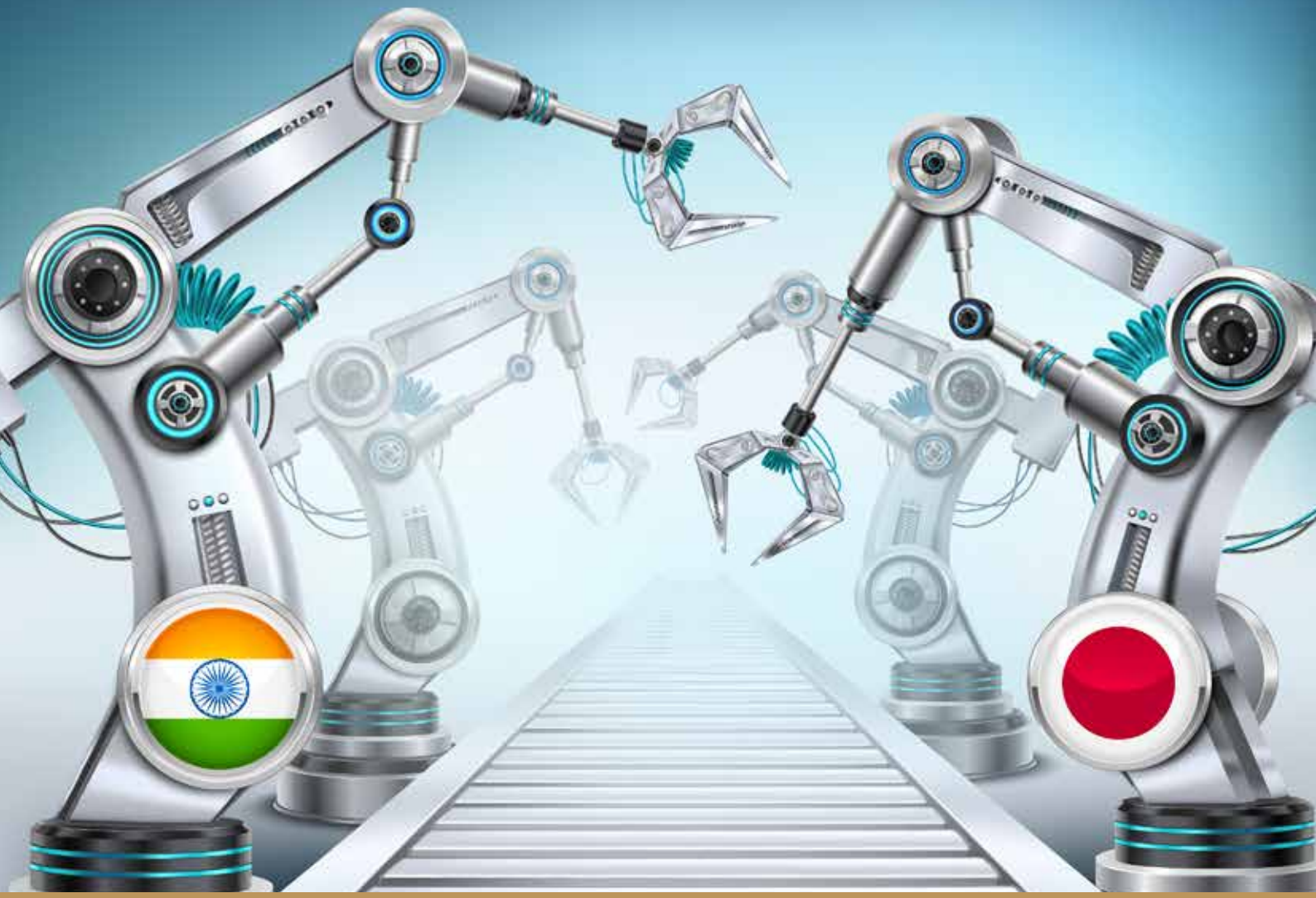
Shardul Amarchand Mangaldas

FICCI

India and Japan Technology Collaboration for Collective Industrial Growth



भारत के राजदूत
AMBASSADOR OF INDIA

सत्यमेव जयते

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MESSAGE

I would like to commend the Federation of Indian Chamber of Commerce & Industries (FICCI) for having cooperated closely in taking forward the positive agenda of India-Japan Business Cooperation Committee (IJBCC). As we navigate the complexities of a rapidly evolving global landscape, our bilateral ties with Japan continue to stand as a beacon of stability, innovation, and shared aspirations. The Japan-India partnership has flourished across various sectors, fostering economic growth, technological advancements, and cultural exchanges.

It is encouraging to mention that this initiative furthers the Special Strategic and Global partnership between both countries. India has had V-Shaped recovery clocking around 7% growth in GDP in the post-covid years. India and Japan will mutually benefit from collaboration in sectors such as Internet of Things, Artificial Intelligence, Semiconductors, Critical Technology, Fin-Tech, Digital Public Infrastructure etc. Based on the past trends and future opportunities, we see high potential in future investment inflows from Japan in infrastructure, manufacturing, agriculture, food processing, start-up ecosystem, financial and health-care sector in India. Both countries have also emphasized on skill and human resource development. It is my firm belief that the future of international trade and investment will be driven by process and technology innovations creating win-win situation for our two countries.

I wish this event success and hope it would provide opportunities to both India and Japan to plan several outreach initiatives to further stimulate bilateral trade, investments and capacity building. IJBCC serves as a vital platform, facilitating a dynamic exchange of ideas, insights, and strategies that propel our bilateral engagement forward. In the spirit of collaboration, let us seize this moment to reaffirm our shared commitment to building a future that reflects the values and aspirations of both our nations.

I wish IJBCC accomplishes its objectives successfully.

(Sibi George)

Tokyo
February 23, 2024

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Foreword

Mr Onkar Kanwar
Chair, India-Japan Business Cooperation Committee &
Chairman, Apollo Tyres Ltd

Japan is the important trade partner and the fifth largest investor in India and has been a strong contributor in the economic growth of various Indian States. Japan is one of the most important development partners for India and has also been a great friend of India. Japan has been a strong contributor towards India's economic development across a wide spectrum of agenda including some of India's flagship initiatives, such as, Make in India, Digital India, Smart cities and Skill India.

The last few years have seen an impressive expansion and deepening of India's 'Special Strategic and Global Partnership' with Japan. Shared values of democracy, respect for the rule of law combined with convergence of political, economic and strategic interests have made this partnership even stronger.

Japan and India share the vision of "Free and Open Indo-Pacific" and have deepened their cooperation under Special Strategic and Global Partnership. High-level meetings under QUAD initiative and the Foreign and Defense Ministerial Meetings ("2+2") have been held.

In the recent years special emphasis have been laid down for cooperation within Digital infrastructure, climate change countermeasures, Supply Chain Resilience Initiative (SCRI) for promoting social innovation towards building a decarbonized society and promoting carbon neutrality by 2070.

This knowledge report will unleash some of the highlights of the investment potential in SMEs in India in various sunshine sectors, including manufacturing, electronics, food, railways, renewable energy, digital partnership, etc. The report also throw light on the recent policy reforms introduced by the Government of India towards attracting greater investments in India. I am sure that the information in this report will be useful for the Japanese investors looking at making investments in India, both Greenfield as well as expansion of existing businesses.

I once again congratulate FICCI and Shardul Amarchand Mangaldas & Co. for this report and wish you happy reading!

Onkar S Kanwar

Onkar S. Kanwar
Past President, FICCI & Chair, India-Japan Business Cooperation Committee (IJBCC)
Chairman, Apollo Tyres

Foreword

Dr. Shardul S. Shroff
Executive Chairman and
National Practice Head - Insolvency and Bankruptcy

This report is prepared for the 47th Joint Meeting of the India-Japan Business Cooperation Committee and the Japan-India Business Cooperation Committee scheduled on March 12, 2024 at Tokyo, Japan, on the theme 'Expanding economic cooperation between Japan and India for a free and open Indo-Pacific'.

The Indo-Japanese partnership, spanning across areas, such as, security, trade, economics and sustainable development, is undergoing transformation through the addition of technology. With digitisation and technology deepening their roots globally, supply chains are transforming, creating a lucrative opportunity for India and Japan to carve out their respective shares in the evolving global market through focusing on technological and innovation driven cooperation.

The long-standing history of bilateral cooperation between India and Japan in the field of science and technology has strengthened in the last several years. While economically, India remains one of the largest bilateral recipient of Japanese aid, the cumulative foreign direct investment inflows between the two countries have also risen significantly on a yearly basis. These two factors coupled together have attracted the attention of the respective governments of India and Japan to explore possibilities of enhancing economic ties, especially provided the ever-evolving geo-political conditions.

Apart from the increase in governmental collaborations and diplomatic developments that have culminated in agreements involving technological interchange in the field of semiconductors and renewable energy, Indian and Japanese companies have also been taking notice of the expanding scope for business and investments. As the number of Japanese companies operating in India, recorded to be around 1,450 in 2023, is steadily rising, it must be underscored that the collaborative ventures between them are being expanded from investments across several crucial sectors, including automobiles, defence and aerospace, electronics, infrastructure, etc., to sharing technology and driving innovation in these sectors.

While this aspect of collaboration allows India to place reliance upon the expertise of Japan in innovation, research and development and technology, especially in sectors, such as, renewable energy, which are gaining prominence and import across the world, it allows Japan to utilise India's cost-effective labour, innovative ecosystem and thriving startup landscape, as well as operationalise its industrial base in India, creating reciprocal benefits for both India and Japan.

Given the plethora of factors that may result in deeper economic ties that can be established between India and Japan on the backdrop of technology, it is crucial for the two countries to realise the true potential for investment by strengthening and streamlining the regulatory ecosystem to develop opportunities for deeper integration of technological exchange. Policy initiatives, such as, the Product Linked Incentives Schemes and National Single Window System need to be specifically catered to fuel technological collaboration between India and Japan, which will act as major step towards diversifying the economic reach and gains for both countries.

The report is positioned to highlight the rising potential for technological collaboration, the resultant increase in investment opportunities and the regulatory landscape to achieve increased cooperation between India and Japan.

Yours sincerely,

Dr. Shardul S. Shroff
Executive Chairman
Shardul Amarchand Mangaldas & Co.

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Snapshot of India and Japan's Synergetic Relations

Introduction

The enduring economic relationship between India and Japan traces its roots through cultural and civilizational affinity, dating back to 752 AD. The Japan-India Association, set up in 1903, is one of the oldest surviving international friendship bodies in Japan.

