC News. South Korea and Japan's Feud Explained. 2 Dec. 2019, www.bbc.com/news/world-asia-49330531.
[108] Seo, Yerim. "Strategic Ambiguity Remains in South Korea's Indo-Pacific Survival Strategy." Young Leaders Blog, Pacific Forum, 21 Sept. 2023, pacforum.org/publications/yl-blog-43-strategic-ambiguity-remains-in-south-koreas-indo-pacific-survival-strategy/.
[109] "Challenges to Minilateralism." MINILATERALISM FOR MULTILATERALISM IN THE POST-COVID AGE, Jan. 1, 2021, pp. 3–5. JSTOR, www.jstor.org/stable/resrep28278.5.
[110] Interview with a Research Scholars from Public Policy Background from Seoul National University and Jawaharlal Nehru University.
[111] Niquet, Valérie. Towards Rapprochement in a Complex World Situation? Trilateral Dialogue Between Japan, South Korea, and the People's Republic of China. Korea Security and Diplomacy Program, Fondation pour la Recherche Stratégique (FRS), 19 June 2025, www.frstrategie.org/en/programs/korea-security-and-diplomacy-program/towards-rapprochement-complex-world-situation-trilateral-dialogue-between-japan-south-korea-and-people-s-republic-china-2025/.
[112] Interview with a Professor from JNU.
[113] Teo, Sarah. "Minilateralism and the Future Regional Security Architecture." RSIS Commentary, S. Rajaratnam School of International Studies (RSIS), 18 Jan. 2021, www.rsis.edu.sg/minilateralism-and-the-future-regional-security-architecture/

CSDR

COUNCIL FOR STRATEGIC AND DEFENSE RESEARCH

C-21, 3rd Floor, Qutub Institutional Area, New Delhi, India - 110016.
Phone: 011-43104566 | Email: office@csdronline.com | Web: www.csdronline.com | Twitter:@CSDR_India