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The Bay Area-Silicon Valley and India

Convergence and Alignment in the Innovation Age

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ABOUT THE BAY AREA COUNCIL ECONOMIC INSTITUTE

Since 1990, the Bay Area Council Economic Institute has been the leading think tank focused on the economic and policy issues facing the San Francisco Bay Area-Silicon Valley, one of the most dynamic regions in the United States and the world's leading center for technology and innovation. A valued forum for stakeholder engagement and a respected source of information and fact-based analysis, the Institute is a trusted partner and adviser to both business leaders and government officials. Through its economic and policy research and its many partnerships, the Institute addresses major factors impacting the competitiveness, economic development and quality of life of the region

and the state, including infrastructure, globalization, science and technology, and health policy. It is guided by a Board of Advisors drawn from influential leaders in the corporate, academic, non-profit, and government sectors. The Institute is housed at and supported by the Bay Area Council, a public policy organization that includes hundreds of the region's largest employers and is committed to keeping the Bay Area the world's most competitive economy and best place to live. The Institute also supports and manages the Bay Area Science and Innovation Consortium (BASIC), a partnership of Northern California's leading scientific research laboratories and thinkers.

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“The San Francisco Bay Area is a vital economic hub in U.S.- India trade and continues to grow in both the diversity of industries it encompasses and the depth of opportunity it represents. India cannot ignore the deep relevance this area holds for it's own economic growth and we are pleased to see the Bay Area Council step out with the India Report to support continued partnership between India and one of our nation's most notable economic powerhouses.”

Nisha Biswal, President,
U.S.-India Business Council
and SVP, U.S. Chamber of Commerce

“India will join China and the US in the top tier of global economies, and that must necessarily include building a top tier Indian high technology industry. India has to attract the right investments and partnerships in this quest and I am sure the US, and the Silicon Valley in particular, will see this as a great opportunity.”

Dr. Arogyaswami J. Paulraj,
Professor (Emeritus), Stanford University

“The incorporation of these devices will make India a leader in the space. The opportunity for India and USA to collaborate leveraging IOT is significant in addressing many challenges. This is a very exciting time for both democracies, with huge potential, to partner, both for innovation and implementation, leading to positive impact in diverse sectors.”

William Ruh, Co-Chair,
Bay Area-Silicon Valley India Focus,
Bay Area Council
and CEO, LendLease Digital

“The Bay Area/Silicon Valley and India are natural partners for innovation-based economic growth. We are committed to supporting and leveraging these ties for a win-win for both the US and India.”

Dr. Nandini Tandon, Co-Chair,
Bay Area-Silicon Valley India Focus,
Bay Area Council
and Co-Founder & CEO,
Tenacity Global Group Inc.

“Economic growth is best served with the inclusion of women in leadership and the priority being given to it in the Bay Area-India focus of the Bay Area Council is very promising.”

Priya Tandon, Special Advisor,
Bay Area Council
and Co-Founder & India CEO,
Tenacity Global Group Inc.

“We are making great strides against cancer but the road is a long one. And now we have a new tool—Artificial Intelligence that will help us move faster. AI will be a great enabler in transforming healthcare, specially cancer. This transformation will be further accelerated by USA and India partnering and pooling their complementary strengths, benefitting their own citizens and collectively impacting the global health at large.”

Robert Ingram, Founding Chair,
CEO Roundtable on Cancer



भारत का राजदूत
वाशिंगटन, डी. सी.

AMBASSADOR OF INDIA

2107 Massachusetts Ave., N.W.

Washington, D.C. 20008

MESSAGE FROM THE AMBASSADOR OF INDIA TO THE UNITED STATES

I extend my compliments to the India Focus of the Economic Institute of the Bay Area Council (BACEI) for bringing out this timely report on building stronger economic ties between the Silicon Valley and India titled, "Bay Area-Silicon Valley and India: Convergence and Alignment in the Innovation Age".

The recent outcome of the largest democratic vote on the planet – the General Elections in India, with a clear and renewed mandate for the Government of Prime Minister Narendra Modi provides a unique opportunity for further strengthening the robust and comprehensive India-US strategic partnership. Prime Minister Modi had said during his visit to Washington DC in June 2017, "We consider the USA as our primary partner for India's social and economic transformation in all our flagship programs and schemes."

The stewardship of Governor Gavin Newsom of the "Golden State" of California, a leader in the United States in industries such as agriculture, pharmaceutical, finance, information technology, aerospace, film and entertainment and tourism, can help realize the untapped potential of bilateral cooperation. A decade ago, Governor Newsom was the first-ever sitting Mayor of San Francisco to visit India. His focus on building California's external trade ties was evident in the fact that soon after taking office earlier this year, he designated Lt. Governor of California Eleni Kounalakis as his top representative to advance California's economic interests abroad.

The potential for economic ties between the United States and India, the world's oldest and largest democracies is immense. India is today the world's third largest economy (PPP terms). It is poised to become a Five Trillion Dollar Economy in the next five years and aspires to become a Ten Trillion Dollar Economy in the next 8 years thereafter. The last five years also witnessed a wave of next generation structural reforms, which have set the stage for decades of high growth. This includes the path breaking Goods and Services Tax (GST) and other taxation reforms. The country has leapfrogged to the 77th rank in the World Bank's Ease of Doing Business Rankings. With a young population and an expanding middle class, the Indian market presents great opportunities for business.

It is therefore natural that bilateral trade and investments have shown a robust growth. Bilateral trade reached \$142 billion in 2018 growing by more than 13% from \$126 Billion in 2017. Trade deficit came down to \$24.2 Billion, a decrease of 11.3% in one year. India has been the top recipient of FDI in the world in the past few years and has received over \$239 Billion of FDI in the last five years. Over 400 of the top Fortune 500 companies have their R&D facilities in India.

California is known world-wide for its innovative and important technology firms such as Apple, Facebook, Oracle and Google. Many of these firms have research centers in India and find a huge market and userbase there as well. India's skilled engineers power these Silicon Valley giants and also contribute to the Start-up ecosystem of the Valley.

The Bay Area Council's timely report on economic ties between Silicon Valley and India traces the 100-year arc of their engagement propelled by Indian immigrants on the US West Coast. It accurately captures India's recent achievements in the Ease of Doing Business, Competitiveness and Global Innovation indices and rightly lays emphasis on India's digital expansion in the fields of health, infrastructure, agriculture, energy, payments, data analytics, IoT and e-commerce. Silicon Valley technology companies have been among the first to realize the business potential of India's digital economy surging on the back of more than 500 million smartphone users today and already higher per capita rates of data transmission than the US and China. Among other things, the report chronicles the maturing of venture capital funding between the Silicon Valley and India, spotlights new tie-ups in the digital space for Indian IT-services companies, and presages growing partnerships in the AI, blockchain, IoT and 'moonshot' spaces.

The report is a welcome and positive read on the India-US economic relationship, in general. We laud the team at the Bay Area Council - President & CEO Jim Wunderman, Co-chairs of BACEI's India Focus Dr. Nandini Tandon and William Ruh, Senior Director Sean Randolph and Special Advisor to BAC Priya Tandon - for shining a light on the potential of India-Silicon Valley economic ties.



(Harsh Vardhan Shringla)
Ambassador of India to the United States

Executive Summary

India's economy has rapidly advanced and is now the world's sixth largest. GDP growth averaged 6.3% from 1980–2016, and was 6.7% in 2017, with 7.3% estimated for 2018 and 7.5% forecast for 2019. In contrast to China, whose population is aging rapidly, India is young: people aged 15–34 account for slightly over a third of its population and most of its eligible workforce. India's economic structure is also changing, as agriculture's share has steadily declined to only about 15% of output, and services now dominate (at more than 50%). India's middle class is growing, and urbanization is accelerating.

This transformation is a work in progress. Agriculture still employs almost 43% of the workforce. India's vaunted IT industry, though fast growing, employs relatively few workers compared to traditional occupations, and while official unemployment rates are low, many jobs are temporary or part-time. India also continues to struggle with a legacy of underperforming education, persistent poverty, and government inefficiency. To address these challenges and push India toward a position of global leadership, the government of Prime Minister Narendra Modi, which took office in 2014, has embarked on a series of bold reforms to streamline government and digitize the economy. That vision looks to a cashless economy, digital government services, telemedicine reaching into rural areas, more use of renewable energy, and connectivity for rural as well as urban citizens through 5G wireless networks.

For a country of India's size, international trade is relatively small, accounting for only 28.67% of GDP and 2.1% of world trade. Service exports are led by India's robust IT sector, which occupies a position of global dominance. The United States is India's largest global customer for the IT, ITeS (IT-enabled services), and BPM (business process management) sector, absorbing 62% of global sales in each year since 2014. Due primarily to its IT service exports, India enjoys a goods and services trade surplus with the US, a source of conflict with the Trump administration. On the investment front, the US

accounts for only 6% of India's cumulative equity FDI inflow, with US FDI to India having slowed in recent years. Clearly, there is considerable room for growth in two-way trade and investment. Silicon Valley is already a major player, with \$21 billion in cumulative investment from 2003–2018, accounting for 79% of all investment from California.

As this suggests, the Bay Area is a major economic partner for India. This has a social and demographic base, as California is home to 20% of Indian immigrants to the US, with 506,971 residents of Indian descent. More than 293,000 live in the Bay Area, primarily in Santa Clara and Alameda counties. Compared to immigrants overall, Indians tend to be professional and educated: nearly three-quarters are employed in management, business, science, and arts occupations; median income (\$107,000 in 2015) is much higher than for the native-born or other immigrant populations; and 77 percent hold a bachelor's degree or above. These numbers reflect the high proportion of Indian immigrants who come to the US as university students or as H-1B workers in jobs requiring a university degree; 20,000 Indian students attend California colleges and universities, with UC Berkeley the largest host institution in Northern California. A vibrant community of business and cultural organizations also anchors India's connection to the region.

When considering opportunities in India, it is important to understand that like the United States, India has a large number (29) of highly diverse states that enjoy considerable political autonomy and offer distinct business environments. The largest states have the scale of countries, with populations ranging from 60 million (Gujarat) to almost 200 million (Uttar Pradesh). States can serve as laboratories for innovation. Business strategies therefore need to take into account not only national government policies, but state environments as well.

Much still needs to be done before India can be considered a world leader in innovation, but its status is rising. A young, entrepreneurial population and a

fast-growing domestic market make India a promising site for venture investment. US venture firms, primarily from Silicon Valley, are the biggest players. After a flood of investment in the early 2000s, some firms left, frustrated by slow returns on investment, but a growing number of unicorns and recent high-profile exits are changing the environment. As a result, both established venture firms and newer market entrants are raising their profiles through operations that give their Indian arms more autonomy and decision-making authority. Most innovation is taking place around goods and services targeting India's growing domestic market.

India is identified abroad with information technology and with its leading IT services companies. IT, IT-enabled services, and business process management constitute a \$167 billion sector that accounts for \$126 billion in exports. As global IT demand is moving beyond traditional network management, systems integration, and software services toward new fields such as mobile technology and digital services, Indian firms are adjusting. Future export growth will come primarily from digital services—cloud computing, big data analytics, IoT, blockchain, automation, artificial intelligence, and e-commerce. Silicon Valley plays a part. Through their presence in the Valley, Indian IT firms are investing, increasing R&D, and engaging startups and other partners that will shape the future of the industry. Some are developing service centers in the US to recruit and train employees locally—in response to customer needs, but also to increased pressure on the H-1B visa system.

The Modi government's Digital India initiative has intensified the focus on digital capability within India. Cloud services and e-commerce in particular are poised for takeoff: the public cloud services market in India is expected to grow by more than 35% to \$1.3 billion in 2020; business to business (B2B) e-commerce is expected to reach \$700 billion; and business to consumer (B2C) e-commerce is forecast to reach \$102 billion. It is estimated that by 2023, India will have a connected market of up to 700 million smartphones and about 800 million internet users. Recognizing those technology opportunities, Bay Area companies such as

Google, Facebook, Oracle, Cisco, Salesforce, VMware, and Zendesk are increasing their investment.

Other sectors also show promise for partnerships. The Modi government plans to double healthcare spending to raise the quality of care, maintain affordability, and extend preventive medical and wellness services to underserved rural areas. Bay Area venture firms are investing in specialty clinics, healthcare IT, diagnostics, pharmaceutical manufacturing, and low-cost medical devices.

Energy and the environment are also priorities. Fossil fuels power most of India's 350 gigawatts of installed electricity generation capacity; of that, 56–75% is coal-fired generation. India has pledged under the 2015 Paris Climate Change Accord to cut greenhouse gas emissions by 33–35% from 2005 levels by 2030 and to achieve 40% cumulative electric power installed capacity from non-fossil-fuel-based energy resources over the same period. Those intentions build on the government's goal of increasing installed capacity of renewables to 175 GW by 2022, more than doubling the 75 GW capacity existing in early 2019. On the environmental side, 15 of the world's top 30 worst cities for air pollution are in India, and 63% of sewage flowing into rivers daily is untreated in urban areas.

Government agencies and states are looking to California for solutions in renewable energy, energy conservation and storage, and environmental mitigation. Companies such as GE, whose digital activity is based in the Bay Area, are developing technologies in India focused on grid transmission and distribution software. Bay Area venture firms are investing in decentralized off-grid solar power, low-cost solar systems for homes and small businesses, and solar-powered microgrids. Lawrence Berkeley National Laboratory's International Energy Studies (IES) Group has worked with India's government and businesses for more than two decades, providing technical and policy analysis on power generation, energy efficiency, and sustainable cities. It also leads the US-India Joint Center for Building Energy Research and Development (CBERD), in which a range of Bay Area businesses, universities, and non-profit organizations participate.

Infrastructure, urbanization, and smart cities are related fields where India's needs and markets align with Bay Area capabilities. India's cities lag their global peers in smart city technology. In response, the government launched a Smart Cities Mission in 2015, targeting 100 cities for infrastructure and services upgrades, backed by partial funding. Early projects focus on CCTV security systems, smart streetlights, emergency warning and response networks, free Wi-Fi along transit corridors (which increased ridership), and "smart classroom" upgrades to secondary and primary schools. Cities also need better multi-agency planning and coordination, data-driven decision making, and simplified processes for permitting and land acquisition. Silicon Valley companies are teaming with Indian IT and engineering firms and startups to build out integrated command and control centers that are critical to managing data flows and coordinating functions, including integrated data storage and security. Reflecting the range of needs and opportunities, Cisco runs a Cisco Smart City center in Bangalore (also known as Bengaluru) to showcase how IoT technology and infrastructure can deliver government services on demand via mobile devices; enable smart streets and buildings, smart parking, and smart meeting and work spaces; and connect users to education, healthcare, and transportation.

India is also a large untapped market for financial services. The Modi government sees mobile technology, fintech, and a cashless society as keys to financial empowerment and business growth, providing access for ordinary Indians to credit, insurance, digital payments, and e-commerce. Fintech acceptance and adoption have grown rapidly, with the traditionally cash-driven Indian

economy responding well to the fintech opportunity primarily triggered by the related surges in e-commerce and smartphone penetration. The shift to digital payments promises to revolutionize India's economy, and in the process, transform the financial sector. Credit Suisse forecasts that digital payments will become a \$1 trillion market in India by 2023. Bay Area companies like Visa, PayPal, WhatsApp, and Google have made inroads in financial services markets but face competition from local service providers, as well as regulatory challenges.

As with any relationship between major countries, there are complex issues. Imposition of 25% and 10% steel and aluminum tariffs by the US in 2018 led India to impose retaliatory tariffs in 2019. The US withdrawal of Generalized System of Preferences (GSP) benefits has also exacerbated the trade relationship. On the Indian side, government proposals to require data generated in India to be exclusively stored in India, and proposed data privacy regulations that are among the most stringent in the world, have drawn strong opposition from both Indian and US IT and financial services companies.

India remains a complex place to do business, but with reforms instituted by the Modi government, barriers have fallen and many processes have been simplified. The re-election of Prime Minister Narendra Modi to a second term in May 2019 assures that these reforms will continue. Sustained economic growth and national strategies that push digitization across a range of sectors and services are creating unique synergies with the Bay Area that open the door to new opportunities, as Bay Area companies expand their global footprint and diversify their market presence in Asia.

Introduction

India and the United States are poised at the threshold of a closer, more productive relationship than at any point in the recent past. The two countries had been distant during the years of the cold war, as the United States confronted the Soviet Union and India embraced a non-aligned status friendly to the Soviet Union and economic policies at home that were socialist at heart. Much changed with the end of the Cold War, as successive Indian governments launched reforms to open India's economy, reduce bureaucratic burdens, and strengthen market forces. A groundbreaking nuclear agreement between the United States and India, to enable cooperation on civil nuclear energy in 2005, reduced political strains and laid the foundation for a new political dialogue.¹ More recently, initiatives under India's current Prime Minister Narendra Modi have further reduced regulatory and bureaucratic burdens on business and embraced digitization as a key to modernizing India's economy.

A shared strategic perspective on political and security issues in the "Indo-Pacific region" has also brought the two countries closer together. While India's stance remains independent and distinctly Indian, common perceptions on regional security have deepened the bilateral dialogue and cooperation. In September 2018, the United States and India held an inaugural 2+2 dialogue between India's Ministers of External Affairs and Defense and the US Secretaries of State and Defense. Their joint statement declared that "The Ministers reaffirmed the strategic importance of India's designation as a Major Defense Partner (MDP) of the United States and committed to expand the scope of India's MDP status and take mutually agreed upon steps to strengthen defense ties further and promote better defense and security coordination and cooperation."² The statement also affirmed that "the two countries are strategic partners, major and independent stakeholders in world affairs"³ and opened the door to defense industry supply chain linkages.

Along these lines, a new Communications Compatibility and Security Agreement (COMCASA) now facilitates interoperability between Indian and US defense forces, providing India access to more advanced communications technology for defense equipment purchased from the United States and from US allies with similar equipment.⁴ In July 2018, US Commerce Secretary Wilbur Ross announced that India would be granted Strategic Trade Authorization (STA-1) status similar to NATO allies, Japan, Australia, and South Korea, facilitating the export to India of high-technology products.⁵

Significantly for Silicon Valley, the September 2+2 meeting included an agreement that an Indian liaison will be included in the Defense Innovation Unit (DIU), the US Defense Department's innovation office in Silicon Valley which seeks to accelerate commercialization and deployment of cutting-edge technology from smaller US technology companies in the defense procurement system. DIU will coordinate with Indian teams from Innovations for Defence Excellence (iDEX), a unit created in August 2018 by India's Defence Innovation Organization⁶ to foster an innovation ecosystem for technologies in the defense and aerospace sectors.⁷ These agreements build on ongoing dialogues, including the India-US Strategic Dialogue on Biosecurity, to which Lawrence Livermore National Laboratory is a contributor.⁸ The US-India strategic relationship was further cemented with the passage in December 2018 of the Asia Reassurance Act of 2018 (ARIA), Section 204 of which identifies the central role of India in promoting peace and security in the Indo-Pacific region, and calls for a strengthening of diplomatic, security, and economic ties between the two countries.⁹

This US shift toward India corresponds with India's changing perception of itself and its role in the world, as it moves from a historical position of "strategic autonomy" toward a position of global leadership that embraces strategic partnerships. India's status as the world's largest democracy and its commitment to

market economy principles provides a strong foundation of shared values, but sustained commitment on both sides will be required for the relationship to achieve its full potential.

This emerging economic and strategic alignment builds on an economic base that is decidedly modest. For two nations of such size, bilateral trade and investment is small—particularly compared to US trade and investment with China and with economic partners with much smaller populations and GDPs.

India's scale, young population, technical capability, entrepreneurial energy, and large immigrant population in the region link it powerfully to the Bay Area and Silicon Valley. For many years, Bay Area technology and other companies have used India's deep base of offshore IT services, opening R&D centers across India, and making the region the largest single source of partners for Indian IT companies globally. As the IT industry changes with the advent of AI and cloud computing, that relationship will shift. New areas for partnership are also emerging as India's economy is rapidly digitized. Opportunities will particularly grow in fields such as health, fintech, infrastructure, smart cities, semiconductor and cellphone manufacturing, and renewable energy—all fields where the Bay Area excels and India's needs and capacities will grow. These linkages present opportunities for the Bay Area and its Indian partners that are unique and large scale, but that also will require focus and patience to realize. For the Bay Area/Silicon Valley, it is time to take a new look at India.

“The most strategic relationship between any two countries in the world is between India and the United States. India is at an inflection point of exponential growth, and implementation is the biggest challenge. To achieve it, partnership with the US, including Silicon Valley, is important.”

John Chambers, CEO, JC2 Ventures,
former Executive Chairman and CEO, Cisco



India's Economy: Poised for Takeoff

The demographics are favorable. The entrepreneurial optimism and energy are infectious. Can a fractious political system finally get out of its own way?

A well-worn cliché about India is that it has a very bright economic future—and has had for decades. In truth, India's economy has grown dramatically from a very low base, pulling a massive population behind it, and the road to prosperity is long. For many, progress is erratic and frustratingly slow, with persistent poverty, inefficient government, and underperforming infrastructure. But there is another reality, of an economy that has grown to become the world's sixth largest, with deep reservoirs of human capital, leading global businesses, armies of motivated entrepreneurs, and potentially vast markets that invite development.

Since the 1991, economic and governance reforms that signaled the beginning of the end of the so-called "License Raj"—the post-colonial tangle of laws, regulations, fees, and taxation that stifled business formation and innovation for decades—India has been on a growth trajectory most nations would envy. GDP growth averaged 6.3% annually over the 1980–2016 period and remained solidly in the 5–8% range coming out of the global recession, according to the International Monetary

Fund. The economy grew by 6.7% in 2017, and the IMF has estimated 7.3% growth for 2018 and forecasts further growth of 7.5% for 2019. India is now the world's fastest-growing large economy, surpassing China (6.6% growth estimated for 2018 and 6.2% forecast for 2019).¹

India's GDP has grown from \$266.5 billion in 1991² to nearly \$2.6 trillion in 2017, edging past France to make India the world's sixth largest economy in nominal GDP terms.³ Per capita income, adjusted for purchasing power parity (PPP), has increased six-fold over the 1991–2017 period, from \$1,140 to \$6,980, according to World Bank data.⁴ However, incomes vary widely across states. A 2017 comparison of per capita income for the four states that contribute the most tax revenues (Maharashtra, Gujarat, Tamil Nadu, and Karnataka) with per capita income for the four states that receive the largest distributions from collected taxes (Uttar Pradesh, Bihar, Bengal, and Madhya Pradesh) showed that average income for people in the four richer states was three times greater than the average for the four poorer states.⁵ The nationwide average per capita income at current prices during 2017–2018 is estimated at about \$1,600 (Rs 1,12,835), according to data from the Ministry of Statistics and Programme Implementation (MOSPI).⁶ Former Reserve Bank of India governor Raghuram Rajan has said that in order to end extreme poverty, the national average will need to rise four-fold and become more widely distributed; getting there could take 20 years.⁷ This points to another conundrum when considering India's economy: average incomes remain low, but India is home to a large and growing middle class that numbers several hundred million.

Over the next decade, it is expected that India will meet or exceed the 7% GDP growth rate needed to keep pace with population growth. The World Economic Forum has estimated that between 2018 and 2030, India’s marginalized and lower classes will shrink in numbers, with more than 140 million households added to the lower-middle and upper-middle income tiers.⁸ The IMF forecasts that India will be the world’s fourth largest economy by 2022,⁹ and the Economist Intelligence Unit estimates that by 2027, India’s consuming classes will have more premium consumers than Japan or Korea.¹⁰

Demographics and Disruption in the Labor Market

According to India’s official jobs data, which is released sporadically and is considered inconsistent, the national unemployment rate has been historically low for a workforce of some 520 million in 2017, hovering around 4% since 1991.¹¹ However, there are indications that despite India’s economic expansion, finding work is becoming increasingly harder, and a

leaked government estimate for the year ending in March 2018 suggests that the unemployment rate has risen to at least 6.1%, the highest in more than 40 years.¹² In addition, the official rate masks important realities, most notably a labor force participation rate of only 52% in 2015 (the most recent year for available data) and an informal economy that employs nearly 90% of workers in unincorporated firms with fewer than 10 employees and no job security or pension benefits.¹³ Small businesses provide the largest share of employment after agriculture and make a significant contribution to India’s GDP.¹⁴

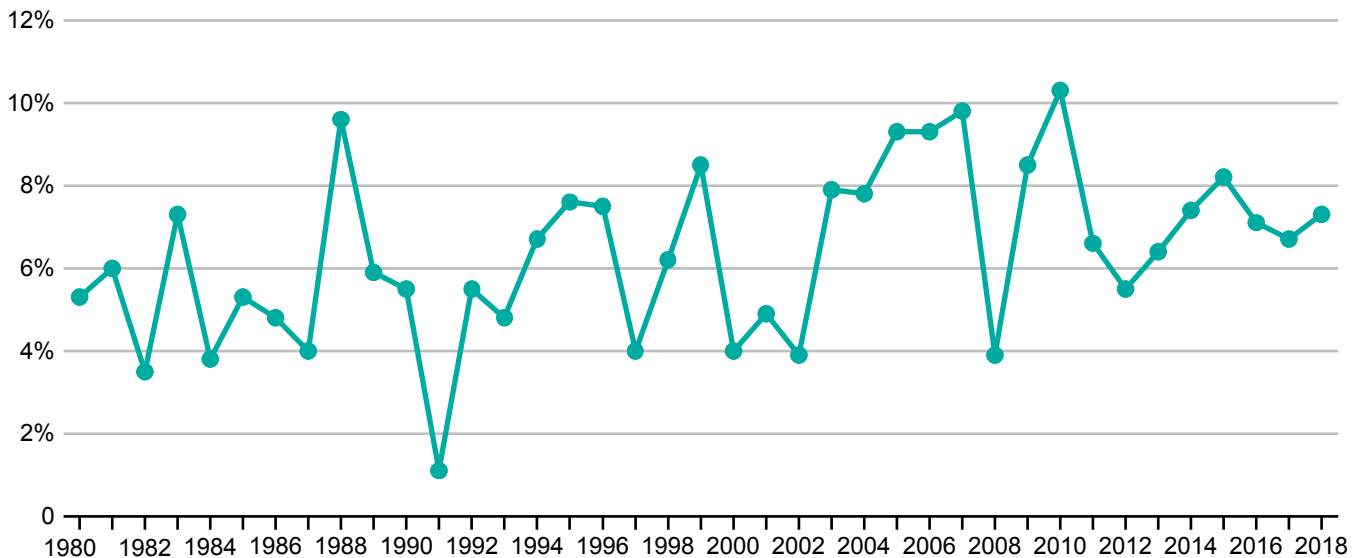
Over time, the workforce has become more urban. Agriculture—for decades India’s largest economic sector—now produces only about 15% of economic output while industry has edged up to slightly above 30% and services now dominate at more than 50%.¹⁵ These trends correspond with a gradual but steady migration from the countryside to cities, which offer more opportunities and significantly higher wages.¹⁶

In sharp contrast to China’s population, which is rapidly aging, India’s population is young. People aged 15–34 make up slightly over a third of India’s population and

EXHIBIT 1

India’s GDP growth rate averaged 6.3% annually over 1980–2016 and has remained solidly in the 5–8% range coming out of the global recession.

India’s Annual GDP Growth Rate, 1980–2018, percent



Source: IMF Data Mapper

Graph: Bay Area Council Economic Institute

most of its eligible workforce;¹⁷ the median age is 28.¹⁸ This is both an opportunity and a challenge: close to a million young people reach working age every month, which means India must create nearly 10 million new jobs every year to keep up.¹⁹

Contrasts in India continue across the spectrum. Graduates of elite technical schools thrive as entrepreneurs, building a soaring internet and gig economy. Yet only a little over a quarter of the population over the age of 25 has completed a secondary education,²⁰ and the World Bank estimates that well over a quarter of the youth population is not in education, employment, or training (NEET).²¹ A fragmented labor market of small, informal businesses, uneven educational opportunity, and job growth concentrated in high-skill service sectors inhibits social mobility and advancement for those less privileged. While the country's youth provide a potentially deep well of human capital, India's much vaunted "demographic dividend" could become more a demographic burden unless sufficient health, education,

and other benefits can be delivered to develop the promise of this growing cadre of young people.