On the technology front, the cooperation between India and Japan in the field of science and technology was formalised in 1985, through the Inter-Governmental Agreement, and the association continues to be strengthened in the form of various technology partnerships and bilateral agreements. The deepening of ties between India and Japan can be mapped progressively, emerging from a 'Global Partnership' in 2000, moving on to a 'Global and Strategic Partnership' in 2006, and culminating to a 'Special Strategic and Global Partnership' in 2014 ("**SSGP**"). India and Japan have held regular summits since 2006 and the elevation and transformation of the relationship between them has provided significant impetus to their economies. India and Japan's cooperation in artificial intelligence ("**AI**") and other emerging technologies also received impetus from the India-Japan Digital Partnership in 2018. Further, the Partnership Agreement between Ministry of Electronics and Information Technology's ("**MeitY**") Start up Hub and Japan External Trade Organisation in 2020 facilitated strengthening of the Indian and Japanese tech startup ecosystem.

On the economic front, Japan has been India's largest bilateral donor and has been extending loans and grants to India since 1958. This financial assistance has accelerated India's economic development in priority sectors, such as, power, transportation and environmental projects. Recently, Japan has committed JPY 232.21 billion official development assistance ("**ODA**") for nine projects in various sectors in India, such as, road connectivity and horticulture.

Japan is the fifth largest investor in India with cumulative foreign direct investment ("**FDI**") inflows of approximately USD 40.84 billion from April 2000 to September 2023. There has been a significant increase in the FDI inflow from Japan to India on a year-on-year basis. India received FDI of approximately USD 1.49 billion in 2021-22, USD 1.79 billion in 2022-23 and USD 2.09 billion from April 2023 to September 2023, from Japan.

Currently, approximately 1,450 Japanese companies are operating in India, in key sectors, such as, automobiles, electrical equipments, telecommunications, chemicals, finance (insurance) and pharmaceuticals. India's total trade with Japan increased from USD 20.57 billion in 2021-22 to USD 21.96 billion in 2022-23 with exports from India to Japan valued at USD 5.46 billion (marking 41% growth in a span of 15 years) and imports to India from Japan valued at USD 16.49 billon (marking 160% growth in a span of 15 years) in 2022-23.

Investments from Japanese companies and funds are also on the rise in India, especially in the startup landscape. For instance, MIXI, Inc., a digital entertainment company in Japan recently announced a corpus of USD 50 million for early-stage startups in India's gaming and digital entertainment industry over the course of three to four years. Similarly, Japan's Incubate Fund Asia has also set aside a corpus of USD 50 million for investments in early-stage startups in India.

Recent diplomatic and strategic developments

There have been multiple bilateral meetings between India and Japan in 2023, especially during the G20 and G7 summits. The key highlights of some of these bilateral meetings are as follows:

- During the visit of the Prime Minister of Japan, Mr. Fumio Kishida, to India in March 2023, the memorandum of cooperation ("**MoC**") between India and Japan signed in 2017 was renewed and the exchange of notes and loan

agreement for the fourth tranche instalment of JPY 300 billion ODA loan from Japan International Cooperation Agency ("**JICA**") for the Mumbai-Ahmedabad High Speed Railway Project ("**MAHSR**") was signed.

- During the visit of the Prime Minister of India, Mr. Narendra Modi, to Japan in May 2023, for the G7 Summit, a bilateral meeting was conducted on the sidelines between India and Japan, to discuss green hydrogen, high technology, semiconductors, digital public infrastructure and further strengthen the bilateral SSGP between India and Japan.
- A bilateral meeting was conducted between the Prime Ministers of India and Japan on the sidelines of the G20 Summit in New Delhi in September 2023, to discuss various facets of the India-Japan bilateral partnership, including infrastructure development, technological collaboration, investments and energy; and to further deepen the India-Japan SSGP.

The launch of the USD 600 million India-Japan Fund ("**IJF**") in October 2023, by the National Investment and Infrastructure Fund and Japan Bank for International Cooperation ("**JBIC**"), with JBIC and the Government of India ("**GoI**") as anchor investors unfolded a monumental milestone in the strategic and economic partnership between India and Japan in the field of climate change and environment. The IJF, presumed to be an important driver in promoting Japanese investments in India, aims to focus on investing in environmental sustainability and low carbon emission strategies.

Opportunities for Technical Collaboration Between India and Japan

A survey of Japanese manufacturers with overseas subsidiaries, conducted by JBIC in 2023, ranked India as the most desirable place to do business in medium and long term, i.e., in the next three to 10 years. The technological prowess of Japan coupled with India's established strengths in software development, skilled human resources and the growing market could further strengthen the technological partnership between the two nations and is likely to lead to a paradigm technological transformation across the globe. This Section of the report provides a brief sectoral overview of the technological partnership between India and Japan, Japan's technological strengths in various sectors, India's appetite for technological collaboration with Japan in such sectors and initiatives taken by the GoI to promote technical collaboration in such sectors.

Renewable energy

Overview of the sector and existing collaborations between India and Japan

India and Japan are both committed to developing and incorporating sustainable technologies and energy sources. Renewable energy emerges as an important sector for growth and collaboration between India and Japan. India has the largest renewable energy capacity expansion plan in the world, and it has set a target to achieve 500 GW of non-fossil fuel-based energy by 2030, at the COP26. India is ranked fourth in the world in the renewable energy installed capacity (including large hydro), wind power capacity and solar power capacity.

As per the Central Electricity Authority, India, the share of renewable energy generation in India is projected to increase from 42% to 64% by 2029-30, indicating the potential for growth and collaboration in this sector.

India has set a goal of reducing its carbon intensity by 45% and achieving 50% cumulative electric power installed from renewables by 2030, and reaching net-zero carbon emissions by 2070. Japan has showcased its support for India's ambitious target to clean energy transition by including India in Japan's Asia Energy Transition Initiative (AETI), launched in 2021, which, amongst others, announced a financial assistance of USD 10 billion to drive sustainable growth and neutralise carbon

emissions in Asia. In order to push technological development, efficiently scale up the production of clean hydrogen and accelerate trade in clean hydrogen in the Indo-Pacific region, the Clean-Hydrogen Partnership was launched by Australia, India, Japan and the United States of America in September 2021.

In a much-awaited development, the recently established IJF announced an investment of INR 4 billion in Mahindra Last Mile Mobility Limited, to focus on promoting sustainable and innovative mobility solutions.

Japan's expertise in renewable energy

Japan has demonstrated cutting edge expertise in the renewable energy sector. Japan introduced one of the world's largest-class hydrogen plants powered by renewable energy, named the Fukushima Hydrogen Energy Research Field ("**FH2R**") in 2020, which was one of its key investments towards net zero carbon emissions by 2050. FH2R employs the technology of solely using power generated from solar panels to conduct electrolysis of water to produce hydrogen.

The involvement of private sector has been truly monumental in driving technological advancements qua hydrogen fuel in Japan. Toyota Motor Corporation ("**Toyota**") is making headway in the renewable energy sector, by starting public trials of a newly developed water electrolyser to produce hydrogen, which uses the fuel cell stack technology utilised in Toyota Mirai, a fuel cell electric vehicle ("**FCEV**"). In a bid to reduce CO2 emissions and switch to cleaner fuels, Toyota is running public trials on hydrogen, synthetic and bioethanol fuels, that are derived from renewable energy sources. The technological prowess of Japanese companies in the manufacturing sector is also commendable. The first carrier ship equipped with the technology to carry liquified hydrogen, named Susio Frontier, was developed by Kawasaki Heavy Industries Ltd., utilising the technology of its Liquified Natural Gas (LNG) carriers. Susio Frontier undertook its first successful long-distance transport to Australia, carrying liquified hydrogen from Japan, in 2022. Further, research on various clean energy fuels is also being undertaken, for example, IHI Corporation is developing the technology to mass produce jet-fuel from microalgae as a sustainable alternative to aviation fuel.

The Japanese private sector has been actively involved in developing new technologies including electrolyzers, regarding which efforts are underway through a collaboration between Asahi Kasei Corporation and JGC Holdings Corporation. Additionally, a collaboration between six private players, five of which are Japanese, is developing the energy demand conversion and utilisation technology using a PEM-type electrolyzer. Other areas of development include transportation and carrier technologies for liquid hydrogen, storage technologies, downstream and upstream hydrogen utilisation, co-firing and boilers, to name a few.

Venturing further from the private sector driven renewable energy breakthroughs, Japan boasts of several community level decarbonisation initiatives. For instance, the island of Hokkaido has several projects that are drivers towards sustainable economic growth, the highlight being the Ishikari Data Center, which is powered completely by locally sourced renewable energy, including solar, wind and biomass.

Need for technical Collaboration: Why and How?

In consonance with India's goal of switching to renewable fuels, the technology created by Japan regarding 'bio-jet' fuel can be a carbon neutral alternative to aviation fuel in India. A similar trajectory could be followed for cooperation between India and Japan regarding biofuel as that between ACME Cleantech Solutions Pvt. Ltd. and IHI Corporation which have recently signed an agreement for supply of green ammonia. Such technological collaborations could also be undertaken between IHI Corporation and Indian companies involved in biofuel production and research, to assess the

existing technology and undertake advance research. Such collaborations, ultimately aimed at commercialising the technology, would help establish India as a major player of the biofuel supply chain globally.

Use of ammonia in the energy sector has become prominent. Japanese companies, such as, Chiyoda Corporation, JERA Co., Inc., and Tokyo Electric Power Company Holdings, Inc., are developing technology to reduce the cost of supplying ammonia by developing a new catalyst. The rising interest of Japan in developing a supply chain for ammonia coupled with the research and development initiatives by India in producing low-cost electrolyzers and competitive levelized costs of electricity for traditional renewables, such as, wind and solar energy, can provide impetus to further collaboration with Japan.

In the hydrogen fuel ecosystem, traditional energy importers, such as, Japan are constantly exploring opportunities for shipping hydrogen over the ocean. Transportation of liquified hydrogen has witnessed constant technological advancements from the Japanese private sector with other countries, such as, Australia under its 'Hydrogen Energy Supply Chain Project'. Transportation and export of liquified hydrogen could thus be an important avenue for technological and investment driven collaboration between India and Japan.

Indian policy initiatives to promote collaboration

In furtherance of its commitments towards renewable energy transition, the GoI introduced the 'Long-Term Low Carbon Emissions Development Strategy (LT-LEDS)' in November 2022, in a bid to decarbonise its energy ecosystem and focus on production of green hydrogen domestically as an exportable resource. Specific measures were also introduced in February 2022 under the 'National Hydrogen Mission' to provide incentives for renewable energy, such as, green hydrogen and ammonia. The GoI is also developing measures akin to the Product Linked Incentives Scheme ("**PLI Scheme**") to provide financial and non-financial incentives for low-cost production of electrolyzer and green hydrogen in India. The GoI is also focussing on developing technologies and related equipment domestically, which might present attractive investment opportunity for technology driven Japanese approach to renewable energy.

For non-hydrogen based renewable energy sources, the GoI introduced the 'National Solar Mission' for developing solar manufacturing capability within India. PLI Scheme incentives have also been offered under the 'National Programme on High Efficiency Solar PV Modules' to scale up manufacturing capacity in High Efficiency Solar PV Modules. For attracting and facilitating complementary investments in the solar energy ecosystem, the GoI has set up project development cells.

