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Seismic Shift

Economic Growth and Strategic Alignment
Between the Bay Area and India

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Foreword

California and the Bay Area-Silicon Valley have been at the forefront of efforts to deepen economic ties with India. The visit to India of a high-level delegation representing the Bay Area Council in January 2020 explored new strategic opportunities for increased bilateral trade and investment with India.

The first India report released by the Bay Area Council in 2009—*Global Reach: Emerging Ties Between the San Francisco Bay Area and India*—documented the deep relationship between the two economies. A second report in 2019—*The Bay Area-Silicon Valley and India: Convergence and Alignment in the Innovation Age*—examined the Indian contributions to the region’s innovation economy and fast-emerging investments that Bay Area companies were making in India. These ties were facilitated by a bold and ambitious agenda led by Prime Minister Modi to digitalize the economy, expand the use of renewable energy, and enact reforms for doing business.

I am happy to note that the Bay Area Council is now releasing this third India report. The synergies that have developed over these years have grown stronger. I am confident that this report will provide a roadmap to further the close ties of cooperation between the Bay Area, California, and India.

Harsh Vardan Shringla
Ambassador to the United States 2019–20
Foreign Secretary of India 2020–21
Chief Coordinator for India’s G-20 Presidency 2023

Executive Summary

Once distant, U.S.-India relations have drawn progressively closer. New economic reforms have created large markets and reduced barriers to foreign investment. This economic engagement parallels a growing strategic alignment between the two countries, driven by the shared perception of a growing threat from China. Alignment is built on a foundation of shared democratic values, the rule of law, and economies built on market principles. In this new environment, India is not an ally in the formal sense—there is no mutual defense treaty between the U.S. and India—and it continues to protect its ability to maneuver as an independent actor. But on a practical level, the interests and challenges shared by the United States and India are drawing both nations more closely together.

Growing Geo-Strategic Alignment

Alignment is reflected in a range of national, bilateral, and multilateral initiatives, including the United States' Indo-Pacific Strategy, the Quad (linking the United States, Japan, India, and Australia), the U.S.-India Climate and Energy Agenda 2030 Partnership, the United States-India Trade Policy Forum, the U.S.-India Initiative on Emerging and Critical Technologies (iCET), and deepening exchanges on global supply chains.

India's Economy

The IMF estimates that India's economy grew 6.8% in 2022 and will grow 6.1% in 2023. This makes India the fastest growing major economy in the world, ahead of China's estimated growth of 3.0% in 2022 and 5.2% in 2023. With a population of 1.4 billion, India is still a lower-middle-income economy with an average income level of \$2,000 (\$7,150 at purchasing power parity). While this is a challenge, a median age of 28.4 gives India a young workforce, an advantage over China, where the workforce is aging rapidly.

Technology, supported by foreign direct investment (FDI), is a major driver of growth as government reforms have greatly reduced barriers. Annual FDI, which stood at \$60.22 billion in FY 2016–17, has grown to \$83.57 billion in FY 2021–22.

Computer software and hardware is the leading sector for investment, with a 25% share, followed by the services and automotive sectors. Investment in manufacturing has also been strong. Among India's states, Karnataka, with its technology capital Bangalore, is the largest recipient of FDI with 38% of total invested equity, confirming the strong orientation of overseas investors toward technology. The largest overseas investors were Singapore (27%), the United States (18%), and Mauritius (16%). Singapore and Mauritius, however, serve primarily as tax platforms, and India's government data doesn't report the original FDI source countries. This makes the United States India's largest known overseas investor.

Measuring Competitiveness

India ranks #37 out of 63 countries in the 2022 IMD World Competitiveness Ranking, advancing six places from 2021. The 2022 Global Innovation Index (GII) ranks India #40 out of 132 countries globally, up from #46 in 2021, and #1 among lower-middle-income countries (up from #2 in 2021.) India also places among a handful of countries as an "innovation achiever" (an economy that performs above expectations relative to its level of development).

Indian States: Laboratories for Innovation

The Modi administration has devolved considerable power to states. While most city governments are comparatively weak, India's states enjoy considerable regulatory authority.

The India Innovation Index measures the competitiveness of Indian states by a range of measures: human capital, investment, knowledge

workers, R&D activity, business environment, and safety and legal environment, as well as knowledge output and knowledge diffusion. In 2021, the top five states were Karnataka, Telangana, Haryana, Maharashtra, and Tamil Nadu.

Bay Area and California investors need to look beyond the national level to consider the business, infrastructure, human capital, technology orientation, and business environment of India's states.

National Economic Initiatives

The Modi government has aggressively courted foreign investment through reforms designed to improve India's business environment and reduce bureaucratic barriers to investment.

Foreign Investment

Under rules developed in 2020, FDI in India falls under either the Automatic Route or the Government Route (which requires an application). Most sectors are now fully open to foreign investment through the Automatic Route, with 100% foreign ownership permitted in a broad range of industries; the Government Route allows up to 100% foreign ownership in certain sectors.

Manufacturing

Make in India, launched in 2014, aims to transform India into a global manufacturing center. Investment in the electronics manufacturing sector is supported by the Production Linked Investment Scheme (PLI) for Large Scale Electronics Manufacturing, launched in 2020, which has offered incentives (a percentage of incremental sales) for products manufactured in India in target industries.

The promotion of domestic manufacturing has been particularly successful in the electronic components sector and in mobile phones, where India has become the second largest mobile phone manufacturer in the world. Apple is now assembling its flagship iPhone 14 in India at a facility operated by its supplier Foxconn on the outskirts of Chennai. Production of electronic goods has more than doubled from \$30 billion in 2014–15 to \$75 billion in 2019–20.

Digital India

This acceleration of markets and investment reflects India's decisive move into the digital space through policies designed to advance digitalization across several fronts. The Modi government's Digital India initiative has been a driver of mobile, cloud, big data analytics, and digital services by promoting ubiquitous broadband and Wi-Fi build-out, low-cost phones, digital literacy, and the Aadhaar biometric card that digitally connects citizens to healthcare and other government services.

India's national digital health program, the Ayushman Bharat Digital Mission, provides an architecture for the delivery of health services using open standards, enabling the creation of longitudinal health accounts (records) that move with the user. The Universal Health Interface (UHI), part of the Mission, enables independent apps to run and users to find and access services. This digital public infrastructure has increased access to and lowered the cost of health and other services throughout the country.

A growing user base and the widespread deployment of mobile smartphones has advanced digitalization and accelerated e-commerce. With 780 million internet users in 2022 (second only to China)—a number projected to rise to 1 billion by 2030 and to 1.5 billion by 2040—India is one of the world's largest and fastest growing digital markets.

Advances in e-commerce and digital services build on the delivery of government payments through the national Aadhaar digital identity system which, with 1.3 billion adult card holders, is the largest digital identity system in the world. Aadhaar's scale and ubiquity have enabled the spread of digital services in fields from digital education to fintech, agritech, and healthtech. The Unified Payments Interface (UPI) has extended the ability to make digital payments to every corner of the country and all income brackets. A cloud-based open-source platform, UPI is a foundation on which companies are invited to innovate. In 2021, Indians conducted 37.9 billion digital transactions. Digital payments in turn have enabled industries such as gaming, which constituted a \$2.6 billion market with 507 million online gamers in FY2022.

A Growing Technology Sector

FY2022 revenue in the technology sector reached an estimated \$227 billion, with 15.5% year-on-year growth.

Startup Investment Takes Off

Startup activity rose to prominence with the 2016 launch of Startup India, an initiative to support startup growth through regulatory reforms, entrepreneurial skills development, and programs to showcase promising companies. Since then, India's startup scene has taken off.

A pivotal year for the startup scene, 2021 saw more than 50,000 active startups, over \$400 billion in valuation across the ecosystem, and venture investment reaching \$38.5 billion. India's share of global venture funding nearly doubled, from 3% to 5.6%.

In the same period, 44 new unicorns (private companies valued at over \$1 billion) were minted. This brought India's overall count of privately held active unicorns to 73, making it the world's third largest home to unicorns after the United States (500) and China (170). Consumer technology, fintech, and SaaS were the leading sectors, accounting for more than 75% of all investments.

Investment momentum was driven by the maturing of India's digital infrastructure, cheap and ubiquitous data, growing depth in the startup ecosystem, and investor confidence supported by successful exits. Venture interest has also been stimulated by crackdowns in China on large tech companies and in sectors such as edtech and gaming, which has discouraged entrepreneurial activity and led to capital flight. Approximately 90% of venture investment in tech is coming from international investors and 10% from domestic investors, but a growing number of Indian LPs are investing through Indian GPs.

In the two years from February 2021 to February 2023, the Bay Area's Sequoia Capital was the top venture investor with 107 deals, Accel was the ninth largest with 70, Y Combinator was eleventh with 54, Matrix Partners was twelfth with 52, Nexus Venture Partners was 26th with 31 deals, and Lightspeed Venture Partners was 31st with 27 deals.

A cutback in venture investment began in 2022, and 2023 will remain challenging for the ecosystem as India tracks with the retrenchment of venture investment seen across the globe. Dealmaking has become more measured as investors refocus on quality assets, valuations have dropped, and the volume of IPOs has fallen as investors confront volatile equity markets. However, even as startups tighten their belts, the underlying strength of India's ecosystem remains intact, offering attractive opportunities.

Expanding U.S.-India Trade

Except for a pause in 2020 due to the pandemic, two-way U.S. goods trade with India has steadily grown since 2018, reaching \$133 billion in 2022. U.S. exports to India have increased to \$47.3 billion. With imports from India of \$85.6 billion, the bilateral deficit was \$38.3 billion. In 2021, the U.S. became India's top trading partner, surpassing China. Globally, services account for more than 40% of India's exports, with the U.S. being its largest market.

The California-India Corridor

University Programs

The economic bridge between California and India is broad and multifaceted. One aspect is academic, where California and Indian universities collaborate on research and other exchanges. CSU-Monterey Bay and San Francisco State University support joint degree programs in information technology with Indian universities. Other Bay Area universities are actively engaged in technical, policy and entrepreneurial cooperation ranging from electric vehicles to life sciences.

The India ZEV Research Centre, led by the Institute of Transportation Studies (ITS) at UC Davis, is working to advance research and policy in transportation decarbonization, focusing on electric vehicles. ITS also partners with government and research organizations to strengthen state-level action.

Launched in 2007, the Stanford-India Biodesign program was a first-of-its-kind collaboration between

Stanford University, the All India Institute of Medical Sciences (AIIMS), and the Indian Institute of Technology (IIT), aiming to train a first generation of medical technology innovation leaders and stimulate India's nascent medtech industry. After a successful nine-year track record that developed new technologies and launched companies, the program's India partners transitioned to independent status, becoming the School of International Biodesign at AIIMS.

Leading Bay Area Companies in India

Bay Area companies with a strong presence include Cisco (with its second global headquarters in Bangalore); Google (which in 2021 accounted for 99.6% of mobile searches in India and plans to invest \$10 billion in India over 5–7 years); Meta (for which India is its largest WhatsApp market, with 487.5 million users in early 2023); Twitter (which currently has 24.45 million active users in India, the company's third largest market in the world after the U.S. and Japan); Salesforce (with 7,500 employees India, making it the company's second largest employment center after the United States); LinkedIn (with members in 2022 numbering more than 90 million in India, LinkedIn's second largest market after the United States); Apple (which is expanding production of the iPhone 14 in Chennai and Tamil Nadu); and Intel (which operates nine design and engineering facilities with 14,000 employees in India, including its largest design and engineering center outside the United States).

Investment Flows from the Bay Area to India

Foreign Direct Investment (FDI) by Bay Area companies in India builds on decades of investment by the region's technology companies in offshore R&D and engineering centers. Through the first seven months of 2022, FDI was on track to be the largest in recent history in terms of dollar amount and deals.

The top sector for Bay Area investment is ICT & Electronics (\$875.4 million, or 64.6% of the total in 2021), continuing the strong focus on R&D, software, and engineering. This came primarily from Silicon Valley (Santa Clara County) followed by San Francisco.

In 2022, the top five Indian states receiving investment were Karnataka, Maharashtra (Mumbai), Telangana (Hyderabad), Tamil Nadu (Chennai), and Haryana (Gurgaon).

Investment Flows to the Bay Area from India

Investment from India into the Bay Area, which is concentrated in Silicon Valley (Santa Clara County) and San Francisco, is much lower than investment in the opposite direction. This imbalance between inbound and outbound investment points to an opportunity for deeper engagement by Indian companies in the region's technology and innovation economy.

India's leading ITC companies—Infosys, Wipro, Cognizant, and TCS (Tata Consultancy Services)—all have a Silicon Valley presence to support and co-innovate with clients (TCS with 1,900 employees and an active program of educational philanthropy). Tech Mahindra, with 1,000 local employees, works with more than 70 regional technology companies across multiple sectors.

Sector Opportunities

Key sectors offering opportunities for Bay Area-India business development include fintech, edtech, pharmaceuticals and healthtech, renewable energy, electric vehicles, semiconductors, infrastructure, smart cities, and space.

Policy Debates

India is no stranger to trade protection or economic nationalism. While its economy is much more open to trade and investment than in the past, policies continue that protect Indian companies, support national champions, and favor domestic businesses in public procurement. Tactically, India is a frequent user of anti-dumping measures and countervailing duties. The recent slowing of market opening reflects an active industrial policy that aims to build both domestic production and export capacity. Tesla, for example, is at odds with the government over India's 100% import duties on electric vehicles.

Data Privacy and Localization

Silicon Valley interests are particularly impacted by ongoing policy debates regarding privacy and data regulation. India's government engaged in more than two years of deliberation on a 2019 Personal Data Protection Bill that it ultimately withdrew in August 2022. Beyond the data protection bill—and of particular concern for Bay Area and U.S. companies—are policies by the Reserve Bank of India to prevent the offshore transfer or storage of credit card and payment processing data without government approval, effectively requiring its storage locally.

The draft of the new Digital Personal Data Protection Bill 2022 was made public in November. It contains many of the same provisions as its predecessor, including mandates patterned after the EU's General Data Protection Regulation (GDPR) that require companies to obtain consent from individuals about whom they are processing data. Exceptions for the Indian government would allow data gathering in the "public interest," a provision that could empower state surveillance and pose problems for Silicon Valley companies that would need to deal with complex legal issues of appropriate government access.

However, in a move welcomed by Silicon Valley companies, the draft backs off from the more aggressive data localization provisions of the earlier version. The new approach, based on the free flow of data to "trusted" geographies, would instead allow the Indian government to evaluate other countries' data protection regimes and certify that their protections are sufficient for the data to be moved. This approach addresses concerns raised by Silicon Valley and other companies regarding infrastructure and other data storage costs as well as cybersecurity concerns associated with mandatory local storage. It also addresses domestic concerns that mandatory local data storage would negatively impact India's large cross-border IT services industry. Non-personal data is out of the bill, and penalties for non-compliance have been reduced. Throughout the undertaking, India's government has been open to input in the drafting process, including from U.S. and Silicon Valley companies.

Sustaining the Reform Agenda

To sustain economic growth at a high level (above 8%), India needs investment in manufacturing, technology, infrastructure, and agriculture. Economic reforms surged at the start of Prime Minister Modi's first term, followed by a slowing of activity, and then accelerated at the end of his second term. Reforms must continue for India to meet its aggressive development goals.

Shaping the Future Relationship

Synergies between the Bay Area and India's robust innovation ecosystem suggest a wide range of opportunities for collaboration. Key thematic areas include defense, critical and emerging technologies (enabled by iCET), standards, state-level collaboration on climate and energy, cross-national support for startups, AI and digital development, skilled immigration, trade, and supply chain integration.

Opportunity, Partnership, and Innovation

The US-India relationship builds on trust, shared interests, and opportunity. The challenge and opportunity on both sides is how to develop deeper research and industrial collaboration, with shared networks and resources, that builds a pipeline of innovative technologies and applications. A strong innovation corridor between India and the United States—in which the Bay Area will play a key role—is critical to achieving this goal. As India shifts from being a global back office to a technology co-creator, the partnership that could result represents one of the great economic opportunities of the coming decade.

Introduction

The San Francisco/Silicon Valley Bay Area has long benefited from a unique relationship with India. In November 2009, the Bay Area Council Economic Institute produced its first report on India, *Global Reach: Emerging Ties between the San Francisco Bay Area and India*, which documented the historic relationship between the two economies, the economic contributions of Indian Americans, and emerging fields of business opportunity. Ten years later in June 2019, a second report, *The Bay Area-Silicon Valley and India: Convergence and Alignment in the Innovation Age*, carried the story forward, focusing on economic initiatives by the Modi Administration, accelerating digitalization, and the business opportunities these developments present. This report updates the narrative again, as India's economic growth continues, spurred by an explosion of startups and venture investment, and as strategic imperatives have deepened political ties. As the alignment between India and the United States grows, the Bay Area will continue to hold center stage as both countries build closer ties through technology, innovation, and investment.





The Strategic Context Deepens

Once distant, U.S.-India relations have drawn progressively closer. A slow warming, which began in the early 1990s and took root with the conclusion of an agreement on nuclear cooperation in 2005, has accelerated since Prime Minister Narendra Modi took office in 2014. New economic reforms have created large markets and reduced barriers to foreign investment. This economic engagement parallels a growing strategic alignment between the two countries, driven by the shared perception of a growing threat from China. Alignment is built on a foundation of shared democratic values, the rule of law, and economies built on market principles. In this new environment, India is not an ally in the formal sense—there is no mutual defense treaty between the U.S. and India—and it continues to protect its ability to maneuver as an independent actor. But on a practical level, the interests and challenges shared by the United States and India are drawing both nations more closely together.

This can be seen in an array of bilateral and regional mechanisms that are growing in importance.

Indo-Pacific Strategy of the United States

Designed to more firmly anchor the U.S. in the region extending from the U.S. West Coast to the Indian sub-continent, the Indo-Pacific Strategy of the United States aims for sustained collaboration with allies and partners, both within the region and beyond it, to meet challenges ranging from competition with China to climate change and pandemics.¹ Major themes include

- **“Free and Open”**—investing in democratic institutions, a focus on international law governing the use of the region’s seas and skies, and shared approaches to critical and emerging technologies, the internet, and cyberspace;
- **“Connected”**—strengthening alliances and relationships with regional partners including India, and strengthening the Quad (Quadrilateral Security Dialog) and delivering on its commitments;
- **“Prosperous”**—facilitating high-standards trade, advancing resilient supply chains, making shared investments in decarbonization and clean energy, and ensuring open cross-border data flows;
- **“Secure”**—advancing integrated deterrence, deepening defense cooperation and interoperability with friends and partners, maintaining peace and stability in the Taiwan Strait, and innovating to meet emerging threats in critical and emerging technologies; and
- **“Resilient”**—working with allies and partners to meet shared climate goals.