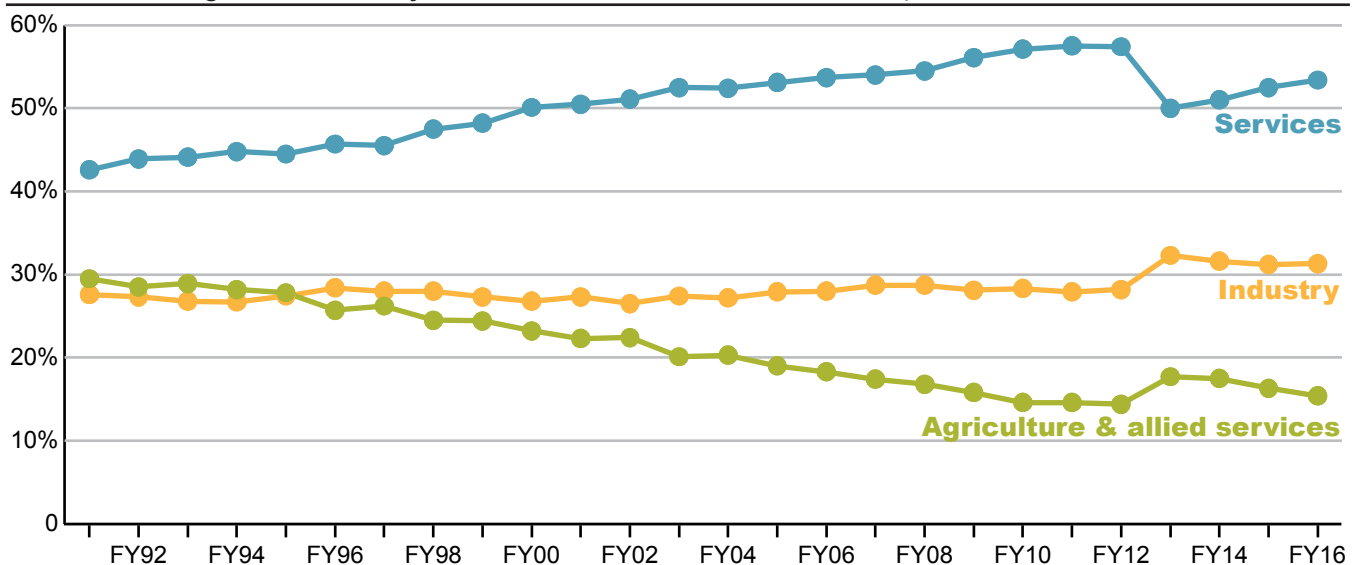
The urbanization narrative is also not as simple as it sounds. Agriculture may produce only 15% of economic output, but it was still employing 42.74% of the nationwide workforce in 2017.²² By contrast, the information technology/business process management sector for which India is most famous accounts for less than 8% of GDP and hires only 3.9 million workers²³ (less than 1% of the workforce). While independent work—ride share, e-commerce, online financial services, and micro-entrepreneurship—have brought 18–22 million workers into the formal economy in recent years, according to McKinsey,²⁴ most jobs are still part-time and/or temporary, contributing to underemployment.

To address the skills gap, a National Skill Development Corporation set up by the government has provided training to more than half a million workers, but only 12% of them have found better work as a result.²⁵ Tough labor rules, most notably on hiring and firing by firms above a certain size, have kept businesses intentionally small,

EXHIBIT 2

Agriculture—for decades India's largest economic sector—now produces only about 15% of economic output, while industry has edged up to slightly above 30% and services now dominate at more than 50%.

Contribution of Agriculture, Industry, and Services to India's GDP, FY91–FY16, percent share of GDP



Source: Firstpost

Graph: Bay Area Council Economic Institute

preferring to avoid tax and regulatory costs and to grow by automating or through temporary contract workers. As a consequence, few Indian manufacturers achieve the scale needed to compete nationwide or globally.

“As of now it seems India has a long way to go in leveraging economies of scale,” acknowledges Nisha Rajan, senior policy coordinator at the US-India Strategic Partnership Forum (USISPF). “However, the trajectory seems positive with the Modi government’s recent efforts to initiate labor reforms in a bid to formalize the Indian economy.”

Rajan points to consolidation of 44 central government labor and employment laws into four unified codes: industrial relations; social security and welfare; wages; and occupational safety, health, and working conditions. Specific reform proposals, in areas such as maternity benefits, the right to unionize, hours of work and overtime, contract labor, gig workers, and tips could affect as many as 140 laws. “The present regime has displayed the political will to reform in this area. There is no doubt that without these reforms India is not likely to achieve the targeted growth rates in its manufacturing sector.”²⁶

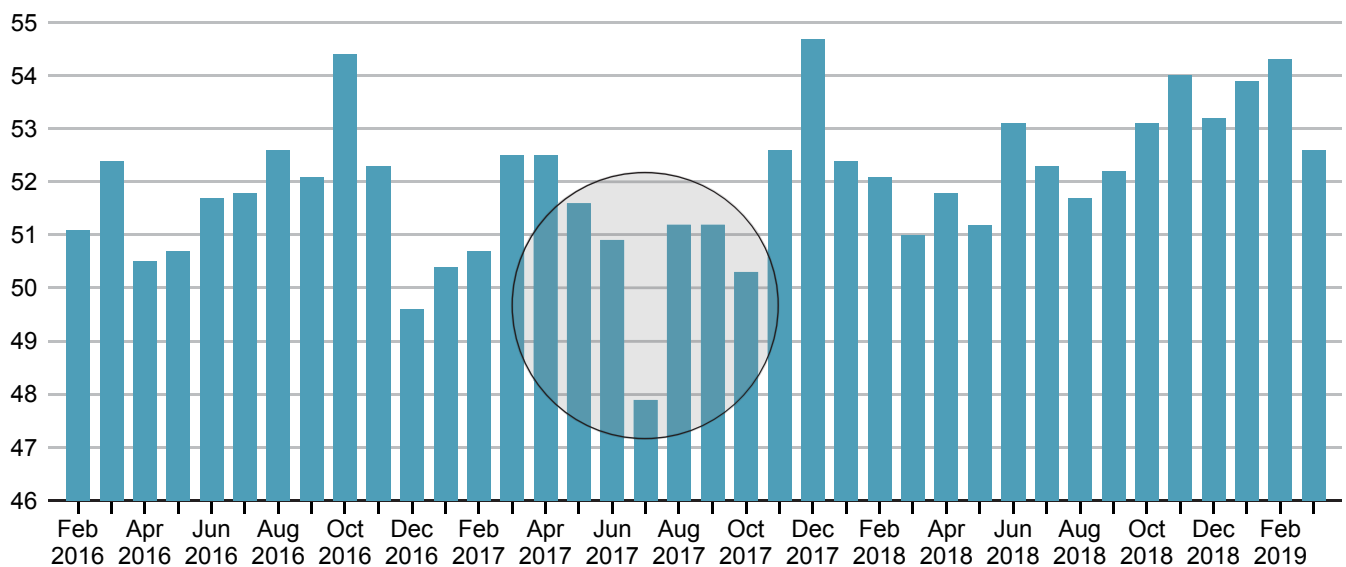
Distinct social pressures also affect the presence and role of women in the workforce. In an April 2017 report, the World Bank Group South Asia Region noted that India’s female labor force participation (FLFP) dropped by an estimated 19.16 million during the period from 2004–05 to 2011–12, from 42.7% to 31.2%. Not all of that decline was necessarily negative. Approximately 53% of the falloff occurred in rural areas, as the expansion of secondary education and changing social norms enabled young women aged 15–24 to continue their education rather than join the labor force early. For the overall category of women 15 years of age and above, the most crucial factor explaining the drop in FLFP was increased stability in family income due to the increase in the relative contribution of regular wage earners and the corresponding decline in casual laborers.²⁷

According to government data published in 2018, women made up 46.23% of students enrolled in higher education during 2015–16.²⁸ Furthermore, a government data assessment by Press Trust of India found that for the period from 2014 to 2017, the gender ratio of PhD candidates at Indian universities was 5 women for every 7 men.²⁹ India’s 2014 National Sample Survey indicates that

EXHIBIT 3

The India Manufacturing Purchasing Managers’ Index lagged in 2017 after demonetization and the goods and services tax launch.

India’s Manufacturing Activity Trend: Purchasing Managers’ Index, monthly data, February 2016 to March 2019



Source: IHS Markit; Trading Economics

74.8% of urban women are literate, compared to only 56.8% of their rural counterparts. Yet women composed only 14.8% of the urban workforce in 2015–16,³⁰ and the Monster Salary Index report on the 2018 gender pay gap in India found that women's earnings were 19% less than men's.³¹ The McKinsey Global Institute has estimated that achieving gender parity by 2025—involving legal protections, pay equity, physical security, child and elder care, closing the education and skills gaps, and changing diversity policies and attitudes—could add 68 million more women to India's workforce and \$2.9 trillion more in GDP to the economy than would be the case in a business-as-usual scenario.³²

Tax & Currency: Out with the Old

Since coming to power in 2014, the government of Prime Minister Narendra Modi has embarked on a series of bold reforms designed to re-ignite growth, streamline governmental processes, and propel India into the 21st century's digital economy. Two disruptive but ultimately positive economic reforms introduced in the past two years slowed business activity dramatically, but only on a temporary basis. First, "demonetization" canceled and replaced commonly used large-denomination notes—86% of India's currency—with new denominations, with the goal of constraining criminal cash flows, tax evasion, and counterfeiting.³³ While the move was generally welcomed, it left ordinary consumers scrambling to convert their cash, often standing in bank lines for hours, while small businesses operating on a cash basis were suddenly unable to pay workers and suppliers. Consumer demand, new hires, and investment stalled during the transition. The comparative ease with which upper classes were able to convert their bills further intensified the lingering, if not growing, sense of social and economic inequality.

Second, a national goods and services tax (GST), effective from July 2017, compounded the short-term friction and uncertainty, even though many expect that its long-term effects will be positive. The GST consolidated various indirect central government and state taxes, including sales, service, excise and state VAT taxes, customs duties, surcharges, and state luxury and "sin" taxes. These were absorbed into a combined central/state GST with fewer tiers, to simplify filing, avoid double taxation, and improve collections. Indirect tax collection is critical in a

largely informal economy of small incomes where only 1.5% of individual taxpayers—19 million people—paid income tax in early 2017.³⁴ Nevertheless, the rollout of the GST—which involved intensive debate over how various goods and services would be classified, as well as in many cases the need to set multiple tiers of taxation relating to certain goods (as opposed to one unitary rate)—was not as friction-free as proponents had hoped.

Combined disruption from demonetization and the GST launch hit businesses hard in 2016–17, coming on the heels of droughts in 2014–15 that hurt farmers, rising oil prices that squeezed manufacturers, and poor infrastructure that continued to cripple farm and retail supply chains.

Amid confusion over tax liability and compliance, private and state company investment hit a 13-year low in the third quarter of 2017, according to estimates from the Centre for Monitoring Indian Economy Pvt. Ltd. in Mumbai.³⁵ Since then, however, businesses have begun to emerge from the shadows. Indian credit rating and data research firm CRISIL reported surges of 19.7% in net corporate tax collections and 18.6% in personal income tax collections between April 2017 and February 2018.³⁶

While demonetization, GST, and other such reforms will prove successful over time, the pace of recovery and future development will be influenced by two longstanding and growing constraints—wealth inequality and a massive overhang of public and private debt.

A Rising Tide Lifts Some Boats

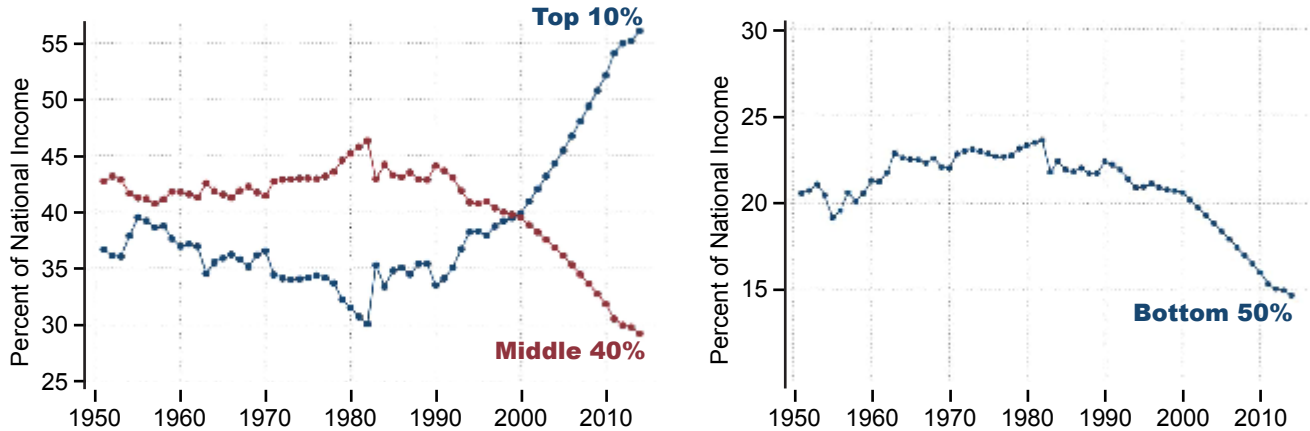
As mentioned earlier, the urban-rural divide, a fragmented labor market of mostly small businesses, and an education and skills gap have combined to concentrate wealth in key cities and sectors.

A 2017 study by economists Lucas Chancel and Thomas Piketty, using tax and survey data and national accounts, shows a steady rise in the share of total national income concentrated among the top 10% of Indian earners and corresponding declines among the middle 40% and bottom half of earners—trends underway since the late 1980s. While all incomes have grown since that time, the author's analysis of India's income growth rates between 1980 and 2015 reveals a much higher income growth rate for the top 10% of earners, who saw a 435% increase in

EXHIBIT 4

Trends underway since the late 1980s show a steady rise in the share of total national income concentrated among the top 10% of Indian earners and corresponding declines among the middle 40% and the bottom 50% of earners.

Top 10%, Middle 40%, and Bottom 50% National Income Shares in India, 1951–2015



Source: Lucas Chancel and Thomas Piketty

their incomes compared to the bottom 50% of earners, who experienced an income growth rate of 90%.³⁷

At the start of the January 2019 World Economic Forum Annual Meeting, Oxfam’s international executive director noted that India’s top 10% of the population held 77.4% of the total national wealth in 2018, with the top 1% holding 51.53%.³⁸ India added 18 new billionaires between 2017 and 2018, bringing the total up from 101 to 119, an increase of 17.82%. By comparison, China’s number of billionaires grew by 16.93 percent, rising from 319 in 2017 to 373 in 2018.³⁹

Rising wealth inequality, combined with lingering fallout from demonetization and GST, have ramped up political pressure on the Modi government. This was evident in the administration’s 2018 budget: higher minimum price supports for farmers; higher customs duties on imported consumer goods to encourage inward investment; national healthcare for poor families; and a corporate tax cut targeted to small and mid-sized businesses.⁴⁰

Turning a Corner

Much work remains to be done to clear the obstacles to faster growth, whether in privatizing mismanaged state-owned businesses; enacting justice system reform to unclog a national backlog of 30 million legal cases

(including 2 million pending for more than a decade);⁴¹ easing extremely restrictive employment rules; reining in energy and agriculture subsidies; or paring back corruption in the allocation of land and capital for infrastructure projects. Nevertheless, there is much to applaud in what has already been accomplished through initiatives—beyond demonetization and GST—that include various forms of deregulation and the aggressive promotion of digitization across the economy. These include the secure digital delivery of government benefits payments through the linking of the Aadhaar digital identity system through mobile phones to the Jan Dhan Accounts system—enabling the opening of over 350 million “zero-balance” bank accounts and allowing the rural and urban poor to participate in the formal banking economy.⁴²

Ultimately, the government holds out the vision of a cashless economy; universal healthcare with telemedicine reaching into rural areas; a gradual shift to cleaner energy over a distributed grid; and modern, efficient water systems and food supply chains connected in the cloud via 5G wireless networks and sensors. A consensus is slowly forming in India that a corner has been turned, that the country has indeed come a long way since 1991, that momentum is increasing, and that this time, despite the usual fits and starts, may indeed be different.



Trade and Investment: Flow Management

India knows it needs to expand trade and lure investment. But how much, and what kinds? And can the infrastructure meet pent-up demand?

The dominant role of small, informal businesses that compose most of India's economy limits the country's trade and investment footprint. Firms have difficulty scaling up to compete for global orders. For many, staying outside the formal tax and regulatory system precludes access to formal trade finance. Thin margins and overreliance on part-time or temporary labor remove the incentive to recruit more skilled workers or train existing ones. Undercollection of taxes and underpayment for utilities starve the government of revenue to upgrade and maintain infrastructure. And while many Indian companies have been growing in size, outside of IT services the country still lacks the nucleus of large, often export-oriented firms that the September 2018 McKinsey "Outperformers" study has identified with the most successful developing country growth models over the last fifty years.¹

For an economy in the \$2.6 trillion size range, India's 2017 two-way goods trade total of \$738.4 billion is

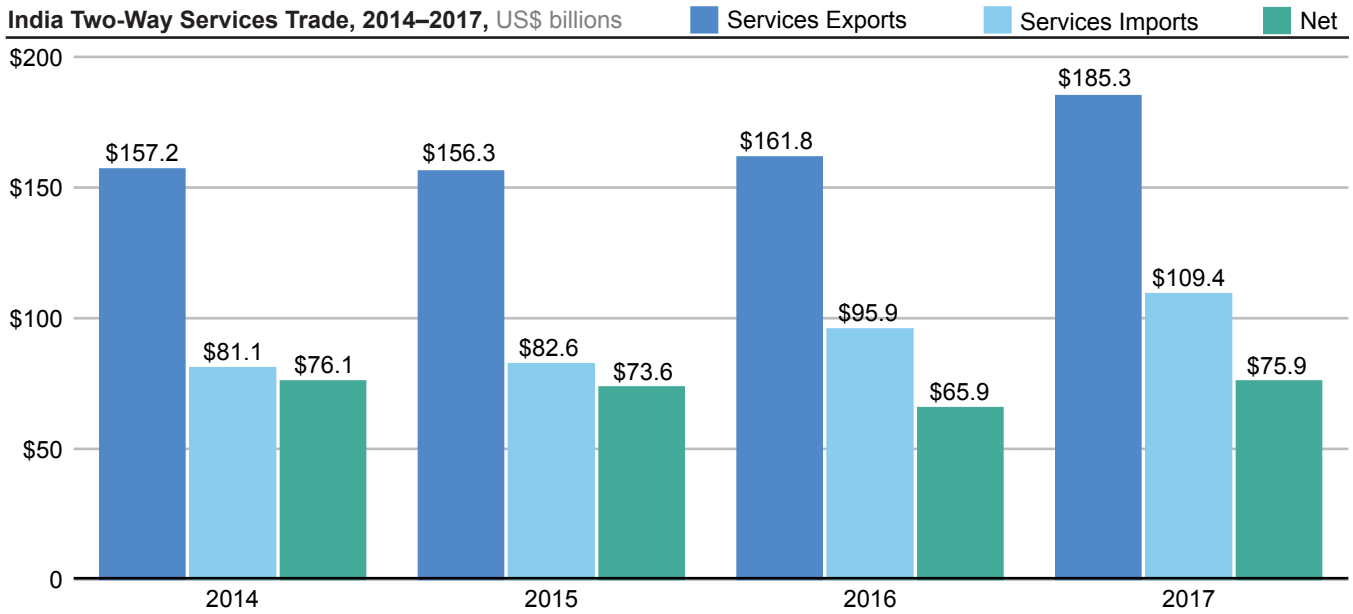
comparatively small, only 28.67% of GDP² and 2.1% of world trade³ (compared to the UK's and France's 41.53% and 44.91% of GDP and 3.0% and 3.2% of world trade respectively). More than two-thirds of India's trade activity concentrates in five states—Maharashtra, Gujarat, Karnataka, Tamil Nadu and Telangana, according to the government's 2017–18 Economic Survey.⁴ Large firms are not necessarily the largest exporters, as is the case in other countries; the top 1% of Indian firms together account for 38% of exports, versus 72% in Brazil, 68% in Germany, 67% in Mexico and 55% in the US.⁵ India's trade deficit is significant: the Ministry of Commerce and Industry reported an annual deficit of \$87.2 billion for the fiscal year ending in March 2018, up from \$47.7 billion in the year ending in March 2017.⁶

Major goods imports include crude oil and mineral fuels; gold and precious stones; electrical machinery; computers and phone system devices, including smartphones; organic chemicals; steel; and optical and medical equipment.⁷ Major exports are petroleum products; gems and jewelry; vehicles; pharmaceuticals; and apparel.⁸

Two-way services trade in 2017 totaled \$294.7 billion, with India running a net surplus of \$75.9 billion.⁹ Top services import sectors include travel, transportation, business services, and telecommunications, computer, and information services.¹⁰ Top services export sectors are travel, transportation, software, and business services.¹¹ While India's global services exports and imports increased by 14.52% and 14.08% respectively between 2016 and 2017, the net surplus increased by 15.17%.

EXHIBIT 5

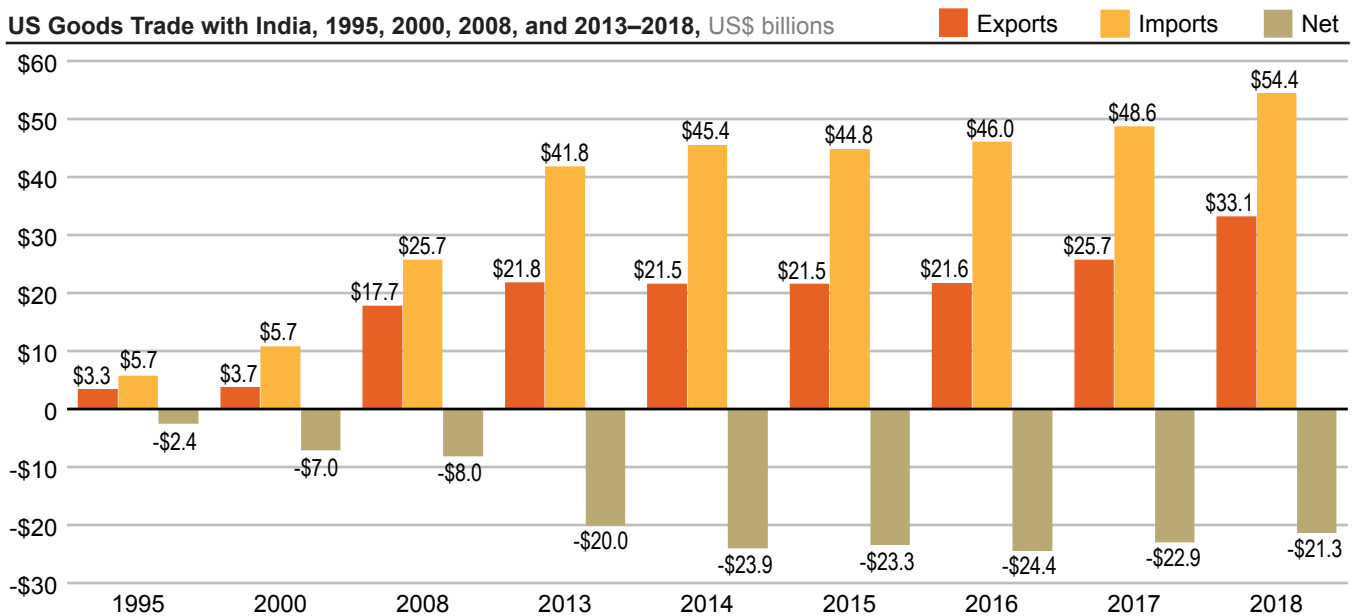
Two-way services trade in 2017 totaled \$294.7 billion, with India running a net surplus of \$75.9 billion.



Source: WITS, World Bank

EXHIBIT 6

After reaching a plateau between 2013 and 2016, US imports and exports both rose between 2017 and 2018; the net US deficit decreased slightly.

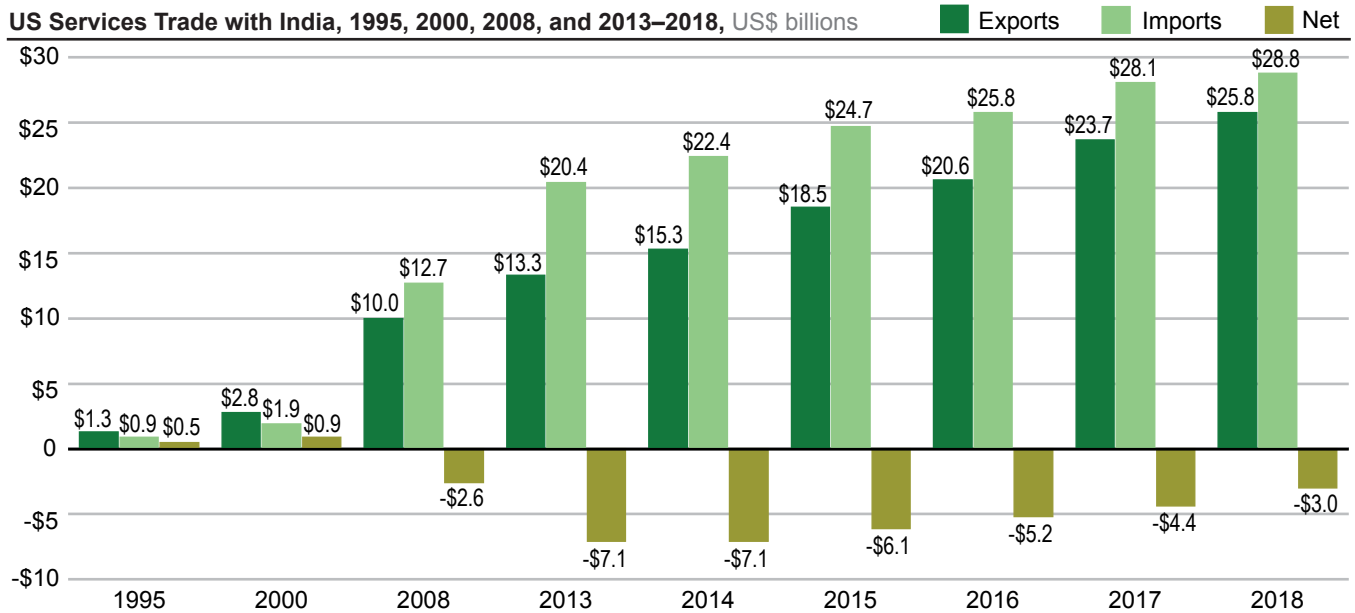


Source: Office of the United States Trade Representative

Graph: Bay Area Council Economic Institute

EXHIBIT 7

The net US deficit in services trade with India has been shrinking by about \$1 billion per year since 2014, from \$7.1 billion in 2013 and 2014 to \$3.0 billion in 2018, a 57.7% decrease.



Source: Office of the United States Trade Representative

Graph: Bay Area Council Economic Institute

Service exports are led by India's robust information technology (IT) sector, which in the last two decades has established a position of global dominance. India's Ministry of Electronics & Information Technology has estimated that exports in the IT-ITeS (IT-enabled services) sector—which includes IT services, BPO (business process outsourcing also known as business process management or BPM), and Engineering R&D and software development—will total \$126 billion for 2017–18, up from \$117 billion in 2016–17, reflecting compound annual growth of more than 10% between 2013 and 2018. IT accounts for 57% of the IT-ITeS sector, while BPO makes up 21.2%, and Engineering R&D and software development composes 21.8%.¹² The US is the largest buyer of Indian IT-ITeS exports, absorbing approximately 62% of global sales in each year since 2014, according to the India Brand Equity Foundation.¹³ This suggests sales of more than \$72 billion to the US in 2016–17.