The GoI also introduced the Green Energy Corridors to facilitate intra-state and inter-state transmission system for projects involving renewable energy. Several bioenergy and biomass programmes have also been introduced to boost the manufacturing capacity of biomass fuels in a sustainable fashion. The GoI has started acknowledging the importance of technological developments in the renewable energy sector through interface with policy initiatives, such as, the 'Renewable Energy Research and Technology Development (RE-RTD) Programme' with a budget of INR 2.28 billion till 2025-26. As per the programme, 70% financial support is provided to entrepreneurs, industry and startups in furtherance of developing and manufacturing cost effective and varied applications of renewable energy.

Comparative analysis of similar collaborations undertaken by Japan in other jurisdictions

Japan places great emphasis on international technological collaboration and development in the energy sector, particularly in the Asian region. The benefits of the technological

breakthroughs made by the Japanese state entities and companies, especially in the energy sector, spill over globally. In Thailand, Toyota, in collaboration with Mitsubishi Kakoki Kaisha, Ltd. and Toyota Tsusho Corporation, has introduced an alternative method of producing hydrogen, from biogas obtained from local chicken manure and food waste. Japan has shared the technology employed in its indigenous city-wide projects, such as, the Ishikari Data Center to countries/ territories vulnerable to climate change, including Fiji, Tuvalu, Kiribati and the Marshall Islands. The programs in such territories are focused on integrating renewable energy generation on a larger scale and ensuring stable power supply.

In furtherance of Japan's proactive attitude to combat climate change, it has partnered with Denmark for researching and developing the technology for floating offshore wind power technologies. In October 2023, Japan's Agency for Natural Resources and Energy, METI and the Danish Ministry of Climate, Energy and Utilities signed a letter of intent in this regard.

Japan is also collaborating with advanced nations to develop new technologies to reduce carbon footprint while being commercially viable. Tsubame BHB Co., Ltd. ("**Tsubame**") collaborated with the Abu Dhabi National Oil Company for developing new methods of producing green ammonia. This partnership is aimed at combining the Tsubame's ammonia manufacture technology and the United Arab Emirates' varied renewable energy sources to produce cost-effective clean ammonia.

Electric Vehicles ("EVs")

Overview of the sector and existing collaborations between India and Japan

Historically, Japan has dominated the market in hybrid vehicles. With the world changing its trajectory towards EVs, there was a period of concern regarding Japan's adaptability to this change in market trend. Rising from its stupor, Japan has been making headway into developing new technologies in the EV sector.

To accelerate India's rapid switch to EVs, in line with India's goal to achieve net-zero carbon emission, India aims to ensure EV sales penetration of 70% for commercial cars, 30% for private cars, 40% for buses, 80% for two and three wheelers by 2030. Accordingly, India is also investing in the necessary infrastructure, including batteries and charging stations.

An important event in India's EV journey is Musashi Seimitsu Industry Co., Ltd.'s investment of INR 700 million in India's EV segment, through its partnership with BNC Motors Private Limited (Bharat New Energy Company) in 2023. Suzuki Motor Corporation has also decided to position its Indian operations as a hub for exporting EVs, and plans to export India made EVs to Japan by 2025. Additionally, Terra Motors Corporation ("**Terra Motors**") launched its charging infrastructure development venture in India in 2023, with the aim to deploy 800 to 1,000 charging points by March 2024.

Japan's expertise in the sector

Toyata has been working on enhancing the performance of liquid lithium-ion batteries (most popularly used in EVs) by improving energy density in square batteries and applying the bipolar structure developed for hybrid EVs to battery EVs. Additionally, in its vision to introduce the next generation of EVs by 2026, Toyota is collaborating with Prime Planet Energy and Solutions Inc., to extensively work on the groundbreaking technology to create solid EV batteries, which would substantially enlarge the cruising range. The new generation batteries incur lower costs and are equipped with technology for faster charging.

Additionally, Toyota is working on a new technology with Mitsubishi Heavy Industries, Ltd. to reduce aerodynamic drag in the EVs, which will further enhance their cruising range. In a bid to revolutionise the entire EV space, Toyota is also

focused on improvements in the production process of EVs, by deploying the use of digital technology in the design of the EV production plant, which will have flexible functioning by eliminating the usage of conveyors and introducing self-propelling assembly line technology.

Japanese companies have made considerable progress in streamlining the technology involved in establishing robust swapping stations. Isuzu Motors Limited ("**Isuzu Motors**") has developed a technology which allows robots to replace the depleted batteries in electric trucks with charged batteries within a timespan of three minutes. Similarly, Honda Motor Co., Ltd. ("**Honda**") and Yamato Transport Co., Ltd. have also collaborated to bring battery swapping technology empowered delivery vehicles to Japan. Since swappable batteries generally have less capacity than chargeable batteries, the two partners are also planning to conduct trials to ensure whether the EVs can maintain its range while delivering packages.

Need for technical collaboration: Why and How?

In the past few years, there has been a global fervour to promote EVs, which is in consonance with India's ambition to attain 500 GWs of renewable energy by 2030. India, being a member of the Clean Energy Ministerial Electric Vehicle Initiative, subscribes to the Clean Energy Ministerial campaign titled 'EV30@30', as per which it aims to achieve a target of 30% new EVs sales by 2030. However, from the Indian perspective, a successful realisation of this goal requires proper infrastructure in place to support EVs. Collaborative efforts with Japan in developing easy-to-build charging stations, supported by Japanese standards that reduce installation costs, would be crucial. Generally, the present technology in Japan allows for a decreased power output and consequently longer charging duration. However, cheaper charging infrastructure, albeit with longer charging durations, will be a reasonable trade-off especially given the generally modest battery capacity of EVs in the Indian market. Battery swapping stations have recently been receiving a lot of interest from the perspective of reducing an over-dependency on battery charging stations, thereby reducing consumer scepticism towards EVs as an alternative to combustion engine vehicles. Battery swapping stations could be a viable alternative for slashing charging related downtime, by allowing the EVs to exchange a discharged battery for a fully charged one. Another reason for their popularity is that setting up battery swapping stations is easier than installing battery charging stations. Especially in India, which has an increasing number of EV users, Isuzu Motor's technology of unmanned battery replacement in a significantly short amount of time, may prove to be groundbreaking in the EV space.

Terra Motors have transformed themselves as end-to-end solution providers in the EVs space, especially for three wheelers in India. Terra Motors is planning to introduce a 'Terra Big Data Base Concept', an AI initiative, by collecting and collating data from EVs and consumers to use for marketing purposes. With India's goal of increasing the reach of EVs within the Indian automobile sector, an excellent opportunity is presented to the GoI to collaborate with such corporates to promote EVs on a larger scale, especially four wheelers, a domain where Terra Motors has not been able to make much headway independently.

Indian policy initiatives to promote collaboration

The Ministry of Heavy Industries, GoI introduced Faster Adoption and Manufacturing of (Hybrid &) Electric vehicles ("**FAME**") in two phases (first in April 2015 and the second in April 2019), for providing incentives to purchase EVs and setting up of charging infrastructure. To further promote the growth of EVs in India, the GoI extended the term of Phase – II of FAME Scheme till March 31, 2024.

Hinging upon the 'India-Japan Dialogue' established in 2007, India and Japan entered into the 'Clean Energy Partnership' in 2022 to expand their collaboration in the area of EVs, battery

storage and charging infrastructure. In this initiative, the GoI also plans to encourage innovation in this sector and establish resilient and trustworthy supply chains between India and Japan.

The PLI Scheme covers automobiles/ auto components as well as Advance Chemistry Cell Battery, with a financial outlay of INR 570.42 billion and INR 181 billion respectively. As per the Guidelines for the PLI Scheme for Automobile and Auto Component Industry issued for effective and smooth implementation of the PLI Scheme by the Ministry of Heavy Industries in September 2021, the incentives within the PLI Schemes are also applicable on EVs, independent of the incentives available in the EVs sector under the Phase – II of FAME Scheme, thus displaying the GoI's intention to enhance collaboration and investment in EVs.

Comparative analysis of similar collaborations undertaken by Japan in other jurisdictions

In furtherance of Japanese companies interest in strengthening their battery swapping infrastructure, Mitsubishi Fuso Truck and Bus Corporation entered into an agreement with Ample Inc. (based in United States of America) in July 2023, regarding electric trucks in the Japanese market. Interestingly, the batteries will be replaced at the Ample battery swapping stations within a span of five minutes by using the former's patented technology, thus, reducing the downtime of EVs by multiple hours.

Further, Project X has been undertaken between Mobility in Harmony ("**MIH**") Consortium and Gogoro Inc., which is a three-seater concept car using the Gogoro's battery swapping technology. The MIH Consortium is led by Hon Hai Precision Industry Co., Ltd. (Vietnam). The usage of Project X can be extended to driverless robotaxi capabilities and features sliding doors for easy passenger entry and exit.

Automobiles

Overview of the sector and existing collaborations between India and Japan

Automobiles sector is a pivotal pillar of support in India's economic growth and the auto component segment has witnessed the highest ever turnover with a growth of USD 69.7 billion in 2022-23 from USD 50.66 billion in 2021-22, owing its success to booming vehicle sales and steady exports. The automobiles sector received a cumulative equity FDI inflow of about USD 35.40 billion between April 2000 to September 2023 where FDI of USD 664 million was received from April 2023 to September 2023. While India is the third largest consumer of automobiles in the world, passenger vehicle penetration is still lagging in relation to developed countries and there is a high potential for growth and technological development.

In Japan, the manufacturing sector constitutes approximately 89% of the total gross domestic product (GDP) and automotive manufacturing forms a substantial part of such percentage. In the past, collaborations in the automobile and ancillary sectors have benefited both Japan and India. Further, several Japanese automakers have established their bases in India to serve Indian consumers.

Japan's expertise in the sector

Japan has been leading innovations in mobility technology at a very quick pace. Startups in Japan play a pivotal role in developing cutting-edge technologies, such as, connected cars, EVs and autonomous driving.

In the face of multiple global innovations in the automotive and mobility sectors, Japan has exhibited innovations in specific sectors including, autonomous taxi services and airport transportation; high-definition maps and open-source software modules for autonomous vehicles; advanced hydrogen fuel cell and alternating-current battery technology.

Japanese companies have been involved in development of hydrogen fuel cell technology, which has a potential to reach a market size of approximately USD 43 billion by 2026, growing at a compounded annual growth rate of 66.9% from 2019 to 2026.

Honda has been working on the application of hydrogen power on automobiles for the past three decades and has been successful in building three models of FCEV. In addition to the already existing advantage that Japan has over other countries with respect to automobile technology, Japanese companies are constantly focussing on further use and development of AI in automobile manufacturing. Automobile companies in Japan are striving hard to integrate the benefits of modern AI based on big data into the manufacturing of real-world products, such as, vehicles.