As part of its Indo-Pacific Strategy and its engagement with India, the White House states that the United States “will continue to build a strategic partnership in which the United States and India work together and through regional groupings to promote stability in South Asia; collaborate in new domains such as health, space, and cyberspace; deepen our economic and technology

cooperation; and contribute to a free and open Indo-Pacific. We recognize that India is a like-minded partner and leader in South Asia and the Indian Ocean, active in and connected to Southeast Asia, a driving force of the Quad and other regional forums, and an engine for regional growth and development.” The strategy commits the United States to “support India’s continued rise and regional leadership.”²

The Quad

A working partnership of the United States, India, Japan, and Australia, the Quad has risen in importance as an Indo-Pacific framework for consultation and cooperation between market-based democracies. While it is not a formal alliance and not expressly aimed at China, its role has grown in the face of military and economic challenges from China. To that end, Quad foreign ministers have pledged to deepen their cooperation to ensure that the Indo-Pacific is free from “coercion,” with Quad members holding annual naval exercises to increase defense interoperability. That cooperation extends to other regional challenges such as climate change and COVID.³

The first in-person summit of Quad leaders was held at the White House in September 2021⁴ and was followed by a March 2022 virtual meeting,⁵ with the next in-person meeting held in Tokyo in May 2022. That meeting focused on initiatives in vaccines, climate change, infrastructure, space, cybersecurity and critical and emerging technologies.⁶ In a related initiative announced in 2022, the Americas Frontier Fund, a deep-tech nonprofit investment fund, will support the development of a Quad Investors Network (QIN) to connect technology investors, executives and startup founders from the member nations around joint research and investment in foundational technologies and supply chain infrastructure.⁷ The four countries have also created a Quad Fellowship program, with 100 slots allocated to placements in STEM fields. Managed by the Bay Area’s Schmidt Futures in consultation with a non-governmental task force composed of academic, foreign policy, and private sector leaders and supported by corporate partners including Google, the fellowships aim to build ties within the next generation of scientists and technologists, with a focus on doctoral students in science, technology, engineering and mathematics.⁸

In the Middle East, India is a partner in a parallel “quad” taking shape between the United States, the UAE, and Israel.

Global Supply Chains

Building on the Indo-Pacific Strategy and in response to global supply chain issues and concerns regarding China, the United States and India have agreed to cooperate to build resilient and diverse global supply chains in critical trade and technology sectors. Both sides have agreed to regularly share perspectives on issues including cybersecurity, semiconductors, AI, 5G, 6G, and next generation telecommunications technology. India has expressed particular interest in partnering with the U.S. and its allies to develop a secure pharmaceutical manufacturing base.⁹

This connects to an 18-economy partnership, announced in July 2022 at a ministerial forum hosted by U.S. Secretary of State Anthony Blinken and Secretary of Commerce Gina Raimondo, to promote the development of resilient supply chains and counter risks arising from current dependencies. The other members of the partnership are the EU, Australia, Brazil, Canada, Congo, France, Germany, Indonesia, Italy, Japan, Mexico, Netherlands, South Korea, Singapore, Spain, and the UK.¹⁰

Trade

In November 2021, the United States and India relaunched the United States-India Trade Policy Forum (TPF), which was established in 2010 but had not met since 2017. Issues on the table in 2022 included bilateral trade, labor, and environmental issues. Continuous engagement takes place through high-level working groups on agricultural trade, non-agricultural goods trade, services, investment, and intellectual property. Digital trade and regulatory practices are also on the table.¹¹

Other Initiatives

An array of other initiatives, in what the State Department has termed the U.S.-India Comprehensive Global Strategic Partnership,¹² fill out the high-level dialogue between the two countries: an annual 2+2

meeting between the U.S. and Indian Ministers of Defense and Foreign Affairs; a revived U.S.-India Homeland Security Dialogue, and the U.S.-India Climate and Clean Energy Agenda 2030 Partnership. Through the Partnership, the U.S. and India have pledged to work together to mobilize finance and speed the deployment of clean energy technologies; demonstrate and scale innovative clean energy technologies needed to decarbonize industry, transportation, power, and buildings; and build capacity to measure, manage, and adapt to the risks of climate change.¹³

Perhaps most significantly for Silicon Valley, President Biden and India's Prime Minister Modi launched the U.S.-India Initiative on Emerging and Critical Technologies (iCET) in May 2022. Led by the National Security Advisors of both countries, iCET aims to expand partnerships between the U.S. and India in critical and emerging technologies, ranging from AI and quantum computing to space and semiconductors, by engaging government, industry, and academia in both countries. iCET is a potentially powerful vehicle to leverage technological capacity in both countries to advance strategic and economic goals.¹⁴

Implementation of these initiatives has taken a number of forms that in some cases predate the Indo-Pacific Strategy. In September 2020, at the 10th Defense Technology and Trade Initiative (DTTI) meeting, India's Secretary for Defense Production and the U.S. Undersecretary of Defense for Acquisition agreed to strengthen bilateral cooperation in defense technology, with a focus on opportunities for the co-development and co-production of defense equipment.¹⁵ Soon after, in October 2020, India and the United States agreed to share geospatial intelligence, paving the way for deeper military cooperation. The BECA (Basic Exchange Cooperation Agreement) for geospatial intelligence gives India access to data from U.S. military satellites, which can be used in targeting and navigation.¹⁶

In the same month, following an agreement between India and Australia to allow access to each other's military bases, India invited Australia to participate in the annual Malabar naval exercise with the United States and Japan.¹⁷ The momentum for closer defense ties between India and the other Quad members was accelerated by military incursions by China in disputed

territory in the Himalayas, the worst outbreak of violence in the area in 45 years, which left 20 Indian soldiers dead and produced a prolonged face-off on both sides.¹⁸

India has also responded to the China challenge economically. In April 2020, without mentioning China, it imposed a requirement that investment from entities in countries that share a land border with India (a group that includes China) have prior government approval, meaning that they would not be eligible for the "Automatic" approval channel that governs foreign investment generally. The announced purpose was to curb "opportunistic takeovers and acquisitions."¹⁹ Following the announcement, Chinese investment—which peaked at \$3.9 billion in 2019—fell sharply.²⁰

Going further in June 2020, the Indian government banned 59 Chinese apps, including TikTok (with 200 million Indian subscribers), Weibo, Tencent's WeChat, and Alibaba's shopping platform Taobao, designating them national security and data privacy threats.²¹ More apps were blacklisted in September 2020, including a number belonging to Tencent, Alibaba, and NetEase. Included in the ban were search engine Baidu and the browser used on Xiaomi's mobile phones.²² An additional 54 apps were banned in February 2022, bringing the total to more than 200. Before the crackdown, Chinese firms accounted for six of the ten most downloaded apps in India. In its wake, TikTok, which had generated 30% of its worldwide downloads in India, withdrew from the market and more Chinese developers followed.²³

In the case of telecommunications, a National Security Directive on Telecommunication Sector (NSDTS) issued in December 2020 creates a "Trusted Sources/Trusted Products" list for telecommunications service providers, with the goal to protect telecommunications supply chain security and discourage use of insecure technology in the network. Both network expansion and upgrades are covered. Approval of trusted vendors is the responsibility of a National Security Committee on Telecom (NSCT) chaired by the Deputy National Security Adviser.²⁴

Reality Check

While India's growing alignment with the U.S. is real, and strategic and economic interests will continue to draw the two countries together, it is important to bear in mind that the United States and India are not treaty allies, and India maintains a measure of independence that gives it room to maneuver. Witness its failure to condemn Russia's invasion of Ukraine: despite a growing defense relationship with the U.S., Russia remains India's largest supplier of defense equipment, and India has declined to support UN resolutions censoring Russia for the Ukraine invasion. Even with restrictions on Huawei and other tech companies, India's trade with China is growing, due largely to its limited manufacturing capacity and consumer demand for inexpensive Chinese products. China became India's largest trading partner in 2008, and trade ties have expanded since then, with 2021 two-way trade surpassing \$126 billion and a balance of \$70 billion in China's favor.²⁵

There are economic policy differences as well. While India has associated itself with the Biden Administration's regional Indo-Pacific Economic Framework (IPEF) initiative announced in 2022, due to differences on labor, environmental, and digital policies, it has chosen only to observe the IPEF's subsequent trade discussions. Having opted out of the IPEF's trade pillar, bilateral discussions in IPEF focus on the initiative's three other pillars: fair economy, clean economy, and supply chains.²⁶

This means that cooperation can't be automatically assumed or strategic alignment extended to all domains. But as India's relationship with the U.S. grows and the U.S.-India dialogue deepens, opportunities will clearly grow not only for closer political ties but for trade and investment as well.





2

India's Economy

India's economy, which was growing before the pandemic, was severely damaged in the downturn that followed but has recovered quickly. The effects will linger, however.¹ India is being impacted by the same pressures that are slowing economies worldwide: war in Ukraine, after-effects of the pandemic, supply chain bottlenecks, and inflation. Tracking with these trends, India's GDP declined 6.6% in 2020, at the height of the pandemic, but rebounded strongly to 8.7% growth in 2021.² The IMF expects growth to slow to 6.8% in 2022 and 6.1% in 2023. However, this still leaves India the fastest growing major economy in the world, ahead of China's expected 3.0% in 2022 and 5.2% in 2023.³

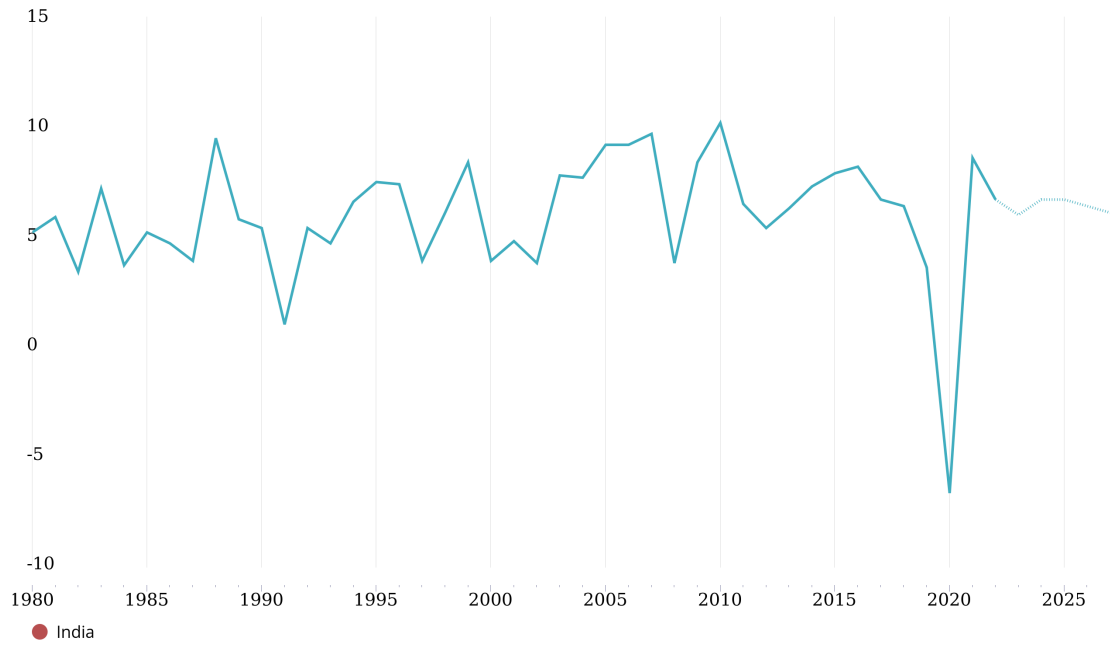
With its vast population, India is still a lower-middle-income economy with an average income level of \$2,000 (\$7,150 at purchasing power parity).⁴ While this is a challenge, a median age of 28.4 gives India a young workforce,⁵ a distinct advantage compared to China, where the workforce is aging rapidly.⁶

The World Bank places India's GDP at \$3.18 trillion, following a sustained rise over the last two decades. Productivity has also grown strongly, measured by GDP per capita.⁷ That growth is needed as India continues to face high unemployment (7–8%),⁸ exacerbated by the COVID-19 pandemic which pushed millions of Indians back into poverty and led many migrant workers to return to the countryside.⁹

India also confronts structural challenges. Its economy is dominated by a small number of large companies (approximately 350) that account for more than half of all corporate revenue, while more than 6 million smaller companies account for only 1% of revenue, with few medium-sized companies in the middle.¹⁰ India also faces large gaps between its most prosperous regions and the rest of the country. A small number of regions account for a large share of national output and dominate exports and innovation, while less prosperous regions are still unconnected to the modern economy. The country's top 70 districts account for 20% of the national payroll, have strong traded and skills-based clusters, and support an average wage that is roughly double the rest of the country; the bottom 305 districts account for 33% of the national payroll but have an average wage roughly half that of the rest of the country.¹¹ This partly reflects a two-tier economy, with prosperous modern sectors but many Indians still employed in agriculture or the informal sector.

Technology, supported by foreign direct investment (FDI), has become a major driver of growth as government reforms have streamlined investment and greatly reduced barriers. Annual FDI, which stood at \$60.22 billion in FY 2016–17, has grown to \$83.57 billion in FY 2021–22.¹²

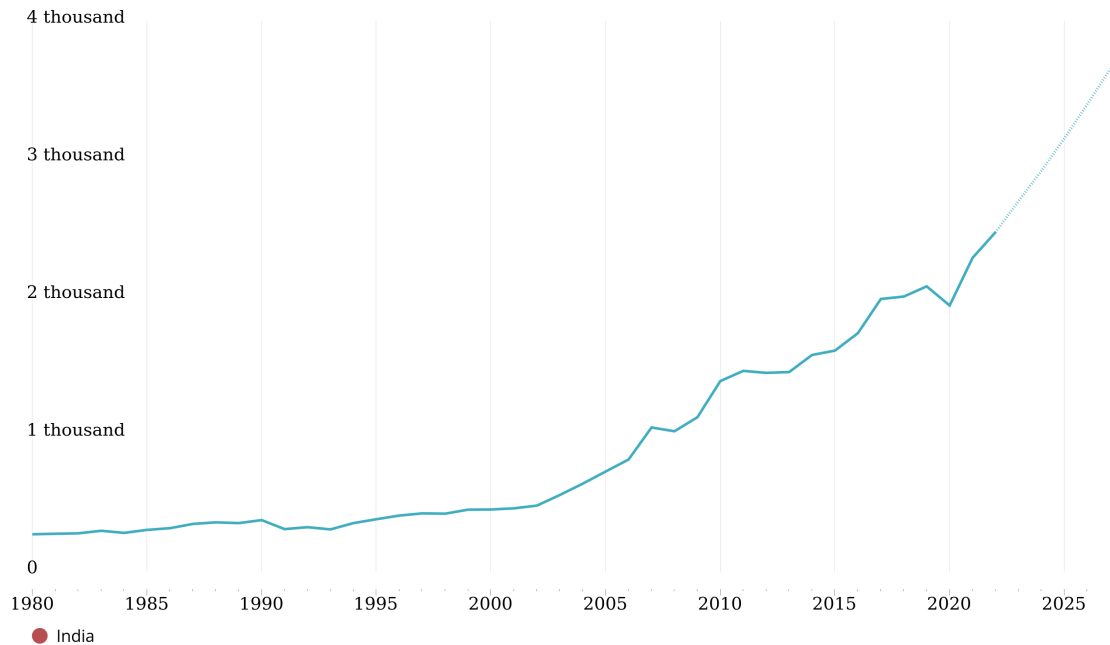
India Real GDP Growth (Annual percent change), 1980–2022



©IMF, 2022, Source: World Economic Outlook (October 2022)

Source: IMF DataMapper, October 2022, <https://www.imf.org/en/Countries/IND#ataglance>

India GDP Per Capita, current prices (U.S. dollars), 1980–2022



©IMF, 2022, Source: World Economic Outlook (October 2022)

Source: IMF DataMapper, October 2022, <https://www.imf.org/en/Countries/IND#ataglance>

Table 1: FDI in India

Financial Year	FDI inflows (\$ billion)
2016–17	60.22
2017–18	60.97
2018–19	62.00
2019–20	74.39
2020–21	81.97
2021–22	83.57

Source Ministry of Commerce and Industry, Release ID: 1796883 and Release ID: 1826946
 Note: Reported FDI numbers vary slightly depending on the source.

Computer software and hardware is the top sector for investment, with a 25% share, followed by the services and automotive sectors. Investment in manufacturing has also been strong. Among India's states, Karnataka, home to India's technology capital Bangalore, is the largest recipient of FDI with 38% of total invested equity, confirming the strong orientation of overseas investors toward technology. In 2021–22 Maharashtra

(26%) and New Delhi (14%) were the next largest investment destinations. The largest overseas investors were Singapore (27%), the United States (18%), and Mauritius (16%).¹³ Singapore and Mauritius, however, serve primarily as tax platforms, and India's government data doesn't report the original FDI source countries. This makes the United States India's largest known overseas investor.

SPOTLIGHT

Between now and 2031 Morgan Stanley predicts growth in India across a range of metrics:

- Manufacturing's share of GDP will rise to 21%, creating an \$1 trillion incremental manufacturing opportunity;
- India's global export market share will more than double to 4.5%;
- India's services exports will more than triple to \$527 billion (from \$178 billion in 2021);
- Per capita income will rise from \$2,278 now to \$5,242, setting the stage for a discretionary spending boom;
- The number of households earning more than \$35,000/year will rise five-fold to over 25 million;
- E-commerce penetration will nearly double from 6.5% to 12.3%;
- Internet users will increase from 650 million to 960 million, while online shoppers will grow from 250 million to 700 million;
- 5% of incremental global car sales will be from India, with EVs making up 30% of personal vehicle sales;
- India's technology services workforce will more than double from 5.1 million to 12.2 million;
- Investment in energy will top \$700 billion as India accelerates its energy transition.

Source: Morgan Stanley Research, "Why This Is India's Decade," October 31, 2022, as reported by MyInd Staff in Economics, "India set to become world's third-largest economy by 2030: Morgan Stanley," MyIndMakers, November 2, 2022, <https://myind.net/Home/viewArticle/india-set-to-become-worlds-third-largest-economy-by-2030-morgan-stanley>

Measuring Competitiveness

India has continued to move up the rankings of global competitiveness.

India ranks #37 out of 63 countries listed in the 2022 IMD World Competitiveness Ranking, behind Spain and ahead of Hungary, advancing six places from 2021. The Ranking is based on a range of criteria grouped under four broad headings: economic performance, government efficiency, business efficiency, and infrastructure.¹⁴

The 2022 Global Innovation Index (GII) ranks India #40 out of 132 countries globally, up from #46 in 2021, and #1 among lower-middle-income countries (up from #2 in 2021.) India also places among a handful of countries as an “innovation achiever” (GII’s term for an economy that performs above expectations relative to its level of development), having consistently out-performed for 12 consecutive years. In 2022, India scored above average among upper-middle-income countries in six of the seven pillars assessed by GII (institutions, human capital and research, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs) and lower only in the infrastructure pillar.¹⁵

Table 2: India’s Performance on the Global Innovation Index

Year	GII Score	GII Rank	Total Countries
2017	35.47	60	127
2018	35.18	57	126
2019	36.58	52	129
2020	35.59	48	131
2021	36.40	46	132
2022	36.60	40	132

Source: WIPO Global Innovation Index 2022

Indian States: Laboratories for Innovation

“India’s states offer unique environments for investment with distinctive resources, infrastructure and policies. Uttar Pradesh, India’s largest with 240 million people, is aggressively developing its infrastructure and capacity to work with global partners.”

Suresh Khanna
Finance Minister of Uttar Pradesh

Since assuming office, the Modi administration has devolved considerable power to states, making them a partner in national economic development. And while most city governments in India are comparatively weak, India’s states enjoy considerable regulatory authority.