According to UN Comtrade 2017 data, 58% of India's imports are from Asia, compared to 18% from Europe,

12% from the Americas, and 8.1% from Africa.¹⁴ Half of India's exports go to Asia, compared to 19% to Europe, 21% to the Americas (including about 16% to the US), and 8.2% to Africa.¹⁵ China is the largest seller to India; the US is India's largest buyer.¹⁶

US-India Trade

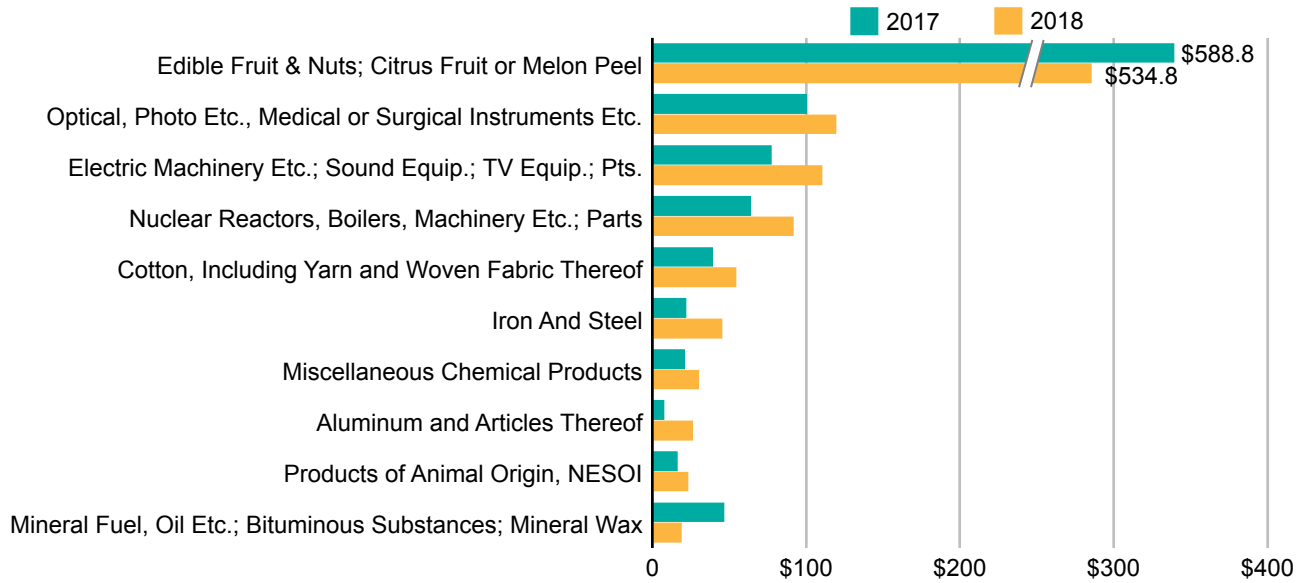
The US has run sustained trade deficits with India that have widened over time, as goods trade volume has increased and as the cross-border flow of IT-BPO (IT services-business process outsourcing) exploded during the 1990s. Two-way US-India goods trade in 2018 totaled \$87.5 billion, with a net US deficit of \$21.3 billion—both up significantly from a decade earlier, when total trade was \$43.4 billion with an \$8 billion deficit.¹⁷

Top US goods imports from India in 2018 included precious metal and stone (diamonds), pharmaceuticals, machinery, mineral fuels, and vehicles. Top exports to India were precious metal and stone (diamonds), mineral fuels, aircraft, machinery, and optical and medical instruments.¹⁸

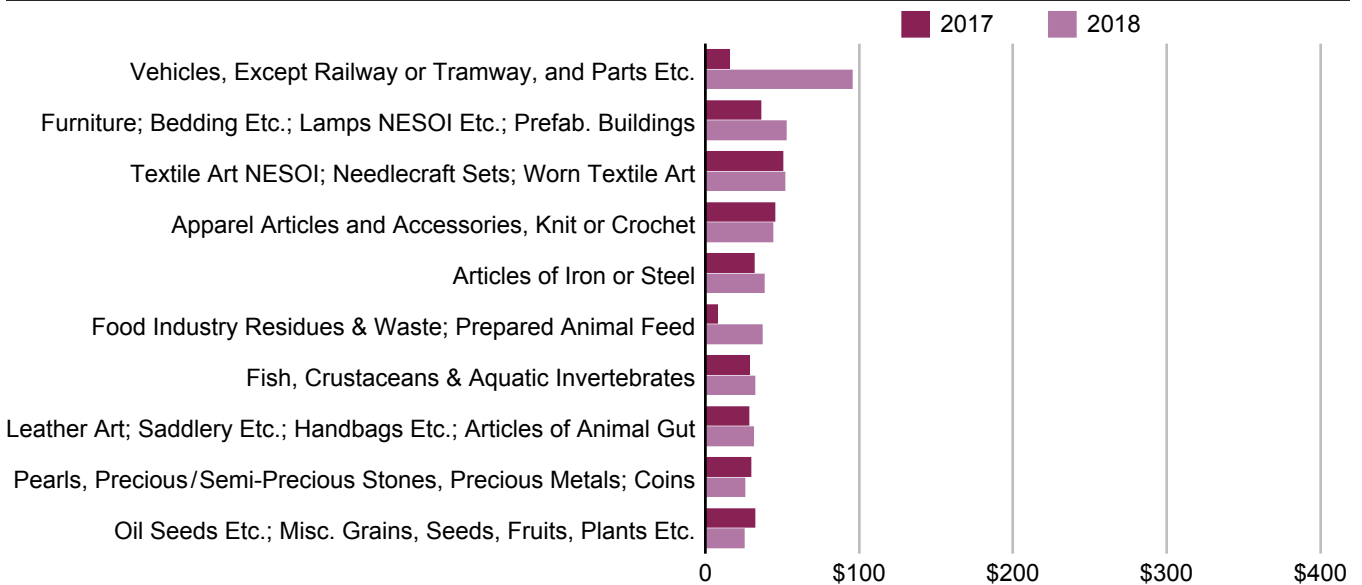
EXHIBIT 8

The Bay Area’s leading exports to India are fruit and nuts. India is a growing auto manufacturing hub, and vehicles are now the leading imports.

Top Ten Exports to India Through the San Francisco Customs District, 2018 Compared to 2017, US\$ millions



Top Ten Imports from India Through the San Francisco Customs District, 2018 Compared to 2017, US\$ millions



Source: USA Trade Online, US Census Bureau

Graph: Bay Area Council Economic Institute

US-India services trade in 2018 totaled \$54.6 billion. US services imports, valued at \$28.8 billion, more than doubled from 2008; services exports to India, valued at \$25.8 billion, were 2.58 times greater. The net US deficit in services trade has been shrinking by about \$1 billion per year since 2014, from \$7.1 billion in 2013 and 2014 to \$3.0 billion in 2018, a 57.7% decrease. Top services imports from India in 2018 were in the computing and telecommunications services, IT, research and development, and travel sectors. Top services exports were in the travel, intellectual property (computer software, audio and visual related) and transport sectors.¹⁹

Exports to India supported an estimated 260,000 US jobs in 2015, the latest year for which data is available, according to a 2017 study by the East-West Center and the Federation of Indian Chambers of Commerce and Industry (FICCI). More than 52,000 of those jobs were in California.²⁰

A Regional Snapshot

Goods

A pattern of steady across-the-board growth applies to Bay Area trade with India, where two-way India ocean and air freight through the San Francisco Customs District in 2017 totaled more than \$1.7 billion.²¹ Unlike the US as a whole, the region has enjoyed a net trade surplus with India since 2015—\$1 billion in exports versus \$700 million in imports. From 2013 to 2017, Bay Area exports to India grew by nearly 52%; imports grew by 11%.

(NOTE: US Census Bureau trade data reported here reflects not only exports produced and shipped or imports received locally, but also includes other US trade using the Bay Area as a gateway, as well as a small share of transshipped goods with origins or ultimate destinations abroad, such as Canada or Mexico.)

Nearly all of the \$237 million in Bay Area air cargo bound for India in 2017 moved through San Francisco and San Jose International Airports; nearly all of the \$802 million in ocean freight moved through the Port of Oakland, which also includes Oakland International Airport.

The potential for expanding US and Bay Area trade with India trade is significant. As a 2017 Brookings analysis highlights, Korea's trade with the US is twice the size

of India's, although Korea's economy is 40% smaller; China's population is similar to India's, yet its trade with the US is six times larger.²²

Services

There is also opportunity to grow services trade with India, and in particular US services exports. The opportunity lies partly in opening the Indian market to foreign legal, accounting, banking, insurance and retail competition (see *Trade Issues below*), and partly in nascent fields such as healthcare, clean energy, infrastructure, smart cities, and logistics, which are discussed in detail elsewhere in this report. These opportunities particularly connect to the Bay Area, given India's needs and what the Bay Area offers.

Currently, much of the Bay Area's services trade with India is in travel and tourism—Indian business travel, tourism, and family visits in both directions—and in technology-based business services provided by Indian visa contract workers employed in the region. The two are, in many respects, closely intertwined, but the IT-BPO activity has a far larger impact on the regional economy in terms of jobs and wealth creation and is still the driver of most visitor traffic to and from India.

Visitors

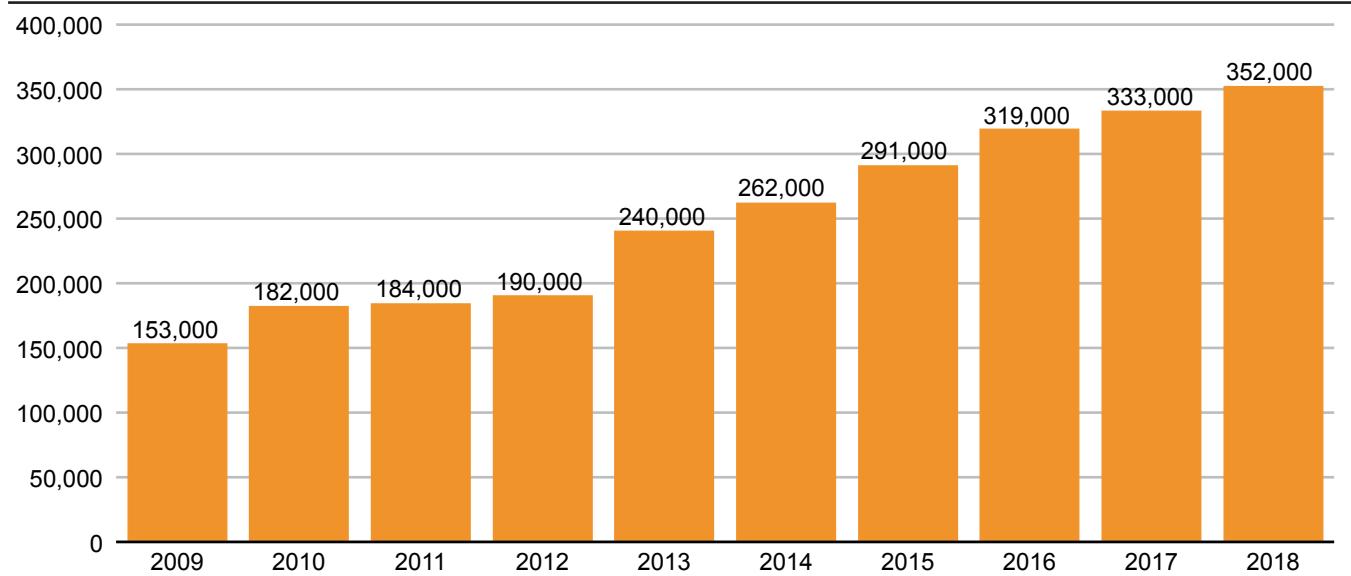
Some 352,000 travelers visited California from India in 2018 and spent an estimated \$788 million in the state, according to Visit California, a non-profit marketing organization that partners with the state's travel industry. Those numbers are expected to grow by almost 6% annually to 443,000 visitors and estimated spending of \$992 million in 2021.²³

Demonetization hurt the Indian travel sector in 2016–17 by taking out of circulation large amounts of cash typically kept on hand for travel and other discretionary purchases. Then, between March and July of 2017, a US-imposed ban on carry-on laptops and tablets on arriving flights from eight Middle Eastern countries led to a sharp drop-off in India-to-US travelers on popular routes via the Emirates airline hub in Dubai and via the Etihad Airways hub in Abu Dhabi. Etihad, which in February had already begun scaling back its flights to the US, completely eliminated its Abu Dhabi to San Francisco flights in October.²⁴

EXHIBIT 9

Some 352,000 travelers visited California from India in 2018 and spent an estimated \$788 million in the state. Those numbers are expected to grow by almost 6% annually to 443,000 visitors and estimated spending of \$992 million in 2021.

Number of Indian Visitors to California, 2009–2018



Source: Visit California

However, overall demand for flights from India to the West Coast soon recovered, and the short-lived laptop ban seemingly created a window of opportunity for Air India, which saw its bookings for flights to the US double in the two weeks after the ban was announced.²⁵ After having launched direct flights from Delhi to San Francisco in December 2015, starting with three weekly flights and then doubling to six flights a week in November 2016, Air India increased its service again to nine flights a week in March 2018. United Airlines also began providing non-stop flights between Delhi and San Francisco with the launch of its “seasonal daily service” in December 2019.²⁶

Global travel is on the rise in India, as the economy grows, living standards improve, and vacations become more accessible and frequent. In the premium segment of the market, Indians are regularly exposed to print and television images of California, and are intrigued by its scenery, available travel experiences, and celebrity

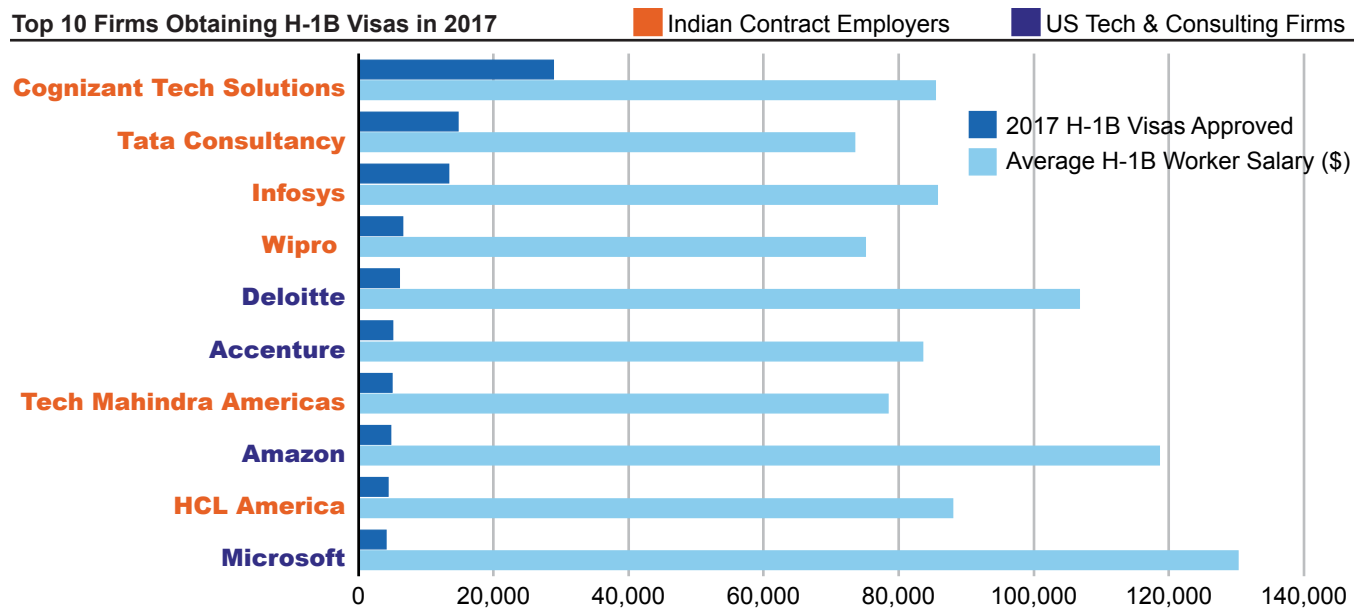
culture. Until recently, the ease of obtaining visas has been a plus for attracting Indian visitors. According to the San Francisco Travel Association, India was one of the four fastest growing international visitor markets in 2018.²⁷ Visit California reports that 53% of visitors from India are leisure travelers, combined business and leisure travel is becoming more common, and Indian visitors traveling as nuclear families is a new trend. The long flight encourages a longer stay, an average of 19.6 nights, and the average spend is \$2,527 per trip.²⁸

IT-BPO

Indian engineers and programmers contribute valuable expertise to a Bay Area tech community that has, over many years, struggled to find both the right global post-graduate talent critical to innovation and the sizeable numbers of skilled workers large firms need. Outsourced skilled tech employment represents an important Indian services export to the US and the Bay Area.

EXHIBIT 10

Six of the top 10 firms obtaining H-1B visas were Indian contract employers, the list being rounded out by large US tech and consulting firms.



Source: US Citizenship and Immigration Services

Graph: Bay Area Council Economic Institute

US Citizenship and Immigration Service (USCIS) latest available fiscal year data shows 67,815 Indian nationals receiving initial H-1B visas in 2017, down from 70,737 in 2016. However, the number receiving extensions for continuing employment totaled 208,608 in 2017, up from 185,489 a year earlier. Initial visas are granted for three years, with an option for a single three-year extension. In total, Indian nationals received 75.6% of H-1B visas approved in the United States in the 2017 fiscal year. Overall, USCIS approved 90.6% of the H-1B visa petitions received in fiscal year 2017.²⁹ According to reporting by The Mercury News, that approval rate dropped to 85% for 2018, while the rate of delays rose sharply, and it appears that greater scrutiny and increased documentation requirements have increased the chances that a delayed application will ultimately be denied.³⁰

Foreign workers, the vast majority from India and China on H-1B visas, made up 71% of the IT workforce in Silicon Valley and 50.3% of the San Francisco-East Bay IT labor force in 2016, according to a January 2018 analysis by the Seattle Times.³¹ Six of the top 10 firms obtaining H-1B visas were Indian contract employers, the list being

rounded out by large US tech and consulting firms.

Leading Bay Area companies drawing on H-1Bs in 2017 included Intel, Google, Facebook, and Apple. According to US Citizenship and Immigration Services data for the 2017 fiscal year, average annual IT sector H-1B salaries, generally ranged from \$71,000 to \$109,000, with the median annual compensation at \$85,000.³²

Trade Issues

Because two-way US-India trade itself is small, trade frictions have been few and mostly minor. But the cumulative impact and different objectives in both countries' trade policies have often discouraged businesses from exploring the opportunities.

India and the US both subscribe to general principles of free trade. With some notable exceptions, both have relatively low tariffs. India's politics are rooted in a strong tradition of social justice and a mandate for government to protect the disadvantaged against market excesses—which makes some trade issues more complex. The US International Trade Administration's commercial guide

on Indian trade barriers³³ outlines key US complaints that include

- import licensing restrictions for motorcycles, pharmaceuticals, refurbished computer parts and boric acid;
- export subsidies—tax exemptions on export earnings, capital goods, local manufacturing taxes, and goods produced in special economic zones—that lower export prices of textiles and apparel and work down government surplus stocks of sugar and grains to support higher domestic producer prices;
- an opaque government procurement process, with different rules and contracts for the central government, states, and various ministries, and domestic business preferences and local content requirements in defense and solar energy;
- restrictions in services sectors including insurance, banking services, securities, motion pictures, accounting, construction, architecture and engineering, retailing, legal services, express delivery services, and telecommunications; and
- limitations of foreign equity in certain major services sectors, including financial services and retail; foreign participation in professional services is significantly restricted, and in the case of legal services, prohibited entirely.

Implementing a goods and service tax (GST) across India, a major Modi government reform, should lead to a more consistent internal market and help to lower transaction costs for foreign as well as domestic companies. Reducing tariffs and achieving greater reciprocity in market access, however, remains a US objective. Indian sectors that are particularly vulnerable to reciprocity-based tariffs include jewelry (where the US consumes 30% of India's exports), shrimp and prawns (where the US consumes 40%) and pharmaceutical products (where the US also consumes 40%).³⁴ India, for its part, has pressed the US for improved access for its agricultural goods, including mangoes, pomegranates, grapes, rice, and honey.

The two countries also disagree on intellectual property protection; India did not recognize global pharmaceutical patents until after the WTO agreement on intellectual property rights went into effect in 1995,

delaying until 2005 and the expiration of a ten-year waiting period to do so.³⁵ Regarding pharmaceuticals, India has taken the broad position that patents and related pricing should not have the practical effect of denying essential medical treatment in developing countries and applies price controls on drugs and on devices such as heart stents that it considers essential (see Chapter 7 on Healthcare/Life Sciences).

India lodged a World Trade Organization complaint in 2016 over US decisions to double fees for special-skill H-1B and intracompany transfer L-1 visas, heavily used by Indian IT-BPO workers, and to reallocate some of the H-1B visa allotment to Chile and Singapore under free trade agreements with those countries.³⁶ With the US and Europe accounting for more than 75% of India's IT outsourcing revenue and India's top three IT companies—Tata Consulting, Infosys, and Wipro—being the largest users of H-1B visas, the fee increases were estimated to cost such service firms an aggregate \$400 million annually.³⁷ A Department of Homeland Security proposal to reverse an Obama Administration policy allowing spouses of H-1B workers holding H-4 visas to work in the US was pushed toward its final stages in February 2019, although its timetable is uncertain and it could be delayed or blocked by lawsuits.³⁸ Elimination of that option would place added burdens on the families of H-1B visa holders. At the same time, USCIS Requests for Evidence from applicants are growing³⁹ and more applications are being delayed or denied; the denial rate for new H-1B petitions quadrupled from 6% to 24% between the 2015 and 2018 fiscal years.⁴⁰

As another point of friction, following a review that was launched in April 2018, the US Trade Representative announced in March 2019 that the United States would terminate India's eligibility for duty-free treatment on a range of exported products under the Generalized System of Preferences (GSP).⁴¹ Designed to help the developing world, the GSP permits duty-free imports of certain products from developing countries that meet eligibility criteria established by Congress. India has been the largest beneficiary of the GSP, with \$5.6 billion in exports covered in 2017–18 and a duty benefit of \$190 million.⁴² The reason announced by the USTR was that India was out of compliance with eligibility requirements, having "implemented a wide array of trade barriers that create

serious negative effects on United States commerce,”⁴³ with specific areas of concern being restrictions on the import of medical devices (knee implants and coronary stents), and dairy and ICT products. Other triggers for the US decision reportedly included the tightening of India’s guidelines on e-commerce (impacting US companies such as Amazon and Walmart-owned Flipkart), higher tariffs on electronic products and phones, and new regulation that would impact US financial services companies such as Mastercard and Visa by requiring them to store their data in India. (For more discussion on these issues, see the Government Initiatives section of Chapter 6.) GSP privileges were officially withdrawn on June 5, 2019.⁴⁴ India had suggested an openness to further discussion on ICT and medical devices, but described the dairy restrictions as non-negotiable for cultural and religious reasons.⁴⁵

In another flare-up of trade tensions, the US also declined to grant India a waiver from its global tariffs of 25% on steel and 10% on aluminum imports, formally implemented on March 8, 2018 to take effect 15 days later.⁴⁶ At that time, only about 2% of India’s steel exports and 2% of its aluminum exports were sold to the US,⁴⁷ representing 2.4% of US imports of steel and 2% of US imports of aluminum.⁴⁸

In June 2018, India notified the WTO of its decision to retaliate with an equivalent amount—some \$241 million—in tariffs on US exports of apples, almonds (where India is the largest worldwide market for US growers), palm oil, cashews, metal products, and other items, originally scheduled to take effect in August 2018.⁴⁹ Since then, India has repeatedly delayed implementation of the new tariffs, saying that it wanted to allow time for negotiations with the US.⁵⁰

Foreign Direct Investment: Early Days, Strong Growth

Inbound

While cumulative global foreign direct investment to India is significant—nearly \$368 billion in equity capital investment and \$165 billion in venture capital, remittances, and other funds over 2000–2017,⁵¹ according to the Department for Promotion of

Industry and Internal Trade (DPIIT)—flows have been inconsistent. Investment has begun to accelerate again under the Modi government. India received a record \$44.8 billion in equity capital FDI in fiscal year 2017–18 (April 2017 to March 2018) up from \$43.4 billion in fiscal year 2016–17,⁵² \$40.0 billion in 2015–16, and \$30.9 billion in 2014–15.⁵³ The total for the first three quarters of the 2018–19 fiscal year (April–December 2018 most recent data) is \$33.4 billion.⁵⁴

According to Dealogic, in 2018 the value of total overseas acquisitions in India reached \$39.5 billion, overtaking the level in China (\$32.8 billion). All mergers and acquisitions involving Indian companies totaled \$93.7 billion, up 52% from one year earlier.⁵⁵

More than half of India’s FDI comes from Mauritius (34%) and Singapore (18%). While both are home to sizable Indian diasporas, most of that FDI does not originate in those countries but is channeled through them. The US accounts for only 6% of India’s cumulative equity FDI inflow, some \$22 billion according to DPIIT (the official US number from the Bureau of Economic Analysis is \$28.3 billion). In recent years, US FDI to India slowed, from \$4.2 billion in the 2015–16 fiscal year, to less than \$2.4 billion in 2016–17, to only slightly over \$2 billion in 2017–18, in part due to uncertainty from demonetization and GST.⁵⁶

The US is the sixth largest foreign investor in India after Mauritius, Singapore, Japan, the United Kingdom and the Netherlands⁵⁷ (with much of the investment through the Netherlands, like that through Mauritius and Singapore, consisting of investment routed from elsewhere due to favorable tax and investment treaties).

India’s federal government has recently taken or is studying a number of initiatives to attract more FDI and to make it easier overall to do business in India. Among them are

- asking states to strengthen single-window clearance systems for fast-tracking FDI approval processes (action taken);⁵⁸
- eliminating Department of Revenue review of FDI projects and mandating that proposals in 11 sectors requiring approval be cleared within 10 weeks from receipt of application (action taken);⁵⁹

- raising the foreign ownership cap on defense FDI under the automatic route from 49% to 51% (action under study);⁶⁰
- allowing 100% foreign direct investment in cash and ATM management companies, which are not regulated under the Private Securities Agencies Regulations Act (action taken);⁶¹ and
- eliminating the Foreign Investment Promotion Board (FIPB), to enable direct clearance of foreign investment proposals requiring government approval by the relevant ministries (proposals requiring security clearance would still be subject to separate Home Ministry review) (action taken).⁶²

Bay Area companies are major investors. Data compiled by fDi Markets, a research unit of the Financial Times, shows 980 direct investments with a cumulative value of \$26.5 billion made in India between January 2003 and August 2018 by 554

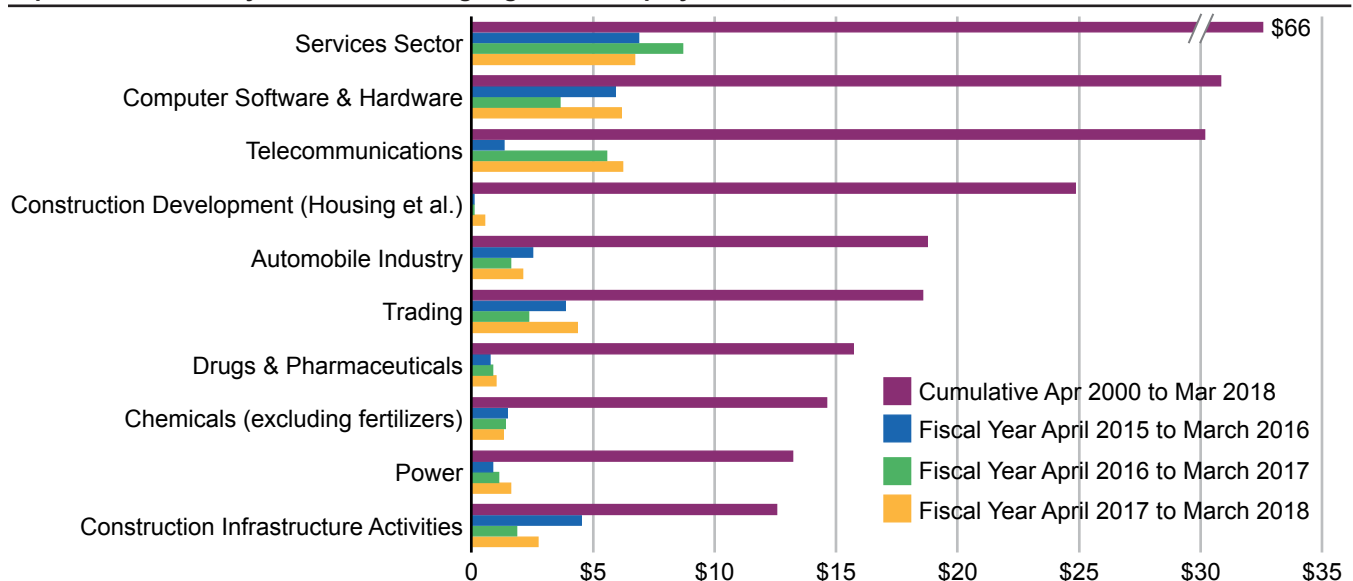
California companies from 74 cities. More than 79% of that cumulative investment value (\$21 billion)—came from 434 companies in 36 Bay Area cities. Of the top 20 California cities where the investment originated, 16 were in Bay Area, and companies from those cities were responsible for 69.8% (\$18.5 billion) of that cumulative investment value, reflecting the significant deal flow to India from San Francisco and Silicon Valley.