Isuzu Motors, one of the big players in the automobile industry in Japan, is focussed on developing carbon neutral fuel, EVs and autonomous driving technology and has also formulated the 'Isuzu Environmental Vision 2050' as a roadmap for maintaining its leadership in transportation and securing a prosperous and sustainable society by 2050.

Need for technical collaboration: Why and How?

Japanese car manufacturers' innovations in green technology automotives are deeply aligned with India's goal of achieving carbon neutrality. Japanese manufacturers are not only focussing on technology development in the EV space but also on innovations with respect to carbon neutral fuels, for example, e-fuel.

Japan strives to decarbonize its economy by relying on utilisation of hydrogen-based energy in the automotive sector, and there is huge potential for the use of hydrogen in the Indian mobility sector too. While adoption of EVs in India has gained popularity, India's dependence on import of lithium and other rare elements highlights the need to focus on alternate clean mobility solutions.

India aims to make its e-mobility industry energy independent by 2047, therefore, reliance on hydrogen to support this goal cannot be ignored. Japan's expertise in hydrogen-based mobility is aligned with India's goal to rely on clean energy-based mobility solutions in the future. The natural scope for collaboration between India and Japan can be witnessed from the GoI's unwavering support for the hydrogen-powered Toyota Mirai.

Further, the role of AI in automotive sector is expected to grow exponentially and has the potential to influence all domains of the automotive sector, including basic domains, such as, annotating and labelling of the enormous amounts of vehicle perception data and advanced domains, such as, facial recognition, threat detection, picture processing, vehicle localization and mapping.

The projected role of AI in the automotive sector is a positive sign for India and Japan's technological ties in this sector. Since India and Japan are considered as AI hubs, umpteen opportunities exist for collaboration between the two countries for satisfaction of automotive sector requirements, including domains, such as, improved user experience, driver and passenger comfort, or development of autonomous and connected vehicles.

Indian policy initiatives to promote collaboration

India's goal is to turn 'Energy Self-reliant' by 2047 and for achievement of this goal, use of hydrogen will play a significant role. In an effort to achieve this goal, the GoI approved the National Green Hydrogen Mission in January 2023 with an outlay of INR 197.44 billion. Through the said mission, development of five million metric tonnes green hydrogen production capacity per annum by 2030 is targeted.

In February 2023, Japan's Energy for a New Era signed a Memorandum of Understanding with the GoI for developing green hydrogen products across India, with the intention of setting up a green hydrogen supply chain in India.

Comparative analysis of similar collaborations undertaken by Japan in other jurisdictions

Honda has collaborated with General Motors Co. in the United States of America to undertake research and development on the use of hydrogen power in automobile industry. The aim of this collaboration is to co-develop next-generation fuel cell system, which will be more durable and cost-effective. The fruits of this collaboration are expected to significantly benefit automotive sector through its direct application on the FCEVs and commercial vehicles. In January 2024, the joint venture between Honda and General Motors Co. named Fuel Cell System Manufacturing LLC (FCSM) began producing the new Honda fuel cell system, which is the first time that hydrogen fuel cells have been produced at such a large scale.

Semiconductors

Overview of the sector and existing collaborations between India and Japan

The Indian semiconductor market was valued at approximately USD 23.2 billion in 2022-23 and is geared to reach USD 55 billion by 2026. There is an exponential demand for semiconductors in India with the adoption of 5G technology.

Japan has undertaken serious efforts to strengthen its domestic semiconductor industry and has resolved to lessen reliance on other nations for essential commodities and establish a robust supply network. Given Japan's technical expertise in the semiconductor sector and the rising demand for semiconductors in India, there is immense potential for collaboration between India and Japan in this sector.

The collaborations between India and Japan in the semiconductor sector have recently picked up pace. In July 2023, a meeting was conducted between the Minister for Electronics and Information Technology, India and a high-level delegation led by Mr. Yasutoshi Nishimura, Minister of Economy, Trade and Industry of Japan, wherein an MoC was executed between MeitY and METI on India and Japan Semiconductor Supply Chain Partnership. The MoC is aimed at strengthening the cooperation between the two countries to enhance the semiconductor supply chain to leverage complementary strengths in advancement of industries and digital technologies.

India is at the stage of advance collaborative discussions with Rapidus Corporation of Japan, a semiconductor manufacturer, regarding the latter's expansion of its presence in India, facilitating a direct channel of communication between India and Japan in the field of semiconductor supply.

Japan's expertise in the sector

Japan has a well-established semiconductor industry due to the presence of already established companies operating in this space. Coupled with this, expertise in precision manufacturing, materials science and chip design positions makes Japan a force to reckon with in the semiconductor industry.

In addition, Japan has expanded its technical prowess in semiconductor lithography technology, given that companies including Nikon Corporation and Tokyo Electron Ltd. are producing high-end lithography machines.

Japan is also the largest manufacturer of semiconductor materials in the world and it produces 50% of the 14 most critical materials required in the process of chipmaking, including photomasks, photoresist and silicon wafers.

Japanese manufacturers, SUMCO Corporation and Shin-Etsu Chemical Co., Ltd., control majority share of the global market

for silicon wafers, a material considered essential for chip fabrication.

Therefore, it is evident that Japan possesses enhanced capabilities in the technology and materials required for production of semiconductors, with Japanese producers often demonstrating best among the class competencies.

Need for technical collaboration: Why and How?

India and Japan agreed to collaborate and align with each other to support manufacturing and research in relation to semiconductors. Both India and Japan envisage, government-to-government and industry-to-industry collaboration, specifically focussing on five critical areas including, semiconductor design, manufacturing, equipment research, establishing resilience in the semiconductor supply chain and talent development.

The ambit of the partnership between India and Japan includes transfer of technical know-how, research and innovation and can potentially pave the way for both the countries to lead global advancements in the semiconductor industry.

The partnership between India and Japan specific to semiconductor industry is poised to deliver benefits, since technology gaps in India's semiconductor industry can be filled with Japan's expertise. For instance, India lags in capabilities required for fabrication of chips. However, this void can be filled in effectively through collaboration with Japanese companies having world class chip fabrication facilities.

Further, Japan's semiconductor industry is witnessing bottlenecks in the process of skilled workforce acquisition. Japan has limited skilled workforce due to limitations, such as, declining labour force, due to reducing birthrate. Collaboration with India in the semiconductors industry is going to resolve this bottleneck, given that, India's young population can solve the problem of workforce acquisition for Japanese companies.

Indian policy initiatives to promote collaboration

The GoI has taken important policy initiatives to support collaboration and investments in the semiconductor industry. The Indian Semiconductor Mission ("**ISM**") has been set up by MeitY in 2021 as an independent business division within the Digital India Corporation to support India's semiconductor industry and transform India into a hub for electronics manufacturing and design. Multiple schemes have been launched under the ISM to support collaboration and investments in areas, such as, semiconductor fabs, display fabs, compound semiconductors and silicon photonics. Further, Design Linked Incentive Scheme aims to offer incentives for development of semiconductor design in relation to Integrated Circuits, Chipsets, System on Chips, Systems & IP Cores.

Comparative analysis of similar collaborations undertaken by Japan in other jurisdictions

International cooperation is a key component of Japanese government's semiconductor strategy, which aims to improve Japan's foundation in next-generation semiconductor technology.

In 2021, world's most advanced semiconductor manufacturer, Taiwan Semiconductor Manufacturing Company Limited, formed a joint venture with Japanese firm, Sony Corporation, in Kumamoto, Japan to address strong global market demand for specialty technologies in the semiconductor industry.

Further, Rapidus Corporation of Japan, a semiconductor manufacturer formed in 2022 and backed by major Japanese corporations including SoftBank Group Corporation, Toyota, Denso Corporation and Kioxia Holding Corporation has collaborated with IBM in the United States of America to undertake foundational research of advanced miniaturized circuits.

Railways

Overview of the sector and existing collaborations between India and Japan

Japan has traditionally invested heavily in India's infrastructural space with ongoing projects in roadways, railways, industrial corridors, amongst others. For instance, Japan's stronghold in railway technology has resulted in deepened collaboration between India and Japan for railway infrastructure projects. In December 2023, JICA sanctioned an ODA of JPY 400 billion for the 5th tranche for the MAHSR project, which is the largest amount committed through a single project loan agreement in the history of JICA globally.

Further, India and Japan are currently working together on six metro rail projects in Ahmedabad, Bangalore, Chennai, Kolkata, Delhi and Mumbai, in order to transform the urban public transport infrastructure in India. For this partnership, Japanese companies are also providing support in propulsion and control systems by establishing their manufacturing base in India.

With the GoI's renewed focus on ensuring safety of railways, India has been cooperating with Japan to study its best practices in this area. Under JICA's Technical Cooperation Project ("**TCP**"), a team of safety experts from Japan visited Indian railways, rail welding portion factory and training centre in 2019, and investigated the status of rail welding execution and safety management. The 'Project for Capacity Development on Railway Safety' was undertaken under the TCP to develop the capacities of the Indian Railways and Dedicated Freight Corridor Corporation of India Limited and Commission of Railway Safety, in relation to safety of the railway network on track maintenance, including rail welding techniques and rolling stock maintenance for improving safety.

Japan's expertise in the sector

Japan's railway system is well known for its efficient functioning, zero to minimal delays and usage of cutting-edge technology. In 1964, Japan inaugurated the first shinkansen train, also referred to as bullet train, running between Tokyo and Shin-Osaka. This train could travel at 210 kmph at that point in time. With constant technological advancements, Japan is now able to operate shinkansen trains at up to 320 kmph. The shinkansen technology has the best safety record, having resulted in zero passenger fatalities during the previous 54 years.

Further, Japan is constantly working on retaining expertise in the railway sector, for example, Japan's largest railway company, East Japan Railway Company (JR East) has launched the HYBARI, a hydrogen-hybrid train which is being developed with the target to achieve zero emissions by 2050.

Japan has adopted a futuristic approach in this sector. In 2027, the world's first superconducting magnetic levitation (SCMAGLEV) passenger train line, the Chuo shinkansen, will be launched in Japan, which is expected to run at a speed of 500 kmph. Further, this technology will also be environmentally sustainable, since the Chuo shinkansen train requires significantly less energy as compared to conventional trains.

Need for technical collaboration: Why and How?

The GoI is focussed on expanding its railway network in line with projected growth in passenger and freight train traffic. The railway network in India is believed to be one of the largest railway systems in the world. The GoI is focussed on bringing in more investments in this sector and is specifically focussed on improving network of high-speed trains.

India poses itself as an appropriate market for the application of Japanese technology in the realm of railway sector. Japan has also stood up to the opportunity and is committed on transfer of technology in this sector. As part of the MAHSR project, Japan has committed to train 1,000 engineers in India.

Indian policy initiatives to promote collaboration

To pursue the goal of modernisation and strengthening of the rail network in India, the GoI allowed 100% FDI in automatic route with respect to railway infrastructure for promotion of investment opportunities for participation in infrastructure projects, such as, high-speed railways, projects relating to electrification, high-speed tracks and suburban corridors.