States in India, like American states, can serve as laboratories for innovation, and global investors in India are often investing not only in the country but in a specific state. Also like the United States, there is variation between Indian states in their approach to technology, investment, and business. Across India, states are establishing single windows to facilitate investment, often like Uttar Pradesh¹⁶ focusing on manufacturing and targeted sectors. Competitiveness is also based on deeper factors that can enable innovation-led growth. These are particularly important for technology companies.

The India Innovation Index 2021 measures the competitiveness of Indian states by a range of measurement pillars in two dimensions: human capital, investment, knowledge workers, R&D activity, business environment, and safety and legal environment (pillars termed “Enablers”); and knowledge output and knowledge diffusion (pillars termed “Performance”). In addition to states, the Index also evaluates city-states and union territories.¹⁷

The top five states in the 2021 rankings were Karnataka, Telangana, Haryana, Maharashtra, and Tamil Nadu, based on indicators such as the percentage of secondary schools with ICT labs (growing in Karnataka’s case from 29% to 46% and in Telangana’s from 17% to

35%), FDI (noting, for example, Karnataka's success in attracting venture capital), enrollment in PhD programs, applications for patents, trademarks and industrial designs, startup growth (where Karnataka accounted for 19,000 out of 61,400 startups nationwide¹⁸), and state policies (such as Tamil Nadu's 2018–23 startup and innovation initiative which aims to turn the state into a global innovation hub).

Among city-states and union territories, Chandigarh comes out on top followed by Delhi, with Chandigarh leading in the metric of knowledge workers and investment in schools (the percentage of schools with functional computer facilities is 99%), and Delhi performing best in business environment and investment. Both score strongly in higher education and PhD enrollment.¹⁹



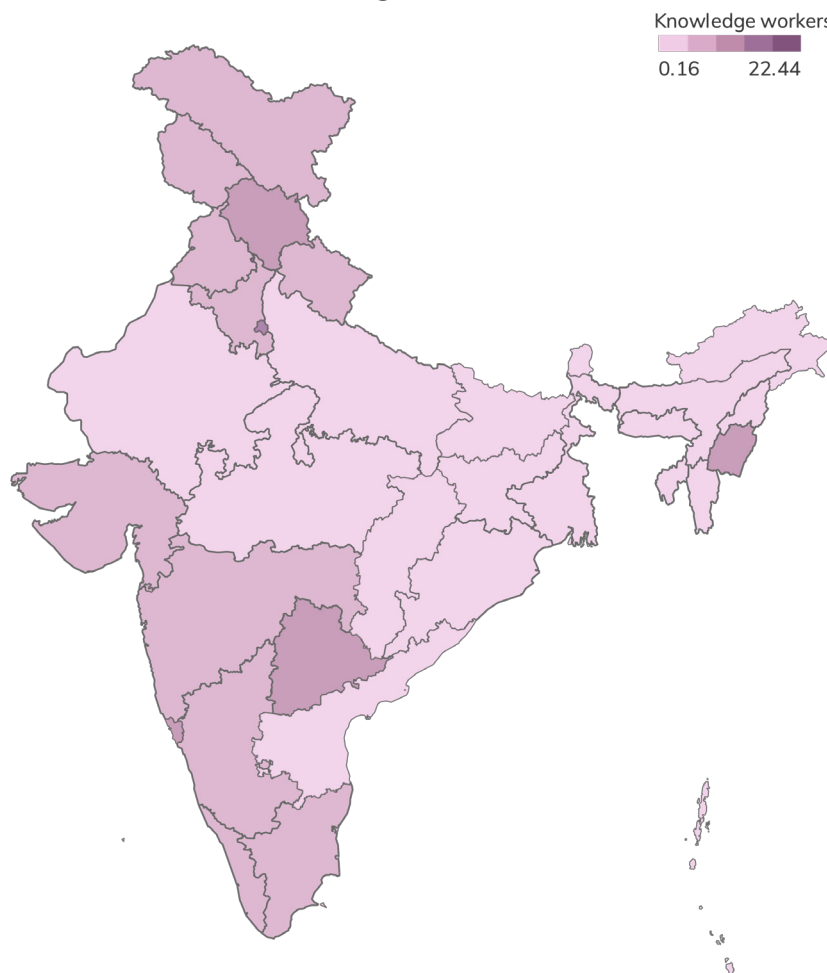
Knowledge Workers

Average pillar score: 5.68

High Performing States/UTs: Chandigarh, Delhi, Manipur, Himachal Pradesh, Goa

Low Performing States/UTs: Lakshadweep, Mizoram, Jharkhand, Andaman & Nicobar Islands, Chhattisgarh

Performance of states in Knowledge Workers



Source: NITI Aayog and Institute for Competitiveness, *India Innovation Index 2021*, July 2022



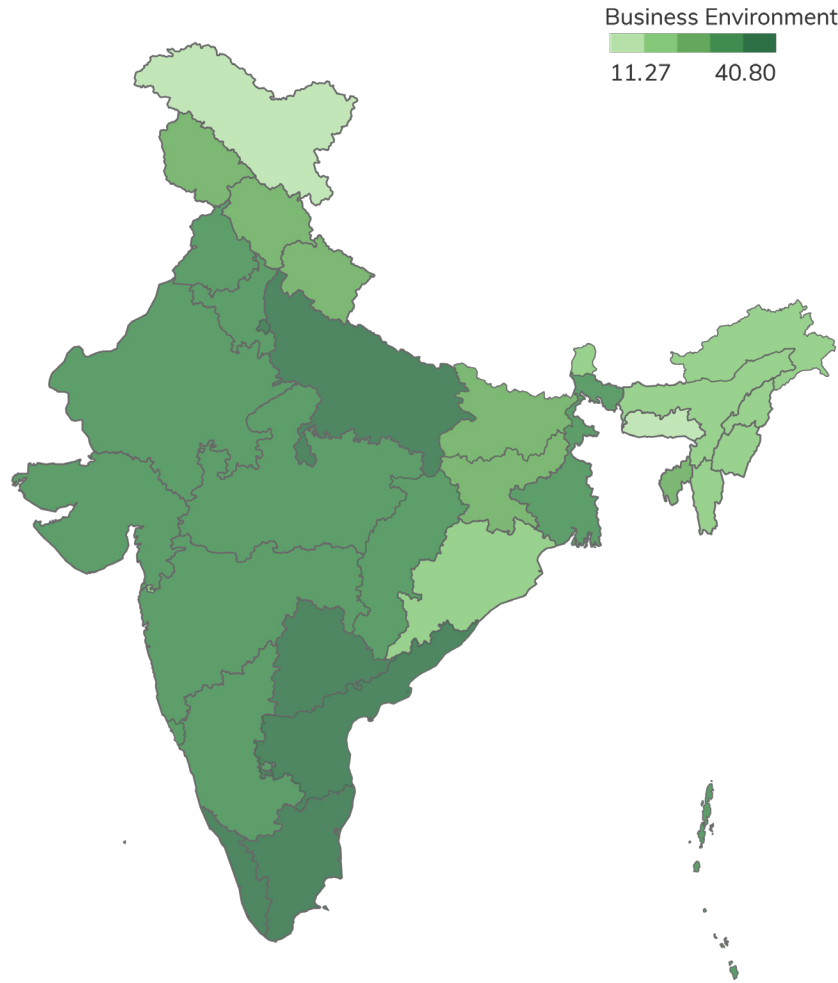
Business Environment

Average pillar score: 28.13

High Performing States/UTs: Uttar Pradesh, Delhi, Andhra Pradesh, Telangana, Tamil Nadu

Low Performing States/UTs: Ladakh, Meghalaya, Lakshadweep, Arunachal Pradesh, Nagaland

Performance of states in Business Environment



Source: NITI Aayog and Institute for Competitiveness, *India Innovation Index 2021*, July 2022

The variability between Indian states can also be seen in metrics such as gross fixed capital formation, where Gujarat accounts for 25% of India's total, followed by Maharashtra and Tamil Nadu. Two states, Maharashtra and Gujarat, account for 50% of all goods exports. Maharashtra alone accounts for 25% of all patenting, and the top five states (with a 40% share of GDP) account for 65% of all patenting, with a per capita

patenting rate five times the average for the rest of the country.²⁰

Bay Area and California businesses investing in India therefore need to look beyond the national level to consider the policies and strategies, infrastructure, human capital assets, technology orientation, and business environment of India's states.

National Economic Initiatives

Now in its second term, the Modi government has aggressively courted foreign investment through a series of reforms designed to improve the business environment and reduce bureaucratic barriers to investment. Under rules developed in 2020, FDI in India falls under either the Automatic Route or the Government Route. With the Automatic Route, a non-resident company is not required to apply for government approval, while advance approval is needed under the Government Route. With aggressive reforms to the application process, most business sectors are now fully open to foreign investment through the Automatic Route, and while 100% foreign ownership is now permitted in a broad range of industries under that route, the Government Route also allows up to 100% foreign ownership in certain sectors, with limitations on others.²¹

Another major initiative relevant for overseas partners is **Make in India**, a program launched by the Modi administration in 2014 with the goal of transforming India into a global hub for design and manufacturing. The Department for the Promotion of Industry and Trade (DPIIT) developed a framework focused on 25 industries, combining large amounts of technical information with supporting policy reforms, with the goal of raising manufacturing's contribution to the economy to 25% by 2020. Regulatory frameworks for investment in manufacturing have since then become less onerous and more transparent.²²

Since its launch, the Make in India initiative has produced gains, particularly as measured by FDI inflows, which rose from \$25.1 billion in FY2014 to \$67.5 billion in FY2021, an increase of 169%.²³ Nonetheless, the goal for increasing manufacturing's contribution to GDP has not been met; manufacturing's share of GDP hovered around 15% from 2014 to 2018, and then fell as India's and the world's economies suffered the effects of the pandemic.²⁴ In recent years, the government has focused Make in India on the objectives of accelerating job creation and promoting domestic manufacturing where basic capability exists, through manufacturing incentives and import disincentives, still with an eye toward increasing manufacturing's share of GDP to 25% within a few years.²⁵ Analysis by Goldman Sachs

suggests that the sectors most likely to benefit from the Make in India initiative are pharma, air conditioners, autos, defense, apparel, IT/SaaS, mobile phones, and logistics.²⁶

Investment in the electronics manufacturing sector has particularly been supported by the **Production Linked Investment Scheme (PLI) for Large Scale Electronics Manufacturing** of 2020, which offered an incentive of 4–6% of incremental sales for a period of up to five years on products manufactured in India in target industry segments. Success in attracting investment in its first round led to a second phase in 2021 with incentives of 3–5% of incremental sales above baseline.²⁷ Among Indian states, Gujarat, Telangana, and Maharashtra have been particularly successful in attracting manufacturing activity.

Promotion strategies for domestic manufacturing have been particularly successful in the electronic components sector and in mobile phones, where India emerged as the second largest mobile phone manufacturer in the world following a 126% jump in production from FY2021 to FY2022.²⁸ Apple is now assembling its flagship iPhone 14 in India at a facility operated by its supplier Foxconn on the outskirts of Chennai. The company had been manufacturing older model iPhones in India since 2017, but not its latest models. Increased production in India reflects a strategy to shift some production away from China.²⁹ Production of electronic goods in general has more than doubled from \$30 billion in 2014–15 to \$75 billion in 2019–20.³⁰

Digital India

This acceleration of markets and investment reflects India's decisive move into the digital space through policies designed to advance digitalization across several fronts. The Modi government's Digital India initiative, launched in 2015, has been a driver of mobile, cloud, big data analytics, and digital services by promoting ubiquitous broadband and Wi-Fi build-out, low-cost phones, digital literacy, and the Aadhaar biometric card that digitally connects citizens to healthcare and other government services.³¹

The Indian government considers the development of digital services essential to quality of life and to

spreading prosperity across the country, especially in rural areas that have not benefited from the IT revolution as much as larger cities. Universal healthcare and digitally enabled telemedicine reaching into rural areas are key targets. India's national digital health program, the Ayushman Bharat Digital Mission, launched in 2021 and provides an architecture for the delivery of services using open standards, creating consent-based longitudinal health accounts (records) that move with the user.³² The Universal Health Interface (UHI) that is part of the Mission doesn't build front-end applications but instead provides a framework that enables independent apps to run, and an interoperable network that enables users to search for and access services.³³

Already, the digital public infrastructure developed through Digital India has created a social safety net that has increased access to and lowered the cost of health and other services throughout the country, reducing the digital divide. As one manifestation of how this capacity has been applied, India has conducted one of the largest digital exercises in history during the COVID pandemic as more than 2.2 billion vaccinations have been facilitated using the Ayushman Bharat Health Account system (digital health ID). Indians are able to find vaccination sites, book appointments, report side effects, and download and share their vaccination status through the government's Co-WIN portal.³⁴

With a major goal of closing the broadband gap, the **National Digital Communications Policy**, launched in 2018, targets India's fast-growing digital economy, which has the potential to reach \$1 trillion by 2025.³⁵ The telecommunications revolution in India has been advanced in the private sector by Jio, a telecom company owned by Reliance Industries, which on launching its commercial services in 2016 offered free calls and data coverage at a price one-fifth the industry average.³⁶ Seeing the opportunity and its scale, Bay Area companies Google, Meta, Intel, and Silver Lake invested.³⁷ What followed was the fastest ramp-up of any mobile network in the world, with 50 million subscribers in the first 83 days and 100 million within a year.³⁸ The wave upended the telecommunications sector by making cheap internet service available to all segments of the population.

A growing user base and the widespread deployment of mobile smartphones have advanced the government's digitalization strategy, accelerating the move to e-commerce. Jio transmitted more data in its first year than any carrier worldwide, leading India to surpass the United States in the number of apps downloaded from Google Play Store. As that happened, Jio's own services expanded to include music streaming, a digital payments service,³⁹ and online shopping for groceries and other goods.⁴⁰ In response, competitors sharply cut prices.

The accelerated deployment of 5G is also another government goal, as India is still behind China and countries like South Korea in 5G deployment. In the government's first auction of 5G spectrum concluded in August 2020, Jio (Reliance Jio Infocomm Ltd.) was the largest buyer, accounting for more than half of the commitments received, followed by Bharti Airtel Ltd. The country's new 5G network will be wholly designed and built in India, with delivery of 5G services in key cities expected by the end of 2022.⁴¹

With 780 million internet users in 2022 (second only to China), a number that is projected to rise to 1 billion by 2030⁴² and to 1.5 billion by 2040,⁴³ India is one of the world's largest and fastest growing digital markets. Despite over 40% of Indian consumers being internet users, only 10% currently shop online, suggesting the potential opportunity for e-commerce as the digital economy advances.⁴⁴

Advances in e-commerce and digital services build on the delivery of government payments through the national Aadhaar digital identity system which, with 1.3 billion adult card holders,⁴⁵ is the largest digital identity system in the world. Aadhaar's scale and ubiquity have enabled the spread of other digital services in fields ranging from digital education to agritech and healthtech. Using Aadhaar as the ID system and linking users with mobile phones to the Pradhan Mantri Jan Dhan Yojana universal access to basic bank accounts system⁴⁶ enabled the opening of millions of "zero balance" bank accounts, allowing the urban and rural poor to participate for the first time in the formal banking economy. Another achievement has been the **Unified Payments Interface (UPI)**, which extended the ability to make digital payments to every corner of the country and all income brackets. As a cloud-based

open-source platform, UPI provides a foundation on which companies are invited to innovate. In 2021 alone, Indians conducted 37.9 billion digital transactions, up from 27.9 billion in 2016 when UPI was launched. Digital payments in turn have enabled the growth of industries such as gaming,⁴⁷ which constituted a \$2.6 billion market with 507 million online gamers in FY2022.⁴⁸ According to Union Minister Ashwini Vaishnaw in remarks at the World Economic Forum, in December 2022 India's digital payment transactions amounted to \$1.5 trillion on an annualized basis, a higher level than in the U.S., UK, Germany, and France combined. UPI accounted for 40% of all transactions.⁴⁹

Despite this momentum, the digital payments industry faces challenges. India's digital transactions last year exceeded China's in number, but with the average Indian user making \$80 of payments per year, compared to \$2,300 in China and almost \$8,000 in the United States. A government cap on transaction fees in the UPI limits business revenues. For now, service providers who use the system are focusing less on short-term profits than on capturing the long-term potential in India's market of 1.4 billion consumers.⁵⁰

A Growing Technology Sector

“The rise of India is deeply linked to the rise of Indian technology.”

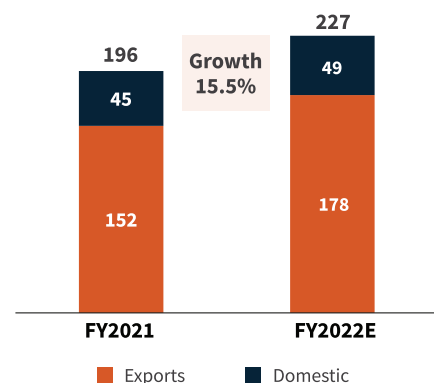
S. Jaishankar, External Affairs Minister of India⁵¹

As in the United States, the pandemic accelerated a digitalization process that was already underway, propelling gaming, social media, and e-commerce. FY2022 revenue for the technology sector reached an estimated \$227 billion, with 15.5% year-on-year growth. All segments of the industry saw double digit growth, estimated at 17% for IT services, 13.5% for Business Process Management (BPM), 19% for software, 17% for engineering R&D, and 39% for e-commerce. Employment in the sector crossed the 5 million mark, with 445,000 added to the technology workforce over FY2021. Ten thousand patents were filed at the end of 2021 by India's top five technology firms, and with a projected FY2022 \$178 billion in technology exports (including IT Services, BPM, engineering R&D, software, and hardware) technology now accounts for 51% of India's services exports. India's domestic technology

All segments of India's technology industry are seeing double-digit growth

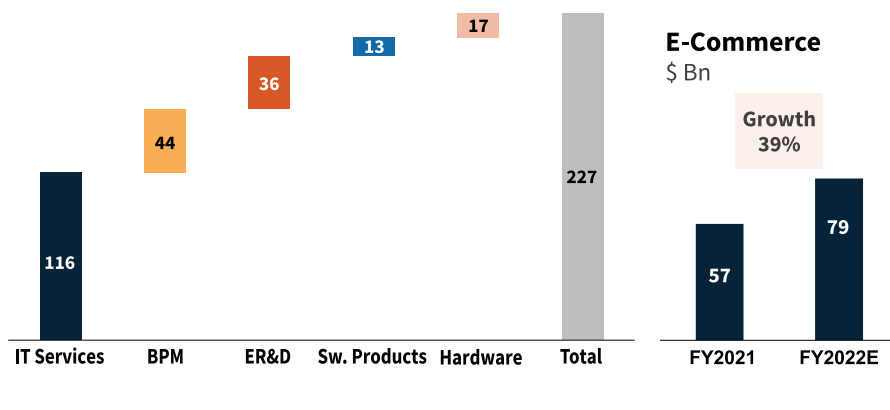
India's Technology¹ Market Set to Cross \$227 Bn, a 15.5% Y-O-Y Growth

\$ Bn



FY2022E- Segmented Breakup

\$ Bn



1. Includes IT services, BPM, ER&D, Software Products, and Hardware

Source: NASSCOM, *Strategic Review: The Technology Sector in India 2022*, February 2022

market has also grown, approaching an estimated \$49 billion in FY2022. Including e-commerce, technology today accounts for 7.4% of India's GDP.⁵²

A 2022 survey by NAASCOM indicates that 70% of technology CEOs expect FY2023 spending to be in line with FY2022's already high levels, with R&D spending growing between 10% and 20%. Four verticals—BFSI (banking, financial services and insurance), healthcare, manufacturing, and retail/e-commerce—are expected to be the primary consumers of technology, with solutions built on AI, data analytics, automation, and cloud. Growth opportunities in FY2023 should be driven by demand for platform BPM, data management, and engineering R&D (particularly cloud). Software product expansion will particularly build on productivity software and cybersecurity.⁵³

Startup Investment Takes Off

Startup activity in India rose to prominence with the Modi government's 2016 launch of Startup India, an initiative designed to support startup growth through regulatory reforms, entrepreneurial skills development, and programs to showcase promising companies.⁵⁴ Since then, India's startup scene has taken off as investors gained confidence in the market following a dearth of exits and low returns in the mid-2000s. Walmart's \$16 billion purchase of a 77% stake in online retailer Flipkart in 2018⁵⁵ was a turning point, demonstrating that large-scale exits and returns are possible.