There were 730 investment projects distributed among the top 10 Indian industry sub-sectors that received FDI from California between January 2003 and August 2018. The Software Publishing subsector dominated with 300 projects (41%), followed in order by Semiconductors & Other Electronic Components with 87 projects, Custom Computer Programming Services with 74 projects, Communications Equipment with 72 projects, and Internet Publishing & Broadcasting & Web Search with 69 projects.

EXHIBIT 11

Cumulative FDI inflow to India’s services sector has been more than twice as large as investment in other sectors, although the three top sectors paced each other during the fiscal year ending in March 2018.

Top 10 Indian Industry Sectors Attracting Highest FDI Equity Inflows, 4/2000–5/2018 & Recent Fiscal Years, US\$ billions



Notes: Services sector includes Financial, Banking, Insurance, Non-Financial/Business, Outsourcing, R&D, Courier, Tech Testing and Analysis. Construction Development includes Townships, Housing, Built-Up Infrastructure.

Source: DPIIT

Graph: Bay Area Council Economic Institute

EXHIBIT 12

Between January 2003 and August 2018, 69.8% (\$18.5 billion) of the investment flow to India from California originated from companies in 16 Bay Area cities.

Cumulative India Investment by Companies in Bay Area Cities Among the Top 20 California Cities Where Investment Originated January 2003–August 2018			
Bay Area Cities	Number of Companies	Number of Projects	Capital Expenditure US\$ millions
San Jose	77	158	\$2,791.1
Santa Clara	51	100	\$3,350.3
Sunnyvale	38	79	\$1,579.9
San Francisco	54	71	\$1,238.2
Mountain View	34	62	\$2,054.0
Redwood City	17	59	\$924.1
Palo Alto	29	57	\$1,581.8
Milpitas	20	28	\$438.7
Fremont	16	25	\$275.9
San Mateo	14	24	\$699.8
Menlo Park	11	18	\$507.3
Pleasanton	8	17	\$274.8
San Ramon	7	16	\$2,047.1
Los Gatos	6	14	\$68.4
Campbell	4	11	\$124.0
Cupertino	6	10	\$523.1
Total	392	749	\$18,478.5

Source: fDi Markets

Table: Bay Area Council Economic Institute

Noteworthy investments in India by Bay Area companies in recent years include the following:

- **Alphabet** (Google) has made six investments totaling \$138.5 million over 2016–2018, expanding its engineering, design, development, and testing operations in Hyderabad and Bangalore, opening a Mumbai data center, and expanding its sales and marketing footprint, all in support of its mobile and cloud computing services for e-commerce and payments.
- Palo Alto cloud data management, backup, and recovery firm **Rubrik** invested \$55.6 million over 2017–2018 in a Bangalore sales, marketing, and support center employing 300 people.
- **Aemetis (AE Biofuels)** has invested \$475.8 million between December 2007 and February 2019, building and expanding a plant in the port city of Kakinada in Andhra Pradesh, that turns agricultural waste oils into biodiesel fuel for domestic sales and export to Europe and the US.
- In 2015, **Cisco Systems** undertook a \$40 million expansion of its 372,000 square meter “campus-in-a-city” manufacturing facility in Bangalore. Over 2016–2018, it opened a \$38 million innovation lab in Jaipur and a \$38 million networking academy and startup incubator in Kerala, both focused on internet-of-things (IoT) research and development, and an \$8.3 million global digital experience center in Mumbai, targeting the financial services sector.
- In 2018, San Mateo investment management firm **Franklin Templeton Investments**, partnering with Santa Clara/Hyderabad IT services firm **Innova Solutions**, launched a \$68 million investment in a 40-acre financial

technology R&D campus and incubator in the new city of Visakhapatnam (Vizag) in Andhra Pradesh.

- Starting in December 2017, Richmond-based **MBA Polymers** built an \$11.5 million waste management and post-consumer plastics production facility in Pune.
- **Saama Technologies**, a Campbell data management and analytics firm, opened an \$18.10 million artificial intelligence R&D center in Chennai in 2017, focused on optimizing clinical trial technology.
- In 2017, **Heat and Control**, a Hayward food processing machinery manufacturer, has opened a \$14 million, 11,800 square meter manufacturing and testing facility to serve the Asia market.

Outbound

Measures of India’s outbound FDI tend to be incomplete estimates that focus on large, publicized deals while missing the considerable volume of smaller entrepreneurial investments worldwide. Different sources also count and report FDI differently. The United Nations Conference on Trade and Development (UNCTAD)

reports \$11.3 billion in outbound FDI from India in 2017.⁶³ During the decade from 2006 to 2016, FDI has ebbed and flowed as investor confidence has risen and fallen at home, with a pronounced rebound in 2017.

Paralleling inbound FDI sources, the two largest destinations for India’s outbound FDI are Mauritius and Singapore, where many Indian businesses are domiciled. While those sites received 20% of outbound investment in 2014, they accounted for 58% in 2017. Three other tax jurisdictions—the British Virgin Islands, Jersey, and Switzerland—make up the top five destinations, with the US in sixth place.⁶⁴

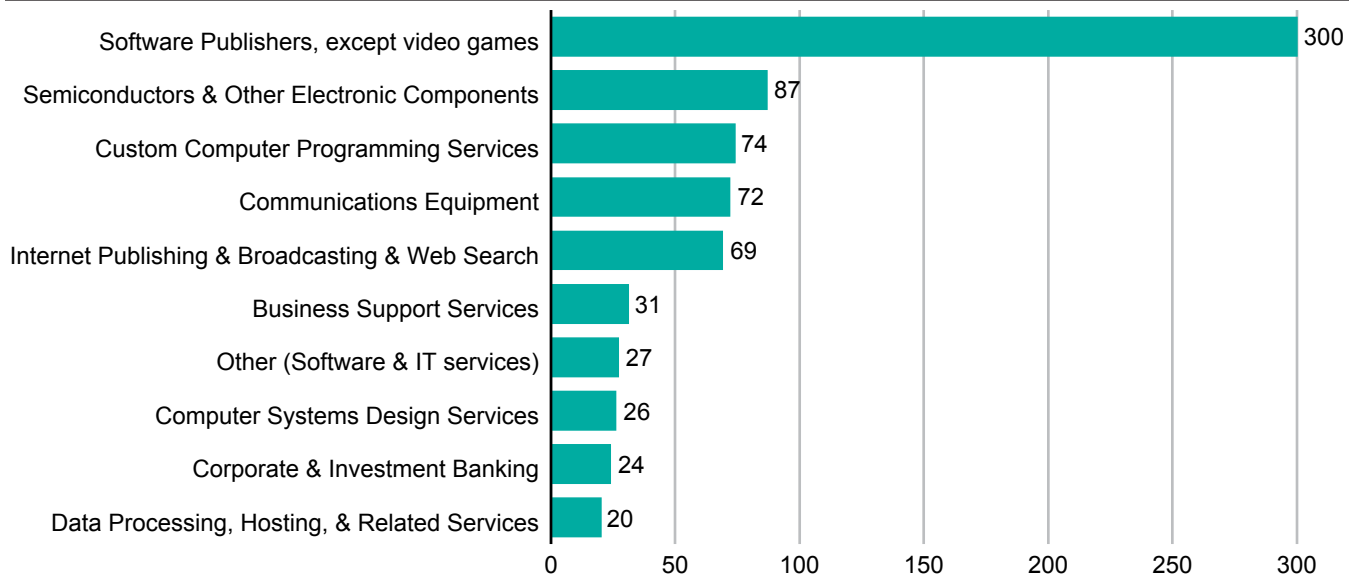
The cumulative flow of Indian investment into the US had a compound annual growth rate (CAGR) of 13.29% between 2010 and 2017.⁶⁵ The rise was steady, except for a dip in 2016—which is consistent with worldwide FDI flows in that year—with the growth resuming quickly in 2017.⁶⁶

According to the US Commerce Department’s SelectUSA program, India’s stock of foreign direct investment in the US totaled \$13.1 billion in 2017.⁶⁷ Some of the risk capital part of this investment came from Indian tech giants Infosys and Wipro, which both

EXHIBIT 13

Software Publishing dominated the top 10 industry sub-sectors that received FDI from California between January 2003 and August 2013.

Number of Projects in Top 10 Industry Sub-Sectors Receiving Outbound California FDI to India, Jan. 2003–Aug. 2018



Source: fDi Markets

Graph: Bay Area Council Economic Institute

have venture capital arms that actively invest in startups as part of their strategies to seek new lines of business, particularly in the big data, AI, and automation new technologies sectors.⁶⁸ Examples of Bay Area companies that have received such investment include

- Mountain View headquartered big data analytics company Waterline Data Service, which received a \$4 million initial investment through the Infosys Innovation Fund in January 2016 and a follow-on investment of \$1.5 million dollars as part of a Series C funding round in 2018;⁶⁹

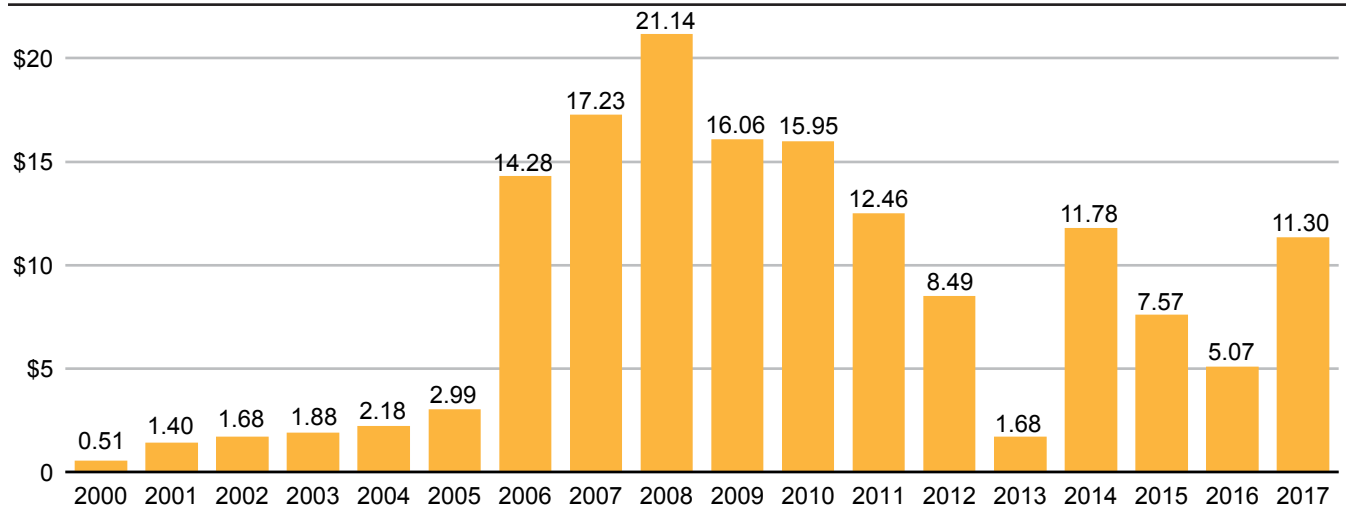
- Campbell-based scale-up computing and big data resource architecture company TidalScale, which received an initial Infosys Innovation Fund investment of \$1.5 million in 2016 followed by a second investment of \$1.5 million in September 2018;⁷⁰ and

- San Francisco business process platform company Tradeshift, which received an undisclosed investment amount from the venture arm of Wipro when it partnered with Tradeshift in early 2017 to offer cloud-based supply chain solutions.⁷¹

EXHIBIT 14

India's outbound FDI rose and fell in the decade between 2006 and 2016, as investor confidence fluctuated at home, with a pronounced rebound in 2017.

India's Outbound FDI, 2000–2017, US\$ billions

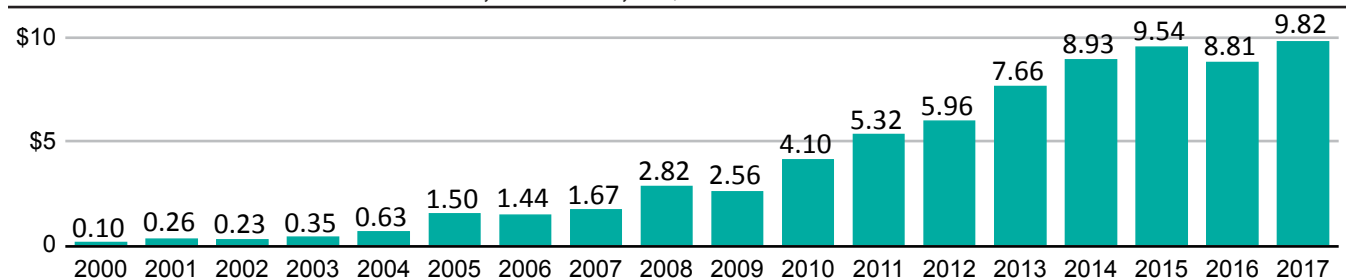


Source: UNCTAD World Investment Report 2017 Annex Tables

EXHIBIT 15

Aside from a dip in 2016, FDI from India to the US grew steadily between 2010 and 2017.

India's Outbound FDI to the United States, 2000–2017, US\$ billions



Source: BEA data compiled by Statista

SPOTLIGHT

Trade Opportunities: Follow the Money

The US and India, with \$142.1 billion in two-way goods and services trade in 2018,¹ are still well short of the policy goal of \$500 billion in trade set by the two governments in 2014.² But pent-up demand in many parts of the economy holds promise for significant trade growth in coming years. A few examples follow.

Agriculture

In 2016, McKinsey Global Institute analysts predicted that India's middle class would triple to 89 million households by 2025.³ Younger Indian households want convenience, fresher and healthier food, and a more diverse diet. But India's food supply chain is strained. Most of the market is farm to table, with modern supermarket penetration at 3% of food sales.⁴ Adoption of processed food to extend shelf life is relatively low;⁵ cold storage is in short supply, is concentrated in only four affluent states, and is mostly suitable only to store potatoes, a commodity that produces 20% of agricultural revenue; 30–40% of fruits and vegetables are wasted, mainly due to lack of post-harvesting facilities and cold storage;⁶ and 20% of food grains are lost due to inefficient supply chain management.⁷

Opportunity Sectors for US Exports to India

Higher-value processed foods such as chocolate, wine and distilled spirits, and dried or preserved fruit; food freezing, drying and packaging technology and equipment; cold storage equipment and systems; food and retail logistics services.

Healthcare

India's healthcare sector—hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism, health insurance, and medical equipment—is forecast to grow from \$160 billion in 2017 to \$370 billion by 2022. Demand is being driven by 100 million elderly patients, rising incomes, higher incidences of lifestyle diseases, and expanded access to insurance. Hospital chains and private equity investment are fueling rapid growth in healthcare facilities, diagnostic and pathology labs, and the health insurance sector. More than 80% of the \$86 billion healthcare investment needed by 2025 is likely to come from the private sector.⁸ India imports about 80% of the medical devices it requires, and a quarter of that comes from US firms.⁹

Opportunity Sectors for US Exports to India

Medical devices/instruments; diagnostic equipment/supplies; hospital and clinic equipment/supplies; medical records/remote monitoring and treatment IT; hospital/clinic engineering and construction services; insurance.

Energy

Economic growth and rising living standards are driving higher energy demand. With a total installed capacity of 344,000 MW,¹⁰ India is pursuing an "all of the above" energy strategy, with nearly 300 global and domestic companies committed to generate 266 GW of solar, wind, hydro, and biomass-based power over the next 5 to 10 years, a \$310–350 billion investment.¹¹ Soon after coming to power in 2014, Prime Minister Narendra Modi launched a plan to bring electricity to all Indian households by December 2018; as of September 2017, the target was to electrify nearly 40 million homes, but success has been slow in coming. A December 31, 2018 government press release said that electricity connections had been brought to 23.9 million households across 25 states. Once full electrification is achieved, the next goal will be to ensure reliable 24/7 power to all households without brown-outs.¹²

Opportunity Sectors for US Exports to India

Power generation equipment and components; grid transmission and distribution equipment and IT; renewable energy products and services; demand-side management services and supplies; energy-efficient appliances, materials, and building design methods and materials; advanced battery systems; LED lighting and components.

Smart Cities

The Smart Cities Mission launched in June 2015 identified 100 applicant cities from all states to develop designated areas for "smart city" development.¹³ As of mid 2017, \$20 billion in investment had been proposed by 59 cities under their project plans, and 2,313 projects worth \$14.48 billion were in various stages of implementation in 49 cities that had submitted project level details.¹⁴ Among the projects covered by the Smart Cities Mission are affordable housing, integrated multi-modal transport, traffic management, creation and preservation of open spaces, water and waste treatment, digital payment systems using smart debit cards, and command-and-control centers integrating and overseeing functions such as Wi-Fi hotspots, GPS-enabled garbage trucks, and environmental and flood sensors.¹⁵

Opportunity Sectors for US Exports to India

Urban planning/architecture/construction services; smart grid equipment/installation; water and waste treatment systems; digital banking and payments; smart roadway materials and components; landscaping design services; data network equipment/management; biometric scanning technology.



The Bay Area Indian Community: A Cross-Border Success Story

For more than a century, Indian immigrants have created opportunity and wealth in Northern California.

The first recorded Indian immigrants arrived in Northern California in the late 1800s. Most were Punjabi Sikh volunteers under British colonial rule, sent to Canada as soldiers and police officers. They left India for greener pastures, only to find harsh winters and discrimination in British Columbia. With rumors of better paying work with the lumber mills and railroads in California, they drifted south, many settling in the Sacramento Valley as farmers.

More Punjabis began arriving by ship in San Francisco in 1899, either from India directly (via Kolkata) or from Hong Kong. Nearly all were men looking for work; average laborer wages in California were \$2 a day, ten times what they'd earned back home. By 1910, the US census statistics on the foreign-born population recorded 4,664 persons born in India.¹ By 1920, Indian immigrants owned 2,099 acres and leased another 86,340 mainly in the Sacramento, San Joaquin, and Imperial Valleys, growing peaches, grapes, pears, almonds, beans, potatoes, celery, asparagus, and lettuce.²

Indian engineering, medicine, and agriculture students also came to the West Coast in the early 1900s, attending mainly the University of California, Berkeley and Stanford University. Again, nearly all were men; women were sent to Britain for their education. A Sikh religious organization, the Pacific Coast Khalsa Diwan, established a hostel in Berkeley where Indian students could stay for free; in 1912, California potato farmer Jawala Singh funded the Govind Singh Sahib Educational Scholarship to educate deserving Indian students abroad.³ Nationalist sentiment among Bay Area Punjabi immigrants and students led to formation of the Pacific Coast Hindustani Association, later called the Gadar Party, by Stanford philosophy lecturer Har Dayal.⁴

As with immigration from other parts of Asia, the path to the United States has at times been blocked. After the war, the 1917 Immigration Act and 1924 Oriental Exclusion Act together put sharp restrictions on Indian immigration to the US. Passage of the 1946 Luce-Celler Act finally created a path to immigration and naturalization for up to 100 Indian immigrants annually; the 1965 Hart-Celler Act lifted country quotas entirely and reopened the US to non-European immigrants. Significantly, Hart-Celler also encouraged visas for immigrants with special skills such as scientists and engineers.⁵

A New Wave of Immigrants

Indian immigration began to increase substantially starting in 1966. First, Punjabi entrepreneurs arrived as farmers and laborers but eventually formed small businesses as truck and taxi drivers. Alongside the Punjabis, Gujarati traders also arrived, carving a niche as restaurant owners, hotel owners, and apartment managers. The latter became known as “patels”, a term for the record keepers appointed by rulers in ancient India to track crops and receipts for each parcel of land or “pat.”⁶ A nationwide trade association for patels, the Asian American Hotel Owners’ Association (AAHOA) was formed in 1989 for Indian hotel owners and operators who faced discrimination in obtaining financing and insurance. Today it represents owners of 26,000 hotels—2.5 million rooms—nationwide,⁷ nearly half of all US properties.

A second track of Indian immigrants included aerospace and defense engineers in the 1970s, followed by IT software engineers and programmers arriving in the 1980s at the height of airline, telecommunications, and financial services deregulation. Scientists, engineers, programmers and newly arriving students gravitated to Silicon Valley. Early research by UC Berkeley professor AnnaLee Saxenian showed that in 1990, 21% (12,237) of the scientists and engineers in the Silicon Valley workforce were Asian-born, and of that group, 23% were Indian. Of the total 28,520 Indians in the region’s workforce, 32% held advanced degrees (compared to 11% for the white population), and the educational attainment level was even greater in the high technology portion of the workforce, with 55% of the Indian tech workers holding a master’s degree or PhD (compared to 18% of the white tech workers).⁸

According to Saxenian’s estimates, by 1998 at the height of the first tech boom, 774 Silicon Valley tech firms employing 16,598 workers, with a combined \$3.6 billion in annual sales, had an Indian CEO.⁹ An emerging commercial internet and corporate Y2K fears drew thousands of new programmers and students to the Bay Area. Later research by Saxenian and Vivek Wadhwa at Duke University showed that between 1995 and 2005, entrepreneurs of Indian ancestry were key founders of 15.5% of all Silicon Valley startups, and that of the engineering and technology companies

founded by Indian immigrants nationwide, 26% were located in California. Of those companies, 90% were in two industry fields: software and innovation/manufacturing-related industries. Indian immigrants filed more than 10,000 patent applications over 1998–2006, mainly related to electrical engineering, chemistry, physics, agriculture, and “human necessities” such as agriculture, food, apparel, and medical and life-saving innovations.¹⁰

According to a National Foundation on Immigration Policy analysis of the 91 US startup companies valued at a billion dollars or more as of October 2018, 50 had immigrant founders. India ranks number three out of the 25 countries of origin for those immigrant founders; with 8 founders, India placed just behind Canada and Israel (each with 9) and ahead of the UK (7), China (6), and Germany (4). Indian founders of Bay Area billion-dollar companies include Bipul Sinha, Arvind Nithrakashyap, Soham Mazumdar and Arvind Jain (of Palo Alto cloud storage company Rubrik), and Laks Srin (of San Francisco based HR and benefits management company Zenefits). Other billion-dollar companies founded by Indians that are no longer startups but have either been acquired or have had IPOs, include application performance company AppDynamics (Jyoti Bansai), battery power company Bloom Energy (K.R. Sridhar), cloud platform Jasper (Jahangir Mohammed), and enterprise data software center solutions provider Nutanix (Dheeraj Pandey, Ajeet Singh, and Mohit Aron).¹¹

The number of Indian immigrants nationwide roughly doubled every decade over 1980–2010 and, by 2015, the latest year for which data is available, was about 2.4 million, making India the second largest source of immigrants to the US after Mexico, according to a 2017 report by the Migration Policy Institute (MPI).¹²

The Community Today

California is the leading destination state for Indian immigrants, home to 20% of the nationwide total. The US Census Bureau’s American Community Survey (ACS) 1-Year Estimates for 2017 (the latest estimate available) place the population of Indian descent in California at 506,971—about 1.3% of the state’s total population—up from 477,330 in 2007.¹³ For the 8 Metropolitan Statistical Areas (MSAs) that fall within the combined Sacramento,

San Francisco Bay, Monterey Bay and Northern San Joaquin Valley areas (the Northern California Megaregion) the ACS estimate of the Indian immigrant population totaled 293,000 for the period from 2013 to 2017. The largest Indian immigrant communities were in the San Francisco-Oakland-Hayward and San Jose-Sunnyvale-Santa Clara MSAs, at 119,000 each, but there

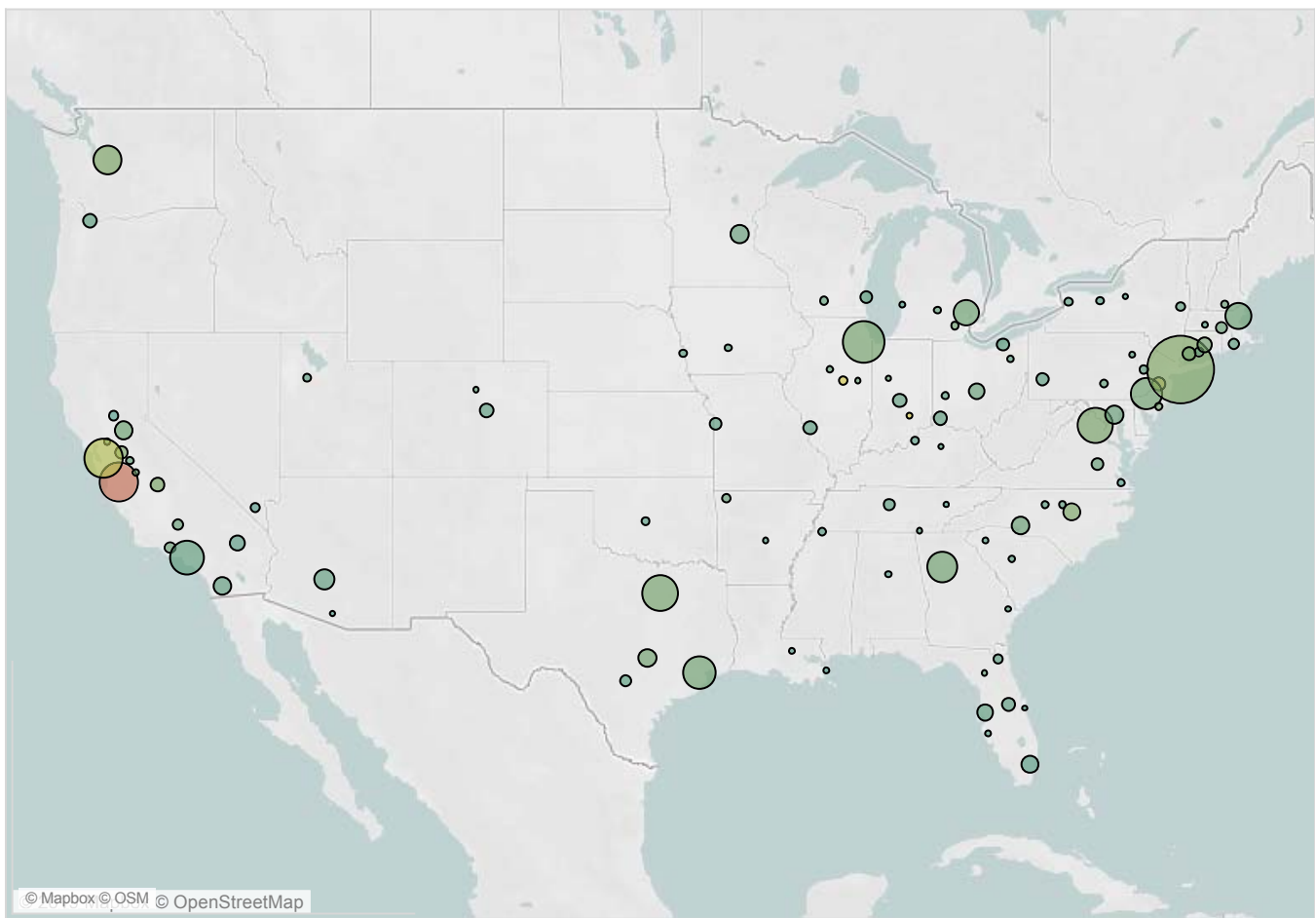
were significant populations in the Sacramento Area (33,000) and the Northern San Joaquin Valley (19,000).¹⁴

English language proficiency is high. According to the Census Bureau's 2015 American Community Survey, only 26% of Indian immigrants reported limited proficiency, compared to 49% for the total US immigrant population.

EXHIBIT 16

The Indian immigrant population in the Bay Area (238,000) is the second largest among US metropolitan areas, exceeded only by New York (357,000).

Estimated Indian Immigrant Population in the US by Metropolitan Statistical Area (MSA), 2013–2017



© Mapbox © OSM © OpenStreetMap



Migration Policy Institute (MPI) Data Hub
<http://migrationpolicy.org/programs/data-hub>

Select Country/Region of Origin
 --- India

Share of Total MSA Population
 0.2% 6.0%

Note: Population estimates include naturalized citizens, lawful permanent residents (LPRs), certain legal non-immigrants (e.g. persons on student or work visas), those admitted under refugee or asylee status, and persons illegally residing in the US. Estimates for MSAs with an immigrant population under 2,000 are not provided due to insufficient sample size. Rankings apply only to MSAs with immigrant populations over 2,000.