In 2022, the National Rail Plan Vision – 2030 ("**NRP**") was released by the Ministry of Railways, GoI with the aim of developing a futuristic railway infrastructure by the end of the decade. The NRP aims at reforming and modernising the railways while ensuring safer and more affordable passenger and freight services. To achieve the objectives of the NRP, private sector investments are solicited in domains, such as, operations and ownership of rolling stock, development of freight and passenger terminals and development/operations of track infrastructure.

Comparative analysis of similar collaborations undertaken by Japan in other jurisdictions

Japanese railway technology is renowned across the globe. Recently, a Japanese manufacturer has received a big demand from the United Kingdom for production and maintenance of high-speed trains. Japan's success in this sector is based on decades of experience and knowledge that went into creating safe and reliable shinkansen trains. Japanese companies are being preferred by European countries as an alternative to European manufacturers because of the cutting-edge technology and reliability being offered by them.

Defence and space

Overview of the sector and existing collaborations between India and Japan

Cooperation between India and Japan on defence equipment and technology holds immense scope and potential. The Indo-Japanese relations have attained new heights in the past decade, with the two countries entering into various agreements in relation to Japanese defence technology, joint development and domestic production of defence equipment in India.

In 2023, during the India-Japan Defence Policy Dialogue, the Defence Secretary, GoI solicited Japanese defence industries to look at investment opportunities in India under the 'Make in India' initiative. Japan is a pioneer in terms of technological prowess in the defence sector. The 'India-Japan Vision 2025' is geared to leverage Japanese technology in modernising the Indian defence sector.

Given the common concern of security issues faced by both nations, several initiatives, such as, an agreement concerning defence equipment and technology transfer, setting up of the Joint working group on defence equipment and technology cooperation (JWG-DETC) and cooperative research on Augmentation Technology for Unguided Vehicles (UGV) / robotics, are being discussed between the two nations.

Further, India and Japan have made significant strides in 2023 in space collaboration. In August 2023, Dr. Saku Tsuneta, Vice-Chair of Japan's Cabinet Committee on National Space Policy visited the Indian Space Research Organisation ("**ISRO**") and discussed potential cooperation opportunities, such as, the 'Joint Lunar Polar Exploration' mission, utilisation of data from Aditya L1 and Chandrayaan-3 missions and development of smaller lander for lunar exploration, with Mr. S. Somanath, Chairman ISRO. Pursuant to such discussions, ISRO and the Japan Aerospace Exploration Agency are exploring opportunities to share data and strengthen the cooperation in space science.

Although the current market size of Indian space industry is estimated to be around USD 8.4 billion, with the implementation of the Indian Space Policy, 2023 (**"ISP"**), it is projected that by

2033, India's space industry will touch USD 44 billion, with the private sector holding the reigns. As per the Start-Up India portal of the Department for Promotion of Industry and Internal Trade ("**DPIIT**"), GoI, the number of space startups have increased significantly from 1 to 189 over a span of 9 years from 2014 to 2023, and investments have risen to USD 124.7 billion in 2023.

Japan's expertise in the sector

Japan's research and development programme has ensured that the existing military technology is constantly updated and quickly deployed in the field. In order to further enhance military technology, Japan is also looking to acquire the technology for hypersonic glide vehicles and counter aerial drones and swarm attacks. It is also acquiring the technical know-how for unmanned underwater vehicles. Further, in the space sector too, Japan enjoys a strong reputation in research and development. Japanese private players, such as, Mitsubishi Heavy Industries, Ltd. and Kawasaki Heavy Industries, Ltd. have expertise in precision engineering and cutting-edge technology in the aerospace sector. Hence, developing a strategic partnership with these companies will provide excellent opportunities for the growth of aerospace sector in India.

Need for technical collaboration: Why and How?

India and Japan are constantly making strategic investments in their military sectors. India ranks forth in the world in military expenditure. Japan is also equally committed towards advancement of its military sector and is ranked 10th in military expenditure. The commitment of both the countries highlights the scope for collaboration between them.

With Japan revising its national security strategy and focussing on emerging technologies, and India opening its private sector for defence industries, the two nations can align their policies and collaborate in the defence sector.

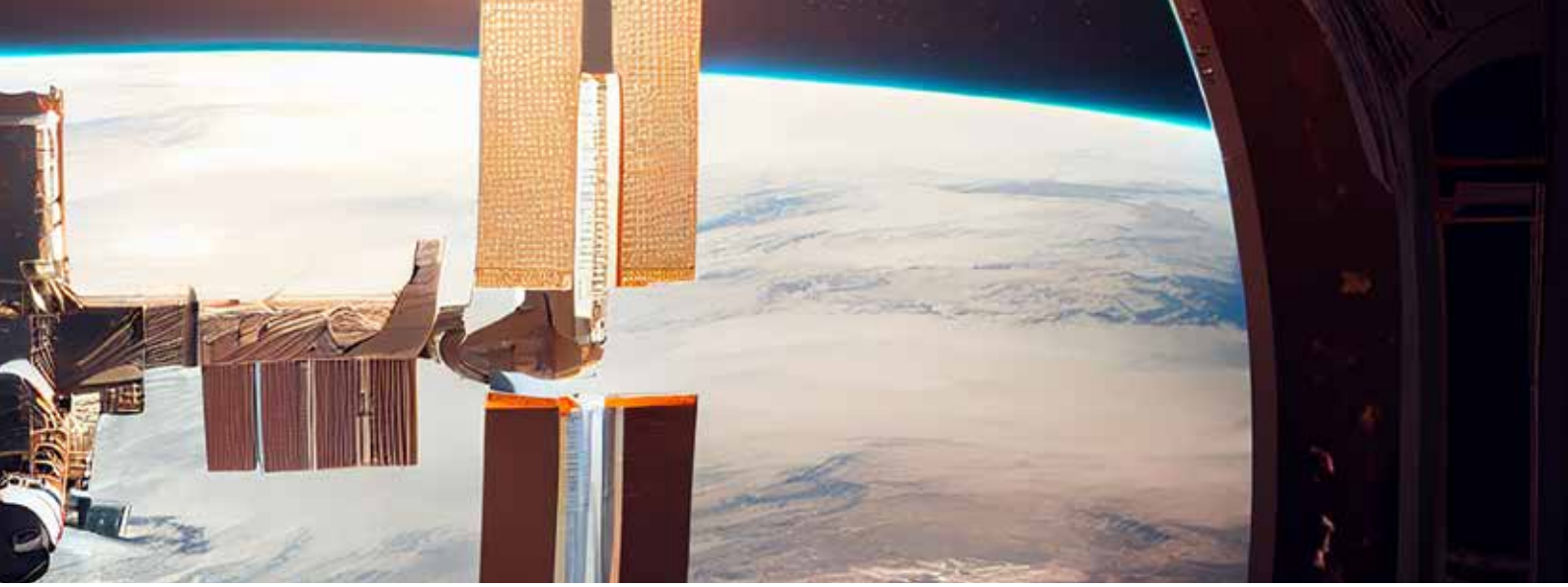
Both the countries have collaborated on identified sectors, including dual-use technology areas, such as, unmanned armed vehicles (UAVs), robotics and intelligence systems. Another probable area of confluence between the two countries is robotics, wherein India can benefit from Japanese technology for the purposes of border surveillance.

Japan's advanced technology in space will provide India the much-needed impetus to grow further.

Indian policy initiatives to promote collaboration

The GoI has adopted several initiatives, such as, liberalisation of FDI policy allowing 74% FDI under automatic route and between 74% to 100% under government route, increasing the allocation of defence budget of military modernization for procurement from domestic sources progressively, to promote avenues of investments and collaboration in indigenous design, development and manufacture of defence equipment for realising the goal of self-reliance in defence manufacturing in the country. In 2023, two dedicated Defence Industrial Corridors were established in Uttar Pradesh and Tamil Nadu with the target of attracting investments worth INR 200 billion by 2024-25 for development of defence industries, domestic supply chain and strengthening of defence manufacturing ecosystem in India.

In February 2024, in alignment with the ISP, the FDI thresholds and entry routes for various sub-sectors of the space sector have been liberalised. For example, upto 74% FDI under the automatic route has been allowed for satellites-manufacturing and operation, satellite data products and ground segment and user segment and FDI between 74% to 100% in such activities is under the government route, 100% FDI under the automatic route has been allowed for manufacturing of components and systems/ sub-systems for satellites, amongst others.



Comparative analysis of similar collaborations undertaken by Japan in other jurisdictions

Japan has collaborated with multiple countries on defence related technology. Australia seeks to acquire nuclear technology for powering submarines for its Project Aukus from Japan. This is one of the more innovative uses of nuclear power in military and defence.

Japan and United States of America seek to collaborate on airborne combat and advanced unmanned aerial vehicles through employment of AI and machine learning technologies developed by both countries.

In September 2023, Japan's Mitsubishi Heavy Industries, Ltd., announced collaboration with an Italian company and a United Kingdom based company, for delivering technology for next-generation combat aircrafts. This collaboration between the three nations denotes collaboration of cutting-edge defence technology.

In the space sector, in January 2023, Japan has signed a Framework Agreement with United States of America for cooperation in space exploration and use of outer space, including the moon and other celestial bodies, for peaceful purposes.

Further, in 2023, Astroscale UK collaborated with Astroscale Japan for the advancement of refuelling capabilities in the low-earth orbit environment, amongst others.

Regulatory and Policy Framework for Facilitating Technical Collaboration

Brief overview of regulatory background: Making investments more accessible

At present, India has one of the most investor friendly FDI regimes globally. Apart from the strategically important sectors, most sectors are open to 100% FDI under the automatic route, (such as, manufacturing, services and construction development sectors), subject to sector specific conditions and security requirements, making India a lucrative investment destination. Such a receptive approach towards FDI by the GoI has resulted in increased FDI inflows in India, with a figure of USD 33 billion reported from April 2023 to September 2023.

Other than the sector specific policy initiatives undertaken by the GoI as highlighted in the above Section of this report, several other milestone initiatives have been adopted by the GoI to enhance opportunities for growth, development and collaboration with Japan, such as:

PLI Scheme

The GoI launched the PLI scheme in 2020, which provides incentive between 4% to 6% on the incremental sale of goods manufactured in India for a period of five years. PLI scheme covers 14 key sectors with an outlay of INR 1.97 trillion to enhance exports and attract investment in the areas of core competency and cutting-edge technology. It is noteworthy that PLI units have been established in more than 150 districts (24 States), attracting over INR 950 billion of investment till September 2023.

National Single Window System ("NSWS")

NSWS acts as a single platform to enable the identification and obtaining of approvals and clearances needed by investors, entrepreneurs and businesses in India. NSWS has the potential to positively impact other ongoing trade and investment promotion activities. For example, it has successfully processed over 255,000 approvals as of November 2023 and facilitated applications for over 400 investors in different government schemes.