A pivotal year for the startup scene, 2021 saw more than 50,000 active startups, over \$400 billion in valuation across the ecosystem, and venture investment reaching \$38.5 billion. India's share of global venture funding nearly doubled, from 3% to 5.6%, and venture's share in the investment mix with private equity grew for the first time to more than 50%.

In the same period, 44 new unicorns (private companies valued at over \$1 billion) were minted. This brought India's overall count of privately held active unicorns to 73, making it the world's third largest home to unicorns after the United States (500) and China (170).

Deal volume in 2021 grew to 1,545 compared to 809 in 2020, while the average deal size grew from \$12.4 million to \$24.9 million. Significantly, global VCs led more than 90 mega rounds of more than \$100 million in India (compared to 20 in 2020), typically as follow-on investment rounds in market leaders. Of the larger deals, 11 were rounds of \$400 million or more. Early-stage deals also grew in size, with Series A rounds reaching an average of \$10 million. Behind this trend, from 2021–2022 the count of active investors rose from 516 to 660. Tiger Global and Sequoia Capital were the leaders in deal volume and capital deployed, but the domestic investor base grew as well.

Most 2021 investments in Indian startups were concentrated in consumer technology sectors, especially B2C e-commerce, which saw a sharp rise in investment. Overall, consumer technology, fintech, and SaaS (software as a service) were the leading sectors, accounting for more than 75% of all investments.

Investment momentum was driven by the maturing of India's digital infrastructure, cheap and ubiquitous data, growing depth in the startup ecosystem, and investor confidence supported by successful exits. The total value of VC exits reached \$14.3 billion in 2021, with secondary transactions (sales to later-stage venture funds) accounting for 61% of that value and IPOs accounting for 38%. Three marquee exits accounted for 60% of the VC exit total value: BillDesk's acquisition of PayU (\$4.7 billion), Paytm's IPO (\$2.5 billion) and Zomato's IPO (\$1.3 billion). Three other high-profile IPOs—Policybazaar (\$750 million), Nykaa (\$710 million), and Indigo Paints (\$155 million)—brought the count of major VC-backed 2021 IPO exits to five. In addition to India markets' scale and potential returns, venture interest in India has been stimulated by an environment of tightening regulation and crackdowns in China on larger tech companies and in sectors such as edtech and gaming, which has stifled entrepreneurial activity there and led to some degree of capital flight.⁵⁶

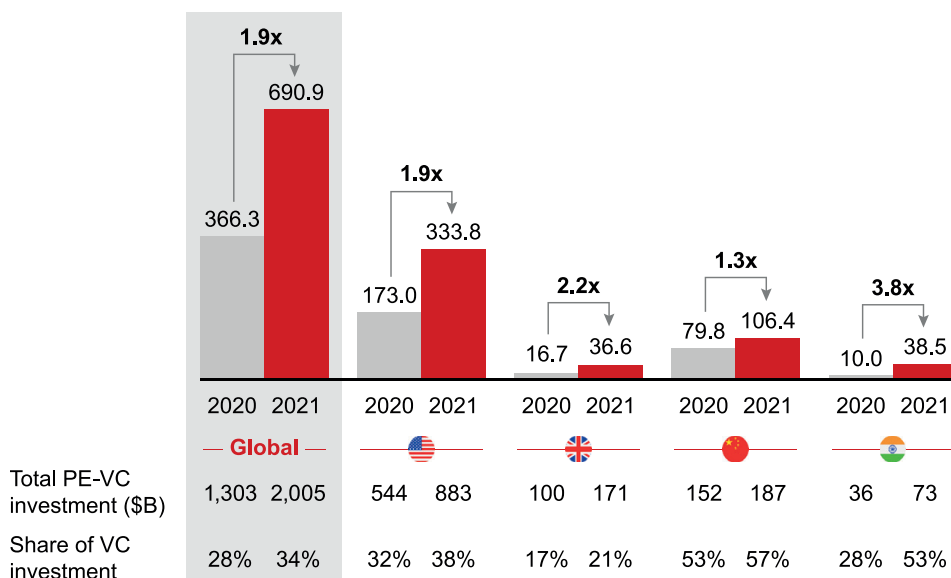
This dramatic expansion of startup activity has led to growing competition for talent, leading to attrition estimated at 25% across tech firms, and to rapidly rising salaries (10–20%).⁵⁷

Approximately 90% of venture investment in tech is coming from international investors and 10% from domestic investors, but a growing number of Indian LPs are investing through Indian GPs. For example, Chiratae Ventures, one of India's leading venture firms, has raised

40% of its \$1 billion in assets under management from inside India. Investors in GPs have been attracted by returns in the top 10–25 percentile of performance. Family funds and insurance and pension funds are also increasing their allocations to Indian GPs.⁵⁸

2021 was a record year for the global investment landscape—VC investments surged 1.9x globally, with India seeing significantly faster momentum

Overview of global VC investments (\$B)



India investments overview

2021 was a banner year for investments in India
PE-VC investments doubled over previous year

Share of VC investments grew significantly
Rose from <30% of private capital deployment in 2020 to 50%+ in 2021, at par with China

VC investments in India grew 3.8x over 2020 base
Faster than both VC investment growth globally (1.9x) and in China (1.3x)—
India's share in global VC capital deployment doubled from <3% to 5.6%

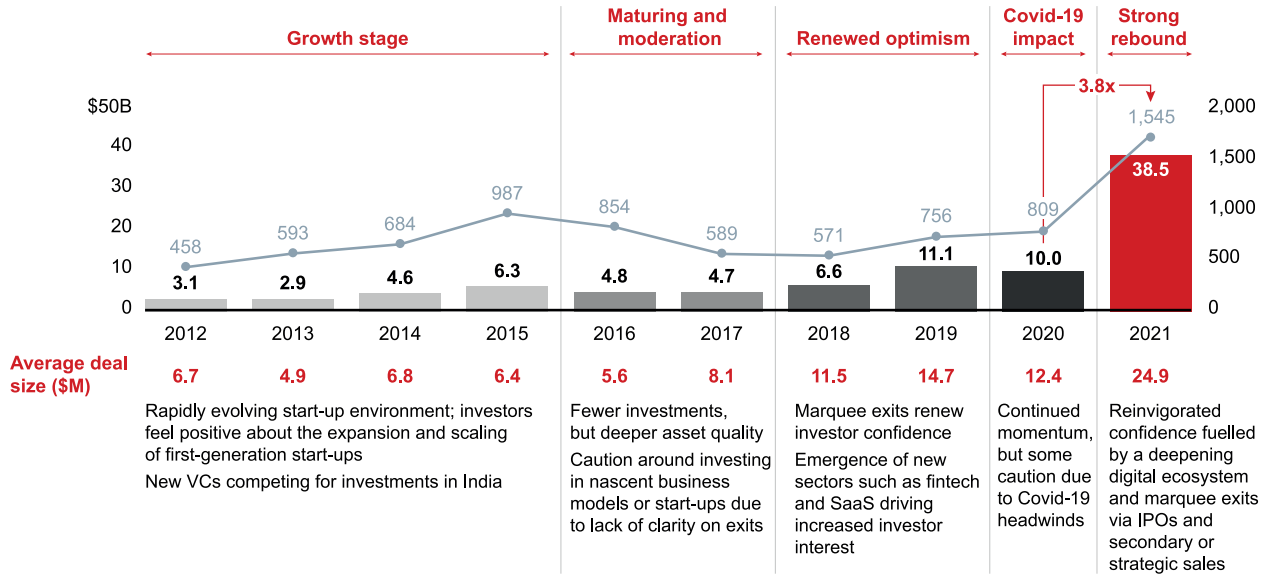
Notes: PE-VC investments figures include real estate and infrastructure deals; investment value and volume excludes limited undisclosed deal value transactions; India investments in 2020 exclude Jio and Reliance Retail deals worth \$26.5B
Sources: Bain PE & VC deals database; Pitchbook; Venture Intelligence; AVCJ; VCCEdge

Source: Bain & Company and India Venture and Alternative Capital Association, *India Venture Capital Report 2022*, March 2022

VC deal flow in India saw momentous growth in 2021, reaching a decadal high of \$38.5 billion in invested capital

Annual VC investments in India (\$B)

— Number of deals

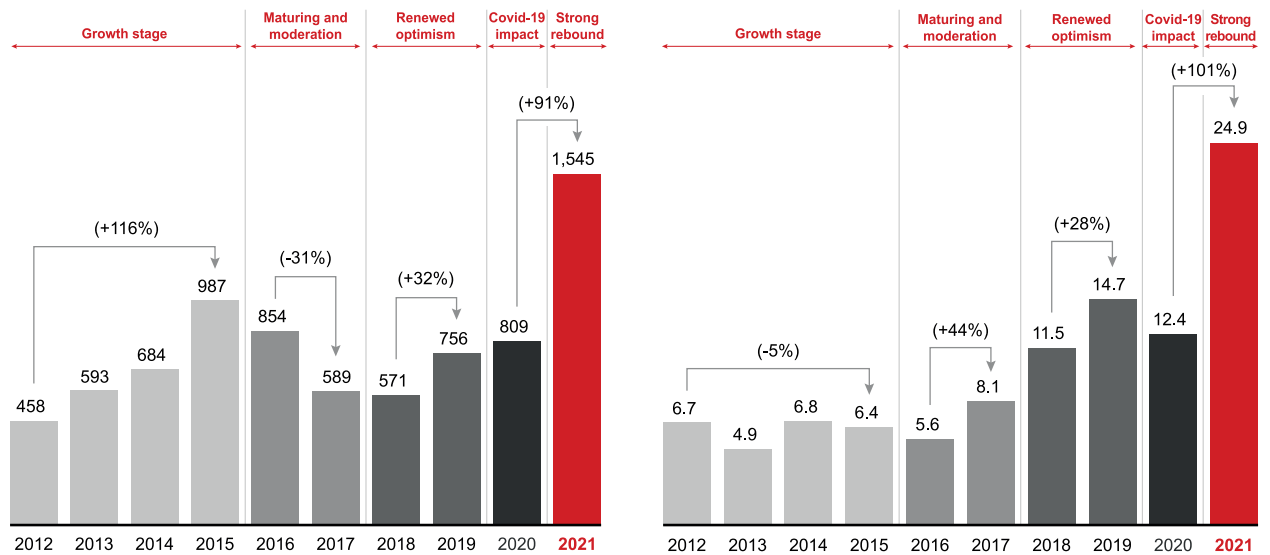


Sources: Bain VC deals database; Pitchbook; Venture Intelligence; AVCJ; VCCEdge

Across the last few years, deal volumes have fluctuated, but deal sizes have seen a steady expansion (apart from a marginal COVID-19-led drop in 2020)

Number of VC deals in India

Average VC deal size in India (in \$M)

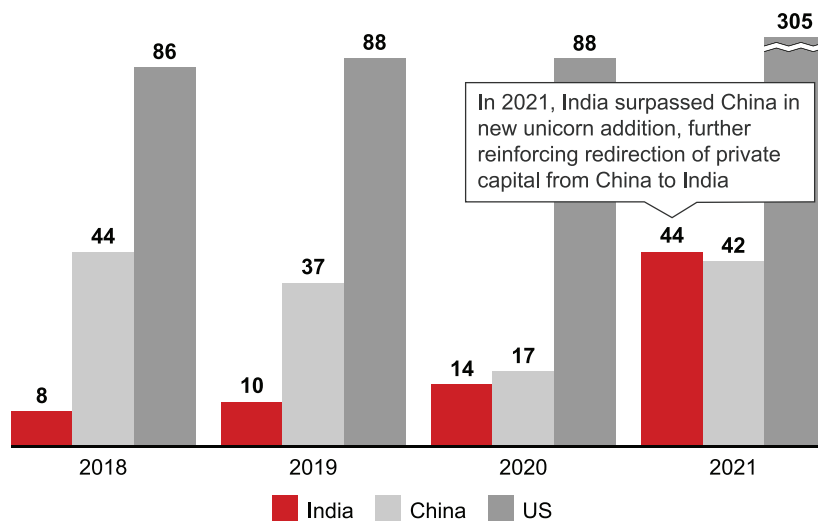


Sources: Bain VC deals database; Pitchbook; Venture Intelligence; AVCJ; VCCEdge

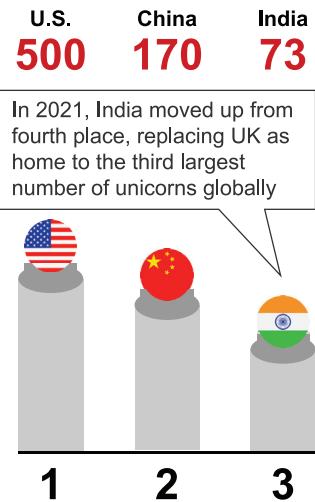
Source: Bain & Company and India Venture and Alternative Capital Association, *India Venture Capital Report 2022*, March 2022

Soaring valuations led to the addition of 44 unicorns in 2021—taking India to third place in terms of total unicorns globally

Number of new unicorns* added in the year



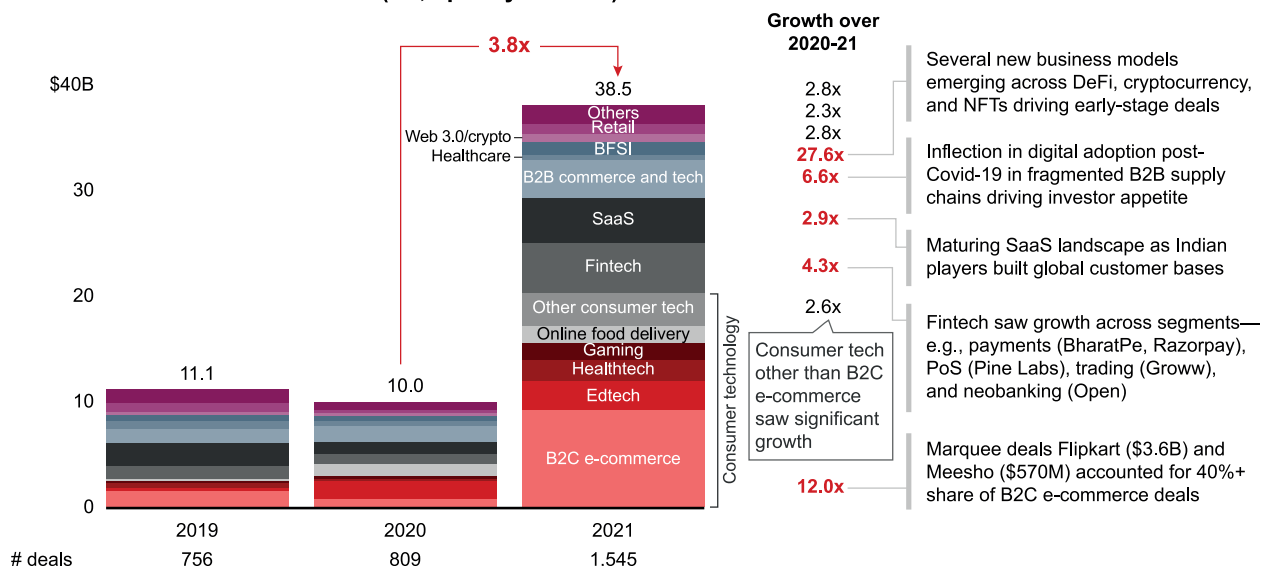
Current unicorn** base globally



* In-year unicorns defined as private companies that were valued at \$1B+ in the respective year; some unicorns included are either bootstrapped or listed in the US, while operating in India. ** Number of current unicorns excludes public, acquired or devalued companies
Sources: Tracxn; CB Insights; Bain analysis

Consumer tech, fintech, and SaaS continue to dominate overall investment value (75%+ share); sharp rise in Web 3.0/crypto-focused investments

Annual VC investments in India (\$B, split by sectors)



Notes: DeFi = decentralised finance; NFT = non-fungible tokens; other consumer technology includes travel and transportation, media and entertainment, social networks, job portals, proptech, and others
Sources: Bain VC deals database; Pitchbook; Venture Intelligence; AVCJ; VCCEdge

Source: Bain & Company and India Venture and Alternative Capital Association, *India Venture Capital Report 2022*, March 2022

SPOTLIGHT

Venture Perspective: Chiratae Ventures

Chiratae Ventures (formerly IDG Ventures India), a leading Indian early-stage technology-focused venture capital firm, has been investing in the Indian tech ecosystem since the formation of its first fund in 2006. Since then, five more funds have been launched. With approximately \$1.1 billion in assets under management, the firm has backed more than 125 startups (75+ are active) across consumer media and tech, SaaS, healthtech, fintech, and other verticals. Infosys co-founder Kris Golpakrishnan is among the many distinguished domestic LPs, and Cisco Investments counts among its overseas LPs. On average, the firm invests \$100 million each year—to date producing 3 IPOs, 8 unicorns and 17 market leaders—and has given exits to its investors for 12 years in a row.

Looking ahead, Chiratae believes that India's tech startup portfolio will surpass \$150 billion in revenue by 2027, up from \$20 billion in 2020. With that, the growing number of high-performing private equity and venture fund managers in India and top-tier returns (Chiratae has already returned \$650 million to LPs) create a major opportunity for both domestic and global LPs to invest. Chiratae's own portfolio companies have scaled to \$2 billion in revenues, including \$200 million in exports. For example, FirstCry is the largest baby care e-commerce company in India and also caters to consumers in the Middle East. Lenskart, following acquisition of a Japanese company, will be the second largest eyewear company in the world. Cropin, an agtech pioneer, digitized farm and a-ecosystem intelligence for more than 16 million acres of farmland globally and is aspiring to build intelligence for one third of global cultivatable lands by 2025, using cutting edge technology like AI, machine learning, and remote sensing.

The calculation of the scale of opportunity comes from what the firm terms the Population Scale Economy: a market of over 1 billion consumers for commerce, social, health, and other services; over 100 million SMEs; and with more than 300 million people looking to be educated. Funding patterns bear this out. According to the firm, in the past six years Indian startups have absorbed close to \$150 billion from angels, VCs, and private equity. With over 15,000 tech startups funded since 2007 by Angels and VCs, the revenue of these startups is approximately \$35 billion today. The firm expects the startup ecosystem to cross \$200 billion in revenue in the next 5 years.

Looking at India's tech and startup future, Founder and Chairman Sudhir Sethi is an optimist: "At Chiratae we expect the India tech startup community to continue scaling rapidly and benefit over a billion Indians as well as spawn global businesses from India."