Source: Migration Policy Institute tabulation from the US Census Bureau's pooled 2013–2017 American Community Survey

The median age of Indian immigrants was 39 years, younger than the average for immigrants overall (44 years) but older than the native population (36 years); 82% of Indian immigrants were of working age (18–64) versus 80% for all immigrants and 60% for US natives.¹⁵

Compared to immigrants overall, those from India tend to be professional and educated. In 2015, 73% of Indian immigrants were likely to be employed in management, business, science, and arts occupations, compared to 31% for all immigrants and 38% for US natives. Median household income for Indian immigrants was much higher (\$107,000) than the income medians for the overall foreign- and native-born populations (\$51,000 and \$56,000, respectively). The ACA 2015 results indicated that 77% of Indian immigrants held a bachelor's degree or higher, versus 29% of all immigrants and 31% of US natives. The difference reflects the high proportion of Indian immigrants coming to the US as university students or H-1B workers in jobs requiring a university degree.¹⁶

According to the International Institute of Education (IIE)'s annual Open Doors report, 196,271 students from India were enrolled in US higher education institutions in the 2017–18 academic year, up 5.4% from the previous year. In the two prior years, 2015–16 and 2016–17, student numbers grew from the previous year by 24.9% and 12.3% respectively. Indian students now represent 17.9% of the more than 1 million foreign students enrolled, second only to China's 33.2%. Principal fields of study are engineering (35.4%); computer science and math (37.5%); business and management (9.8%); and physical/life sciences (5.5%). Graduate students make up 48.7% of the total.¹⁷ The National Science Foundation's Survey of Earned Doctorates found that between 2012 and 2015, 86.5% of US science and engineering doctorate recipients from India reported plans to stay on and work in the US.¹⁸

Indian students studying STEM disciplines in the US lead all other countries in their participation in the Optional Practical Training (OPT) program, which allows foreign students to remain in the United States to work for one year as trainees after they obtain their degrees or two years if the degree is in a STEM field. In fiscal year 2017, Indians accounted for 50,507 STEM-OPT authorizations,

more than half (56%) of the total, ahead of China which accounted for 21,705 (24%).¹⁹

There is reason to be concerned, however, about whether this highly positive inflow will be sustained. Despite a higher cumulative number of Indian students continuing and extending their education in the US in 2017, the Open Doors report issued in November of that year reports a falloff in F-1 visas received by Indian students: 62,537 received in 2016, down 16.43% from the previous year.²⁰ A 2017 survey of 250 US colleges and universities by six education groups, including IIE and the American Association of Collegiate Registrars and Admissions Officers, reported 26% fewer undergraduate F-1 visa applications from India and 15% fewer graduate applications. These trends were attributed to financial difficulties owing to demonetization, but also to concern over potential changes in H-1B visa policies, and a perceived rise in hate crimes in the US following the death of Indian engineer Srinivas Kuchibhotla at a bar in Kansas in February 2017.²¹

The decline in foreign student enrollment in the US is not limited to Indian students; a quarter of responding universities saw fewer Chinese student applications, and 32% reported fewer graduates applying. Applications from the Middle East were down 39% for undergraduates and 35% for graduates. Among the reasons given: a perceived rise in student visa denials at US embassies and consulates in China, India, and Nepal; a sense that the US is now less welcoming to individuals from other countries; uncertainty over changing visa benefits and restrictions, especially around job opportunities and the ability to travel and re-enter the US after travel; and concerns that the White House travel ban might be expanded to include additional countries.²²

As of 2017, Bay Area universities have not so far experienced a similar drop, possibly due to the Bay Area's sizable Indian community; the region's image of openness and tolerance; the reputation of its universities; its relative quality of life; and the continued presence of considerable numbers of job opportunities in the region, particularly in the technology sector.

Open Doors shows some 20,000 Indian students attending California colleges and universities in 2018,

12.4% of all foreign students in the state.²³ UC Berkeley is the leading Northern California host institution, with 572 students from India enrolled in the fall of 2017.²⁴ Other leading Bay Area institutions hosting Indian students, included Stanford (459),²⁵ UC Davis (404),²⁶ and San Francisco State University (178).²⁷ Fields of study are consistent with national trends.

University Ties

Major Bay Area universities enjoy deep, longstanding relationships with India and with a vibrant Indo-American community. Among them are the following.

UC Berkeley

An Institute for South Asian Studies (ISAS) and, within it, the Berkeley India Initiative (BII), were launched in 2007 to foster research on India's economy and global links, especially in high-technology; to identify policies to expand economic opportunity and mitigate poverty and wealth inequality; and to examine issues of governance in the world's largest democracy. BII serves as a focal point for cross-disciplinary programs at Berkeley, including

- a 2017 two-day Berkeley India Conference, organized as a student initiative in partnership with ISAS, the Institute of International Studies, and Ashoka University, and focused on critical issues associated with the future of youth, in particular addressing poverty alleviation;²⁸
- the Sarah Kailath Chair of India Studies and Memorial Lecture series, highlighting influential Indian women, such as film director Mira Nair, Infosys chair Sudha Murthy, and former Indian Ambassador to the US Nirupama Rao;
- a medical technology accelerator launched in Bengaluru (also known as Bangalore) with Indian incubator IKP Eden to encourage scalable low-cost medical solutions for rural India and a "smart cities" challenge for the city of Allahabad by the Berkeley Innovation Acceleration Group (IAG) and USISPF—both led by IAG international development director and former Intel executive Manav Subodh;

- the Berkeley-India Joint Leadership on Energy and the Environment (BIJLEE) initiative, formed in 2008 by the College of Engineering and the US Department of Energy's Lawrence Berkeley Lab, which led to participation in US DOE energy efficiency and demand-side conservation programs in India;
- the Berkeley Executive Program in Management, a one-year program from Berkeley-Haas School of Business and India-based Northwest Executive Education, aimed at senior executives, with modular courses in India, Silicon Valley, and online, covering leadership, innovation, strategy, and product management and communications; and
- the US-India Conference, an annual event that, in addition to ISAS, has included among its sponsors the All-India Management Association (AIMA), the Garwood Center for Corporate Innovation, TiE Silicon Valley, and Hero Enterprise and aims to disseminate current research on key policy issues to academic, policy, and public audiences in the US and India; attended by Berkeley's Chancellor and US and Indian business leaders and academics, the forum addresses a wide range of issues in technology, Indian government policy, entrepreneurship, and US-India relations, and featured India's Finance Minister Arun Jaitley as keynote speaker in 2017.²⁹

Stanford University

Stanford's Center for South Asia provides a central forum for research, teaching and events related to South Asia. Within the university's departments

- the Stanford King Center on Global Development (formerly known as the Stanford Center on Global Poverty and Development) teamed with academics, a management consultant, and 17 textile manufacturers in Tarapur in a multi-year initiative to introduce and track management best practices that improved factory conditions;
- Stanford Seed, an initiative of the Stanford Graduate School of Business (GSB), in 2017 established a training center in Chennai for a year-long, immersive leadership program to help founders and leaders of small and medium-sized enterprises scale their companies;

- Stanford Ignite Bangalore was launched in 2013 at the Infosys Bangalore campus, as a nine-week certificate program for non-professionals, with local and online instruction to promote entrepreneurship;
- the Stanford-India Biodesign fellowship program, begun in 2007 in collaboration with the All-India Institute of Medical Sciences and the Indian Institute of Technology (IIT) Delhi, trains medtech fellows in India and at Stanford in biodesign from concept to prototype to market;³⁰ and
- India's Ministry of Human Resource Development engaged Stanford and the All-India Council for Technical Education (AICTE) in 2016 to design and administer a test to measure learning outcomes of engineering students at India's 3,000 registered technical institutes.

- UCSF's Francis I. Proctor Foundation for Research in Ophthalmology has a longstanding relationship with the Aravind Eye Care System, contributing to research and treatment for corneal ulcers, cataracts and glaucoma.
- UCSF, through the UC Global Health Institute, has partnered with St. John's Research Institute in Bengaluru to study mental illness among patients with dual diagnoses of heart disease and diabetes, and with the Public Health Research Institute of India on issues involving HIV and women's health.
- The School of Medicine's Ob-Gyn Department is working with CARE India on a mentor training program for midwives in Bihar state.
- A \$1.5 million grant from the Bill and Melinda Gates Foundation funded UCSF and UC Berkeley researchers in Madhya Pradesh and Bihar, to evaluate mobile health education and intervention apps that social workers use to deliver health and nutrition services to mothers with young children.

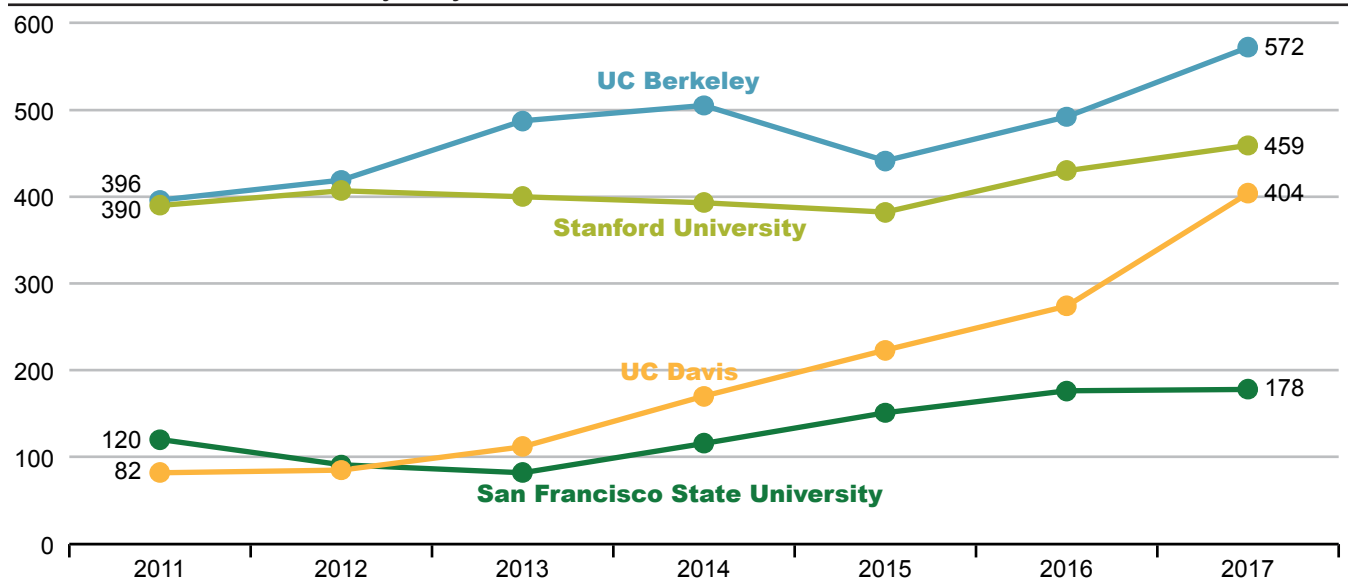
UC San Francisco

UCSF, a graduate school in medicine and life sciences and a leading teaching hospital facility, has been active in India for more than a decade.

EXHIBIT 17

UC Berkeley is the leading Northern California host institution for Indian students studying in California.

Number of Indian Students at Major Bay Area Universities, 2011–2017



Source: Stanford University, College Factual, San Francisco State University

Graph: Bay Area Council Economic Institute

UC Davis

A large Northern California Indo-American farming community dating back to the 1800s has drawn Indian students to UC Davis with diverse cross-border programs such as

- Feed the Future, a US government global hunger and food security initiative, which hosts an innovation lab at UC Davis focusing on managing risk for India's farmers through financial initiatives, including crop insurance, links to spot and futures markets, and commodity exchanges;³¹
- the Energy Efficiency Institute (EEI) at Davis, which registered a non-profit "sister center" in 2016 with the state government of Andhra Pradesh and has hosted a summer academy in India for underprivileged college students and a three-day sustainability workshop for Indian non-profits in the city of Visakhapatnam;³²
- a collaboration between the UC Davis School of Law and Jindal Global Law School, which jointly hosted a December 2017 conference on law, institutions, and justice in Sonapat, Haryana; the two schools have cooperated since 2012 on faculty and student exchanges, faculty collaborations, joint research, and publications; and
- participation by UC Davis, along with UC Berkeley and UC Santa Cruz, in the Tata Social Internship Program, an eight-week upper-division internship in which international students join Tata Group's community development teams working on economic and social empowerment in areas surrounding Tata's India operating units.

It is important to understand the dynamics that lie behind demand from Indian students to continue their education in the Bay Area and both the direct and indirect benefits that accrue to Bay Area universities as well as to the regional economy.

With the exception of elite technical and management schools—established under British colonial rule to train civil servants and engineers to run basic state-owned industries—India's education system has a long way to go in attaining world-class status. The government has committed to universal education; more pupils are in

primary and secondary education than ever, and literacy rates grew from 52% in 1991 to 74% in 2011.³³ Beyond the basics, however, education quality is lacking, beset by entrenched unions and corruption in teacher hiring and testing; unprepared students automatically moving on to the next grade without remedial education being available; outdated curriculums; and inadequate support for alternative private schools.

At the university level, the elite institutions—IIT (the Indian Institutes of Technology), IISc (the Indian Institute of Science) and IIM (the Indian Institutes of Management)—provide a very small number of enrollment opportunities relative to India's large student population, and graduates still find few good options for continuing with advanced study in India. US universities are viewed as among the world's best, rigorous yet flexible, and creative in their approach to learning. Bay Area universities are viewed as the gold standard in terms of science, technology, engineering, and mathematics (STEM) education, and also enjoy strong appeal with their proximity to Silicon Valley, San Francisco, and East Bay technology and life sciences clusters.

Indian students from the elite technical universities come especially well-prepared to Bay Area graduate schools. They enjoy high rates of master's and PhD completion, success in finding work with established companies or founding new ones, and high numbers of STEM patents filed. Most are self-funded or family-funded while at university; IIE data suggests they spent a cumulative \$752 million in California during 2017 on tuition and living expenses. Many Indian alumni also give back through endowments of facilities, initiatives, fellowships and scholarships, and as business contacts and mentors. The result is a virtuous circle of innovation and prosperity spread throughout the regional economy.

Academic Leadership: Giving Back to India

While this feeds the Indian diaspora in the Bay Area, a number of long-established and successful Indian leaders in the region are giving back to India by supporting the development of new, private universities that promise to deliver a higher level of educational opportunity with more innovation than is currently available in India, where curricula tend to be crowded and rigid, and entrepreneurial support is likely to be limited.

Bay Area Indian leaders were instrumental in forming the 1997 academic alliance that launched the highly ranked **Indian School of Business** in Hyderabad in 2001, followed several years later by the opening of a second campus in Mohali.³⁴

Bay Area leaders, including Prasant Mohapatra, Vice Chancellor for Research at UC Davis, and former UC Berkeley Chancellor Nicholas Dirks, serve on the Board of Governors of the Chennai-based **SRM Institute of Science and Technology** (formerly known as SRM University), now one of the top ranking universities in India, and were advisors on its expansion to a new campus in Amaravati, the capital of Andhra Pradesh and one of India's leading technology centers.

While SRM is technically focused, another new private school, **Ashoka University**, is more focused on the liberal arts. Anita Manwani and Arjun Bhagat are founding trustees along with other prominent Indian business leaders in the US and India. Land was acquired and infrastructure developed for an undergraduate campus outside of Delhi, which is now expanding from an initial 20 acres to 50. Ashoka's primary focus is to ensure that the next generation of India's leaders has the critical thinking skills and curiosity that is developed in liberal arts teaching in the US. As Manwani puts it, "We want the next generation of government leaders to be aware of the downstream effects of their decisions—economic, social, and cultural. For example, if you're building a dam, is it just about the engineering, or are you also thinking about the impact on the local community and the ecosystem? This kind of instruction—which promotes critical thinking and a multidisciplinary approach to problem solving—isn't typically available in India."

The university's faculty is international. Its student body currently totals 1,600, aiming eventually for 3,700, and is enrolled in undergraduate, graduate, and PhD degree programs in arts as well as pure sciences (computer science, physics, math, etc.), including inter-disciplinary majors. It also offers a one-year post-graduate Young India Fellows program to train students to become socially committed leaders of change. Ashoka has student and faculty exchange programs with leading universities in the US, Europe, and Asia.

Recent graduates are employed in tech, consulting and research, pharma, and NGOs.³⁵

Business Networks

A vibrant community of immigrant professionals, students, technology entrepreneurs, and investors has contributed to a rich, unique set of cultural and business networks in the Bay Area, most notably in Silicon Valley.

Cultural and benevolent associations offer Punjabi, Gujarati, Marathi, Tamil, Rajasthani, Sindhi, Telugu and other arrivals social support and a connection to home. Over decades, the Bay Area has embraced Indian culture—from traditional Indian classical music taught at the Ali Akbar College of Music founded by renowned sarodist Ali Akbar Khan in 1967; to one of the largest collections of South Asian art in the US at San Francisco's Asian Art Museum; to the film restoration work and scholarship at the Satyajit Ray Film and Study Collection at UC Santa Cruz; to widely-attended Bay Area celebrations of Diwali, the Rajasthani Holi Festival of Colors, and the Ratha Yatra Festival of Chariots in San Francisco's Golden Gate Park; as well as sold-out Indian pop music concerts; popular high-end restaurants such as Amber; Michelin-star Indian restaurants Taj Campton Place in San Francisco and RASA in Burlingame; and classes in traditional dance, yoga, and meditation.

By the late 1980s, a unique set of Indian professional networks was taking shape in Silicon Valley. Graduates of the elite Indian technical institutes, mainly data network engineers and software programmers, were in sudden demand by large US corporations beginning to digitize business processes and work flows to improve productivity. Airlines, banks, insurers, and healthcare providers saw huge opportunities for leaner operation, reduction of paperwork, and improvement of customer service and regulatory compliance. Tech firms in Silicon Valley were eager to help, but ran up against a shortage of skilled IT workers. Having engineers do that work remotely in India was no longer adequate to meet demand, so graduates were brought over to work, most on H-1B visas, and to continue their post-graduate educations on F-1 and J-1 visas.

Indian IT workers quickly became embedded within large US multinationals and at major Silicon Valley enterprise network integration, chip design, and software service firms. Some were hired and sponsored directly, while others came through Indian contract employers such as Infosys, Wipro, Cognizant, and Tata Consultancy Services (TCS). Ambitious post-graduate students and mid-level engineers and programmers stayed on in the Valley to found startups and later become investors. An entrepreneur/investor/mentor ecosystem formed to accelerate the process.

Supporting that community, a weekly print and online newspaper based in San Leandro, **India-West**, was established in 1975 by Stanford graduates Ramesh and Bina Murarka. The paper offers a mix of news from India and about the local and national diaspora, including coverage of Indian-American tech companies and entrepreneurs in Silicon Valley, and has won 50 journalism awards during its last 40 years of operation.³⁶

Also in the region, city-to-city ties are supported by organizations such as the **San Francisco-Bangalore Sister City Initiative**.

Early business associations included the **Silicon Valley Indian Professionals Association (SIPA)** and **Indian Business & Professional Women (IBPW)**, launched in 1987 and 1994, respectively. Industry-specific associations followed, for professionals in law, life sciences, venture capital, and other fields. But the largest, most influential business organization, which is still active today, is **The Indus Entrepreneurs (TiE)**.

TiE was formed in 1992 in Silicon Valley by a core group of 20 Indian tech professionals—among them Cirrus Logic founder Suhas Patil; Sun Microsystems co-founder and venture investor Vinod Khosla; Kailash Joshi, who set up IBM India and the IBM-Tata joint venture in the early 1990s; former McKinsey senior partner Rajat Gupta; and Hotmail co-founder Sabeer Bhatia. Over time, TiE has expanded worldwide, with 61 chapters in 14 countries, and with 12,000 general and 3,000 charter members³⁷ (experienced entrepreneurs and senior, established executives recruited by invitation only). It has broadened its membership over time to embrace entrepreneurs of many nationalities in many fields,

although the Silicon Valley chapter remains largely Indian and tech-focused.

The group's primary mission is to nurture entrepreneurial startups from incubation through late-stage financing and development within an ecosystem of collaborators, mentors, and investors. Its 2018 TiE Inflect annual conference drew 5,400 attendees to Santa Clara over two days in May. While TiE remains a pillar of the Bay Area Indian business community, particularly for entrepreneurs, the community's leadership has matured and is now more broadly distributed, as Indian business leaders such as Google CEO Sunder Pichai have risen to prominence and independently assumed national and global roles.

Indiaspora is an organization formed in 2012 to raise the Indian-American community's profile, that has since grown to include the global diaspora. It partners with government to create stronger ties with diaspora populations, as well as the private sector and NGOs, to create more effective philanthropy and promote giving within the diaspora community.³⁸

Software executive and Sand Hill Group angel investor M.R. Rangaswami, who founded Indiaspora, draws support from prominent thought leaders such as KMPG India Chairman & CEO and former US Assistant Secretary of Commerce Arun Kumar and others in the Bay Area, including Sumir Chadha, co-founder of India-focused investment firm WestBridge Capital; angel investor Asha Jadeja Motwani; Anand Rajaraman, a tech entrepreneur and co-founder of Jungle Corp., which pioneered internet price comparison shopping; Jyoti Bansal, founder of AppDynamics, which was acquired by Cisco for \$3.7 billion in 2017; and Vab Goel, founder of venture capital firm NTT.

Rangaswami says Indiaspora, influenced by Jewish community organizations and the Chinese Committee of 100, grew out of a nationwide Indian community that had expanded and matured over years. "We asked ourselves," he explains, "If the Indian community is so successful, why isn't it more politically and socially active; if we're one percent of the population, why aren't we one percent of the membership in Congress?" The answer was the lack of a unifying organizational

infrastructure. “We had the various cultural organizations, we had associations for doctors, lawyers, and tech, yet nobody talked to one another. We needed a catalyst.”

Early achievements included the 2013 Indiaspora Inaugural Ball in Washington honoring President Obama, which was attended by 1,300 Indian Americans from across the country. The Obama administration, having already hired dozens of Indian Americans into senior positions, hosted newly-elected Prime Minister Modi at the White House. After a 2015 Modi visit to Silicon Valley attracted 20,000 people to a stadium reception in San Jose, momentum increased, and in 2016 the community helped elect Ro Khanna to the 17th District (Santa Clara-Fremont) House Seat and former California Attorney General Kamala Harris to the Senate.

Indiaspora hosted another gala in 2017 in Washington, DC, to celebrate the milestone of achieving one percent representation of Indian Americans in the US Congress; worked with the Modi government to promote a US-India-Israel “Tech Triangle”; partnered with NASSCOM to bring a delegation of business leaders to New Delhi in January 2018; organized delegations of Indian American business leaders to Israel and Canada,

including a trip to London in July 2019; and hosted a Philanthropy Summit in Washington, DC, as well as dinners with United Nations Ambassador Nikki Haley and Nobel Laureate Kailash Satyarthi. A 2018 Indiaspora report found that people of Indian origin have donated \$1.2 billion to US institutes of higher learning since 2000.

Rangaswami says ties between India and the Bay Area are as strong as ever. H-1B visa numbers here have not dropped off as in other parts of the US; business travel and tourism have shown no letup; and Silicon Valley venture capital firms have launched India-based, India-focused funds—a trend that is expected to increase.

The difference today from a decade ago, he maintains, is that the business community has matured to the point that networks of alumni, angel investors, accelerators, mentors, and VCs are well-established, and a critical mass of firms in Silicon Valley and beyond have Indian founders and senior management.³⁹

Two national business organizations, the **US-India Business Council (USIBC)** and the **US-India Strategic Partnership Forum (USISPF)** also have a strong presence in the region.



Indian States: Laboratories of Innovation

India's diverse states enjoy considerable autonomy and have distinct business environments. Many are embarking on initiatives and reforms—around digitization, energy, and entrepreneurship—that support and parallel the national government's.

As a large and diverse nation with 29 states, India presents opportunities that should be understood not just at the national level but at the state level as well. The largest states have populations at the scale of countries (e.g., Uttar Pradesh 199.6 million, Maharashtra 112.4 million, Madhya Pradesh 72.6 million, Tamil Nadu 72.1 million, Gujarat 60.4 million),¹ and while city governments are comparatively weak, state governments can be powerful. As in the US, states also serve as laboratories for experimentation. Reflecting this and India's complex political landscape, the Modi government has looked to like-minded states as partners in implementing national reforms, promoting a race to the top through "competitive federalism."

While reform is afoot across India, not all states have industries or policies that align closely with the priorities

that drive California and the Bay Area. With respect to technology, innovation, energy, entrepreneurship, and climates supportive of business, some stand out.

States are setting ambitious energy market goals. Gujarat was the first state to make significant changes in this area, taking advantage of the advent ten years ago of the National Solar Mission. Today, Karnataka, Telangana, Madhya Pradesh, Rajasthan and Haryana are also moving fastest on energy market reforms, through measures designed to expand the use of renewable energy, reduce power theft, increase tariff collection, and engage private partners in electricity distribution. Karnataka, for example, has taken the lead in having the most renewable energy capacity installed in the country. Gujarat is the first state to develop offshore wind capacity. Haryana, for its part, has approved a bioenergy policy that aims to attract private investment sufficient to generate 150 megawatts of power and support new technology R&D.²

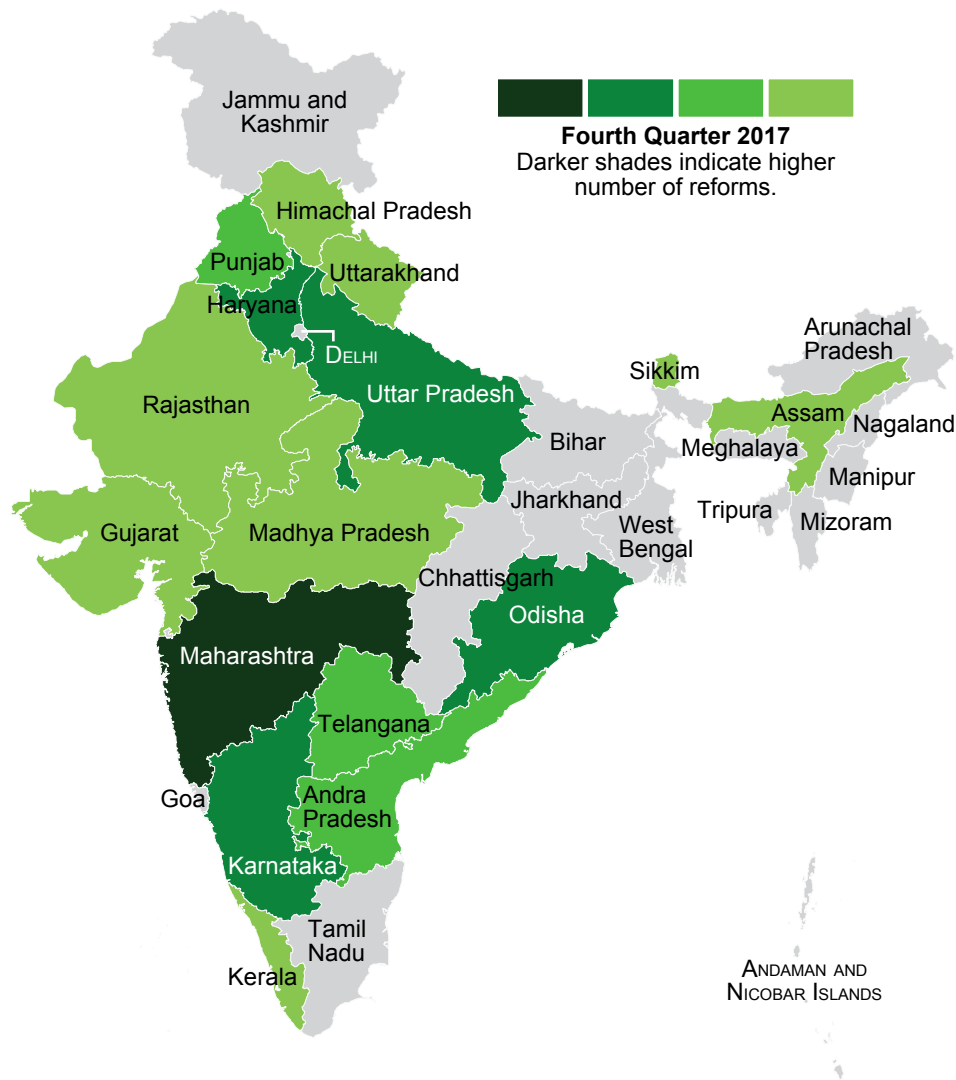
Technology innovation is being embraced as a way to stimulate growth and improve services. Karnataka, home to India's leading IT hub Bangalore, was an early mover in IT, while Telangana was an early leader in life sciences. They have subsequently been joined by Rajasthan, Kerala, Andhra Pradesh, Odisha, Haryana, and Tripura, all of which are moving fast on policies to advance India's knowledge and innovation economy. Telangana, for example, has a Rural Technology Policy to establish one technology center in every district, with each center

able to train 10,000 rural youth.³ In 2017, Karnataka launched a fund through its KBITS (biotechnology and IT services) organization with an initial investment of \$1.5 million to support agricultural innovation start-ups,⁴ and also awarded \$1.5 million in grants to 26 biotechnology startups under its Idea to Proof of Concept (Idea2POC) Grant initiative, which is part of the broader Karnataka Startup Policy 2015–2020.⁵

Land use, which directly impacts economic development, is being addressed. Reforms governing land use, an issue that often complicates industrial growth and larger commercial projects—particularly where land must be assembled from many smaller plots—are being actively pursued in Bihar, Chhattisgarh, Odisha, Maharashtra, Jharkhand, Punjab, Rajasthan, Haryana, Uttar Pradesh, Tamil Nadu, and Uttarakhand.