Startup India Action Plan ("SIAP")

In extension of the much-acclaimed SIAP launched in 2016, a Startup20 Engagement Group was institutionalised under India's G20 presidency in 2023, to create a global narrative for

supporting startups and enabling synergies among startups, corporates, investors, innovation agencies and other key ecosystem stakeholders.

Reduction in compliance burden and decriminalization of offences

In order to reduce the cumbersome compliances in India, the 'Regulatory Compliance Portal' was launched by DPIIT in January 2021. The objective of this portal is to function as an online repository of all Central and State-level compliances and to minimize regulatory compliance burden. Based on data uploaded on the Regulatory Compliance Portal, more than 3,600 compliances have been decriminalized and more than 41,000 compliances have been reduced by various Ministries/ Departments and States/ Union Territories. Additionally, the Jan Vishwas (Amendment of Provisions) Bill, 2023 was passed by the Parliament in August 2023, through which a total of 183 provisions are proposed to be decriminalized in 42 Central Acts administered by 19 Ministries/ Departments.

Strengthening of Intellectual Property Rights ("IPR")

Serious policy and legislative reforms have been undertaken recently by the GoI to strengthen the IPR regime to support innovation. India's rank in the Global Innovation Index (GII) amongst 132 economies has improved from 81st in 2015 to 40th in 2023. The number of patents granted has seen an eight-fold growth from 5,978 in 2014-15 to 47,735 in 2023-24 (up to November 30, 2023). Number of designs registered has recorded a two-fold increase from 7,147 in 2014-15 to approximately 15,506 in 2023-24.

Conclusion

The cooperation between India and Japan has come a long way since 752 AD and today India considers Japan as its most trusted partner in economic and technological modernization. The partnership between the two nations holds significant promise, particularly in the realm of technology. Over the years, both nations have cultivated a strong bond based on mutual respect, shared values and a common vision for regional and global stability. Technological ties between India and Japan have deepened through collaborative efforts in various domains, including but not limited to renewable energy, EVs, automobile, railways, defence, etc. and there remains immense scope for technical collaboration in key sectors, such as, space, telecommunication and agriculture.

The growth in the above-mentioned sectors coupled with favourable government policies vindicate the economic potential of investments by Japan in India. As both countries continue to deepen their technological ties, the India-Japan partnership not only strengthens bilateral relations but also contributes to regional stability and global progress. It sets a promising precedent for future collaborations, offering immense potential for mutual growth and prosperity.

Transforming Small and Medium Enterprises
A Blueprint for Indo-Japan Collaboration in Manufacturing and Machine Tool Technology

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Introduction

In today's technology-driven global era, the collaboration between nations has become important in strengthening economies and driving innovation. Japan, renowned for its manufacturing and machine tool technology, has expertise that can benefit India's burgeoning small and medium-sized enterprises ("**SME**") sector. Meanwhile, India's rapidly growing SME market offers a fertile ground for innovation and market penetration. By fostering collaboration between Japanese technological giants and Indian SMEs, both countries can unlock new opportunities, drive innovation, & propel economic growth.

Growing Manufacturing/Machine Tool Landscape in India

India is one of the fastest growing countries in the world, with an estimated year-on-year growth of 7.3% in real GDP during 2023-24. The manufacturing industry plays a vital role in driving the economic growth of India. The industry is expected to reach USD 1 trillion by 2025 and contribute to 25% of national GDP in 2025.

SMEs play a key role in the Indian economy, contributing to approximately 29% of national GDP, 45% of exports and 36% of manufacturing output in 2022. As of 2023, India boasts around 640,000 SMEs. A large number of SMEs are the backbone of India's industrial development due to their large share and remarkable contribution in it.

The significant growth expected in India's manufacturing sector is driven by infrastructure development, rising income levels, urbanization, increased consumer spending and other government initiatives *(Make-In-India, Production Linked Incentives (PLI) Scheme, Skill India Mission and Udyam Registration, etc.).*

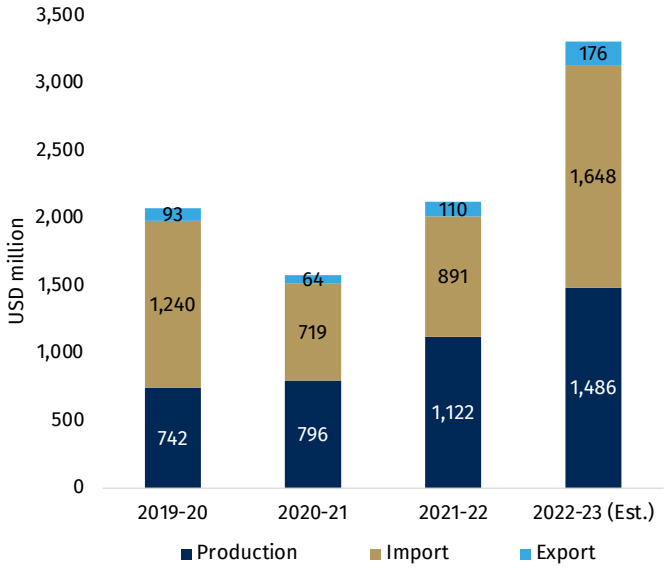
Machine Tool Industry Overview

The machine tool industry is critical sub-sector of the manufacturing industry. Machine tools are at the origin of every manufacturing process involving metals. From cars to airplanes, from watches to computers, from solar panels to automobiles, almost everything is made using machine tools.

Growth in the machine tool industry is being driven primarily by the Auto sector (automotive & auto components) as the industry adopts electric vehicle manufacturing, followed by agriculture, the consumer sector and general engineering. New growth areas will emerge from segments, such as, semiconductors. The domestic consumption of machine tools in India has potential to grow by USD 1.9 billion during 2020-2024 and the market's growth momentum will accelerate at a Compound Annual Growth Rate ("**CAGR**") of 12.78%.

As can be seen from the data, India remains a net importer of machine tools with about 50% to 55% of machine tools being imported, mainly from countries, such as, China, Japan, Germany, Taiwan and South Korea. There is significant gap between consumption and production, which means there is a huge opportunity to increase the domestic production in India. The industry, especially the SME sector, is looking for global collaborations to enhance domestic production. Japan is poised to be the most prominent country for such collaborations.

Indian Machine Tool Industry - Import, Export & Production



Source: Indian Machine Tool Manufacturer's Association (IMTMA)

The machine tool industry comprises more than 1,000 manufacturers in the organized and unorganized sectors. Although 90% of these companies are in the SME sector, about 80% of the production is contributed by 15 to 20 large companies. The large organised players cater to India's heavy and medium industries whereas the small-scale sector meets the demand of ancillary and other units.

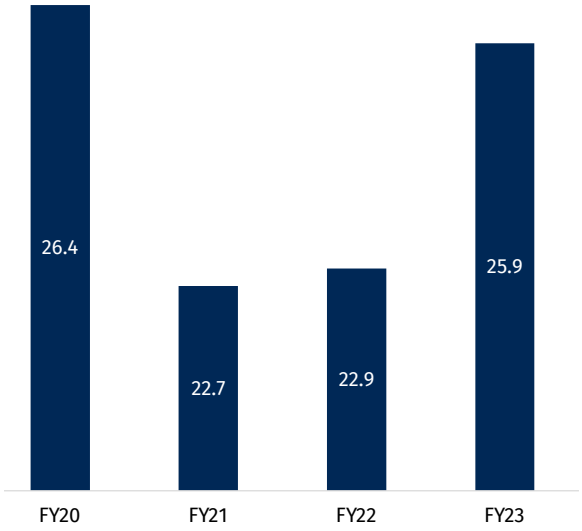
Key End User Segments driving growth in Machine Tool Industry

Automotive, electronics, engineering & capital goods are major markets for machine tools in India. Other key focus industries include railways, construction, defense/aerospace, medical devices, telecom & network products, pharma, food, white goods and textiles which are boosted by with increasing government investments.

Automotive: The Indian automotive industry (automobile manufacturers and auto component companies) is estimated to account for approximately 60% of the machine tool market in India in 2023, according to Indian Machine Tool Manufacturers' Association (IMTMA). The sector has been evolving rapidly due to the adoption of electric vehicles by Indian users, government initiatives (Automotive Mission Plan 2026, scrappage policy, PLI scheme, etc.,), increasing demand in logistics and rising middle class incomes.

Approximately 26 Mn automobiles were produced in India in 2023.

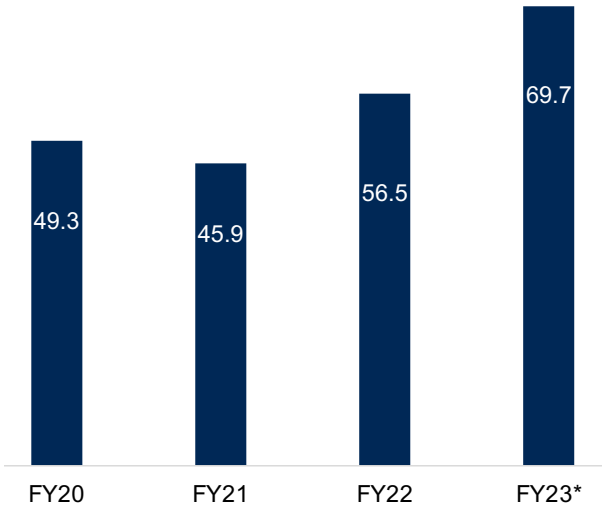
Units of Automobile Produced (Million)



Source: IBEF

The Indian auto component industry is expanding and set to become the 3rd largest globally by 2025, according to IBF.

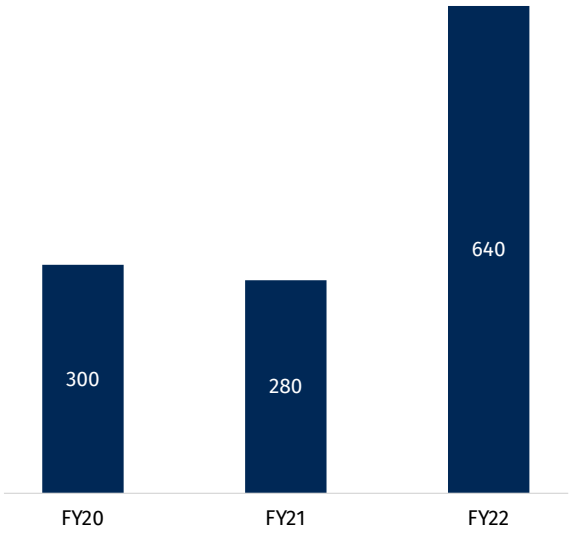
Auto Components (aggregate turnover USD Billion)



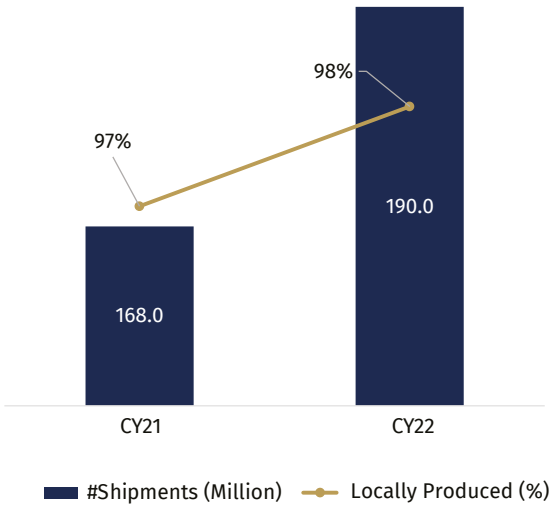
Source: IBEF

Electronics: Indian electronics system design and manufacturing is one of the fastest growing segments. Over 2X growth in domestic electronics production in last six years from USD 49 billion in FY 2017 to USD 101 billion in FY 2023. One of the key growth areas is smartphone manufacturing. India is now the second largest phone manufacturing country after China, with two billion smartphones produced between 2014 to 2022, registering CAGR of 23%. In 2022, 98% of shipments in the overall Indian market were "Made-In-India".