Sources: Interview with Sudhir Sethi, February 2023; Sethi, Sudhir, "Venture capital propels India's tech start-up ecosystem", Preqin Territory Guide: India 2022, July 13, 2022, <https://www.preqin.com/insights/research/blogs/venture-capital-propels-indias-tech-start-up-ecosystem>; Chiratae Ventures, "Sudhir Sethi, Founder & Chairman, Chiratae Ventures – The India Opportunity at 256 Summit in ADFW," YouTube, November 25, 2022, https://youtu.be/o6GK2_IgHJQ; Chiratae Ventures, "A Keynote by Sudhir Sethi Chairman Chiratae Ventures at the Digital India Week 2022," YouTube, July 8, 2022, <https://youtu.be/gnQdkJenUw0>; CanadianSME, "Founder of Chiratae Ventures Shares How India Might Emerge As A Desirable Investment Location for Canadian Businesses, CanadianSME Business Magazine, December 7, 2022, <https://web.archive.org/web/20221222110216/https://canadiansme.ca/founder-of-chiratae-ventures-shares-how-india-might-emerge-as-a-desirable-investment-location-for-canadian-businesses/>

Bay Area venture firms are primarily investing through their India affiliates. In the two years between February 2021 and February 2023, Sequoia Capital was the top investor with 107 deals, Accel was the ninth largest with 70, Y Combinator was eleventh with 54, Matrix Partners (India) was twelfth with 52, Nexus Venture Partners (India) was 26th with 31 deals, and Lightspeed Venture Partners was number 31 with 27 deals.⁵⁹

A curtailment of venture investment in Indian startups was evident in 2022, and 2023 will remain challenging for the startup ecosystem as India tracks with the retrenchment of venture investment seen across the globe. Dealmaking has become more measured as investors refocus on quality assets. Valuations have dropped and the volume of IPOs is expected to fall further as investors confront volatile equity markets. In the first eight months of 2022, Indian startups raised \$20.82 billion in funding, down 17% from the \$25.3 billion raised in the same period in 2021. Declines were seen across all stages—seed, early stage, and late.

Table 3: 20 Most Active Investors in India's Startups, Feb. 2021–Feb. 2023

Rank	Investor	No. of Deals
1	Sequoia Capital	107
2	Tiger Global Management	105
3	LetsVenture	91
4	Venture Catalysts (VCats)	83
5	Inflection Point Venture (IPV)	83
6	9Unicorns	79
7	Better Capital	76
8	Blume Ventures	75
9	Accel	70
10	Titan Capital	56
11	Y Combinator	54
12	Matrix Partners India	52
13	Elevation Capital (SAIF Partners)	51
14	BEENEXT	50
15	Mumbai Angels Network	46
16	Chiratae Ventures (IDG Ventures)	41
17	3one4 Capital	41
18	SOSV	39
19	Indian Angel Network (IAN)	37
20	Alteria Capital	37

*Bold name indicates company with Bay Area headquarters or presence

Table 4: 20 Top-Funded Startups and Tech Companies in India, Feb. 2021–Feb. 2023

Rank	Company	Sector	Total Funding
1	BYJU's	edtech	\$5.6 billion
2	Flipkart	e-commerce	\$3.9 billion
3	Viacom18 Media	digital media/broadcasting	\$2.0 billion
4	Swiggy	food ordering & delivery	\$1.9 billion
5	Dream Sports (Dream 11, FanCode)	games	\$1.3 billion
6	ShareChat (Mohalla Tech)	social networking	\$1.3 billion
7	VerSe Innovation (Dailyhunt)	news	\$1.3 billion
8	Ola (ANI Technologies)	mobile cab booking	\$1.2 billion
9	Paytm (One97)	mobile payment processing	\$1.1 billion
10	Cars24	online used cars marketplaces	\$1.1 billion
11	Meesho	online marketplaces (general)	\$1.1 billion
12	Eruditus Executive Education	edtech	\$1.0 billion
13	Delhivery	e-commerce logistics	\$881.2 million
14	PharmEasy	online healthcare services	\$870.0 million
15	PhonePe	mobile payment processing	\$837.5 million
16	Zomato	restaurant search & discovery	\$812.3 million
17	Blinkit (Grofers)	online supermarket / delivery	\$804.8 million
18	Tata Digital	online shopping & payments	\$770.5 million
19	upGrad	edtech	\$749.3 million
20	OYO Rooms	lending, loans & credit	\$635.0 million

Source: Tech in Asia, "These are the most active investors in India's startups," <https://www.techinasia.com/active-investors-indias-startups>

Although deal count in the January–August time period actually rose from 948 in 2021 to 1,128 in 2022, an increase of 19%, that included an increased number of small-ticket fundraises. Despite the overall rise, the number of deals per month showed a general downward trajectory, falling from 196 in January 2022 to 101 in August 2022.⁶⁰ As a result, many startups (like their Bay Area counterparts) are reducing staffs and conserving cash.

However, even as startups tighten their belts in anticipation of less funding and fewer exits, the

underlying strength of India’s ecosystem remains intact, offering attractive opportunities. Like Silicon Valley, India came off a peak year for investment in 2021, and with substantial funding still available, deal activity should remain strong compared to the pre-2021 period. The current downturn, which is extending into 2023, also presents opportunities for consolidation and buy-outs.

Table 5 shows startups in India that appear to be on the path to success in 2023, based on new funding they’ve been able to raise.

Table 5:
Top 20 Rising Startups in India That Have Recently Raised Funds, Feb. 2023

Recency	Company	Sector	Total Funding
1	Cattle GURU	e-commerce cattle feed delivery	\$240,000
2	Infurnia	3D home design visualization	\$1,500,000
3	Freshbus	inter-city electric bus services	\$3,100,000
4	Loan Kuber	micro-SME digital mortgages	\$4,900,000
5	Melvano	edtech	\$156,000
6	HireSure.ai	human resources tech	\$2,500,000
7	Venwiz	B2B networking platform	\$8,300,000
8	nCore Games	mobile games	\$11,000,000
9	InsuranceDekho	insurtech	\$250,000,000
10	PhonePe	mobile payment processing	\$837,500,000
11	Prozo	logistics/supply chain solutions	\$15,300,000
12	Garuda Aerospace	drones	\$27,000,000
13	ONWO	B2B food-sourcing e-commerce	\$1,600,000
14	Magenta EV Solutions (Chargegrid)	EV charging systems mgmnt.	\$55,000,000
15	TABP Snacks and Beverages	snack & beverage manufacturing	\$2,400,000
16	Turno	commercial EV facilitation	\$16,900,000
17	Entropik Technology	AI/machine learning	\$25,000,000
18	Upwards Fintech	personal loans & credit	undisclosed
19	PadCare	healthcare/hygiene services	\$605,000
20	TapOnn	smart business card networking	\$181,500

Source: Tech in Asia, “50 rising startups in India,” <https://www.techinasia.com/50-rising-startups-india>

Despite the growth of startups in India and the fact that India is now creating new unicorns at a rate equivalent to China's, there is still a gap in the two countries' ecosystems. Although technology companies account for a larger percentage of GDP in India than in China, the valuation of the top ten Indian technology companies is considerably lower than the valuation of their Chinese counterparts. There is also a gap between Chinese and Indian startups in terms of innovation, with Indian companies less focused on hard technology and more on apps.⁶¹

To address these gaps, India's government is increasing its support for startups through

- the Samridh Scheme (2021), a program that aims to accelerate 300 startups by providing funding and business support;
- the Startup India Seed Fund (2021), a program that provides early-stage startups with financial assistance of between \$26,000 and \$66,000;
- support for International Patent Protection in Electronics and Information Technology (2021), which provides financial support for international patenting in the ICT sector and reimbursing startups per innovation for 50% of the cost of expenditures incurred for patent filings; and
- the Multiplier Grants Scheme (2021), a program that encourages collaborative R&D between industry and academic/research institutions, startups, and incubators and accelerators in the electronics and IT sector.⁶²

SPOTLIGHT

Venture Perspective: WestBridge Capital

WestBridge Capital, based in San Mateo, is a leading investment advisory firm with more than \$7.5 billion in assets under management and a focus on technology and technology-enabled businesses. Founded in 2000, the firm raised \$100 million to invest in Indian startups, merged with Sequoia Capital to form Sequoia Capital India in 2006, and separated from Sequoia in 2011 to launch its evergreen Crossover Fund. With a patient approach to investing, it has built a portfolio of 50 companies across multiple stages of investment and has participated in 5 successful IPOs since 2015. Its tech portfolio currently includes 7 unicorns. In addition to investments in Silicon Valley, Indian portfolio companies include Tamil Nadu-based Star Health, an online insurance company that provides cashless access to 14,000 hospitals in India, and Aptus Housing Finance, a home loan company that addresses the needs of self-employed low-and-middle-income clients in rural and semi-urban areas.

Technology is expected to drive 90% of its portfolio in the next ten years. In addition to investment, WestBridge provides portfolio companies with assistance in talent acquisition, go-to-market strategies, and business development. Co-founder and Managing Partner Sumir Chadha sees innovation as a differentiator: "Innovation in India continues to accelerate rapidly. We are seeing exciting companies emerging across a variety of sectors that have the potential to be global challengers."

Source: WestBridge Capital

To sustain startup growth, the government indicates that it also plans to address residual issues that have hindered even faster startup growth, primarily by reducing regulatory compliance burdens. One issue that has particularly impacted startups is India’s Angel Tax, which taxes the capital raised from Indian investors through the issue of shares by unlisted companies, if the share price of the issued shares is more than the fair market value of the company. An exemption from the tax designed to help startups has not proven effective due to a number of disqualifying restrictions that were added. To reduce their exposure to Indian laws, many startups receiving capital from non-resident investors are establishing holding companies outside of India. Angel investors, who play a critical role supporting startups before they become the focus of venture and private equity firms, also see the tax as a constraint. According to a 2021 survey by Local Circles and the Indian Venture Capital Association, 73% of startups have received one or more Angel Tax notices.⁶³

Other concerns have been expressed regarding the potential impact on startups of exacting cybersecurity and privacy protection requirements.

Expanding U.S.-India Trade

Except for a pause in 2020 due to the pandemic, two-way U.S. goods trade with India has steadily grown since 2018, reaching \$133 billion in 2022. U.S. exports to India have increased to \$47.3 billion. With imports from India of \$85.6 billion, the bilateral deficit in 2022 was \$38.3 billion.⁶⁴ Two-way trade in 2021 exceeded 2020 levels by nearly 45%, the largest increase of trade with any U.S. partner.⁶⁵ That year, the U.S. also became India’s top trading partner, surpassing China.⁶⁶ Reflecting the growing importance of bilateral trade, in

November 2021 U.S. Trade Representative Ambassador Katherine Tai and India’s Commerce and Industry Minister Shri Piyush Goyal revived the U.S.-India Trade Policy Forum (TPF) after a hiatus of four years.⁶⁷

Globally, services account for more than 40% of India’s exports,⁶⁸ with the U.S. being India’s largest market.⁶⁹ In 2019, the last year for which figures are available, the U.S. exported \$24.3 billion in services (\$1.1 billion more than in 2018, and 144% above 2009 levels), and imported \$29.7 billion in services (\$64 million more than in 2018 and 143% more than in 2009), bringing two-way service trade to \$54 billion.⁷⁰ This reflects the leading role that computer, software, and information technology services play in the US-India relationship.

India is California’s 9th largest export destination, up from #10 in 2020, with 2021 exports of \$6.67 billion. Manufactured exports accounted for \$3.913 billion, agriculture \$1.079 billion, and electronic products \$734 million.⁷¹ India is an important global market for California almonds (\$824.3 million in 2020).⁷²

Table 6: U.S.-India Goods Trade 2018–2022 (\$ Millions)

	Exports	Imports	U.S. Balance	Total
2022	47,332.2	85,670.8	-38,338.6	133,003.0
2021	40,052.2	73,172.6	-33,120.4	113,224.8
2020	27,078.1	51,119.8	-24,121.7	78,197.9
2019	34,222.8	57,879.0	-23,656.2	92,101.8
2018	33,176.6	54,249.6	-21,073.0	87,426.2

Source: United States Census Bureau, “Trade in Goods with India,” <https://www.census.gov/foreign-trade/balance/c5330.html>

The California-India Corridor

University Programs

The economic bridge between California and India is broad and multifaceted. One aspect is academic, where California and Indian universities collaborate on research and other exchanges. In Southern California, USC is particularly active, with joint engineering research programs with eight campuses of the Indian Institute of Technology (IIT). Across the state, several California State University campuses support student exchanges, joint research, or joint degrees. In Northern California, CSU-Monterey Bay supports a joint degree program in Information Technology with Vidyalankar Institute for International Education in Maharashtra, and San Francisco State University has a joint degree program in Information Technology with Lovely Professional University in Punjab. Elsewhere in the region, UC Berkeley Extension supports student exchanges with Shiv Nadar University in Uttar Pradesh and a joint degree program with O.P. Jindal Global University in Haryana. UC Davis conducts faculty exchanges with Amrita University and SRM University in Tamil Nadu.¹

Technical, policy, and entrepreneurial cooperation ranges from electric vehicles to life sciences.

The India ZEV Research Centre, led by the Institute of Transportation Studies (ITS) at UC Davis, is working to advance research and policy implementation in the field of transportation decarbonization in India, focusing on electric vehicles through a unique California-India

policy partnership. The initiative is supported by the ClimateWorks Foundation and the Hewlett Foundation. ITS has also developed a strategic partnership with key Indian government agencies and Indian research organizations, including WRI India, to promote Zero Emission Vehicle transitions in India and strengthen state-level action. The Centre also aims to support greater collaboration on climate action between the US and India, through various platforms including the U.S.-India Strategic Clean Energy Partnership² and the Clean Energy Ministerial.³

Launched in 2007, the Stanford-India Biodesign program was a first-of-its-kind collaboration between Stanford University, the All India Institute of Medical Sciences (AIIMS), and the Indian Institute of Technology (IIT), with the goal of identifying and training a first generation of medical technology local innovation leaders who would help to stimulate India's nascent medtech industry. Every year, four India fellows spent six months working in multidisciplinary teams to learn and apply biodesign process to real-world healthcare projects identified in Stanford's healthcare facilities. Upon returning to Delhi, the fellows would repeat the process to apply innovative solutions that address the unmet healthcare needs of Indian patients, doctors, and healthcare facilities. After a successful nine-year track record of training 32 innovators who developed 14 technologies and started 13 companies, the program's Indian partners transitioned to independent status, becoming the School of International Biodesign at AIIMS.⁴

Despite this important base of relationships, the depth and breadth of economic and technological ties between California and India suggests that significant room remains for university programs of this kind to grow further.

Leading Bay Area Companies in India

Leading Bay Area companies have a strong and expanding presence in India.

Cisco

Cisco (which has its second global headquarters in Bangalore) supplies technology to major Indian telcos including state-owned Bharat Sanchar Nigam Ltd (BSNL), Reliance Jio Infocomm, Bharti Airtel, Vodafone Idea, Tata Communications, and Sify Technologies, with a focus on building the back-end network for India's 5G rollout and developing use cases for end clients. In March 2021, Cisco announced that part of its \$5 billion Cisco Capital fund to support 5G projects globally would be invested in India.⁵

Google

In June 2021, Google accounted for 99.6% of mobile searches in India.⁶ Its suite of services in India includes Google Pay—which as of May 2020 had 75 million transacting users, competing with India's Paytm which had 30 million active users⁷—and Kormo Jobs, an app it expanded to India in 2020 (after a 2018 launch in Bangladesh) that helps users find entry-level jobs.⁸

In 2020, Google announced plans to invest \$10 billion in India over 5–7 years through its Google for India Digitization Fund, which focuses on infrastructure, affordable internet access and new product development tailored to the Indian market. Focal points include deploying artificial intelligence (AI) solutions for healthcare, education, and agriculture. Through the Digitization Fund in 2021, Google invested \$4.5 billion in Jio Platforms Ltd., India's largest telecommunications company by subscribers; the relationship extends Google's reach into hitherto untapped consumer digital markets.⁹ In addition to Jio, Google announced in 2022 that it is investing \$700 million in Bharti Airtel, India's

second largest telecom provider, and it has committed another \$300 million to commercial agreements with the company to support cooperation on 5G technology, cloud services, and engagement with manufacturers to lower the cost of smartphones.¹⁰

Meta (formerly Facebook)

In 2020, Facebook announced that it was also investing \$5.7 billion in Jio Platforms. The investment creates a bond between the two companies that brings Jio closer to Meta's WhatsApp, which is widely used by Indian consumers just getting online.¹¹ India is WhatsApp's largest market, with about 487.5 million users in early 2023.¹²

Twitter

Twitter statistics in January 2023 show 24.45 million active users in India, the third largest number in the world after the United States (77.75 million) and Japan (58.2 million).¹³

Salesforce

Salesforce has operated in India since 2005 and supports employees in Bangalore, Mumbai, New Delhi, Pune, and Hyderabad. The Salesforce Centre of Excellence that opened in Hyderabad in 2016 focuses on R&D. The company's approximately 7,500 employees (up from 2,000 in 2020) make India Salesforce's largest employment center outside the United States. Customers are clustered in the fields of manufacturing, banking, financial services, and retail.