EXHIBIT 18

Among states enacting positive new initiatives, policies, and reforms to support entrepreneurs and industry, Maharashtra has taken an early lead.



Source: Center for Strategic and International Studies

Visualization: Bay Area Council Economic Institute

Uttar Pradesh and Odisha, for example, have launched plans to create land banks of 5,000 acres⁶ and 120,000 acres,⁷ respectively, for allocation to the industrial sector. This is a complicated area where much remains to be done, as land use policies are inherently political. An earlier policy enacted in 2005 to enable land assembly and provide targeted tax incentives to encourage development through Special Economic Zones (SEZs) met with opposition, due to concerns over whether farmers were being adequately compensated for their land and whether sub-optimal sites were being chosen so that well-connected people could benefit from the sale of land to the government.

Digital initiatives at the state level mirror national initiatives and cover an array of applications.

- **LED lighting:** Reforms are being most actively pursued in Andhra Pradesh (where, for example, the government has announced plans to replace one million conventional streetlights in seven districts with LED lighting⁸) and Odisha (which has announced plans to replace all conventional streetlights with LED lighting in all 114 urban local bodies in the state⁹).
- **Digital payments and procurement:** Nagaland will implement digital payments for its rural employment program, and Maharashtra will likewise allow beneficiaries of state government programs to have payments directly credited to their accounts. Six states (Andhra Pradesh, Arunachal Pradesh, Assam, Gujarat, Telangana, and Uttar Pradesh) will use the central government's e-government marketplace (GeM) to conduct procurements.¹⁰ Telangana has launched T App Folio, a mobile application to provide citizens with a single platform to access government services and transfer payments.¹¹ Tamil Nadu has launched an e-governance policy to enable government departments to provide all their services digitally.¹² Uttar Pradesh has announced an online single-window system to digitally process applications, fee payments and clearances for entrepreneurs and business people.¹³
- **Digital health:** Telangana and Karnataka stand out for their digital health initiatives. Telangana will experiment with digital health records, and is partnering with Microsoft to use cloud-based big data to improve children's healthcare screenings. Karnataka is partnering with Tata Trusts to open a digital health services hub that will use digitized records to better track recipient benefits. Uttar Pradesh is also harnessing digital tools to expand the state's healthcare reach by making five telemedicine clinics available to citizens in areas without easy access to hospitals.¹⁴
- **Small business support:** Gujarat has signed a memorandum of understanding with Google to advance its "Digital Gujarat" agenda to train entrepreneurs and small- and medium-sized businesses to use digital platforms for business development.¹⁵

Entrepreneurship is actively supported through state initiatives. States that are active in this area include Karnataka, Odisha, Uttar Pradesh, Haryana, Maharashtra, Telangana and Andhra Pradesh.

- **Support for women entrepreneurs:** Telangana has announced the creation of We-Hub, an innovation hub exclusively for women, backed by a \$2.5 million investment fund. Punjab has unveiled a draft Punjab Startup Entrepreneurship Development Policy, also supporting women entrepreneurs, that aims to create 1,000 start-ups over five years and provides funding for public incubators. Maharashtra has approved an initiative for women entrepreneurs backed by \$100 million in subsidies.¹⁶
- **Support for startups:** Rajasthan has launched iStart, a program to support start-ups by providing business plan assessments, skill building, mentoring, and connections to potential investors. Kerala will provide new incentives for start-ups that make it easier for private firms and international agencies to set up incubators and accelerators. Karnataka's new biotechnology policy will create funding mechanisms and mentorship programs to stimulate start-up activity in the biotechnology sector.¹⁷ Karnataka has also created a new legal framework to allow startups innovating new business models to operate under clear regulations and an initiative promising \$437.50 a month for one year to entrepreneurs who incubate their ideas in the state's incubation center.¹⁸ Uttar Pradesh has announced a startup strategy to both develop IT parks in Tier II cities and develop

investment nodes that enable the use of smart technologies for better city management.¹⁹

The leading Indian think tank Institute for Competitiveness ranks India’s states and union territories for overall competitiveness using a broad range of measures in three categories: Innovation, Investment, and Factors of Production (including labor, infrastructure, and capital). In both 2016 and 2017, Maharashtra led the rankings for Innovation-Driven States, Karnataka was #1 for Investment-Driven States, and Uttar Pradesh topped the rankings for Factor-Driven States.²⁰

City Competitiveness

Major cities also concentrate technology and resources and compete for investment. Companies, capital, and labor concentrate in cities. Compared to China, where well under half (42%) of the population lives in rural areas, India remains predominantly rural, with 66% of the population living in the countryside according to 2017 data (the latest available) from the World Bank.²¹ India is rapidly urbanizing, however, and has the

second largest number of urban dwellers in the world (450 million) after China (804 million) and ahead of the United States (267 million).²² By 2030, the number of urban residents is expected to grow to 607 million.²³ As already massive cities such as New Delhi, Mumbai, Kolkata, and Bengaluru (also known as Bangalore) grow, population has overwhelmed existing infrastructure. This makes the delivery of basic infrastructure services a priority. Cities are also looking to differentiate themselves as technology centers that can attract both talent and investment. These two dynamics have often produced a dichotomy in which gleaming tech campuses line crumbling, overburdened roads and highways in an environment with often poor air quality. Both worlds reflect the reality of India’s cities.

Part of the answer to India’s development challenges lies in the movement of underemployed agricultural workers from the cities to more productive employment in larger population centers. Up to now, India has not succeeded in creating enough urban jobs or the infrastructure needed to support them. Digitization is being looked to as an answer.

EXHIBIT 19

Maharashtra, Karnataka, and Uttar Pradesh lead other Indian states in their respective competitiveness categories.

Institute for Competitiveness Top 10 Rankings of Indian State and Union Territories, 2017 and 2016

Rank	Innovation-Driven States		Investment-Driven States		Factor-Driven States	
	2017	2016	2017	2016	2017	2016
1	Maharashtra	Maharashtra	Karnataka	Karnataka	Uttar Pradesh	Uttar Pradesh
2	Tamil Nadu	Tamil Nadu	West Bengal	Andhra Pradesh	Jammu & Kashmir	Manipur
3	Delhi	Delhi	Arunachal Pradesh	Punjab	Madhya Pradesh	Tripura
4	Kerala	Goa	Andhra Pradesh	West Bengal	Manipur	Madhya Pradesh
5	Goa	Gujarat	Rajasthan	Mizoram	Assam	Jammu & Kashmir
6	Gujarat	Kerala	Telangana	Arunachal Pradesh	Tripura	Odisha
7	Sikkim	Himachal Pradesh	Punjab	Rajasthan	Odisha	Bihar
8	Himachal Pradesh	Sikkim	Mizoram	Chhattisgarh	Meghalaya	Assam
9	Haryana	Uttarakhand	Nagaland	Nagaland	Bihar	Meghalaya
10	Uttarakhand	Haryana	Chhattisgarh		Jharkhand	Jharkhand

Source: Institute for Competitiveness

Visualization: Bay Area Council Economic Institute

EXHIBIT 20

Bengaluru has emerged as the most creative city in India, followed closely by Mumbai and Pune. All three are also among the top cities on the Creativity Index.

India's 50 Most Creative Cities



Source: Institute for Competitiveness and Martin Prosperity Institute

In a 2017 ranking of 50 Indian cities, the Institute for Competitiveness places the following Tier I cities among India's most competitive top ten: #1 Bengaluru (Karnataka), #2 Mumbai (Maharashtra), #3 Pune (Maharashtra), #4 Chennai (Tamil Nadu), #5 Ahmedabad (Gujarat), #6 Delhi (Delhi), #7 Hyderabad, (Andhra Pradesh), and #10 Kolkata (West Bengal). Leading Tier II cities ranking in the top ten are #8 Nagpur (Maharashtra) and #9 Gurgaon (Haryana).²⁴

A related Creativity Index—based on technology, talent and tolerance criteria—shows a wide divergence between cities, with a large proportion scoring less than 0.5 (meaning there is a low correlation). The top cities

for creativity are Delhi, Hyderabad, Bengaluru, Mumbai, and Chennai, with other top performers including Noida, Pune, Kolkata, Kochi and Chandigarh.²⁵ Factors considered in the ranking include the number of internet subscribers, number of wireline subscribers, share of the population with a computer or laptop with internet, share of the population with mobile phones, number of R&D institutions, number of incubators, population above 25 years old with a graduate degree, and the number of engineering and MBA graduates. These Indian cities are home to the Indian operations of most of the Bay Area's leading companies, and at present offer the strongest base in India for the technology industry.



Innovation, Startups and Investment: Poised for Breakthrough

India doesn't yet rank among the world's leading economies for innovation, but its status has been rising. A young, entrepreneurial population and a growing domestic market make India a promising destination for venture investment.

India has been rising in the World Bank's Ease of Doing Business rankings, moving up from 130th place for 2015–16 to 100th place for 2016–17 and 77th place for 2017–18. Though much ground remains to be covered—China ranked 46th for 2017–18, up from 78th for the two preceding years—the Bank rated India among the top ten countries measured by improved performance for both the 2016–17 and 2017–18 periods.¹

Patent filings are another measure of how far India has come, but also how far it has to go. In 2018, innovators and research organizations in India filed 2,013 patent applications with the WIPO (World Intellectual Property Organization), registering the highest growth of any country (27%). However, that still places it far below China's 53,345 international patent applications in the same period. The United States filed 56,142.²

With its young population and a growing and educated middle class, India is a natural home for entrepreneurs and a magnet for venture capital. Entrepreneurial activity has grown rapidly, to the point where India is now the world's third largest base for startups after the United States and China, which have the world's largest numbers of startup incubators and accelerators.³ The large number of Indians studying at Bay Area universities, Indians employed in the region's technology community, and Indian immigrants who have founded companies, lead technology companies, or are technology investors in the region is a testament to India's inherent entrepreneurial potential.

India's innovation and venture environment still falls short of its potential. The Global Innovation Index overall score ranks India 57th out of 126 countries evaluated in its 2018 report. That overall ranking is the average of sub-index scores that are composed of rankings for seven individual categories in which India placed as follows: 80th for Institutions (political environment, regulatory environment, business environment); 56th for Human Capital and Research (education, tertiary education, R&D); 77th for Infrastructure (ICT, general, ecological); 36th for market sophistication; 64th for business sophistication; 43rd for knowledge and technology outputs; and 75th for creative outputs.⁴

Each year since 2011, however, and despite this variation, India has been ranked by the Global

innovation Index as an *Innovation Achiever* relative to its level of development, moving up in the standings every year. In addition, India is 12th on the list of the top twenty countries that account for the highest combined shares of patents and scientific articles. Two cities, Bengaluru (#65) and Mumbai (#92) rank in the top 100 urban clusters for patent and scientific publishing performance. These numbers suggest how far India has come, and how far it still has to go.⁵

Venture Investment

Indian markets, and with them venture investment in India, can be complex, as culture, religion, and income levels vary widely and social stratification runs deep. Tier I or Tier II cities have different market profiles from rural areas. This raises the question for investors about the addressable market: Is it the 1% of extremely wealthy Indians, the growing middle class, or the base of the pyramid that is barely self-sustaining but is large and also offers market opportunities? Money can be made at every level, but it is important to know who you're selling to.

In its 2018 report on global metro areas and their tech companies, CB Insights ranked 25 tech hubs according to their total number of investment deals between January 2012 and May 2018. Three Indian cities placed on the list: Bengaluru (#10), New Delhi (#13), and Mumbai (#18). The analysis went on to divide the list into three segments: 6 top cities dubbed Heavyweight Hubs that had a 670 average deal count during the 2012–2018 period; 10 High Growth Hubs in the mid range (including Bengaluru and New Delhi) with a 171 average deal count; and 9 remaining Up and Comers (including Mumbai) with a 75 average deal count.⁶

Year-to-year funding has swung widely. CB Insights reports that Indian tech startups raised a record \$10 billion in 2017. Significantly, that flow was dominated by unicorns (companies valued at more than \$1 billion), with only \$206 million going into seed and angel-stage deals. This is mirrored in the pattern of venture deals between 2015 and 2017: surges have been driven by funding going to unicorns while drops in funding have been driven by less attention to unicorns. When India

reached the record funding level of \$10 billion in 2017, the number of deals dropped by 19.3%.⁷ CB Insights found that as of June 12, 2019, India ranked fourth in the world for its number of unicorns, with 4% of the global total at 16, after the UK's 5% with 19, China's 25%, and the United States' 49%.⁸

The short list of major investors that has led this charge, often investing in the same company through multiple rounds, includes Blume Ventures (Mumbai), Indian Angel Network (New Delhi), Sequoia Capital India (the India VC arm of the Bay Area's Sequoia Capital), and Accel India (the independent arm of the Bay Area's Accel).⁹ The size of India's unicorn club more than tripled between 2014 and 2018, from four to thirteen. New entrants include hotel aggregator Oyo Rooms, valued at \$5 billion in 2018, which attracted investment from SoftBank, Sequoia Capital India, and Lightspeed India Partners. Large companies have dominated fundings in India's tech ecosystem—led in 2017 by Flipkart and Ola Cabs.¹⁰

India-bound venture capital investment has faced headwinds, despite collectively raising \$3.8 billion between the start of 2015 and early 2018. With the lack of exits in the mid 2000s, India's top eight VC firms (many from the Bay Area) slowed their seed and early-stage investment. The internet sector was a particular disappointment, where exits were few and returns on investment were low. Overall early-stage funding in 2017 hit a low, prompting a shift to sectors such as financial services and software as a service.¹¹ Life sciences investment has also struggled, as discovery research has not advanced as rapidly as expected.¹²

But the shift in the last three years toward large scale fundings of later-stage companies may also reflect a more disciplined investment strategy in the wake of a large-scale rush to the internet sector in 2014–2015. Perceptions of India could change as a result of Walmart's purchase in 2018 of a 77% stake in India's largest online retailer Flipkart, a deal valued at \$16 billion. Walmart has 21 wholesale cash-and carry stores in India and plans to open 50 more, and the Flipkart deal will strengthen its position in the online market.¹³ India's largest VC-backed tech exit, it also sends a message to investors that India can generate large-scale exits and returns. Accel India was an early Series

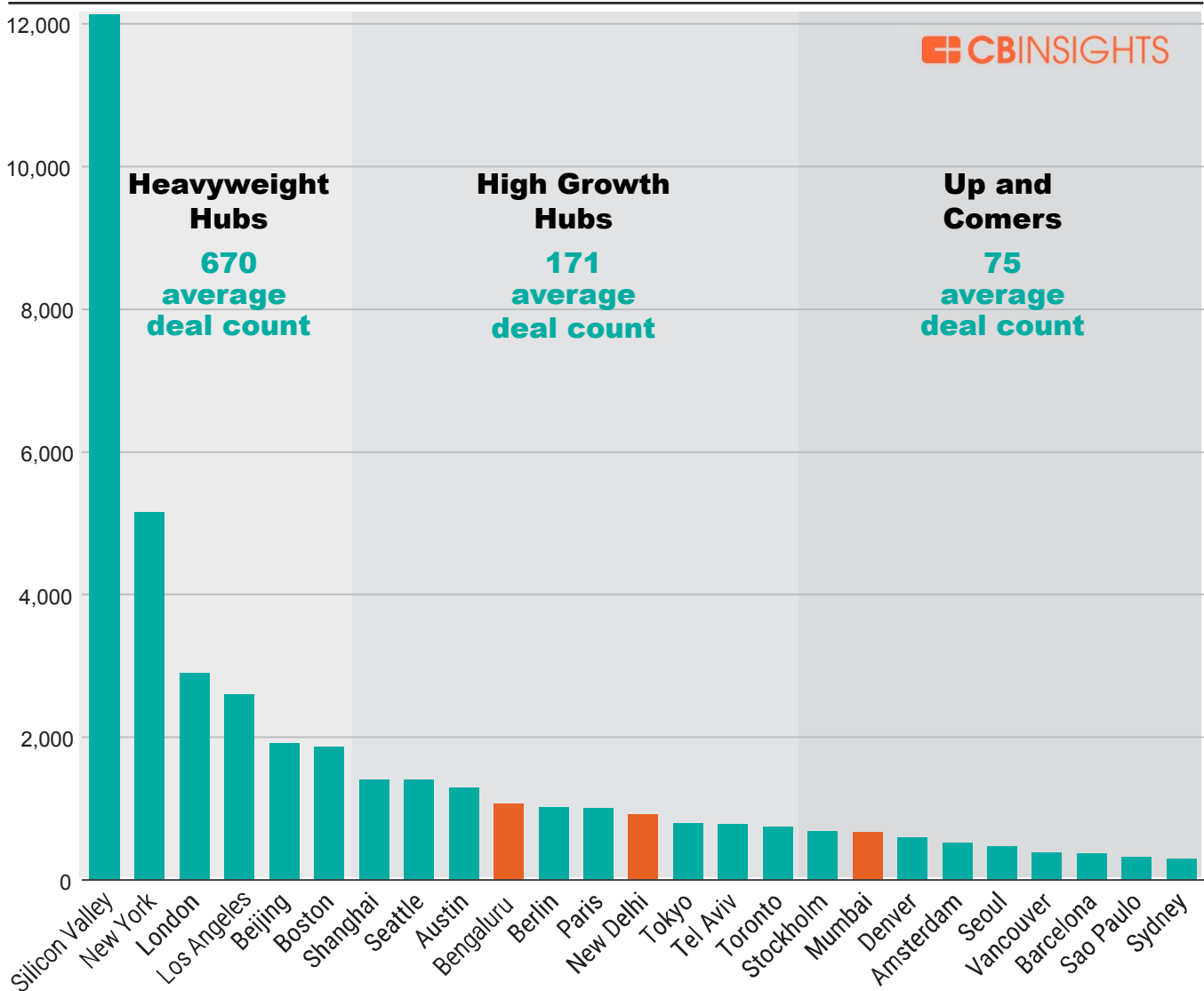
A investor, later joined by SoftBank Group, New York's Tiger Global Management, South Africa's Naspers, China's Tencent Holdings, Microsoft, Morgan Stanley, and HDFC Bank. Flipkart is currently the best-funded

tech company in India, with over \$6 billion in disclosed funding. The second largest exit since 2010 was online travel company MakeMyTrip, which went public in that year at a valuation of \$477 million.¹⁴

EXHIBIT 21

While Silicon Valley companies saw more tech deals than all non-US metro hubs combined, Bengaluru and New Delhi placed in the High Growth Hubs group, and Mumbai placed as an Up and Comer.

CB Insights 2018 Comparison of 25 Tech Hubs by Number of Startup Investment Deals, Jan. 2012–May 20, 2018



Source: CB Insights Global Tech Hub Report

Visualization: Bay Area Council Economic Institute

Bay Area Connections

Growth-stage investment in India is funded primarily by leading US VCs, with Indian firms doing smaller scale investments; approximately 90 percent of venture deployment in India is by US and other international firms.¹⁵ US limited partners are also active participants in Indian venture firms.

Today, India is in its third wave of venture investment. In the first, in the early 2000s, firms came from Silicon Valley, made investments, and went home without establishing a local presence. In the second phase, US-based VCs established satellite offices in India, but decisions were largely made in the US. The most recent wave began in the late 2000s and saw the US venture community's presence increasingly localized. Some firms, such as NEA, Kleiner Perkins, Canaan, and DFJ, were not prepared to make all-in commitments and left.¹⁶ The remaining top tier firms, seeing that satellite offices that lacked autonomy were not working, have strengthened their local presence through dedicated India funds and a shift of decision-making authority to the local level. For those who stayed, the return on investment is starting to come.

Sequoia Capital, with India operations based in Bangalore, has invested more than \$2 billion in 130 Indian companies and completed 55 exits since 2007. In 2018, the firm launched its sixth India fund, which closed at \$695 million.¹⁷ In April 2019, Sequoia and Accel both added to their already existing investments in electric motorbike hailing company Bounce, a competitor with Uber in the India market.¹⁸ Further deepening its engagement with startups, in 2019 Sequoia India launched Surge, an accelerator program serving Indian and Southeast Asian startups, and startups that are oriented toward Indian and Southeast Asian markets, which includes initial investments of \$1–2 million for accepted participants. At the close of the program, which supports two waves of 10–20 companies each year for 16 weeks, participants have the opportunity to raise more capital from a curated panel of investors.¹⁹

Accel launched its fifth India fund in 2016, for which it raised \$450 million.²⁰ Accel was among the investors that received big benefits from Walmart's purchase of 77% of Flipkart in 2018, and it also kept some of

its Flipkart shares, leaving its position in the company worth about \$1.1 billion after having invested into the company about \$160 million over several funds since 2008.²¹ Accel was also among the investors in Bangalore-based TaxiForSure and had another good exit in 2018 when that company was acquired by rival online cab booking service Ola for \$200 million in a cash and stock deal.²²

Matrix Partners raised \$300 million for its third India fund in 2018. Recent investments include Bangalore health drink startup &ME, which is targeting the women's market,²³ Bangalore-based video sharing app Clip App, for which Matrix led a \$6 million Series A round,²⁴ and (together with Ola and other Indian companies) motorbike hailing company VOGO²⁵

WestBridge Capital is a leading India-focused investment venture firm, with over \$2.5 billion in capital under management and a strategy of investing in high-quality public and private businesses in India with a long-term orientation. Co-founder Sumir Chadha sees growing innovation around India's domestic market, with particular opportunity in fintech and consumer goods: "Bank accounts have been established for millions of people, and more loans are being made on digital platforms, often on mobile phones. Most accounts are still with government banks, but private banks are starting to take more of the market. Consumer markets also have lots of room for growth and penetration, particularly in the middle class."²⁶

IDG Ventures India, recently renamed **Chiratae Ventures**, launched its first India fund in 2006, putting up 100% of the initial \$150 million capitalization. The first fund's early-stage investments mostly focused on online retail, including fashion apparel and accessories portal Myntra, baby clothing and supplies website FirstCry, and eyewear retailer Lenskart. A second fund of the same size focused on B2B services—such as agricultural equipment and supplies seller AgroStar and packing materials supplier Bizongo—along with startups in the sharing economy such as home-sharing site NestAway, home furnishings rental platform RentoMojo, and credit management services firm CreditMantri.²⁷ A third \$208 million fund closed in 2017²⁸ and will focus primarily on Series A and B investments, balanced out by a few larger, late-stage plays. Among the sectors

being explored are consumer media and tech, fintech, software/SaaS, and healthtech.²⁹ Recent portfolio additions include trade finance/factoring portal Vayana, salary advance lender EarlySalary and AI-driven blood screening and diagnostics platform SigTuple. Successful exits have included Myntra, acquired by Flipkart in 2014, and business process management software developer Newgen Software Technologies, which had its initial public offering in January 2018.³⁰

Over time, IDG Ventures India has become a more Indian entity. Initial lead investor IDG Ventures has reduced its participation, with a 50% interest in the second fund and a 25% interest in the third fund, which had about 45% of its capital raised from India-based investors. A fourth fund in the \$275–300 million range was launched in 2018 under the new Chiratae brand.³¹

PointGuard Ventures is taking a different approach to venture investing that mirrors the move by some Indian tech companies to transfer more activity to the United States. The firm was co-founded by Krish Panu, a serial entrepreneur who helped design the first electronic voting machine launched in India. Recognizing that innovation was happening in the United States but that much of its implementation was happening in Asia—and China and India in particular—in its first fund PointGuard Ventures focused on investment in the US, then helping portfolio companies set up R&D centers in India. Seeing a young population, growing markets, and entrepreneurial energy, the firm will focus its second fund on investment in India, with the objective of taking companies and technologies developed in India global. The heart of that strategy involves bringing them to the United States.

Panu observes that India is shifting from being service-oriented to being product-oriented: “They already have the global product mindset. Indian engineers have learned how to develop cutting-edge technology, they have experience, and they’re entrepreneurial. They also know how to take risks. Indian entrepreneurs understand how the global capital market works now, which is very new. Many are ready to become global, and we can help them do that by growing in the US.” Areas of focus include enterprise software, mobile applications, artificial intelligence, and the convergence of medicine with IT, with an emphasis on data collection and processing.

Indians returning from the US to start new businesses offer a promising starting point. PointGuard Ventures will help open doors to customers and partners, while building an R&D and business strategy for scaling to the United States and beyond. In this way, the firm is looking to reverse the historical pattern of US investment flowing to India by making the flow two-way.³²

Other venture investors include **Nexus Venture Partners**, which in 2018 led an \$8 million Series A round for Santa Clara-headquartered Observe.AI, an AI-based call center conversational platform with a nine-person tech team located in Bengaluru,³³ and **Lightspeed Venture Partners**, which recently led a \$20 million funding round for magicpin, a social network platform for local discovery, real-time promotions, and loyalty programs in the Delhi National Capital Region, Mumbai, and Bengaluru.³⁴ JC2, a venture firm founded in 2018 by former Cisco CEO John Chambers, has invested in 18 startups, half of which have a founder of Indian origin. Two of those are in India: Uniphore, a customer experience company, and cybersecurity company Lucideus.³⁵

New venture firm entrants that are deeply rooted in India have doubled down on the market. Mohanjit Jolly joined DFJ in 2007, after working with Silicon Valley seed fund Garage Technology Ventures, and spent five years (2007–2012) with the firm in Bangalore.³⁶ When DFJ exited the market, he co-founded **Iron Pillar**, which closed its maiden fund in 2018 with \$90 million in commitments from global LPs and Overseas Private Investment Corporation (OPIC) as the anchor investor. The firm will focus on mid-stage tech investing, principally companies raising \$10–50 million in B, C, or D rounds.³⁷ An optimist on the market, Jolly points to the opportunity to leverage India’s large human capital base, improving technology infrastructure, and booming entrepreneurial ecosystem: “Entrepreneurs are seeing that they can leverage India’s strengths to build globally competitive companies without a massive presence in Silicon Valley. Pent-up consumption demand among the young, aspirational Indian demographic and technology democratization are leading to a wave of consumer-centric unicorns. Then there is the mobile revolution: the combination of inexpensive smartphones and the lowest cost data plans in the world, thanks in large part to Mukesh Ambani’s Jio, has completely upended the mobile market. That foundational connectivity layer is

bound to catalyze many more interesting opportunities over the coming decade."³⁸

Jolly sees white space in industry verticals that large Indian companies haven't filled, with investment opportunities in renewables (distributed solar, microgrids), fintech, e-commerce, health, and education. The biggest opportunity may be in mobile-enabled products and services, where he believes Indian companies have an edge: "India is in many ways a mobile-first or mobile-only environment. You can't just take a product from the US and repurpose it. This creates an innate advantage and opportunity for Indian entrepreneurs in everything from digital health to logistics, mobile gaming, and consumer markets (which are mobile-centric)."