Phone Production Value in India (USD Million)



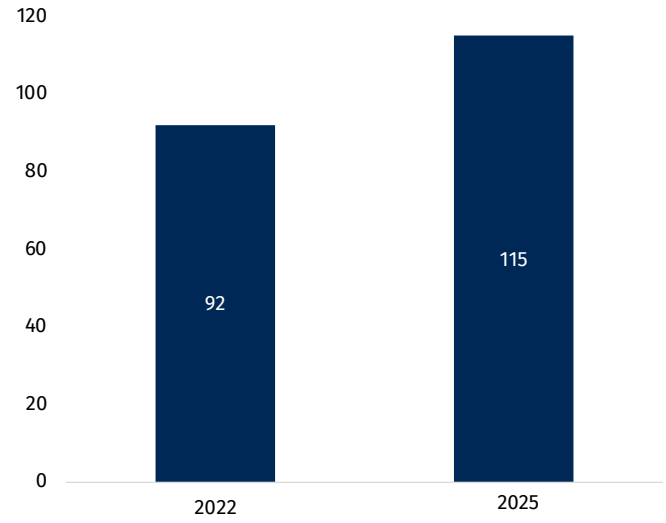
Smartphone shipments



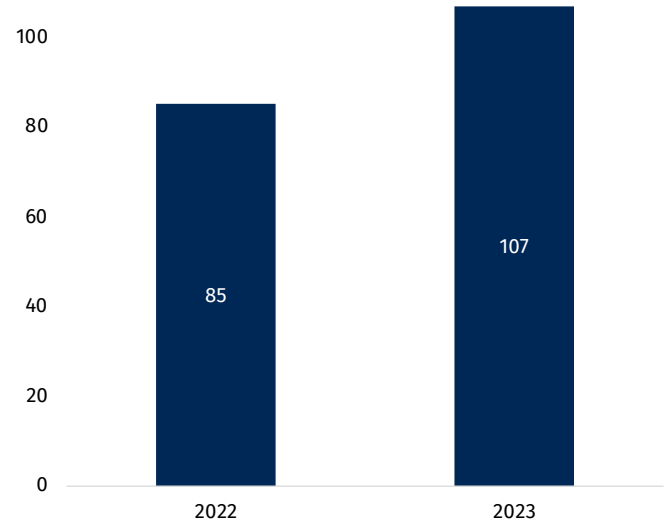
Source: Counterpoint's 'Made in India' Research, 2022, Ministry of Electronics & Information Technology

Engineering & Capital Goods: India's capital goods market serves a strong base for its engagement across sectors, such as, engineering, construction, infrastructure and consumer goods. It accounts for 27% of total factories in India and 63% of overall foreign collaborations. The sector is expected to reach USD 115 billion by 2025.

Capital Goods Turnover (USD Billion)



Construction Equipment Sales ('000 units)



Source: IBEF

Key Challenges Faced by Indian Machine Tool Industry

Technology Gap: This is one of the key challenges faced by Indian machine tool manufacturers. The machine tool industry is capital, technology and knowledge intensive industry with a high R&D intensity. It requires multi-disciplinary knowledge and understanding of mechanical, hydraulic process and software engineering. Moreover, it takes time to develop these competencies and master the expertise in machine tool production.

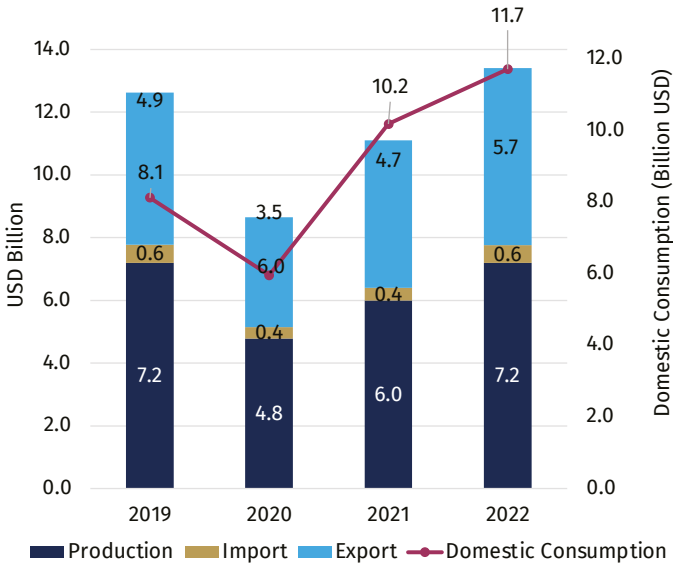
Investment Gaps: As machine tool is a capital-intensive industry, Indian companies find it difficult to allocate CAPEX. This situation is further aggravated for SMEs, which form major portion of machine tool industry and which struggle with limited availability of funds.

Product Gaps: Many advanced products are being manufactured by Indian machine tool companies. Products, such as, large size machine tools, highly reliable Computer Numerical Control machines with zero downtime, linear motor technology for high speed and acceleration, machines with plug and play features, multi-tasking machines to reduce cost per unit and compact machines with minimum footprint to optimize space utilization are being imported to meet the domestic demand.

Japanese Prowess in Machine Tool Industry

In the Japanese machine tool industry, the increasing exports, as shown in the graph, indicate the proven quality of Japanese machine tools. In certain specialized areas, such as, industrial robots, high-precision machine tools and large size machines, Japanese companies are already established and are producing parts, sub-assemblies and full machines. By having Indian SME partners, these products can also be made in India, for consumption in India and for export from India.

Japan Machine Tool Industry - Import, Export & Production



Source: Japan Machine Tool Builders' Association (JMBTA)

Industrial Robots: Japan is home to some of the world's leading industrial robot manufacturers. As of 2022, 45% of the industrial robots worldwide were originally produced/

designed in Japan. Orders for Japanese industrial robots were worth USD 7.35 billion in 2022.

Advanced and High-Precision Machine Tools: With technological advancements and extensive R&D in machine tools, Japan has become a world leader in precision machinery. Companies, such as, Yamazaki Mazak Corporation, Fanuc Corporation, DMG Mori Co., Ltd., Okuma Corporation, Makino Milling Machine Co., Ltd. and Amada Co., Ltd. have pioneered the production of precision machine tool, which have different characteristics in different areas and are highly heterogeneous.

Large Size Machines: Japan is also the world leader in large size machine tools.

Indo-Japan Collaboration | Growing Needs and Benefits

The Indo-Japanese collaboration in the machine tool sector represents a strategic convergence of mutual interests and complementary strengths, addressing a growing need while unlocking substantial benefits for both nations.

For Indian SMEs: Indian SMEs are looking towards a future of expansion and integration into both local and global markets. Their strategic objectives can be outlined as follows:

- **Technology and Product Offering Enhancement:** By partnering with Japanese SMEs, Indian companies hope to fortify their product offerings and technological capabilities. Japan's leadership in manufacturing innovation, precision engineering and quality control can help Indian SMEs upgrade their products and services to world-class standards.
- **Business Expansion:** Collaboration with Japanese counterparts provides an opportunity to tap into advanced manufacturing technologies and machine tools, enabling Indian SMEs to meet the stringent quality and precision requirements of both domestic and global customers.
- **Supply Chain Integration:** Becoming an integral part of both the Indian and international supply chains is critical for Indian SMEs. They aim to evolve from being local players to recognized global participants in the manufacturing ecosystem. Partnering with Japan can facilitate access to sophisticated machine tool technologies and manufacturing systems, enhancing their capability to serve as reliable suppliers in competitive supply chains.
- **Investment Support:** Access to investment is critical for Indian SMEs, especially as the cost of capital in India is considerably high. Collaboration with Japanese entities could mean not only technology transfer but also potential financial investment and partnerships.

For Japanese Companies:

Many Japanese companies, both large and small, with a technological edge, find India to be an attractive destination for several strategic reasons that align with their broader global objectives.

- **Supply Chain Resilience:** In recent years, global supply chains have faced unprecedented disruptions due to various factors, including geopolitical tensions, trade conflicts and pandemics. Diversifying manufacturing and supply chain operations into India can allow Japanese companies to mitigate these risks. India's growing manufacturing sector, backed by a robust domestic market, offers a reliable alternative to traditional manufacturing locations.
- **Export Hub Potential:** India's strategic geographical location and its extensive network of trade agreements make it an ideal hub for Japanese companies looking to export their products, particularly to Africa and the Middle East. By setting up manufacturing operations in India, Japanese firms can leverage the country's advantageous position to access the global market, which can significantly enhance their global presence.
- **Cost Efficiency:** India's competitive advantage in terms of lower labour, raw material, component costs and logistic/ production costs for exports provides a substantial opportunity for Japanese companies to reduce their

manufacturing costs. Additionally, the GoI's policy of attracting FDI, further contributes to making India a cost-effective manufacturing location.

How can India and Japan collaborate in manufacturing and machine tool technology?

Business Development Ways

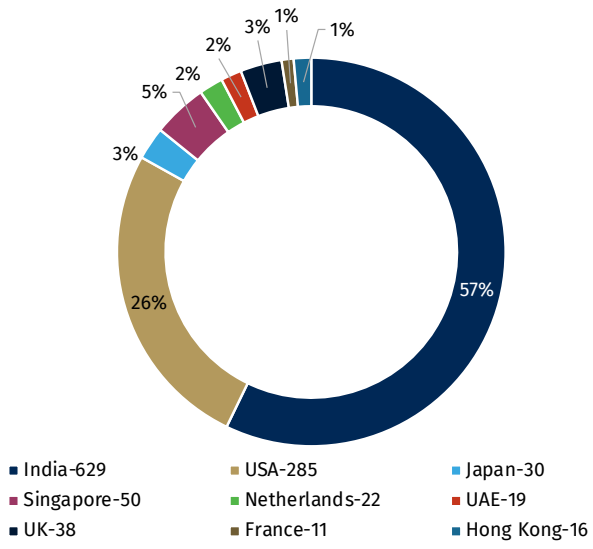
Transfer of Japanese technology in Indian manufacturing SME industry entails both transfer of tangible technologies and intangible knowledge, methodologies and best practices honed by Japanese companies over decades of innovation and refinement.