Salesforce Ventures is an active investor in Indian startups that can help to grow the larger ecosystem, eventually creating a market for Salesforce services. Similarly, the Salesforce Startup Program, launched in December 2021, helps startups scale their businesses. This supplements Trailhead, the company's free online learning platform. A partnership with the All India Council for Technical Education (AICTE) supports virtual internships with the aim of bolstering the digital skills of 200,000 students by 2027.¹⁴

WhatsApp

Meta's WhatsApp has grown its digital payments service in India, enabling users to connect their bank

accounts to the app and send money to each other. After restricting WhatsApp Pay in beta mode to 1 million users since February 2018, the government gave the service regulatory approval in November 2020 to launch on the Unified Payments Interface (UPI) for an initial maximum of 20 million users.¹⁵ The user cap was raised to 40 million a year later, and in April 2022 it was increased to 100 million.¹⁶ The company is also working with banks such as ICICI to explore ways to bring financial services such as insurance, micro-pension, and credit to low-wage workers in the informal economy and rural areas.¹⁷

LinkedIn

With more than 90 million members in 2022,¹⁸ up from 10 million in 2011,¹⁹ India is LinkedIn's second largest market after the United States. LinkedIn's 25th supported language and first Indian regional language, Hindi, was added to its network in 2021, allowing it to better serve a market of more than 500 million Hindi speakers in India and over 600 million globally.²⁰ In June 2022, the company announced that it was investing \$500,000 in a regional partnership with UN Women to launch a pilot program in Maharashtra to advance women's economic empowerment by cultivating the digital, soft, and employability skills of 2,000 women over a three-year period.²¹

Apple

Apple has invested in India through its contract manufacturer Foxconn, starting with the assembly of the iPhone 11 at its plant near Chennai in 2020. This was the first time that Apple produced a current generation iPhone in India, having used Taiwan-based contract supplier Wriston to produce older generation phones since 2017.²² The upgrade of its production in India reflects both an investment in India's cell phone market, now the world's second largest, and a move to diversify production away from China. In September 2022, Apple increased its investment further as Foxconn began producing the flagship iPhone 14 at its Chennai facility. While the vast majority of iPhones are still made in China, the shift reflects the ongoing strategy by Apple to reduce its heavy dependence on Chinese sources.²³ In November 2022, Taiwanese contract manufacturer Pegatron, whose facility in Tamil Nadu has (like Wriston)

historically produced older models, became the second Apple supplier to produce the iPhone 14 in India.²⁴

Apple opened its first online store in India in 2020, after the government relaxed once-strict prohibitions on foreign direct retail,²⁵ and supports an App Design and Development Accelerator in Bangalore.²⁶

Intel

Intel has approximately 14,000 employees in India at nine design and engineering facilities, including eight in Bangalore and one in Hyderabad. It has invested more than \$8 billion in India, expanding its R&D and innovation footprint there to become the company's largest design and engineering center outside the United States.²⁷

Bay Area-India Foreign Direct Investment

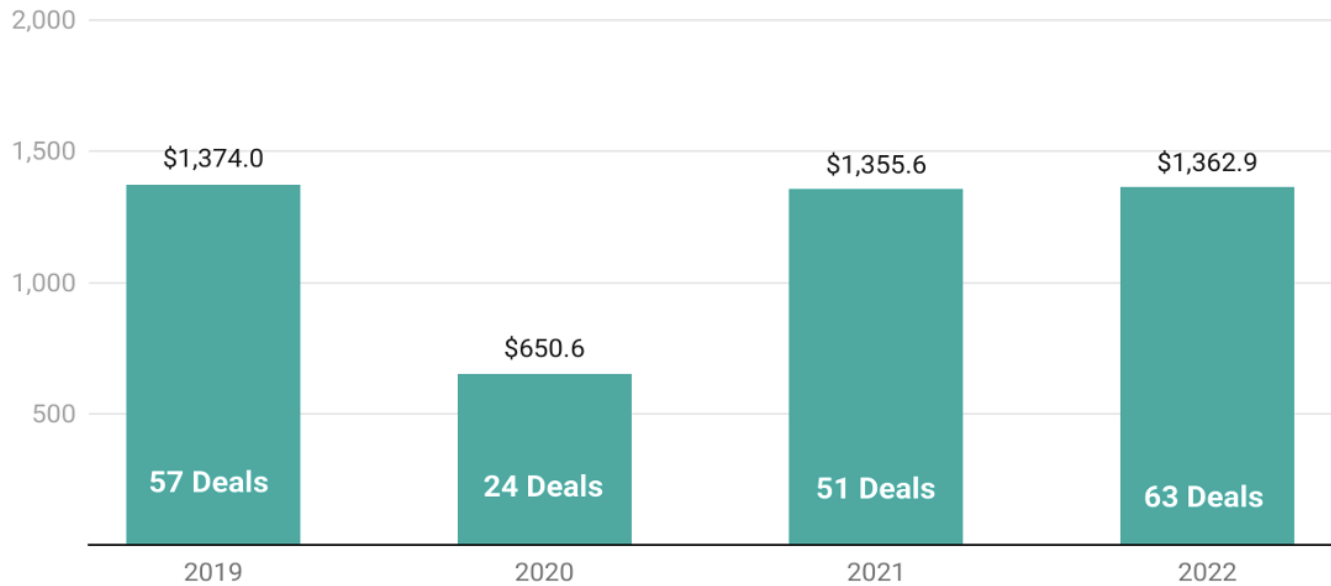
Investment Flows from the Bay Area to India

Foreign Direct Investment (FDI) by Bay Area companies in India builds on decades of investment by the region's technology companies in offshore R&D and engineering centers. Investment declined in 2020 in the wake of the COVID-19 pandemic but returned to pre-pandemic levels in 2021. Through the first seven months of 2022, FDI was on track to be the largest in recent history in terms of dollar amount and deals.

In 2019, the top sectors for Bay Area investment were ICT & Electronics (\$709 million, or 51.6% of the total), Construction (\$402.6 million, 29.3%), and Creative Industries (\$66.2 million, 4.8%). After the dip in 2020, Bay Area companies increased their investment in ICT & Electronics in 2021 to \$875.4 million, or 64.6% of the total, continuing the strong focus on R&D, software, and engineering.²⁸

This investment came principally from Silicon Valley (Santa Clara County) followed by San Francisco. Other counties where FDI to India has historically originated are San Mateo and Alameda.

FDI in India from Bay Area Companies, 2019–2022 (\$ millions)



2022 contains data through July

Chart: Bay Area Council Economic Institute • Source: FDI Markets • Created with Datawrapper

FDI in India from Bay Area Companies, 2021

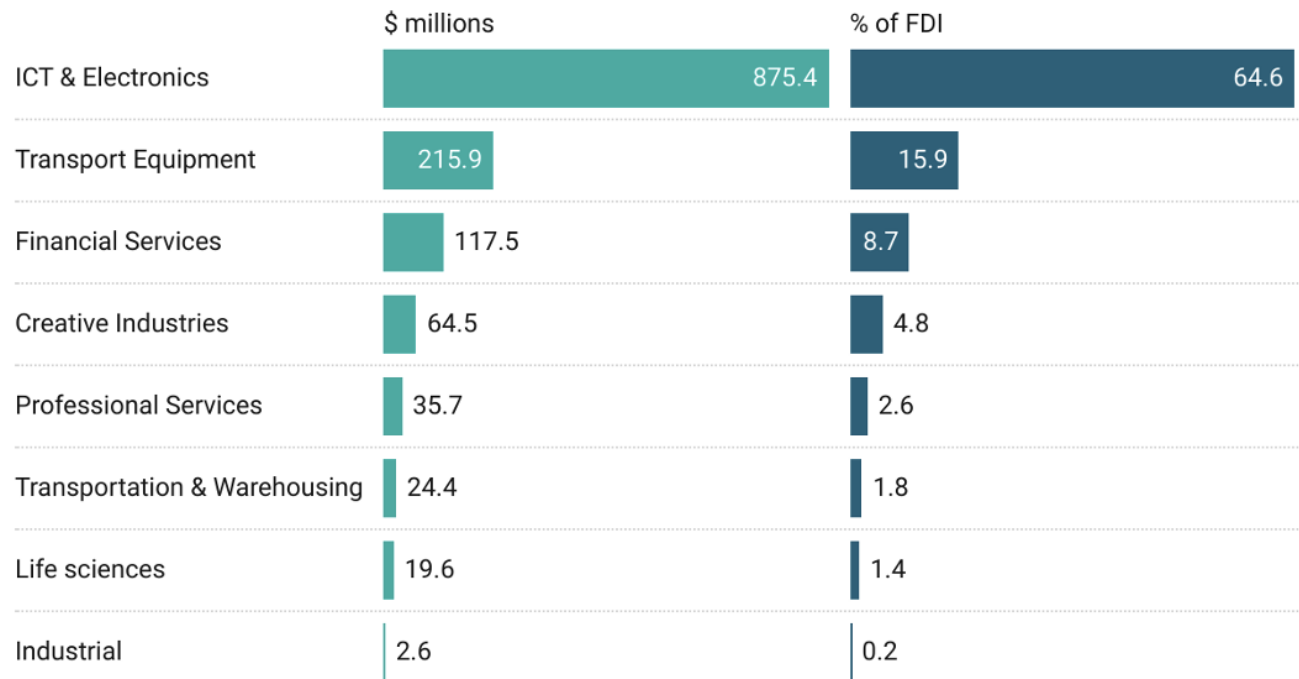
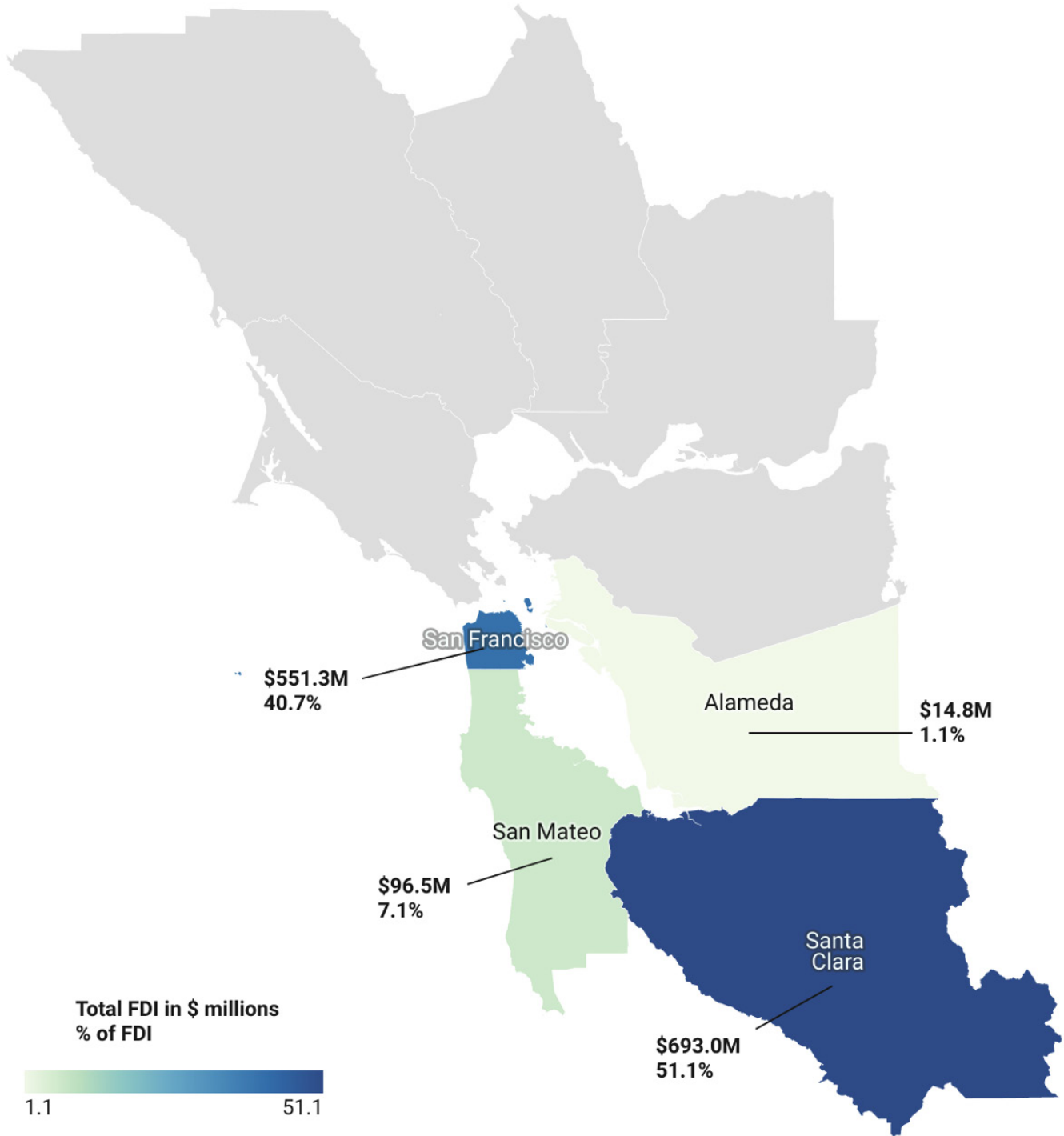


Chart: Bay Area Council Economic Institute • Source: FDI Markets • Created with Datawrapper

FDI in India by County Source, 2021



Map: Bay Area Council Economic Institute • Source: FDI Markets • Created with Datawrapper

Bay Area FDI in India – Top 5 States in India by Capital Investment, 2022 (\$ Millions)

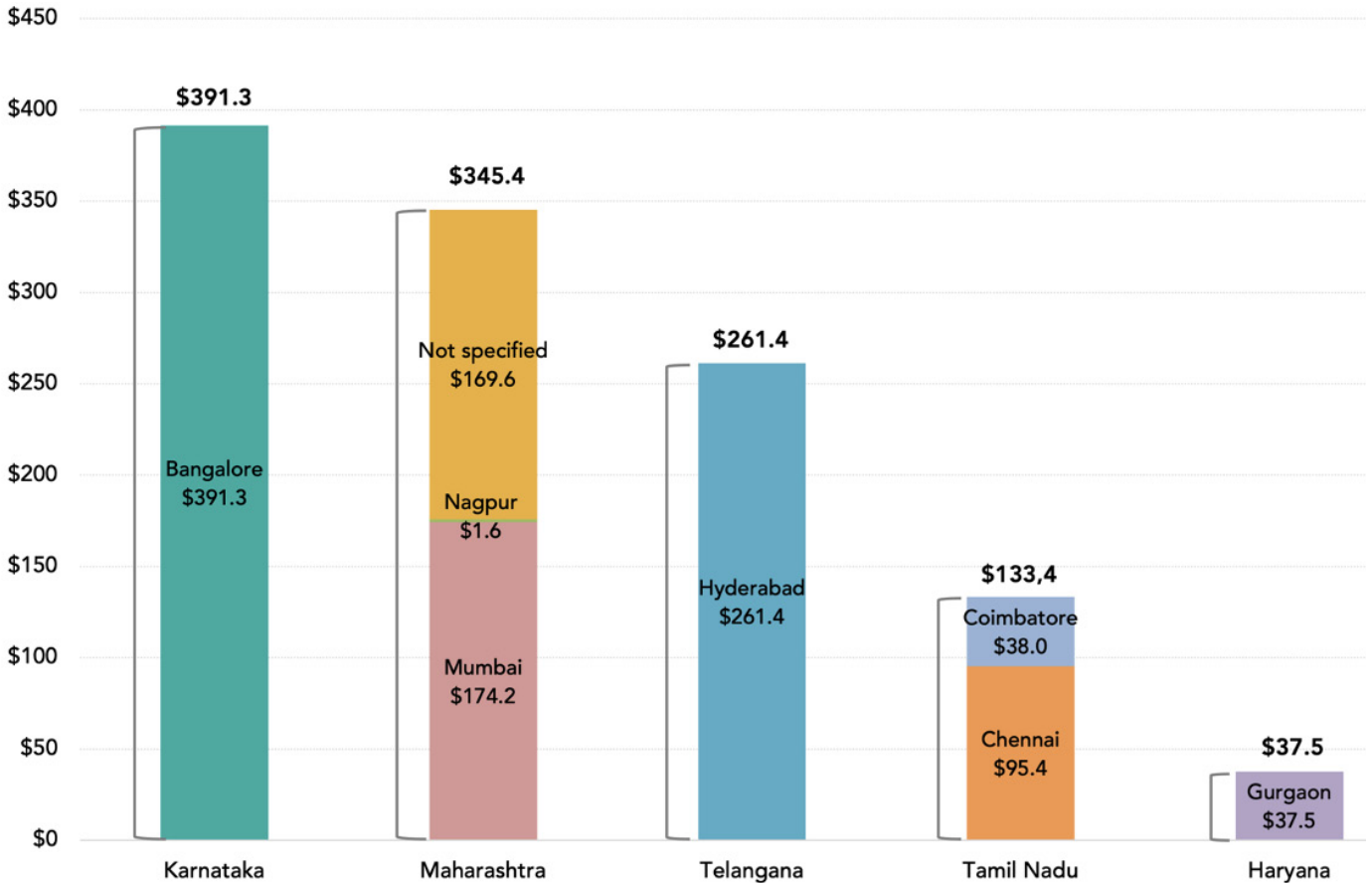


Chart: Bay Area Council Economic Institute • Source: fDi Markets

In 2022, the top five Indian states receiving foreign direct investment from the Bay Area were Karnataka, Maharashtra (led by Mumbai), Telangana (Hyderabad), Tamil Nadu (led by Chennai), and Haryana (Gurgaon), reflecting the heavy concentration of engineering assets and skills in those states. Investment

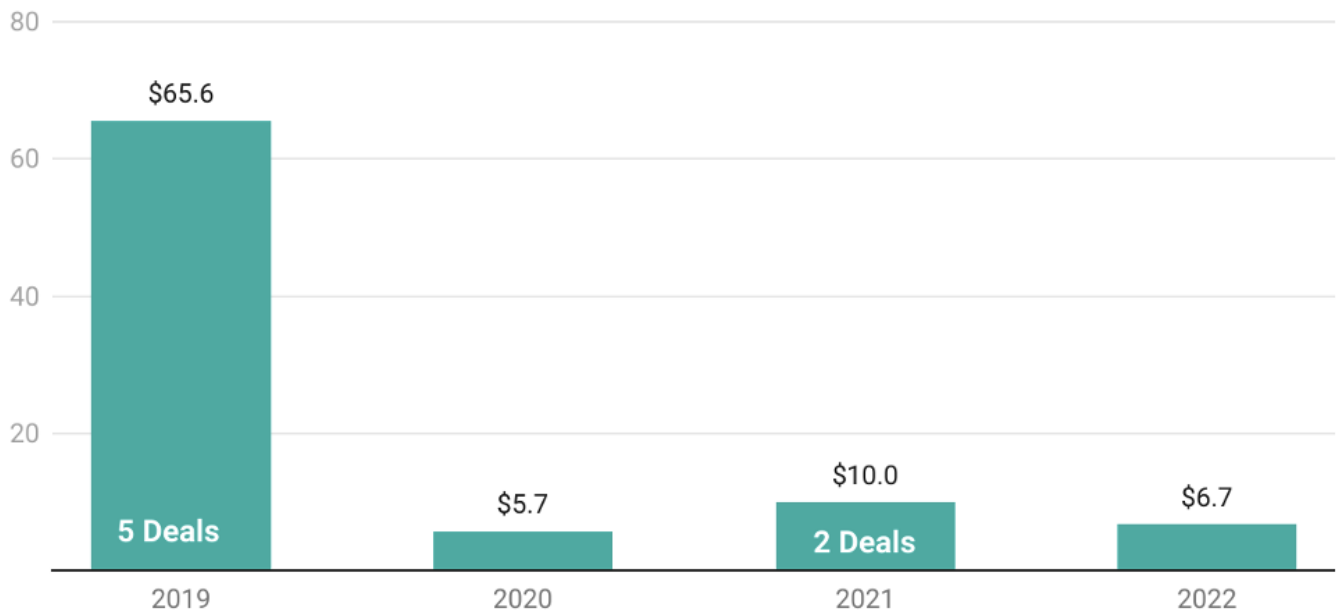
Investment Flows to the Bay Area from India

Investment from India into the Bay Area is significantly lower than investment in the opposite direction. Like the region’s outbound pattern, inbound investment is concentrated in Silicon Valley (Santa Clara County) and San Francisco. In 2019, there were five deals totaling

\$65.6 million into San Francisco and Santa Clara County, with \$38 million of that directed to the ICT & Electronics sector and AI and big data analytics. The other \$27.6 million was invested in the Transportation and Warehousing sector, focusing on R&D.

The pandemic impacted the inbound flow. In 2021, only two incoming deals were completed, from Zoomcar and Teliolabs. As in 2019, the top two sectors were Transportation Equipment and ICT & Electronics. Through the first six months of 2022, there was only one Indian investment in the Bay Area—from Intangles, an AI company that focuses on transportation solutions.²⁹ This imbalance between inbound and outbound investment points to an opportunity for a deeper

FDI in the Bay Area from India, (\$ millions)



2020 and 2022 only had one FDI deal

Chart: Bay Area Council Economic Institute • Source: FDI Markets • Created with Datawrapper

engagement by Indian companies in the region's technology and innovation economy. India only places #17 in the ranks of foreign-owned establishments in California, with 270 businesses supporting approximately 8,000 jobs. This compares to 3,523 businesses supporting more than 100,000 jobs from Japan, 694 companies supporting more than 18,000 jobs from China, 405 companies with nearly 17,000 jobs from Taiwan, and 390 companies supporting 13,000 jobs from South Korea. Of the jobs currently supported by Indian companies in California, 63% (nearly 5,000) are in the Bay Area, primarily in the Professional and Business Services sector.³⁰

India's leading information technology companies—Infosys, Wipro, Cognizant, and TCS (Tata Consultancy Services)—all have a Silicon Valley presence to support and co-innovate with clients (TCS with 1,900 employees in the region and an active program of educational philanthropy). Tech Mahindra's experience demonstrates how the products of collaboration can flow in both directions.