The entrepreneurial bridge between India and Silicon Valley is also being built through venture banking and other services. **Silicon Valley Bank**, which opened an office in Bangalore in 2004 and another in Mumbai in 2007,³⁹ was instrumental in first introducing many Bay Area VCs to India. SVB India helped US clients, including venture firms, through office space and local services, and created a seed fund to invest in local entrepreneurs. Its venture investment activity was later spun out as an independent firm, **Saama Capital**,⁴⁰ and its venture lending activity was spun out as **Innoven Capital** when it was sold to Singapore's Temasek Holdings in 2015.⁴¹

Saama, which remains connected to the bank, currently has about 36 companies in its direct portfolio.⁴²

Since then, the Bank has not maintained a physical presence in India, but manages its India business through its Silicon Valley-based Global Gateway unit, which focuses on helping entrepreneurs from India with the potential to become global companies bridge to the US market, through banking services, introductions and network support. SVB Global Gateway managing director Andy Tsao observes that ten years ago expectations were high among investors that India would produce a crop of global technology firms. Many venture firms entered the market but most were disappointed when that vision wasn't realized, and subsequently withdrew. Asked what's different today, he points to the shift from offline to online commerce. Companies like Flipkart and Snapdeal in e-commerce, Ola (an Uber competitor), and Paytm (which is pervasive in India and enables payments by phone without using cash) have been noticed. In particular, Walmart's acquisition of Flipkart was a major liquidity event for investors on a scale that had been lacking in the past. Still, most Indian companies receiving venture investment are domestic market plays, and with the exception of a handful of SaaS companies, not likely to go global. Most leading venture firms that are active in India remain conservative, watching for breakout companies but largely focusing on early-stage investing.⁴³



Information Technology: Upward Mobility

The Modi government has emphasized technology innovation in its push for modernization, starting with its Digital India initiative to push out government services, communications, banking, healthcare, and e-commerce to both rural and urban areas.

IT, IT-enabled services (ITeS), and business process management (BPM) in India constituted a \$177 billion sector in the fiscal year ending March 2019—\$41 billion domestic and \$136 billion in exports—that employs 4.14 million workers, according to data from the National Association of Software and Services Companies (NASSCOM).¹ It is the largest private sector employer in India.²

NASSCOM's survey of CEOs' opinions about the prospects for the fiscal year ending in March 2020, found concerns about global protectionist policies against India and lack of digital skills in the workforce as key risks that could hinder growth in the IT sector. However, despite the potential challenges of global macro economic risks, CEOs are cautiously optimistic about the sector and

expect digitization initiatives to continue.³ In response to changing global markets and pressure on the traditional IT outsourcing model, Indian IT & ITeS companies, such as Infosys, Wipro, and Tata Consultancy Services (TCS), have set up more than 1,000 global delivery centers in about 80 countries worldwide.⁴

Much of the industry's export growth will be in digital services—cloud computing and big data analytics, internet of things (IoT), blockchain, automation, artificial intelligence and e-commerce—versus traditional IT network services such as systems integration and software.

In the 2018 fiscal year, India's IT and ITeS-BPM sector totaled \$167 billion, of which exports composed about \$126 billion. Exports of software products and IT, BPM, and software engineering services have had a 12.26% compound annual growth rate between 2009 and 2018.⁵ The US is India's leading buyer of IT-ITeS-BPM services, accounting for 62% of export sales of those services in FY18, according to the India Brand Equity Foundation (IBEF).⁶

Domestically, India's IT and ITeS-BPM sector—including software products, engineering services, and hardware—is expected to become a \$350 billion industry and contribute 10% of India's GDP by 2025⁷—fueled by a projected domestic market of 850 million internet users.⁸ Private equity/venture firm Omidyar Network predicts that rising mobile phone penetration and falling data costs will add 500 million new internet users between 2017 and 2022.⁹ Cisco and International Data

Corporation (IDC) project that this growth, propelled by both service exports and domestic demand, will add more than 1.4 million new IT jobs to India's economy by 2027, driven primarily by emerging technologies such as IoT, big data, cybersecurity, and digital retooling within organizations. This will place growing pressure on the IT workforce, requiring employee upskilling and new educational programs.¹⁰

Recent analysis by LinkedIn, based on users of its platform in India's top ten cities, finds that the top jobs being hired for are in software and IT services (software engineers, systems engineers, and business analysts), manufacturing (design engineers, software engineers, and project engineers) and finance (relationship managers, software engineers, and sales managers), followed by corporate services and education. The top five cities that act as hubs for talent are New Delhi (inclusive of Gurgaon and Noida), Bengaluru, Hyderabad, Mumbai, and Chennai, with half of the professionals who switch cities within India moving to these destinations.¹¹

The Modi government's **Digital India** initiative, rolled out in 2015, will be a key driver of mobile, cloud, and big data analytics as it promotes ubiquitous high-speed broadband and Wi-Fi build-out across India; low-cost phones, digital literacy, and job training programs; and the **Aadhaar** biometric identity card that connects citizens to healthcare and other government services. Bay Area tech CEOs, including Apple's Tim Cook, Google's Sundar Pichai,¹² Mark Zuckerberg of Facebook, and Elon Musk of Tesla,¹³ have committed to support to the effort, while former Cisco chairman John Chambers has stated that India is positioning itself to take advantage of the opportunities afforded by ever-increasing global digitalization in a way that few other countries are.¹⁴

McKinsey & Company estimates core digital sectors such as IT and business process management, digital communication services, and electronics manufacturing could double their contribution to GDP, rising to \$355–435 billion by 2025, while newly digitizing sectors (such as agriculture, education, energy, financial services, healthcare, logistics, and retail) and digital applications in government services and labor markets could each create \$10–150 billion in incremental economic value—causing productivity to surge.

With 560 million internet subscribers in 2018 (second only to China), India is already one of the largest and fastest growing markets for digital consumers. Indians download more apps—12.3 billion in 2018—than any country except China and spend more time on social media—an average of 17 hours a week—than social media users in China or the United States. The share of Indians with at least one digital financial account has more than doubled since 2011 to 80%, thanks in part to the government's mass financial inclusion program. The enrollment of 1.2 billion people in the Aadhaar program, the single largest digital identity program in the world, in particular has enabled the spread of other digital services, with almost 870 million linked bank accounts as of February 2018.¹⁵

Even with this, the market has considerable room to grow. While many people have digital bank accounts, 90 percent of all retail transactions are still done using cash and only 5 percent of trade is done online. McKinsey estimates that by 2023, India will have a connected market of up to 700 million smartphones and about 800 million internet users, which could propel the growth of e-commerce with the potential economic value of \$25–35 billion in the country's retail sector in 2025. The benefits of these digital opportunities are accruing to small companies as well as large ones: McKinsey's 2017 survey of more than 600 Indian businesses found that 94% of small companies were accepting digital payments, compared with only 79 percent of large firms.¹⁶

Bharti Airtel reports that data usage per customer on its network rose 125% over a single year to 9.2 GB in 2018 and up 900% over two years, as smartphones have become the primary screen for customers. Counterpoint Technology Market Research has forecasted that monthly data consumption per user could reach 11 GB by the end of 2019, propelled in part by growth in Tier II and Tier III cities where mobile penetration is surging.¹⁷

Mobile commerce in India, and digital services in general may be on the threshold of revolutionary change for another reason. Mukesh Ambani, India's richest man and the head of Reliance Industries, invested \$35 billion of the company's money to roll out India's first all-4G network, **Jio**. Its offering includes free calls and a data price that is a quarter of the industry average. This has upended India's

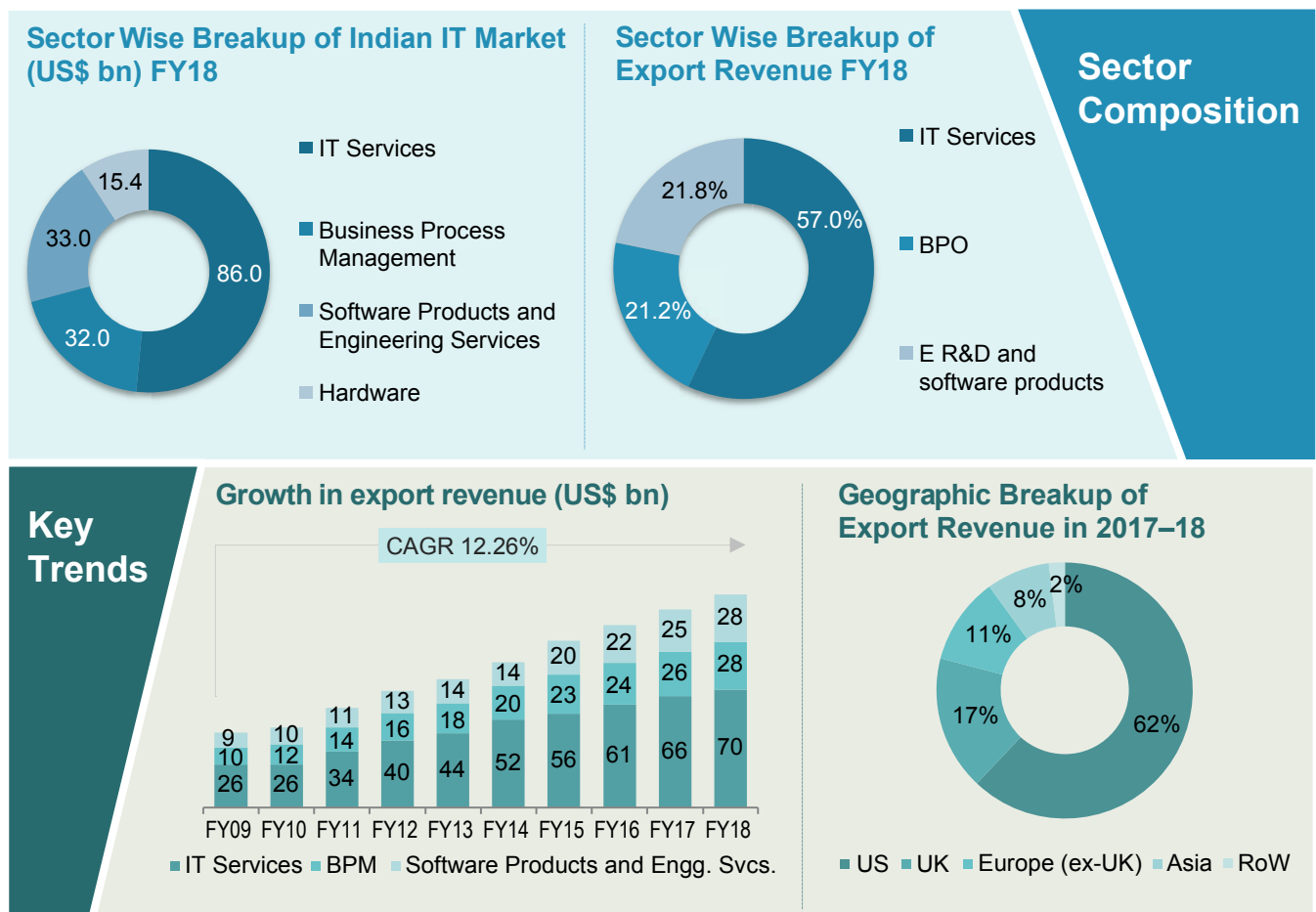
telecom sector by making very cheap internet available to all segments of the population. Access to extremely low-cost data, combined with India's growing mobile and smartphone deployment, has the potential not only to accelerate the government's digitization strategy, but also to impact digital service providers such as Google and Facebook, and revolutionize sectors such as retail. After its rollout, Jio transmitted more data in its first year than any carrier worldwide, leading India to surpass the US in the number of apps downloaded from Google's Play Store. In response, Jio's competitors have sharply cut prices, from more than \$3 a gigabyte before Jio's

launch to roughly 60 cents today. Monthly per user data traffic in India has grown 570% in the two years since the service was introduced.¹⁸

Tech consultancy Gartner predicts that the public cloud services market in India will grow by more than 35% to \$1.3 billion in 2020, with a proliferation and expansion of data centers and hosting services driven by rural internet penetration and e-commerce growth. Business to business (B2B) e-commerce is expected to reach \$700 billion, while business to consumer (B2C) e-commerce is forecast to reach \$102 billion.¹⁹

EXHIBIT 22

The US is India's leading buyer of IT and ITeS-BPM services, accounting for 62% of export sales of those services in FY18.



Source: India Brand Equity Foundation

Growth in activity is mirrored by growth in investment. IBEF reports that India's computer software and hardware sector attracted cumulative foreign direct investment (FDI) inflows worth \$35.82 billion between April 2000 and December 2018.²⁰ According to EY India, the country's e-commerce and consumer internet companies raised over \$7 billion in private equity and venture capital funding in 212 deals during 2018. EY India partner Vivek Soni remarked in March 2019 that "The last four years have witnessed a spectacular increase in PE/VC investments in India, and e-commerce has been one of the leading sectors in attracting these investments."²¹

Government Initiatives

The Indian government views the development of digital services as being essential to improving quality of life and spreading prosperity across the country, especially throughout rural areas that until now had not seen the same direct jobs and service benefits from the IT revolution as larger cities. While mobile connectivity in India has been revolutionized, especially by Jio, broadband remains a challenge. As of 2018, the latest figures from the Telecom Regulatory Authority of India (TRAI) indicated that there were 22.2 million broadband subscriptions in the country, compared to roughly 250 households. Closing that gap is part of India's drive to achieve a \$1 trillion digital economy and is one of the many issues being addressed by the National Digital Communications Policy–2018. The government has announced that it aims to attract investment of \$100 billion for the initiative, which has six overarching goals:

- providing broadband for all;
- creating four million jobs;
- increasing from 6% to 8% the share that the digital communications sector contributes to GDP;
- taking India into the top 50 places in the ICT Development Index of the United Nations International Telecommunication Union (ITU);
- ensuring digital sovereignty; and
- enhancing India's contribution to the global digital economy.²²

While many of the projects required to achieve these goals will create opportunities for overseas partners,

the digital sovereignty goal is causing major concern, particularly for Bay Area companies that are global and rely heavily on data. First, The Reserve Bank of India (RBI) issued a directive in April 2018 to require global payment firms to store and process all customer data exclusively in India. Visa, together with payment firms Mastercard and American Express, have opposed the "only in India" move, fearing it will raise costs and divert planned investments by requiring them to open local data centers.²³ They also believe that it will inhibit their capacity to transfer and analyze data for global fraud detection if back-up copies can't exist elsewhere, and will inhibit startups (that need to access cross-border cloud platforms as they expand globally) and innovation more broadly. Another concern companies have expressed is the exposure of data to inappropriate use by government officials. Google, Facebook, Oracle, Salesforce, PayPal, Microsoft, and Amazon would also be affected.

As proposed under the umbrella concept of digital sovereignty, India's data localization rule is among the world's most restrictive. Following the Indian Supreme Court's August 2017 landmark ruling that privacy is a fundamental right, the government has issued a proposed bill (the Personal Data Protection Bill, 2018) that, if adopted in its present form, would impose significant restrictions and safeguards on the use of data, with a number of features that many global companies find onerous. Current proposals would require explicit consent for the use of certain kinds of data, with the data fiduciary being legally liable for any harm that might be caused.²⁴ The regulations could negatively impact India's future as a global data analytics hub. As expressed by Microsoft India's managing director Anant Maheshwari, if there is concern that "every state official can do anything with that data, you ask yourself why would somebody send their data to India."²⁵ Besides payments firms, many Indian IT firms such as Cognizant, Wipro, and Genpact, as well as organizations such as USISPF (U.S. India Strategic Partnership Forum) and India's NASSCOM (National Association of Software and Services Companies) have also voiced their concerns regarding the Personal Data Protection (PDP) Bill. On the occasion of his appointment as telecommunications minister at the beginning of June 2019, Minister Ravi Shankar Prasad announced his intention to get the PDP bill to the Parliament as quickly as possible.²⁶

The digital sovereignty and data localization debate has a multilateral context as well, as India has opposed proposals by the EU to create new and higher standards for the global governance of e-commerce. The US, EU, and China are among 76 WTO members that launched negotiations in January 2019 to set future e-commerce rules and obligations. The EU proposal included addressing barriers that prevent cross-border sales; addressing forced data localization, while ensuring the protection of personal data; prohibiting government requirements for mandatory source code disclosure; and banning customs duties on electronic transmissions.²⁷

Another concern for Bay Area and other US tech companies is a potential shift by India's government toward a model that favors Indian technology companies over foreign ones. In a January 2019 closed door meeting, the Secretary of India's Telecommunications Department reportedly told assembled startups that the government will introduce a "national champion" policy to encourage the rise of Indian companies. This development, which at some level parallels China's drive to create national corporate champions, comes as US tech and online companies have enjoyed growing success in India's online markets and has taken on a protectionist tone. Mukesh Ambani, India's richest man and the founder of Reliance Jio, is an advocate of the national champions point of view.²⁸

Trends

Indian IT firms Infosys, Wipro, Tata Consultancy Services, Cognizant, and Tech Mahindra have faced headwinds in recent years, on several fronts. In the export segment, they were slow to adapt to a shift in customer demand beyond traditional IT toward more advanced digital services. Recent US congressional and White House proposals to restrict H-1B visas by redefining "visa-dependent" companies, mandate higher minimum wages paid to visa holders, and tighten enforcement have added to uncertainty and, in some respects, threaten the cross-border business model.

Foreign venture capital and angel investors see India under the Modi government as the new, friendlier alternative to China and are on the hunt for startup investment opportunities. Risk-averse legacy Indian tech companies that previously resisted growth through

M&A have struggled to compete for talent in tight markets at home and in the US. As a path forward, they are now embracing small acquisitions and equity stakes and partnerships involving digital startups with specific competencies. In foreign markets, including the US, they are opening innovation hubs to hire and train locally, while using targeted acquisitions and partnerships to broaden service offerings.

"The fact is that there is a huge shortage of tech talent in the US," Wipro chief strategy officer Rishad Premji told NASSCOM's annual leadership forum in 2018, and while 70% of H-1B visas go to Indian nationals, only 20% go to Indian tech companies. The task for industry, he said, will be "changing the narrative, focusing on the value that the IT companies bring to US companies and companies globally." At home, HCL Technologies former CEO Vineet Nayar told Forbes India that IT firms need to adapt quickly rather than incrementally if they are to stay relevant. "Legacy is a drag on our future," Nayar said. "Because the country is old, the legacy in the social sector is a drag, and because our IT industry is now old, the legacy is a drag."²⁹

The Bay Area-IT Connection Shifts

As Indian IT firms up their game and adapt to a changing market, Bay Area tech giants and entrepreneurs are looking west toward a nascent, increasingly mobile internet market ripe for disruptive change.

From the standpoint of overseas companies, China is a growing factor in how they look at India. Over time, many tech companies that had invested heavily in Chinese joint ventures, R&D centers, university partnerships, and contract manufacturing were not seeing the longer-term results they had expected. The Chinese government's 12th Five-Year Plan called for China to nurture national champions, accelerate the replacement of foreign technologies with domestic ones, and lead or dominate key technology sectors both at home and abroad. Potentially intrusive cyber security policies that provide for government access to source code, and other policies requiring foreign investors to transfer technology or take on local joint venture partners, have increased concerns regarding

the protection of key IP. For some foreign companies and industries, particularly in the internet sector, China's market is completely closed.

In that context, India—a democracy with a young, skilled, often English-speaking workforce and a modernizing, pro-business government—has looked increasingly attractive. Additionally, the Modi government's "Digital India" initiatives to introduce leapfrogging technologies—mobile devices, telemedicine, electronic banking and payments, internet access to government services—offer large-scale opportunities only recently emerging in the US.

The resulting convergence of interests is bringing Bay Area and Indian IT companies and entrepreneurs together in new ways that promise significant advances in technology, business processes, and economic development. Through their Bay Area presence, Indian IT companies are investing, engaging startups and other partners in the development of cutting edge technologies that will shape the future of the industry, and testing new business models as they reconfigure their global service and workforce base. At an inflexion point as the US and global economies shift and immigration debates intensify, some Indian IT companies are looking to the future presented by the Internet of Things (IoT) and other digital transformations where a changing environment in the US may lead to a shift away from traditional offshoring to new service models that center more expertise and jobs in the US.

In August 2014, **Infosys** established a second headquarters for the Bengaluru firm in Palo Alto,³⁰ along with an innovation hub design studio to explore potential applications for IoT, AI, machine learning, virtual and augmented reality, and robotics. The focus was on diversifying the company's offerings and capabilities quickly, through acquisitions and cultivation of creative talent. Silicon Valley is seen as a key node for Infosys in the US. Company executives describe the region as a place to think about the art of the possible—including the next generation workforce—and as a place where Infosys has a unique combination of facilities and partners. The Palo Alto studio remains a proof-of-concept lab where staff, clients, and partners can collaborate on solutions in AI, virtual and augmented reality, robotics, and IoT.³¹ It is also a place

to showcase innovations developed in-house or by partners, foster cross-border activity between Silicon Valley and India, and provide an "aspiration lab" hosting hackathons and other programs for community college and high school students.

Education and workforce development is a growing part of the Infosys US strategy, according to company vice president and head of government affairs Anurag Varma. In 2017, the firm committed to hiring and training 10,000 workers locally in the US through innovation centers in Indiana, North Carolina, Connecticut, Arizona, Rhode Island, and Texas.³² The centers are state-of-the-art facilities modeled on the Palo Alto center (launched in 2014) that are focused on developing workplaces featuring agility, collaboration, and co-design. Such "workplaces of the future" are built starting with the company's 8–12 week training program for all of its hires, from lateral recruits to fresh grads from four-year universities and, for the first time, even partnerships with community colleges for new employees with two-year degrees who can have a prosperous future with the company. Infosys has begun its outreach to Bay Area community colleges to recruit talent, drive internship programs, and supplement curricula based upon the company's own existing base of 1,100 IT courses.

Varma notes that the plan for the innovation centers was a pragmatic business decision that predated the 2016 US elections and wasn't driven by the immigration policy debate. "That wasn't the genesis," he says. "As technology is changing, so is the workforce. If you have a Fortune 500 client that's being disrupted, you can't ask them to give you 8 to 12 months to come up with the right people and move them through the H-1B process. They'll tell you no, they need an agile workforce close by." Infosys also realized that costs were comparable for hiring and training someone locally with less seniority—including second-career candidates with experience, such as veterans—versus paying visa fees, compliance costs, and higher salaries to overseas workers who may still need specialized training. Training locally for its workforce of the future could prove to be a better investment than bringing in workers on H-1B visas.

So far, this strategy of investing to create a network of centers for digital transformation in the US—a change

from the historical Infosys business model—is working. The company has met its goal, announced in May of 2017, of hiring 10,000 American IT workers within two years. While using H-1Bs still has cost advantages according to Infosys, a first-year hire in the US can be as productive as a similar new hire from India with up to four years of experience.³³

Wipro opened its Innovation Centre in Mountain View in August 2017, labeling it a showcase for the “Art of The Possible.” Its principal focus is on demonstrating new enterprise applications in AI, virtual reality, hyperspectral imaging, machine vision, and collaborative robotics and automation. Entrepreneurs and small and mid-sized tech firms are invited to showcase and integrate their innovations with Wipro’s ecosystem. The Centre also provides facilities for startups to collaborate on specific projects with Wipro clients through its “Digital Pod” — one of 14 worldwide—and its “Rapid Proto Lab.”³⁴

Wipro has invested in Bay Area technology startups through its Wipro Ventures \$100 million corporate venture arm, which has focused so far on early- to mid-stage startups. Bay Area investments include artificial intelligence startup Vicarious, cloud-based business network Tradeshift, and AI team solutions provider Moogsoft, all in San Francisco; app testing platform HeadSpin and cybersecurity firm CyCognito, both in Palo Alto; big data storage and management company Imanis Data (formerly Talena) and software-defined wide area networks company CloudGenix, both in San Jose; AI platform Avaamo in Los Altos; and automated cyber threat incident management solutions firm Demisto in Cupertino.³⁵ In 2017, the company acquired Cooper, a San Francisco-based digital design and business strategy consultancy, for \$8.5 million and absorbed it into Designit, the design arm of its Wipro Digital business unit.³⁶

Tata Consultancy Services (TCS) has chosen an approach of providing facilities and tools for ad hoc teams of global tech partners and clients to collaborate on specialized solutions. In 2012, TCS opened its Silicon Valley Customer Collaboration Center in Santa Clara, a workspace designed to bring innovative talent together with customers. The center serves as the world headquarters for TCS Mobility Solutions—which advances big data, analytics, and mobile technology

product and service offerings across company verticals such as banking, retail, and travel—and TCS Next Gen Solutions—which develops specific software engineering and design solutions for customers.³⁷ In 2016, TCS opened its Digital Reimagination Studio in Santa Clara, which enables teams to maximize the benefits of digital technologies via rapid product prototyping.³⁸

Tech Mahindra has been in the Bay Area for over 20 years and is today a prominent player in technology consulting and digital transformation, working with companies like Google, Cisco, Adobe, Facebook, Uber, Genentech among others.

The company’s presence was initially focused on telecom, but its acquisition of Satyam, a leading Indian IT company, in 2009 brought with it a larger Silicon Valley operation that has since grown significantly—with the number of key customers in the Bay Area doubling.

Over the time, TechM has also moved up the value chain from traditional cost arbitrage model to one of value arbitrage with digital transformation taking center stage. Today it is a one-stop solution provider for engineering, IT networks, and BPO services, with a state-of-the-art lab in Fremont which showcases end-to-end solutions for customers. It currently employs over 1,000 associates in the Bay Area (and another 7,000 worldwide) working for Bay Area customers.

Its growth in the region reflects a recognition at the company’s headquarters that Tech Mahindra needed to grow beyond outsourcing to move up the value chain: the advent of AI and cloud computing would inevitably cannibalize its business and the company could face severe headwinds if it didn’t embrace change. It follows the “run, change, grow” strategy where Tech Mahindra runs their customers’ IT systems and operations; engages them around disruptive change and digital transformation; and helps them go to market through jointly bundled services. Working with startups is part of the equation, helping Tech Mahindra reimagine the company’s position in a changing market.

Tech Mahindra Senior Vice President and SBU head for Technology Business Harshul Asnani says, “It is a very interesting time living and working in the Silicon Valley. We are fortunate in the Bay Area to get a front-row view of the new technologies that are emerging

and their impact on societies. We also believe we're at an inflection point, with many technologies converging to form the foundation of the modern economic infrastructure and creating unique opportunities."³⁹

Asnani further adds, "Silicon Valley is central to Tech Mahindra's growth strategy. As part of the TechMNxt initiative, we have taken a forward position in key fields like AI, blockchain, 5G, and IoT and have undertaken a massive initiative internally to reskill our 120,000 associates." Asnani also believes that one of the best ways to tap into Silicon Valley is through partnerships with startups: "Startups have great technology but don't have market access. We can take them to our customers and build a business together." The company has identified 30 startups in the US, UK, India, and Israel as partners or as recipients of funding. In Silicon Valley, TechM has funded and/or partnered with nine startups, including AI Ops company Fixstream (where it has a major stake) and other startups like Avaamo, H2O.ai, and Spanugo, to enhance its suite of offerings.

While most of its Bay Area activity is concentrated in Tech Mahindra, the Mahindra Group's presence in Silicon Valley also includes Fremont-based Mahindra Genze, which has conceptualized and designed an electric bike/scooter in Silicon Valley.

The movement of IT companies between the Bay Area and India goes in both directions. Many Bay Area companies have a significant presence in India, particularly around IT.

Google is deeply engaged in India, where Google Search and the Android smartphone operating system both enjoy 90% market shares, where Gmail has its largest user base, and where YouTube is watched online and offline by 80% of internet users (some 225 million viewers) each month.⁴⁰ India saw 36.9 billion app downloads from the Google Play Store between January 2012 and August 2018, the highest rate among all countries in the world including the US (which had 35.1 billion downloads).⁴¹ Its mobile payment app Tez, (see Chapter 10 on fintech), launched in September 2017, had 10 million downloads, and captured a 60% share of mobile payments in its first month. Google also provides Wi-Fi stations and coverage in partnership with Indian Railways.⁴²

X, the "Moonshot Factory" of Google's parent company **Alphabet**, is developing a Free Space Optical Communications (FSOC) network for Andhra Pradesh—a state of 53 million—layering onto the existing Wi-Fi network a system of laser-beaming transmitters atop roofs, utility poles, and other structures, to help bring internet access to 12 million households and 13,000 business, government, and institutional locations that the state government has pledged to connect as part of its AP Fibre Grid program. For Alphabet, the effort is part of Google's Next Billion Users (NBU) initiative to enable more first-time internet users.⁴³

In another NBU project, Google sent out four-person teams to shadow cross-sections of locals in Mumbai, Hyderabad, Delhi, Ahmedabad and Bengaluru at home and work, as they walk, take transit, run errands, see friends, and get information to solve routine problems like finding a nearby ATM or an all-night pharmacy. The end product is Neighbourly, an ad-driven hyperlocal discovery and community app, launched on May 31, 2018 in English, Hindi, Marathi, and six other Indian languages.⁴⁴ Mumbai, a metro area of 20 million, was the test market, with progressively more cities added, including Delhi, Bengaluru,⁴⁵ Ahmedabad, Coimbatore, Mysore, Vizag, and Kota.⁴⁶

One asset for Google is India's diversity, which requires planning and flexibility to address different price points, devices, product needs, languages, and services across a broad market. "When we build better products for India, we eventually build better products for everyone," NBU vice-president Caesar Sengupta told a Google for India event in December 2017.⁴⁷

According to strategic marketing consultancy Kepios, **Facebook** had 300 million Indian users in January 2019, making India the world leader in terms of Facebook audience size, outpacing the 210 million US Facebook user base by 42.9%.⁴⁸ With an intensified focus on India after it was banned in China in 2009,⁴⁹ reaching the market and bringing more new users online in India are high priorities for Facebook. The social media platform has doubled its audience base in India since 2015, and its expansion is expected to continue.⁵⁰

In 2016, Facebook unveiled its Express Wi-Fi service in India, which allows internet service providers (ISPs)

and entrepreneurs to create Wi-Fi hotspots in their areas and resell internet access to local customers.⁵¹ An initial ad-driven service, Free Basics, allowed access to 36 bookmarked websites in a free package for mobile providers to offer customers without data plans, but that was blocked by the Telecom Regulatory Authority of India (TRAI).⁵² For the launch of the Express Wi-Fi service, Facebook partnered with Bharti Airtel and other resellers to deploy hotspots in rural areas, and the new service offering full internet access for a price⁵³ was well-received.