Below are few ways to orchestrate the collaboration:

- **Mergers & Acquisitions ("M&A"), Joint Ventures ("JV"):** M&A and JVs can play significant role in facilitating India-Japan collaboration on machine tool technology. It can serve as a platform for the Japanese machine tool giants to enter the Indian market which is poised to grow significantly over the next few years.

  Historically, Japan has been one of the largest bidding countries in India in terms of value and volume, as can be seen from the statistics.

Top Bidding Countries for M&A in India by No. of deals, 2020 -2022*



Source: India Briefing, 2022

- **Innovation with Startups:** India has the third largest startup ecosystem in the world with a total capital of USD 70 billion invested from 2019 to 2023. There are 31,000 tech startups with 91 active unicorns (privately held startups valued over USD 1 billion). Large international companies are collaborating with Indian startups to achieve speed and scale in their operations. This eco system offers great opportunities for Japanese companies to collaborate with Indian startups. They can engage in open innovation with Indian startups, which can accelerate technological advancement and market reach in the sector.

Support System for Japanese Companies

There are support systems to enhance the collaboration.

- **Japan Industrial Townships ("JITs"):** India and Japan have collaborated to establish JITs in India, which are special arrangements only for Japanese corporations, helping them with ease of doing business. As of 2021, Japan has set up 12 dedicated country-specific industrial townships in India across nine states of India. About 114 Japanese corporations have set up their operations in JITs as of February 2022. Establishment is being undertaken by both private and government entities. JITs follow a plug and play model.
- **SME facilitation cell by Embassy of India, in Japan:** India has launched SME facilitation cell in Japan in 2023, to promote Japanese SMEs to enter Indian market. It provides assistance to Japanese SMEs wishing to enter the Indian market and benefit from cost-effective labour, vast market access & strategic location of India. The cell will also provide information on market trends, regulatory guidelines & potential business opportunities.

Success Cases

Japan has maintained significant presence in the Indian market for decades through collaborations, JVs and strategic investments. Some of the leading companies present in India are Suzuki Motor Corporation, Toyota Group, Hitachi, Ltd., Panasonic Holdings Corporation, Denso Corporation, Nippon Steel Corporation, Kawasaki Heavy Industries Ltd., Sony Group Corporation, Mitsubishi Corporation, Mitsui & Co., Ltd., Honda, Yamaha Motor Co., Ltd., Daikin Industries, Ltd., Fast Retailing Co., Ltd., Toray Industries, Inc., TDK Corporation, Otsuka Pharmaceutical Co., Ltd., Meiji Seika Pharma Co., Ltd., Terumo Corporation, Omron Corporation, etc. These companies have made significant contributions to the Indian economy across various sectors, including automotive, electronics, infrastructure, pharmaceuticals, consumer goods and heavy industrial equipments. Some of the major recent success

stories of Japanese companies with manufacturing technologies collaborating with Indian companies are outlined below:

- In December 2023, Mitsui & Co. Ltd, along with major Dutch EV bus manufacturer VDL Groep has invested in Pinnacle Mobility Solutions Private Limited, an Indian manufacturing company that produces and sells electric buses and electric small commercial vehicles. The decision was taken against the backdrop of a rapidly growing EV industry in India and the government's vision for EVs by 2030.
- Yamazaki Mazak Corporation, a leading machine tool manufacturer, has set up a new manufacturing plant in India to meet the growing demand for machine tools in automotive, medical, aircraft and semiconductor industries. It has been operational since May 2023. The initial investment is about USD 27 million. It manufactures new type of vertical machining centre, which is designed and developed in Japan for the Indian SME market.
- Brother Industries, Ltd., a leading Japanese company known for printers, fax machines and sewing machine, has invested in India to build a machine tool production plant in Tumakuru near Bengaluru. Scheduled to be completed in September 2024 with the investment of JPY 2 billion, approximately USD 13 million. It aims for significant growth in the industrial equipment business handling machine tools.
- Hoshizaki Corporation, a leading Japanese manufacturer of commercial equipment for food and beverage, had Western Refrigerator, an Indian manufacturer, as their group company in 2013. They had successfully built four production facilities in India. The latest one is built in Gujarat and started production by November 2022.
- Nittoseiko Co. Ltd., a Japanese company that provides fastening solutions and products with revenues of USD 300 million in 2023, announced on February 2024 that it would acquire Vulcan Forge Pvt. Ltd., a Delhi based company manufacturing bolts and other products (USD 8.6 million revenue in 2023). This is Nitto Seiko's first base in India. It will develop local automakers and other companies by integrating Vulcan Forge's plants and technologies.
- Infrastructure projects are another area where there are multiple opportunities for collaboration between Indian SMEs and Japanese companies. The large-scale investment projects in the Indian railways are one such area. For example, the Japanese government supports the high-speed railway project "Shinkansen bullet train", Delhi metro and other metros. Another area would be increasing private investment in infrastructure buildings in India by Japanese corporations. A recent example is Sumitomo Realty & Development Co., Ltd. which will invest JPY 500 billion (USD 3.3 billion) in office building projects in India. These Japanese investments and technologies will accelerate collaborations and business opportunities with Indian manufacturers, including SMEs.

ABOUT IJFF

The India-Japan Friendship Forum (IJFF) has been formed under the patronage of Ambassador of Japan to India and is chaired by Amb. Deepa Wadhwa, Former Indian Ambassador to Japan.

The secretariat for IJFF is located and would be provided by FICCI, New Delhi.

The mission of IJFF is to increase visibility of Japan in India, and thereby enhance mutual understanding between India and Japan by showcasing art and culture and exchange knowledge and ideas and to deepen understanding on Japan amongst Indians.

The India-Japan Friendship Forum partners with several organisations both in India and Japan to organise various activities to foster and facilitate exchange of people and ideas between the two countries.

The launch of the IJFF was held on January 8, 2019 in the august presence of **H.E. Mr. Taro Kono, Minister of Foreign Affairs of Japan** and **Shri Suresh Prabhu, Minister of Commerce and Industry and Civil Aviation**. IJFF has 28 partner organizations working towards promoting India-Japan relations are partners to the IJFF.

Some of the major events and prorammes organsed under IJFF include India-Japan Tourism Roundtable during FICCI's Great Indian Travel Bazaar (GITB) 2019; Celebration of New Imperial Era (Reiwa) and welcoming JCCII board members; India-Japan Collaboration Opportunities in Fintech; Special lecture by Shri Ramesh Abhishek, Former Secretary, DPIIT, Government of India and welcome reception for Japanese Ambassador H.E. Mr Satoshi Suzuki.

An exclusive website of IJFF under the address of ijff.co.in has been launched and is live now for everyone to access.

FICCI INITIATIVES WITH JAPAN

- Economic Engagements- India-Japan Business Cooperation Committee (IJBCC)
- People to people connect: “India-Japan Friendship Forum”(IJFF)
- Engaging parliamentarians: “India - Japan Forum of Parliamentarians”
- Connecting Indian States: “Dialogue with States”
- Promoting Government of India’s flagship initiatives including Make in India, Skill India with Japan
- Partnership through MOU with JCCI, JETRO and JCCII
- Experience of conducting Investment promotion roadshows for Vibrant Gujarat & Advantage Assam in Japan
- Facilitating India-Japan sectoral cooperation including auto & auto components, electronics, fintech, green energy, pharmaceuticals and medical devices, defense manufacturing and tourism
- FICCI Representative office in Japan

ABOUT SAM & CO.

Shardul Amarchand Mangaldas & Co., founded on a century of legal achievements, is one of India's leading full-service law firms. The Firm's mission is to enable business by providing solutions as trusted advisers through excellence, responsiveness, innovation and collaboration.

SAM & Co. is known globally for its exceptional practices in mergers & acquisitions, private equity, competition law, insolvency & bankruptcy, dispute resolution, international commercial arbitration, capital markets, banking & finance, tax, intellectual property, data protection and data privacy, technology law and Infrastructure, Energy and Project Finance.

The Firm has a pan-India presence and has been at the helm of major headline transactions and litigations in all sectors, besides advising major multinational corporates on their entry into the Indian market and their business strategy. Currently, the Firm has over 820 lawyers including 166 Partners, offering legal services through its offices at New Delhi, Mumbai, Gurugram, Ahmedabad, Kolkata, Bengaluru, and Chennai.

ABOUT FICCI

Established in 1927, Federation of Indian Chambers of Commerce and Industry (FICCI) is the largest and oldest apex business organisation in India. Mahatma Gandhi addressed FICCI's 4th AGM in 1931. Our 96th AGM was held in December 2023. With our rich legacy, FICCI would play an even greater role as India emergence as the 3rd largest economy.

FICCI works with its key stakeholders to foster active engagement and dialogue with decision makers, to support steps that are good for commerce and industry.

As a member-led and member-driven organisation, FICCI represents over 2,50,000 companies across all segments of economy including public, private and multinationals. The diverse membership base of FICCI across all Indian states includes both direct and indirect members through its 300 affiliated regional and state level industry associations. FICCI has a large international presence via partner agreements with 250 national business associations in over 100 countries.

CONTRIBUTOR PROFILES

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Awards and Recognition

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Asia Pacific Outside Counsel Diversity Awards 2023

Morgan Stanley

'Outstanding'
in 2023-24 for Banking and Finance, Banking and Financial Services, Capital Markets, Competition/Antitrust, Construction, Corporate and M&A, Dispute Resolution, Energy, Insurance, Infrastructure, Pharmaceuticals and Life Sciences, Private Equity, Regulatory, Real Estate, Restructuring and Insolvency, Technology and Telecommunications

asialaw

'Ranked #1'
by deal count
In the Bloomberg India Capital Markets League Tables 2022

Bloomberg

'Ranked #1'
in deal count and value in the annual MergerMarket India League Tables 2023

Mergermarket
An Acuris company

'Tier 1'
in 2024 for Antitrust and Competition, Banking & Finance, Capital Markets, Corporate / M&A, Dispute Resolution-Arbitration, Insurance, Private Client, Private Equity and Investment Funds, Projects and Energy, Real Estate & Construction, Restructuring & Insolvency, Tax, TMT and White Collar Crime

The LEGAL 500

'Tier 1'
in 2023 for Banking, Capital Markets: Equity and Debt, M&A, Private Equity, Project Development: Energy, Infrastructure and Transport, Project Finance, Restructuring & Insolvency

IFLR 1000

Country Firm of the Year 2022, India

WWL

'Band 1' in 2024 for
Capital Markets
Competition/Antitrust
Corporate/M&A
Dispute Resolution
Arbitration
Fintech
Private Equity
Projects, Infrastructure & Energy
Restructuring & Insolvency
White Collar Crime

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