SPOTLIGHT

Tech Mahindra in the Bay Area

A leading provider of digital transformation, consulting, and business re-engineering services and solutions and an early mover in the Bay Area, Tech Mahindra (TechM) has operated in the region for more than twenty years. Today, it works across multiple sectors serving more than 70 technology companies including hyperscalers (young companies that are fast-growing), platform companies, independent software vendors, semiconductor companies, infrastructure technology players, retailers, manufacturers, banks, and SaaS, fintech, healthcare, automotive, and life sciences companies, as well as startups and more than 20 ecosystem partners. Close to 2,000 associates, with 1,000 in the Bay Area, deliver projects and engagements for these customers through multiple delivery centers in 8 countries.

TechM is often a core part of its clients' product and technology development and engineering and digital transformation processes. Key roles include

- product development and testing;
- process and system transformation for the SaaS business model; and
- advancing the adoption, implementation, and support for cutting edge technologies like cloud and AI developed in Silicon Valley.

TechM has invested deeply in technology and talent in the region, collaborating with partners such as UC Berkeley and with players in Silicon Valley's startup ecosystem. This collaboration includes a lab in Fremont with investment of over \$100 million, providing access to U.S.-based device manufacturers for localized testing and certification (avoiding the need to send unreleased devices out of the country with its attendant technology and design leaks). The Fremont facility is the world's first and only lab approved for testing and certifying consumer devices for the major North American telecom carriers—AT&T, T-Mobile, and Verizon.

TechM considers the U.S. West Coast, and particularly the Bay Area, as the hub for building its global partnership ecosystem and technology incubation initiatives, which are central to its growth strategy.

Harshul Asnani, Tech Mahindra's Global Head of Technology Business (based in the Bay Area) says, "Tech Mahindra is pivoting to be a cloud-first/digital-first company, and Silicon Valley plays a critical role in its transformation. We are looking to grow 2x in the region in the next 5 years and will make commensurate investments as we double down and co-innovate with customers and partners on emerging technology use cases for metaverse, Web 3.0 and cybersecurity."

Source: Interview with Harshul Asnani, Senior Vice President & SBU Head – Global Technology Business, Tech Mahindra February 2023

Sectoral Growth Opportunities

Fintech

Fintech companies in India are expected to handle \$1 trillion in assets by 2030, generating \$200 billion in revenue. A large segment of venture funding (\$3.5 billion out of \$7.8 billion raised in 2021, or 44%) is directed toward digital payments. The digital payments sector in turn is evolving to support new business models across a range of sectors outside banking such as insurance, agriculture, proptech, wealthtech, e-commerce and B2B supply chain. Indian regulators are actively encouraging innovation through regulatory sandboxes. As of March 2022, India was home to 21 fintech unicorns.³¹

Edtech

As in the United States, edtech accelerated during the pandemic as educational institutions supporting 311 million students shut down. Since 2020, the sector has seen exponential growth, moving from a value of \$700 million toward an expected \$4 billion in 2025. Edtech is India's most heavily funded technology sector, with four companies (Unacademy, upGrad, Vedantu, and Eruditas) valued at over \$1 billion and BYJU's (a decacorn) valued at more than \$10 billion. The trend has facilitated the adoption of innovative teaching and learning methods, enabled by the National Education Policy (2020), which emphasized the positive role of technology in advancing education. State governments have also introduced innovative digital learning platforms.³²

Pharmaceuticals and Healthtech

India's pharmaceutical market is projected to reach \$120–130 billion by 2030, up from \$42 billion in 2021. Worldwide, India is the largest supplier of generic drugs, accounting for 20% of global production, and it has played a major role in meeting worldwide vaccine demand.³³ The COVID vaccine Covaxin was developed domestically by the Indian pharmaceutical firm Bharat Biotech, while the Covishield vaccine developed by Oxford University and AstraZeneca was manufactured in India by the Serum Institute of India, the largest manufacturer of vaccines in the world.

The Department of Pharmaceuticals' "Pharma Vision 2020" strategy targets end-to-end drug discovery as key to India's drive to move the sector upscale and its aspiration to become a pharmaceutical innovation hub.³⁴

India's broader healthcare system is also evolving, with 2.5x growth in the healthcare market from 2016–2022, and a market approaching \$370 billion. Health IT (telehealth and health information systems) is a major target. An estimated 2,000+ healthtech startups are operating in India's startup ecosystem, drawing \$1.2 billion in investment in 2021.³⁵

COVID has been a factor, opening new fields for potential collaboration in the healthcare and healthtech sector, including infectious disease modeling, prediction and forecasting, and the management of biosafety, health, and occupational health hazards. Other promising fields include the development of biologics such as biosimilars and cell and gene therapies. India, with its large population of previously untreated patients and a good hospital network, is highly competitive as a site for clinical trials.

Climate and Energy

India is the world's third-largest energy consuming country and the world's third largest carbon emitter after China and the United States (though emissions per capita are significantly lower, at less than half the world average). Energy use has doubled since 2000, driven by urbanization, industrialization, a growing population, and rising incomes.³⁶ According to the Central Energy Authority's statistics on installed megawatt capacity on March 23, 2022, India's energy mix leans heavily toward coal (53% including 2% lignite), followed by renewable energy sources (39% including hydro, solar, wind, and biomass), natural gas (6%), and nuclear (2%).³⁷

Transitioning away from this fossil-dependent mix poses significant challenges. Over the next 20 years, India will need to add new electricity generating capacity equivalent to the total power capacity of the European Union today. The IEA (International Energy Agency) estimates that India will see the largest increase in energy demand of any country between now and 2040.³⁸ The consequences of not shifting to cleaner

energy sources are potentially severe. By one estimate, India suffered an income loss of \$159 billion or 5.4% of its GDP in 2021 due to extreme heat and its impact on labor productivity. Similar impacts can be expected as global temperatures continue to rise.³⁹

In 2016, India set the goal of having 175 GW of renewable energy installed by end of 2022, including 60 GW of wind and 100 GW of solar, up from 29 and 9 GW respectively in 2017.⁴⁰ At COP26, in 2021, it announced the goal of net-zero GHG emissions by 2070. While that places India's target later than the dates set by other major economies (the U.S. target is 2050 and China's is 2060) its interim goals are worth noting. Specifically, India plans to draw half of its energy requirements (500 GW) from renewables by 2030. Carbon dioxide emissions would be cut from business-as-usual levels by 1 billion tons by the end of the decade, and major entities such as India's rail network, which now runs primarily on diesel or coal-generated electricity, would turn net-zero. The 2030 target is essentially a repackaging of India's prior goal of 450 GW by counting nuclear and hydro generation (currently 53 GW).⁴¹

India aims to reduce emissions intensity per unit of GDP by 45% by the end of the decade, up from its prior goal of 33–35%. According to former environment minister Prakash Javadekar, the emissions intensity of India's economy has already been reduced by more than 24% from 2005 levels.⁴² But the transition from coal will be challenging and meeting the accelerated goal will entail a massive restructuring of the energy sector. At COP26, India committed to phasing down (but not phasing out) coal in the power sector in the near term; with growing demand for energy, the National Electricity Policy includes near-term plans for an additional 25 GW of coal capacity by 2026–2027.⁴³ Rapidly growing energy demand also requires India to expand its use of natural gas. In order to reach its 2070 net-zero emission goals, India plans to invest \$40 billion to develop new gas pipelines and LNG terminals and to expand exploration and production as natural gas is used to replace higher-emitting oil in the energy mix.⁴⁴

The challenge can also be seen in India's problems meeting its current targets. As of May 2022, with just seven months remaining in 2022, only 57% of its 100 GW target for solar production and 67% of its 60

GW target for wind power had been met. While the deployment of utility-scale solar is largely on track, the deployment of rooftop residential and commercial solar has lagged for both supply chain and regulatory reasons. Wind developers, for their part, have found it difficult to deliver power at the low prices yielded by reverse auctions.⁴⁵

The government has recognized the importance of storage in meeting its renewables targets, responding with large tenders and with policy support. Interstate transmission charges have been waived for storage projects, standard bidding guidelines for storage systems have been issued, and a National Energy Storage Policy is in the works to address industry barriers.⁴⁶

India's renewables strategy looks to create a domestic solar industry that would reduce dependence on Chinese imports. Steep import duties have been put in place and large subsidies are available for companies that build solar factories domestically.⁴⁷ According to Power and Renewable Energy Minister Raj Kumar Singh, as of mid-2022 India had 15 GW of solar cell and manufacturing capacity, with an additional 50 GW in the pipeline.⁴⁸ U.S. manufacturer First Solar is investing to meet what it expects to be growing Indian demand with the July 2021 announcement of a \$684 million factory in Tamil Nadu. High duties—which increase the cost of imported panels by 40%—would have made importing its products prohibitive. More than a dozen companies have reportedly applied for Indian government assistance to build 19 GW of solar panel capacity by 2023.⁴⁹

Hydrogen is an emerging field, as seen in the National Hydrogen Mission announced in August 2021.⁵⁰ The Mission aims to accelerate the development of hydrogen technologies and of hydrogen production, and to stimulate demand in specific sectors (fertilizer, steel, petrochemicals) through mandates for the use of green hydrogen in industry similar to the government mandated purchase of power from renewable sources. The strategy also includes demonstration projects for transportation.⁵¹ India is targeting 5 million tons a year of green hydrogen capacity by 2030, and in response Indian companies have announced plans for large-scale green hydrogen projects.⁵² A \$2 billion incentive program supports the mission, which in addition to

increased production capacity aims to reduce the cost of hydrogen over the next five years by scaling up production. India plans to sell 70% of its production to South Korea, Japan, and countries in Europe.⁵³

Renewable energy investment in India reached record levels in 2021–22, up 125% over 2020–2021 and 72% above the pre-pandemic level of 2019–2020.⁵⁴ To meet the country’s 2070 net-zero emission goals IEA (International Energy Agency) has estimated that between now and 2030, \$160 billion per year will need to be invested across India’s energy economy.⁵⁵

These targets are stimulating startup activity. Among leading cleantech startups are

- ReNew Power, which by generating capacity is India’s largest renewable independent power producer, has a renewable asset base of more than 13 GW (of which 7.5 GW are installed capacity as of May 2022) and is generating 1.8% of India’s total electricity annually;⁵⁶

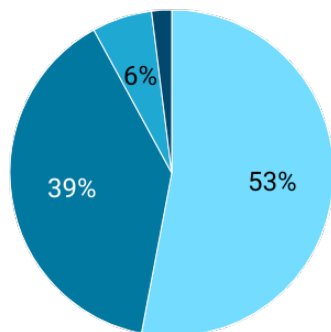
- Avaada Energy, India’s leading solar project developer, which has some of the largest solar and wind projects across 11 Indian states and a current peak capacity of 2,982 MW;⁵⁷
- Log9, a nanotechnology cleantech company, which develops aluminum fuel cell technology for stationary and automotive applications; and
- Skilancer Solar, which produces robots that clean solar panels without the use of water.⁵⁸

The U.S. Commercial Service identifies energy as offering the best industry prospects for doing business in India, identifying energy-related equipment as offering particular opportunities for deals with power utilities.⁵⁹ Smart grid, grid resilience, and battery storage offer other opportunities for Bay Area and U.S. companies.

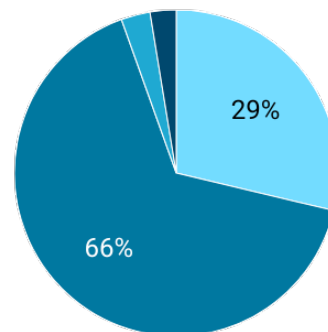
Energy Mix of India’s Installed Electricity Capacity

Percentage of megawatts as reported in the National Electricity Plan (Draft): Generation Vol-I, September 2022

■ Coal & Lignite ■ Renewables ■ Natural Gas ■ Nuclear



March 31, 2022



2031–2032 Projection

Chart: Bay Area Council Economic Institute • Source: Central Electricity Authority, India Ministry of Power • Created with Datawrapper

Electric Vehicles

Electric vehicles are a related priority. The industry is still at a nascent stage, with only 35,000 vehicles on the road in India. Tata Motors currently leads the field, but other Indian companies such as Mahindra are poised to challenge. The current market being small, foreign companies aren't yet a major factor.⁶⁰ The government has targeted 30% of private vehicle sales and 70% of commercial vehicle sales to be electric by 2030, supported by incentives rolled out in 2019 for EV manufacturing as well as sales. According to Goldman Sachs calculations, electric car sales quadrupled in India between October 2021 and October 2022, accounting for 1.3% of new car registrations in September 2022.

One of the biggest challenges to a larger market is cost, as the average price for an electric vehicle is double the cost of a conventional car. With batteries accounting for 40% of EV costs in India, it will be important to bring down battery prices.⁶¹ Charging infrastructure is another challenge. By one estimate, India needs to install 46,000 chargers to reach global benchmarks. The current ratio of EVs to public chargers is 6 for China and the Netherlands, 19 for the United States, and 135 for India.⁶²

Bay Area expertise in electric vehicle, battery, and charging technology could contribute to the solutions.

Semiconductors

India aims to become a significant producer of semiconductors. The development of semiconductor chip production capacity is considered critical to the country's national security and its aspiration to emerge as a global hub for electronics design and manufacturing. Semiconductor capability is also expected to strengthen India's supply chain resilience as domestic demand from the telecom, cloud, and EV industries grows rapidly. Today, India imports all its semiconductor needs (about \$32 billion per year), mainly from the United States, Taiwan, South Korea, and China.⁶³

In December 2021, the Indian government approved \$10.2 billion for the development of a Semiconductor and Display Manufacturing Ecosystem, which will cover up to half of the initial investment required to build

front-end fabrication facilities (fabs) and coordinate with states to develop industrial parks that can provide fab infrastructure. The program also extends financial support for back-end packaging and test facilities and for chip design and talent development.⁶⁴ The government's long-term goal is an integrated end-to-end ecosystem that spans design, fabrication, packaging, and testing, advanced by a recently launched national India Semiconductor Mission (ISM).⁶⁵

The global leaders in the fab sector include Taiwan, the United States, South Korea, China, and Japan, while in the fabless (design) segment, the top countries are the United States, Taiwan, and South Korea. Currently, India has no semiconductor fab (front-end or back-end) industry. Earlier efforts to build fabs were unsuccessful due to insufficient investment, local expertise, and infrastructure.⁶⁶ However, India hosts large out-sourced operations in the fabless segment, operated by overseas semiconductor companies such as Qualcomm and Samsung. These facilities employ approximately 60,000 engineers and often handle end-to-end design of sophisticated semiconductors, averaging about 3,000 chips a year. There are, however, no significant Indian companies in this segment. The country's semiconductor imports are either embedded in imported electronics systems or feed electronics manufacturing facilities. India currently assembles nearly 300 million phones with a significant semiconductor component.

The Indian government has been looking to Silicon Valley to partner with local companies for its semiconductor fab programs. Intel has resisted, citing the need for India to first build greater domestic demand for chips and create a significant local design and back end assembly and test industry. Applied Materials has similarly suggested that India first needs to develop a broader semiconductor ecosystem.

The Hinrich Foundation has produced an insightful analysis of India's semiconductor industry, looking at the success of Taiwan's semiconductor sector as a model. While the government's initiative addresses long-standing barriers relating to infrastructure, the report argues that Taiwan has also been successful due to its integration into global semiconductor supply and value chains. As India's strategy evolves, this suggests the need to avoid import substitution and the importance of

reducing barriers to the importation of state-of-the-art components and equipment. The report also suggests that the government avoid excessive subsidies to domestic producers that could discourage investment by international industry leaders.⁶⁷

Amplifying the emerging government partnership and the opportunities it opens for business, in March 2023 U.S. Commerce Secretary Gina Raimondo and India's Union Commerce and Industry Minister Piyush Goyal signed a Memorandum of Understanding addressing the semiconductor supply chain. The memorandum aims to establish a collaborative mechanism for semiconductor supply chain resilience and diversification, building on the U.S. Chips and Science Act and the India Semiconductor Mission.⁶⁸

Silicon Valley semiconductor companies have massive chip design operations in India, and this, coupled with the need for the United States to diversify its supply chain and the strategic alignment of the two countries through the Quad, makes the semiconductor sector an important field for collaboration.

Infrastructure and Urban Sustainability

More than 270 million people will be added to India's urban population over the next two decades, and Oxford Economics projects that 17 of the world's 20 fastest growing cities between 2019 and 2035 will be in India.⁶⁹ This will lead to growing demand for electricity in the residential sector and rapid growth in India's infrastructure and building stock, with an attendant increase in demand for construction materials such as steel and cement. With this scenario, energy demand is expected to grow at a rate three times the global average. A key contributor to the growth of urban demand will be the increased use of air conditioners, making energy-efficient building codes and construction practices critical. Transportation has been the fastest growing area of energy demand, with particularly high demand for diesel used in trucks. This points to a growing need for transportation infrastructure—from highways and railways to ports and airports.⁷⁰

The 100 Smart Cities Mission was launched by Prime Minister Modi in 2015 as an urban renewal and retrofitting initiative targeting the development of smart cities, with completion planned in 2023. The initiative is

premised on the belief that cities will need to increase their efficiency and better monitor and integrate their infrastructure in order to optimize resources, maximize services, and deliver a higher quality of life for urban residents. Much of this will come through solutions such as data-driven traffic management and intelligent lighting systems. The initiative covers 100 cities across India's states and union territories.

Thematic goals include adequacy of water supply, assured access to electricity, sanitation including solid waste management, efficient urban mobility and public transport, affordable housing, robust IT connection and digitalization, e-governance and citizen participation, environmental sustainability, safety and security, and health and education. Besides retrofitting, the program includes greenfield projects that support urban expansion, with costs contributed in equal amounts by the central government and local authorities.

Tactically, the initiative focuses on compact areas that can create a replicable model for other aspiring cities. The Smart Cities Mission's place-based strategy complements the Atal Mission for Rejuvenation and Urban Transformation, which has similar goals but follows a more project-based strategy. A number of overseas governments including the United States have been participating. Through the U.S. Trade and Development Agency (USTDA), the United States decided to participate in the smart development of Visakhapatnam (Andhra Pradesh), Allahabad (Uttar Pradesh) and Ajmer (Rajasthan).⁷¹

In late January 2023, the Ministry of Housing and Urban Affairs reported that of the 7,804 projects under the Smart Cities Mission, 67.22% (valued at \$11.9 billion) were complete and 33.77% (valued at \$9.9 billion) were expected to be complete by June 2023. The four states with the most completed projects were Karnataka (768), Madhya Pradesh (577), Uttar Pradesh (553), and Tamil Nadu (531).⁷² The finance minister also announced continuing support for the Smart Cities Mission in the FY24 budget, as well as the establishment of an urban infrastructure development fund for smaller towns and reforms in urban planning and property taxes to improve urban sustainability.⁷³

Silicon Valley innovations in smart city technology can help India meet its urban sustainability goals.

Space

Space offers another opportunity for collaboration. The Indian Space Research Organization (ISRO), the government's space agency, has had considerable success since its establishment in 1969, enabling India's development of advanced heavy-lift rockets and the capacity to launch complex satellites for remote sensing, weather forecasting, and military communications. ISRO has also conducted space exploration missions, sending probes, orbiters, and landers to the Moon and Mars.

Significantly, India has started outsourcing the building of its launch systems and satellites to the private sector, much as NASA has done with private U.S. companies such as Space-X. Today, private and public companies provide more than 50% of India's rocket and satellite systems.

NewSpace India Limited was established in 2019 as a public sector unit with the authority to enter into joint ventures with industry to produce and assemble launch vehicles and satellites. Under reforms launched in 2020, ISRO now allows private companies to use its facilities to test and launch their own systems. And the Indian National Space Promotion and Authorization Centre (IN-SPACe) was established in 2022 as a vehicle to regulate, coordinate, and facilitate private sector launches and satellite building across the country. The creations of New Space and IN-SPACe are central to the liberalization of India's space sector. Recent advances include the successful launch of the Vikram-S sub-orbital rocket by startup Skyroot, the first launch vehicle for spacecraft entirely designed and built by a private Indian company.⁷⁴ Other noteworthy space startups include Agnikul Cosmos, which has developed a single-piece fully 3-D printed upper stage launch engine; Dhruva Space, which is developing an indigenous small satellite platform with a focus on the assembly, testing and operation of satellites; Pixxel, which is building hyper-spectral earth-imaging satellites and the analytical tools needed to mine the data they gather; and Bellatrix Aerospace, which specializes in new technologies for in-space mobility, electric propulsion, and orbital transfer vehicles. Approximately 150 space startups are currently operating in India, up from ten in 2019.⁷⁵

Most space startups are at the incubation level but over a quarter are at an advanced stage of product development. The strategy of both encouraging

startups and opening the door to collaboration with large private companies is designed to produce an ecosystem that will propel growth across the sector, as ISRO concentrates on R&D.

India's talent base and demonstrated capacity to build and launch both rockets and satellites opens a significant field for cooperation with Silicon Valley and other U.S. companies.

Trade Policy Debates

India is no stranger to trade protection or to economic nationalism. This is to some degree a legacy of India's pre-1990s policies, which embraced import substitution, were suspicious of U.S. and Western investment, and put in place high tariff barriers. More recently, domestic lobbies such as CAIT (Confederation of All India Traders), which represents small traders, have opposed the expansion of U.S. retail companies such as Amazon and Walmart.⁷⁶ While India's economy is much more open to trade and investment than in the past, policies continue that protect Indian companies, support national champions, and favor domestic businesses in public procurement. The Self-Reliant India (Atmanirbhar Bharat) program provides subsidies under the Production-Linked Incentives scheme for local production and import substitution.⁷⁷ In trade, India withdrew from negotiations for Asia's multilateral RCEP (Regional Comprehensive Economic Partnership) agreement in 2019.⁷⁸ Tactically, it is a frequent user of anti-dumping measures and countervailing duties.

The recent slowing of market opening in India reflects an increasingly active industrial policy that aims to build both domestic production capacity and export capabilities. Tesla, for example, is at odds with the government over India's 100% import duties on electric vehicles, which discourage sales. While the national government and several states would like Tesla to assemble its cars in India, the company first wants to establish a sales and service presence to test its competitiveness in the market.⁷⁹ Minister for Road Transport and Highways Nitin Gadkari has stated that Tesla must manufacture in India before its cars can use the roads.⁸⁰ This approach stands in contrast to China's, where the opening of Tesla's large production facility in China followed on its successful market entry.

Data Privacy and Localization

Silicon Valley interests are particularly impacted by ongoing policy debates regarding privacy and data regulation. India's government engaged in more than two years of deliberation on the Personal Data Protection Bill 2019 that it ultimately withdrew from consideration in August 2022, saying that the bill had become too complicated and it would produce a rewritten version. The abandoned bill had been criticized by privacy advocates for giving the government excessively broad powers over personal data and was disliked by tech companies for increasing their compliance and data storage burdens, requiring them to get specific permission for most uses of a person's data and mandating that certain data about Indian users be stored only within India.⁸¹

Beyond the scope of the data protection bill—and of particular concern for Bay Area and U.S. companies—are policies by the Reserve Bank of India to prevent the offshore transfer or storage of credit card and payment processing data without government approval, effectively requiring its storage in India. The data localization strategy has been supported by Indian companies seeking to stave off challengers, such as Reliance Jio, Bharti Airtel, and Paytm,⁸² and also by smaller companies concerned that U.S. companies with large data platforms are competitively advantaged over local counterparts.

When the 2019 data protection bill was withdrawn from consideration, India's Minister of State for Electronics and Information Technology (MeitY) stated that it would "soon be replaced by a comprehensive framework of global standard laws including digital privacy laws for contemporary and future challenges." Beyond the data localization issues, the 2019 version of the bill had alarmed large tech companies because it included the regulation of both personal and non-personal datasets in a single law, producing a complex mix that also gave sweeping powers to the government.⁸³ Related issues of concern to Silicon Valley and some Indian companies included the compliance-heavy legal framework and its associated cost, as well as ambiguities that raised questions of interpretation—for example, the lack of a clearly expressed definition of "critical personal data" that would be required to be stored in India.⁸⁴

Other concerns were raised regarding provisions that would enable the government to compel businesses to produce anonymized and non-personal data for policy-making purposes,⁸⁵ but without specific criteria.

The draft of the new Digital Personal Data Protection Bill 2022 was made public in November. While slimmed down, it contains many of the same provisions as its predecessor, including mandates patterned after the EU's General Data Protection Regulation (GDPR) and laws in U.S. states like California that require companies to obtain consent from individuals about whom they are processing data. Exceptions for the Indian government, on the other hand, would allow data gathering in the "public interest,"⁸⁶ a provision that potentially empowers state surveillance and could pose problems for Silicon Valley and other companies that would need to deal with complex legal issues of appropriate government access.

However, in a move welcomed by Silicon Valley and other U.S. companies, the draft backs off from the more aggressive data localization provisions of the earlier version, which required companies with personal data on Indian citizens to store that information in the country. The new approach, based on the free flow of data to "trusted" geographies, would instead allow the Indian government to evaluate other countries' data protection regimes and certify that their protections are sufficient for the data to be moved.⁸⁷ If retained in the bill's final version, this approach addresses concerns raised by Silicon Valley and other companies regarding infrastructure and other data storage costs and cybersecurity concerns associated with mandatory local storage. It also addresses domestic concerns that mandatory local data storage would negatively impact India's large cross-border IT services industry.

The revised bill does not affect the ability of the Reserve Bank of India to require the localization of financial data, a topic that is still subject to debate.⁸⁸ Non-personal data is left out of the bill; non-personal data may be included in a new Digital India Act, but its removal from the Digital Personal Data Protection Bill 2022 is appropriate regarding privacy legislation. In addition, penalties for non-compliance, which had also been modeled on Europe's GDPR (fines of up to 4% of annual gross revenue), have been reduced.⁸⁹

India’s government has been open to input in the drafting process, including from U.S. and Silicon Valley companies.

Other issues have arisen regarding government requests to internet companies to block or remove content, witnessed by an ongoing dispute with Twitter over the government’s policing role.⁹⁰ Like other countries, India is continuing to wrestle with the challenge of content moderation, an open internet, and the appropriate terms for government intervention.⁹¹

Sustaining the Reform Agenda

To sustain economic growth at a high level (above 8%), India needs large-scale investment in manufacturing, technology, infrastructure, and agriculture. The Center for Strategic and International Studies (CSIS) has produced an India Reforms Scorecard to measure progress in aspects of reform that many experts consider key to growth. These fall into three buckets: Goods Trade (where the Modi government has leaned protectionist), Foreign Investment (where the

government has worked hard to remove restrictions on foreign investment), and Domestic Reforms (such as a Goods and Services Tax, a stronger Insolvency and Bankruptcy Code, and reduction in the corporate tax rate). Some reforms—to simplify land acquisition, address onerous labor regulations, and restructure agriculture markets—have failed due to political pushback. The scorecard, which tracks major reforms completed in the Modi government’s first two terms, shows a surge of reform at the start of the first term, followed by a slowing of activity, and then an acceleration of activity toward the end of Modi’s second term. In addition to the completed reforms recorded on the scorecard as of June 2022, CSIS has tracked another 15 reforms from the first term and 6 reforms from the second term that are “in progress” or partially completed and still require action.

As this suggests, there is still some distance to be covered in the sphere of reform if India is going to meet the government’s goal of making India a \$5 trillion economy by 2025.⁹¹

Modi Government: Reforms Per Year

Per CSIS India Reforms Scorecard

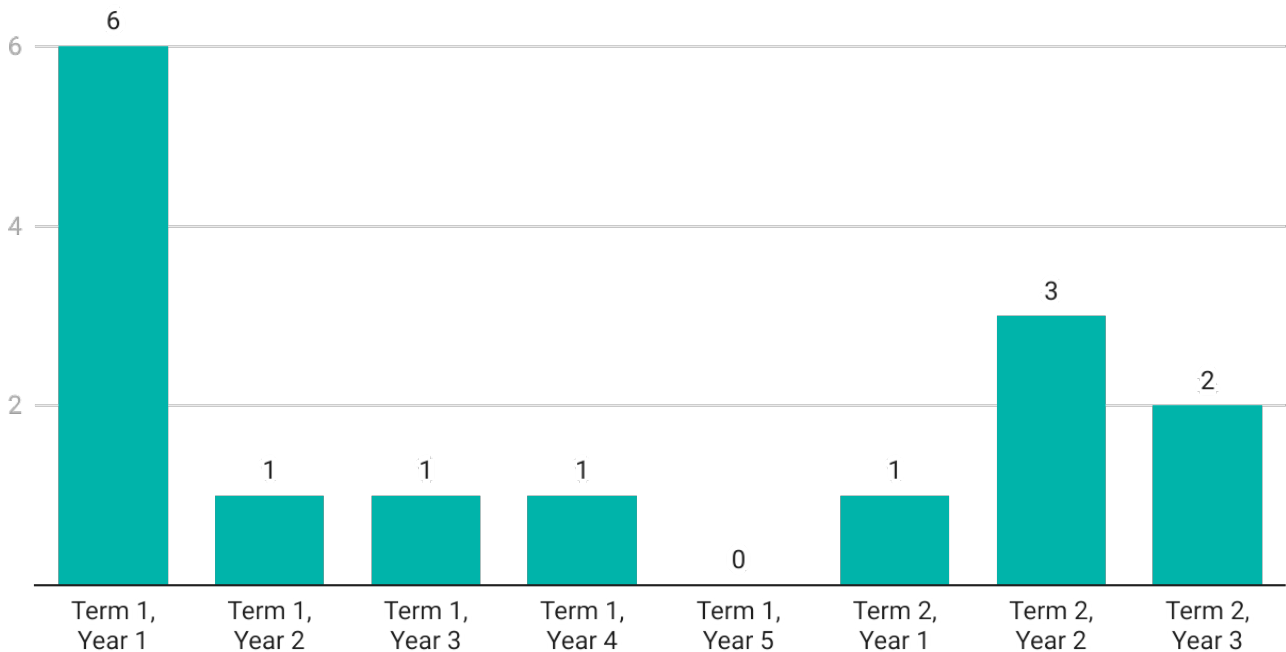


Chart: Bay Area Council Economic Institute • Source: CSIS • Created with Datawrapper

Shaping the Future Relationship

“India has the conditions in place for an economic boom fuelled by tech startups, offshoring, investments in manufacturing, the energy transition from fossil fuel to clean energy, use of tech in all sectors like Finance, Consumer, Health, Agriculture and a strong digital infrastructure now accessible to 800 million Indians. These drivers position India well to scale from the world’s 5th largest economy to the 3rd largest in 5 years from today at \$5 trillion GDP.”

Sudhir Sethi, Founder and Chairman
Chiratae Ventures¹

India’s External Affairs Minister S. Jaishankar describes the evolution of the technology and supply chain relationship between the United States and India as one of “trusted geographies,” where the supply strategy is “just in case” more than “just in time” and supply chains evolve with the strategic relationship.² He also describes India’s industrial goal as being “technologically more capable, not technologically self-reliant. Having capabilities isn’t the same as protectionism or a throwback to the past.” Both strategies, if pursued to their full extent, bode well for the U.S.-India relationship.

Jaishankar also observes that the quality of India’s partners is key, with the central questions being who gives India access to technology, who collaborates, and who’s a market (“Where is there a bridge in technology? Where there’s access we’ll grow together.”) This also

augurs well for the economic relationship as a whole and in particular for the relationship with the Bay Area, whose strength in technology aligns with India’s development path, which is propelled by technological change.

Synergies between the Bay Area and India’s robust innovation ecosystem suggest a range of opportunities for collaboration. As suggested in the preceding section of this report, this includes opportunities in specific sectors. It also includes thematic opportunities and others connected to shared strategic goals. How priorities and policy issues on both sides are managed will influence the pace of progress.

Defense

Defense, for example, offers distinct opportunities as both governments have welcomed projects through the U.S.-India Defense Technology and Trade Initiative (DTTI) and the Industrial Security Agreement that facilitates bilateral defense trade and industrial cooperation. This framework includes reciprocal participation by U.S. and Indian vendors in each other’s defense supply chains.³

Critical and Emerging Technologies

Launched in May 2022 by Prime Minister Modi and President Joe Biden, the Initiative on Critical and Emerging Technologies (iCET) provides another important platform for deepening the India-U.S.

technology relationship. The Carnegie Endowment for International Peace has recommended a number of initiatives to advance its goals:⁴

- innovation fellowships, hackathons, and dialogues;
- establishment of business and university-supported centers of technology excellence, to support research and the translation and scaling of technologies from lab to market;
- establishment of a National Science Foundation (NSF) branch in India;
- creation of a joint innovation fund;
- collaboration on space technology, including competitions and hackathons that bring together space entrepreneurs from both countries;
- collaboration on quantum computing through a shared platform that engages government, academia, and industry stakeholders around R&D and the development and deployment of talent in both countries (e.g., internships and training for students and young professionals);
- relaxation of U.S. restrictions on the export of quantum hardware to India, and support for tie-ins of Indian academic institutions and startups with U.S. companies active in quantum; and
- jointly skilling of semiconductor talent (building on the government's Chips to Startup scheme to skill 85,000 semiconductor professionals at all stages of the semiconductor value chain).

Standards

With their large markets and technological capacity, the development of trusted supply chains between the United States and India and the mutual recognition of standards between them can support U.S. and India leadership in the setting of standards globally.

Climate and Energy: States

India's electricity sector is highly decentralized, with state governments playing the leading role in determining the makeup of generation within their own grids. Some states like Karnataka, Gujarat, Rajasthan,

Tamil Nadu and Telangana are well down the road toward meeting national goals (which the government breaks down into sub-targets for each state), but most are not. Technical exchanges between California and Indian states in fields such as data analysis, demand forecasting, weather forecasting, electricity storage, and the ability of consumers to choose suppliers could advance the process.⁵

Startups

Indian startups increasingly have global ambitions and look to the United States both for funding and as their first market outside of India. Silicon Valley plays an important role in this process. Many overseas governments and private entities support accelerators in the Bay Area that serve as a bridge for their startups to Silicon Valley and its resources and potential partnerships. TiE (The IndUS Entrepreneurs) has played an important role in supporting and mentoring Indian-founded startups in the region, but more institutional channels could be useful to link India's and Silicon Valley's startup ecosystems.

Digital Policy

Both countries recognize that the digital domain is critical to their futures but lack a shared vision of what the digital economy should look like and the rules that should govern it. The existing bilateral dialogue in the US-India ICT Working Group is conducted by mid-level officials and lacks the visibility needed to drive policy at the highest level, while the high-level US-India Trade Policy Forum only considers digital trade as part of a broader working group on services, which limits the attention it is given.

How India chooses to regulate data has important implications for its future role as a global service center. In November 2021, the government's imposition of a digital services tax on foreign companies, which the U.S. Trade Representative considered discriminatory, was suspended pending a broader agreement on the issue at the OECD.⁶ These issues should be on the table as the U.S. and India seek to align their digital policies.

The Atlantic Council's US-India Digital Economy Task Force has called for a "digital handshake"—similar to the strategic handshake that enables the United

States and India to pursue deeper strategic alignment despite their differences—that would elevate digital cooperation to a central role in the relationship. Its proposals include embedding this concept in a high-level joint statement between U.S. and Indian leaders, convening a US-India Digital Economy Ministerial, and creating specific workstreams to address issues in trade and innovation, resilient supply chains and manufacturing, tech for social good, data flows and digital commerce, and national security and law enforcement cooperation. These steps would be supported by a US-India Digital Economy Advisory Board and Technical Advisory Committee.⁷ It is important for Bay Area and other U.S. companies that common ground be established in order to allow this key aspect of the relationship to grow.

Skilled Immigration

United States immigration policy regarding skilled workers perhaps impacts India more than any other country. Long wait times in India for a U.S. visa, particularly in the wake of the COVID pandemic, are a source of frustration, as is the current U.S. regime for green cards that allocates the same number of green cards to every country. That treats India—a major partner with large numbers of skilled citizens living in the U.S.—the same as small countries with which the U.S. doesn't enjoy a similar relationship. As a result, wait times for a green card for qualified Indians living in the U.S. can extend for as long as ten years, frustrating Indians who have chosen to make the United States their home and contribute to its economy. Nationally, the Bay Area, with its large and highly educated Indian population, is affected more than any other region.

Trade and Investment

As global supply chains realign and investment shifts from China to other countries, India can be a prime beneficiary if it presents the right economic and policy environment. Deeper integration into global supply chains can advance the government's goal to grow domestic manufacturing and employment. To benefit from that supply chain realignment, however, it is important that India avoid the temptation of import substitution and other protective policies that could constrain trade and investment.

The U.S.-India dialogue on trade was elevated in March 2023 with the signing of an agreement between U.S. Commerce Secretary Gina Raimondo and Minister for External Affairs S. Jaishankar to launch a U.S.-India Strategic Trade Dialogue—led at the Foreign Secretary level in India and the Commerce Undersecretary level in the U.S.—to address high-level issues such as export controls and explore ways to enhance commerce in high technology and facilitate technology transfer.⁸ Bilaterally, India has shown interest in a free trade agreement with the United States, something that could benefit both countries, but the Biden administration has avoided discussion of new trade agreements with any country. Meanwhile, India has negotiated a comprehensive economic partnership (CEPA) with the UAE, which entered into force on May 1, 2022,⁹ and is negotiating a new free trade agreement with the UK.¹⁰ With an array of interests that are drawing the two countries closer together, the United States should welcome discussions with India on an agreement that would further open markets.

Opportunity, Partnership, and Innovation

The US-India relationship builds on trust, shared interests, and opportunity. The challenge and opportunity on both sides is how to develop deeper industrial and research collaboration, with shared networks and resources, that builds a pipeline of innovative technologies and applications. The development of an innovation corridor between India and the United States—in which Silicon Valley and the Bay Area will play a key role—is critical to achieving this goal. As India continues its shift from being a global back office to becoming a technology co-creator, the partnership that could result represents one of the great economic opportunities of the coming decade.

Notes

SECTION 1

The Strategic Context Deepens

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