With the surge in South Asian users have come problems similar to those faced in America. Misinformation and hate speech spread on Facebook and the company's WhatsApp instant messaging service have been blamed for numerous acts of violence, and the company has been hard pressed to find solutions.⁵⁴ In mid 2018, Facebook introduced third-party fact-checking in India with a pilot program in Karnataka to fight the spread of false news⁵⁵ and also deployed new features on WhatsApp, such as warnings about suspicious links. In the spring of 2019, the company removed hundreds of pages and accounts from its platforms that it believed were spreading misleading information ahead of India's May election.⁵⁶

Oracle was among the first multinational software companies to set up a base in India, establishing its presence there in 1987, followed by the opening of Oracle India as a wholly-owned subsidiary in 1993.⁵⁷ India is Oracle's sixth largest revenue-producing country⁵⁸ and its second largest base of operations outside the US,⁵⁹ employing 38,000 workers across the country.⁶⁰ Oracle India Development Center teams are responsible for engineering work across the company's complete portfolio, especially cloud offerings. Among the many projects Oracle has enabled are the autonomous database and cloud warehouse unified ATM management system deployed by India's pioneering Federal Bank; an AI-enabled customer engagement website chatbot successfully prototyped in only two weeks by leading electrical appliances company Bajaj Electricals using Oracle's intelligent bots service;⁶¹ and a high-performance, reliable, and scalable e-ticketing platform developed for Indian Railways by the Center for Railway Information Systems (CRIS).⁶²

Oracle's India workforce of more than 40,000 is second only to its workforce in the US. In 2016, it made a \$400

million investment in a 2.8 million-square-foot India headquarters campus in Bengaluru emphasizing cloud computing; nine incubation centers across the country to provide startups with workspace, tools, and training on the Oracle platform; and expansion of its Oracle Academy program, which partners with more than 1,100 educational institutions in India to advance computer science education and drive knowledge, innovation, skills development, and diversity in technology fields.⁶³

Over time, the company has steadily widened its focus in the Indian market to enable the digital transformation of business in previously untapped segments, especially some 51 million small and mid-sized businesses (SMBs), many of whom haven't worked with Oracle or used cloud computing before. In mid-2017, Oracle opened its first "Digital Hub" in Bengaluru to provide SMBs with a complete suite of cloud applications, platform, and infrastructure services as both stand-alone services and as bundles.⁶⁴ In January 2019, the company publicized plans to set up its first India data center for the cloud in Mumbai.⁶⁵

Energy has become another key sector for Oracle; it has won projects in seven states to provide enterprise resource planning and other solutions for utilities and is working on supplying blockchain solutions for oil and gas companies. It sees a \$350 million overall addressable market for ICT across the utilities sector for all Government of India projects.⁶⁶

Salesforce, which entered the India market in 2005,⁶⁷ has more than 1,000 employees⁶⁸ across its four India locations in Bengaluru, Gurgaon, Mumbai, and Hyderabad. The Hyderabad office, Salesforce's largest global office outside of its San Francisco headquarters, was opened in 2011 following the cloud computing and CRM company's \$31 million acquisition of cloud-based online conferencing firm Dimdim, a Boston-based company with a Hyderabad presence.⁶⁹ In early 2017, taking advantage of Hyderabad's global connectedness and deep technology talent, Salesforce opened a center of excellence in Hyderabad to provide customer services such as application support, incident management, escalation management, operations functions, and back-end services.⁷⁰ Clients within India include Janalakshmi Financial Services, HCL, United Breweries, Urban Ladder, Godrej, KFC, DTDC, Edelweiss Wealth Management and InMobi.⁷¹ The company has a strategic

partnership with Pleasanton-based **SpringML**—an Indian-American machine learning and advanced data analytics company operating in Hyderabad—that enhances both companies’ abilities to help customers benefit from advances in machine learning and AI in the energy, healthcare, technology, and media sectors.⁷²

While the Americas continue to be Salesforce’s largest market, India is one of the company’s fastest growing regions, with revenues doubling year-on-year.⁷³ The Salesforce ecosystem is expected to generate up to 1.1 million direct and indirect jobs and \$17.2 billion in aggregate business activity in India by 2022, according to statements by Salesforce India senior area vice president and country leader Sunil Jose in a May 2018 interview.⁷⁴ To help prepare students in India with in-demand job skills for the workforce of the future, Salesforce is working with industry and academia using its Trailhead gamified online learning experience platform and has partnered with ICT Academy, a Government of India initiative, to deliver skills training for more than 200 institutes, reaching more than 100,000 students per year.⁷⁵

The company sees major opportunities in financial services, mobile technology, and retail as the economy becomes increasingly cashless and data-driven. Like Oracle, Salesforce is focused on reaching the SMB market and has launched its Essentials dual suite of easy-to-use intelligent apps for small business teams: Sales Cloud Essentials aims to enable small sales teams to get up and running faster and work smarter, while Service Cloud Essentials is designed to help small service teams set up instant help desks and provide faster, more personalized customer service. Both offerings are intended to provide SMBs with more cost-effective ways to quickly meet immediate needs and still be able to easily scale up to more advanced capabilities in the future.⁷⁶

Zendesk, a San Francisco-based CRM software-as-a-service provider originally founded in Copenhagen in 2007, empowers organizations to improve their customer engagement;⁷⁷ among its US clients are Dropbox, Shopify, Groupon, Vimeo, and Lyft.⁷⁸ While Zendesk has a strong track record catering to the needs of startups and small enterprises, it focuses also on mid-market and larger businesses, as well as employee service,⁷⁹ and it sees potential for serving companies in the financial sector. Company vice president for Asia Pacific

sales Sandie Overtveld told India’s Financial Express in August 2018 that Indian banks and insurance firms are embracing digitization, bringing them in more direct contact with consumers under the Digital India initiative. Insurers in particular, who now rely on networks of sales advisors and agents for nearly all of their business, stand to benefit from disintermediation and direct relationships with at least 25% of their customers.⁸⁰

Zendesk opened a Bengaluru office in 2016 to more closely serve and communicate with an existing Indian client base of about 2,000 businesses,⁸¹ among them taxi-hailing service Ola, matchmaking app Shaadi.com, online classified advertising firm OLX, and online prescription ordering service PharmEasy.⁸² India currently represents 2% of the firm’s business.⁸³ Zendesk sees significant opportunity, given India’s younger, mobile-connected demographic, rising living standards and a rapidly growing e-commerce market expected to reach \$120 billion by 2020.⁸⁴

Apple has so far struggled to gain a footing in India’s market, as 95% of smartphones sold there cost less than \$500, and the company has been unable to open retail stores due to government requirements for local manufacturing. More than half of all iPhones sold in India are older models;⁸⁵ a contract manufacturer, Wistron, has been assembling entry-level iPhone SE and 6S models that Apple sells locally at price points it deemed more realistic for the India market.⁸⁶ However, in April 2019 Apple announced it had begun producing the iPhone 7 at Wistron’s facility in Bengaluru. Shortly thereafter, reports emerged of plans by Apple to produce its high-end iPhone X in India through contract manufacturer Foxconn at a plant in Chennai.⁸⁷

The shift being considered to newer model local manufacturing by Foxconn is in part a response to Apple’s dependence on China for manufacturing and for sales, which is seen as vulnerable to US-China trade frictions. Production in India could help lower the iPhone’s price relative to the less expensive Chinese and Korean phones that currently dominate the market, while addressing the government’s manufacturing goals and working around India’s tariffs on luxury imports. While India’s market is growing, to achieve this Apple would need to address current weaknesses in India’s production systems, including the need for more

workers skilled in precision manufacturing, and the lack of a smartphone supply chain comparable to China's.

Cisco Systems has operated in India since 1995. In addition to its seven sales offices in Delhi, Mumbai, Bengaluru, Chennai, Pune, Kolkata and Hyderabad, the Cisco Global Development Center in Bengaluru—at times referred to as Cisco's "second global headquarters"—is the company's largest campus outside of the US, consolidating R&D, IT services, and customer support functions.

Cisco has filed more than 1,000 patents from India, with 600 issued for innovations across a wide range of technologies. The company has joint development centers with Wipro and Infosys in Bengaluru, with HCL Technologies in Chennai, and with Zensar Technologies in Pune. Its products and services are marketed through more than 2,500 partners and distributors throughout India. Key Cisco customers include Tata Group, Mahindra & Mahindra, Larsen & Toubro, Gas Authority of India, and Hindustan Lever; telecom providers Reliance Industries, Bharti, Vodafone, BSNL, and IDEA Cellular; banking and financial services firms HDFC Bank, State Bank of India, UTI, IDBI Bank, ICICI, and Yes Bank; and the state governments of Rajasthan, Gujarat, West Bengal, and Andhra Pradesh.⁸⁸

Cisco is also a partner with Mukesh Ambani's **Reliance Industries** in the build-out of **Reliance Jio's**, 4G-only virtualized network launched in 2016.⁸⁹ Jio provides India's most extensive 4G coverage with 98.8% 4G availability according to a test by internet analysis website Speedtest in the second half of 2018.⁹⁰ Ambani's and Jio's vision to introduce Indians to smartphone capability and the internet by offering very-low-cost bundles starting with free voice and introductory cheap data has been wildly successful. Cisco and Jio created the extensive 4G network in only three years, and it had acquired 280 million subscribers by the beginning of 2019.⁹¹

Palo Alto-based data center virtualization provider **VMware**, with offices in Bengaluru, Pune, and Chennai, has been in India since 2005⁹² and employs an India workforce of more than 5,000.⁹³ Known for its core strengths in virtualization—the creation of a virtual version of an operating system, server, or storage device, which lowers costs for data centers—VMware is focusing on networking cross-cloud services and

the utilization of AI and machine learning in a hybrid cloud operating model.⁹⁴ "India is involved in almost everything the company does," VMware CEO Pat Gelsinger told the Times of India in 2016, noting that the India operation—in particular the 438,000 square-foot, \$120 million Bengaluru campus⁹⁵—is central to the company's management, storage, networking, and distributed firewalls endeavors, and about half of the engineering for its AirWatch mobile management business is done there.⁹⁶

In agriculture, VMware virtualization technology enables the Chitale Dairy company's centralized server to monitor the health, breeding potential, and output of 200,000 cows for farmers statewide, using radio frequency identification (RFID) sensors as part of a "Cows in the Cloud" program that improves the quality of milk products, thereby boosting the local economies.⁹⁷ VMware virtualization helps Mumbai-based online ticket-selling platform BookMyShow manage demand surges,⁹⁸ and the company's software solutions are also being used by Bharti Airtel and State Bank of India.⁹⁹

Prior to its 2015 split into two companies, computer and peripherals maker **HP Inc.** and enterprise network and cloud solutions developer **Hewlett Packard Enterprises (HPE)**, Hewlett-Packard had been in the India market selling peripherals—mainly printers—and partnering with Hindustan Computers, Ltd., now HCL Technologies, on enterprise computing and networking solutions for the India market.¹⁰⁰ With its 2002 acquisition of PC maker Compaq,¹⁰¹ the company had taken over Compaq's India PC manufacturing, software development, and IT services operations. By 2017, two years after the split, HP Inc. had grown its overall India market share from 25% to 31% and its premium PC segment from 3% to 40%. It also held on to a 46% printer market share and grew its ink-tank printers and gaming PC segments from zero to 20% or more.¹⁰² Since then, HP has been in a race with Dell and Lenovo for the top traditional PC market share in India, but has continued to lead with its 31% market share at the end of 2018.¹⁰³

HP experienced robust 2018 growth in its Asia-Pacific and Japan region, in which India is a key focus area, where the company sees providing mass digital education as an engine for future growth. The company has launched an affordable mini desktop computer geared towards students and enabling schools to

upgrade their STEM labs at minimal cost, Another HP initiative, “HP World on Wheels (WoW)” uses solar-powered, internet-enabled, digital inclusion and learning labs self-contained in buses to bring digital literacy to rural students, and especially rural women. The bus facilities are also used by rural dwellers for Aadhaar and accessing related government services. HP has also collaborated with Microsoft to create “Smart Learning Hubs” at 600 HP World stores across India that are engaging existing customers and customers-to-be with edutainment.¹⁰⁴

San Francisco-based **Uber**, which describes itself as a technology company, entered the India market in 2013.¹⁰⁵ As of April 2019, it operates in 40 cities across India¹⁰⁶ and is investing heavily to expand its market share, after retreats in China and Southeast Asia.

Uber is structured differently in India, more closely resembling a conventional taxi service. Its drivers tend to work full-time rather than driving to supplement other income. Privately-owned vehicles require a special transport vehicle permit, and drivers pay 20% of their earnings to Uber as a technology and service fee. Uber and Ola both partner with banks and car companies that finance vehicles for drivers who don’t have their own cars. Some drivers work for transport contractors that operate the equivalent of taxi fleets, paying drivers a flat fee.

Uber signed up with Paytm in 2015 in order to comply with the Reserve Bank of India’s two-step authentication requirement for online transactions, but later introduced a cash option that boosted ridership. The company added security features to its app—a panic button and GPS tracking—in response to reports of sexual assaults by drivers. Regulators also capped surge pricing in Delhi and Bengaluru.¹⁰⁷

India currently accounts for more than 10% of Uber’s global ride volume and the company has a more than 35% share of India’s taxi market, according to Counterpoint Research.¹⁰⁸ The company’s Asian business has struggled in the face of local competition. Having exited the China market due to competition from home-grown ride sharing company DiDi,¹⁰⁹ in March 2018 Uber sold off its Southeast Asia business

to a Singapore competitor, ride-hailing and food delivery service Grab for a 27.5% stake, in part to refocus on strengthening its competitive position in India. Its main competitor in India, Ola, operates in nearly 125 Indian cities¹¹⁰ compared to Uber’s 40. But Uber is digging in its heels, investing heavily in the market, and is reportedly not prepared to see India go the way of China and Singapore.¹¹¹

Airbnb is also expanding in India with an April 2019 investment, reported to be between \$100–200 million, in Indian hotel booking and managed home property startup Oyo Hotels & Homes. Oyo manages more than 6,000 homes globally and has 18,000 franchised or leased hotels, making it the sixth largest hotel operator in the world by the number of properties. The companies are exploring the listing of 10,000 Oyo properties on Airbnb’s website.¹¹²

Netflix is competing with the India mobile-first streaming company Hotstar, which dominates the market, YouTube, which is India’s second-largest video content platform, and Amazon. Netflix is producing large volumes of Indian-language dramas. Growth in streaming services is being enabled by expanding internet access and plummeting mobile data prices. Netflix in India costs about \$7 a month, but now offers smartphone-only plans that cost less than \$1 for a week of access.¹¹³ Asked in 2108 where new Netflix subscribers will come from in the future, CEO Reed Hastings answered, “Given the consumer base, the next 100 million for us is coming from India.”¹¹⁴

SPOTLIGHT

Aadhaar and Internet Privacy

As it moves forward with modernization, India has come face-to-face with a difficult choice common with the internet: How much individual privacy is worth sacrificing for digital convenience and a perceived public good?

More than 1 billion Aadhaar universal ID cards have been issued as of November 2018,¹ covering 98% of India's adult population, according to the Unique Identification Authority of India (UIDAI). What was established in 2009 as a verifiable identifier to enable citizens to easily receive government assistance payments and prevent fraud has evolved since 2016 into a massive, database of detailed personal, demographic, and biometric data.²

Aadhaar assigns a unique 12-digit number to each person, and in addition to basic personal information includes fingerprints, iris scans, and facial scans. Intended to mitigate corrupt practices and ensure transparency in India's welfare system, Aadhaar IDs quickly became entrenched in daily life, being used by both government and businesses for systems ranging from pensions to scholarships, insurance payouts, and bank accounts. The ID system also quickly ran into controversies over privacy issues, the government's authority to mandate enrollment and data collection, and the lack of safeguards against government

surveillance, with legal challenges going to India's Supreme Court. In September 2018, the court's five-judge bench struck down the section of the Aadhaar Act that allowed corporate entities or even individuals to demand an Aadhaar number for enabling the exchange of goods or services, but the number must still be used for government transactions such as filing income tax returns.

While Aadhaar enrollment is now technically voluntary, possessing the ID still remains a practical necessity and problems with the system have persisted. There have been multiple instances of Aadhaar data leaking online through government websites or its mobile app, mix-ups in which money was transferred to the wrong account, and fingerprint recognition failures which can be life or death issues for poor people needing to receive food benefits.³

In another Modi initiative in mid 2018, the government issued a tender for a new media command center that would collect and analyze 24/7 digital media chatter; map people creating buzz across various topics; rate conversational threads as positive, neutral, or negative; and store the information in a searchable database. The proposal was quickly dropped after three of India's Supreme Court justices remarked that the plan was akin to "creating a surveillance state."⁴

SPOTLIGHT

Digital India: Ubiquitous Data

India's Union Minister for Law & Justice, Telecommunications, Communications, and Electronics & IT Ravi Shankar Prasad makes a persuasive case that India's rapid embrace of mobile devices, digital payments, online access to services, and the Aadhaar national biometric ID card is modernizing India and equalizing economic opportunity, health, and education in record time. At an August 2018 meeting in San Francisco co-sponsored by the Bay Area Council, Minister Prasad encouraged Bay Area firms to forge deeper partnerships with India and invest in an "improved climate."

The numbers are impressive: 1.3 billion Indians, using 468 million smartphones and 701 million non-smartphone mobile phones;¹ 185,000 miles of optical fibre cable laid by the BharatNet project as of November 2018;² 268 mobile phone and ancillary manufacturing units (making India the world's second largest mobile phone producer, up from just two mobile factories in 2014);³ 350 million Jan Dhan zero-balance bank accounts opened for the previously unbanked, rural poor;⁴ more than 20 billion digital payment transactions from April 2017 through March 2018;⁵ about 30 million online authentications every day;⁶ and basic health insurance for 500 million Indians under the Ayushman Bharat scheme launched in October 2018.⁷

"Inclusion is the most important theme when it comes to Digital India," Minister Prasad told business leaders. "We view it in terms of the digital haves and have

nots." It is also important, he added, to acknowledge the challenges posed by technology, most notably in two policy areas of concern to Silicon Valley: the spread of disinformation and extreme speech on social media, and data privacy and security.

In response to a challenge to both private companies' data mining practices and government-mandated collection of citizens' health and financial data under the Aadhaar scheme, the Supreme Court ruled in August 2017 that Indians have a fundamental right to privacy.⁸ The Court followed up in September 2018 with a ruling that Aadhaar is constitutionally valid and stressed the importance of closing the privacy loopholes that have raised concerns about the system.⁹

"When the Constitution came into effect in 1950 it guaranteed every Indian a vote," the Minister said. "Such is democracy and it is an empowering thing. But democracy also leads to chaos. We need to have a fine balance among data availability, data utility, data innovation, data anonymity, and data privacy." He noted that the Court does place limits on privacy in two areas: "There is no privacy to shield corruption or terrorism and privacy cannot be used to kill innovation or stifle R&D."

On data protection, he echoed the Court's position that private companies have a fiduciary responsibility to protect critical personal data, and that sensitive data—or, at minimum, a copy of that data—should reside in India.¹⁰

SPOTLIGHT

GE's Digital Vote of Confidence for India

General Electric Co. CEO Jeffrey Immelt saw important synergies for his firm and India in 2014 with the election of Prime Minister Narendra Modi. Indian manufacturing had languished at only 17% of GDP,¹ suffering from small, outmoded factories and machine shops, notoriously poor infrastructure and logistics, and bureaucratic delays and labor rules.

GE, meanwhile, had embarked on a global journey to build an industrial internet-of-things (IIoT) that connects, integrates, and monitors equipment, processes, and inventory from the edge to the cloud. Its Predix distributed application and services platform, launched in 2013 and released for use by outside companies in 2015, connects data from physical assets to analytics and industrial applications, providing companies with an infrastructure they can use to build their own customized applications within their manufacturing and IT operations.² For example, applications built on the Predix platform have been used in additive manufacturing to monitor the 3D printing of aircraft parts, keeping track of machine utilization and spotting potential problems before they occur.³

The Modi government's Make in India initiative—along with policy changes such as demonetization and a simplified goods and services tax (GST) to bring businesses into the formal economy and encourage them to scale up—provided a helpful catalyst for modernization.

At the intersection of these converging interests is San Ramon-based **GE Digital**, formed in 2015 by merging GE's Software Center, global IT and software teams, and industrial infrastructure security firm Wurldtech,⁴ acquired in 2014. GE Digital's charter was to bring AI, machine learning, and predictive analytics to the factory floor. Among its India investments are

- a 68-acre "brilliant advanced manufacturing" plant, opened in Pune in 2014, which is a first-of-its-kind multi-modal factory set up to manufacture components for different verticals—such as aviation, transportation, healthcare, and energy—using equipment digitally connected in an IIoT, and linked via the cloud to supplier, distribution, and service networks;⁵
- a GE Digital Hub global innovation center launched in Bengaluru in 2016, which is a 200,000-square-foot center for the co-creating of industrial software and analytics solutions with customers and GE experts and opened with a staff of 1,500 engineers and programmers specializing in data sciences, analytics, and product development to deliver IIoT solutions centered on Predix;⁶ and
- GE technology centers with 4,300 employees across locations in Hyderabad, Chennai, Noida, Mumbai, and Bengaluru, which is home to a \$220 million 50-acre campus that is the company's largest integrated multidisciplinary R&D center outside the US.⁷

SPOTLIGHT

Women and Technology: Connecting to a Better Life

No single subset of Indian society has more to gain from the introduction of digital technology, products, and services than women, who comprise slightly less than half of the country's population.

Women currently account for only 25% of India's workforce and 18% of its GDP. McKinsey has estimated that India could add as much as \$770 billion to annual GDP by 2025 with full gender equality, an 18% gain over maintaining the status quo.¹ The female labor force participation rate has been steadily declining, primarily among urban, middle-class women with intermediate education, as living standards and wages rise for their husbands, jobs matching their skills are in short supply, and combined household wages aren't sufficient to pay for full-time help caring for the home and children.

Barriers extend from employment to entrepreneurship. The 2018 Mastercard Index of Women Entrepreneurs (MIWE), which focuses on female entrepreneurs' ability to capitalize on opportunities provided in their communities, ranked India #52 out of 57 countries studied. By contrast, the United States ranked #4 and China #29.² The reasons can be traced to cultural barriers, significant underlying issues in women's participation in the workforce, and access to post-secondary education and financial resources or services.

Research in 2017 by digital talent recruiting portal Belong revealed that nearly half of women with college and post-graduate STEM degrees working in the tech sector leave work after 5–8 years, as they reach a glass ceiling or seek out a better work-life balance. Women make up 34% of India's overall tech workforce, 26% of engineers and 7% of senior management.³

Most Indian women, however, have fewer options: of the estimated 120 million women in the workforce, 97% work in the informal sector because they have to, often in low-paying areas like agriculture, piece-work manufacturing, domestic work, or recycling.⁴

Cultural impediments are a factor, especially in rural India. While the official average literacy rate across India is 74% based on 2011 Census data, that average breaks down into an 82% rate for men versus a 65% rate for women, with female literacy rates as low as 53% in poorer and more rural states.⁵ Local customs and traditions keep many women at home, discouraging work, school, socializing beyond the immediate neighborhood or accessing the internet in community spaces. Rural villages administered by unofficial "khap panchayats", village councils which adjudicate disputes and guide moral behavior, have banned or severely restricted mobile phone use by girls and women outside the home.

Not surprisingly, India has a pronounced gap in technology use among men versus women. Men, as heads of the households, often control household budgets, including purchase and use of mobile phones. A 2018 study by information and communications technology think tank LIRNEasia, in cooperation with the Department of Telecommunications and the Cellular Operators Association of India (COAI), revealed that 80% of Indian men but only 43% of women use mobile phones.⁶ According to a report of October 2017 data from the Internet and Mobile Association of India and marketing firm Kantar IMRB, internet usage is skewed towards men as well, with 59% male versus 41% female internet users in urban areas and 64% male compared to 36% female internet users in rural areas.⁷

Reversing these trends will require a shift in cultural perceptions, accompanied by more attractive work options in the formal sector, improved access to education and skills training, and corporate commitment to hiring, retaining, and providing career paths for women. As India's largest private sector employer, the technology industry has a particularly important role to play, not only in large tech centers like Bengaluru, Mumbai, and Hyderabad, but also in Tier II and III cities. In the countryside, digital connectivity is bringing basic skills, microcredit, work

from home on flexible schedules, and entrepreneurial startup opportunities to rural women, thanks in part to the rollout of mobile broadband, the Pradhan Mantri Jan Dhan Yojana (PMJDY) financial inclusion scheme, and other elements of the Digital India initiative.

“Inclusion is the most important theme of Digital India, in terms of addressing the digital haves and have-nots,” National Association of Software and Services Companies (NASSCOM) President Debjani Ghosh told a San Francisco business audience in August 2018. Ghosh, formerly South Asia managing director for Intel and the first woman to head NASSCOM, stressed the Modi government’s sense of urgency in pushing technology and connectivity out to India’s population. A major goal of this broad thrust is greater independence for women. “When Indians interact with technology you see a clear pattern,” Ghosh explained. “They observe, then they adopt, then they enjoy, and finally they are empowered.”⁸

A range of public and private initiatives are helping, in many cases with support from California companies. Some examples follow:

- **India’s Ministry of Women and Child Development** has created an online retail portal, **Mahila E-Haat** (Online Marketplace), for rural women entrepreneurs to showcase and sell their products, from clothing and jewelry to home furnishings, industrial products, and local services.⁹ The Ministry’s **Support to Training and Employment Programme for Women (STEP)** offers poor women over 16 years of age skills training in fields such as agriculture, horticulture, food processing, weaving and embroidery, travel and hospitality, and computer/IT services.¹⁰
- **NASSCOM** launched the **Women Wizards Rule Tech** program in June 2018 to encourage women in senior management career tracks in tech to stay the course.¹¹ “Things have to change,” Ghosh said during NASSCOM’s annual conference in early 2018. “We have to check talented, capable women dropping out.”¹² The program focuses on leadership training and career development, and builds on findings in the **Women and IT Scorecard—India 2018** report produced by NASSCOM and The Open University UK that flexible work, work-from-home, parental leave, healthcare, and anti-harassment policies could increase the number of women at the senior level in IT firms. Nearly half of the companies surveyed for the Scorecard reported doubling their percentages of women in C-suite roles between 2012 and 2017, and 2017 forecasts from HR managers indicated that nearly half of IT firms will have more than 20% women at the C-suite level.¹³
- **Wireless Women for Entrepreneurship and Empowerment (W2E2)** launched in 2014 in five areas across northern and central India, to train women as resources for other women at the village level, focusing on skills, markets, and access to public services in collaboration with a Google-sponsored digital literacy program, **Helping Women Go Online (HWGO)**. W2E2 is an extension of an earlier **Wireless for Communities (W4C)** program created by the **Digital Empowerment Foundation (DEF)** and the **Internet Society (ISOC)**, to provide low-cost, high-quality internet connectivity in remote, unconnected and rural areas of India.¹⁴
- DEF’s **SoochnaPreneur** mobile entrepreneurship program, with funding support from handset chip manufacturer **Qualcomm Inc.**, equips young rural female and male “digital entrepreneurs” with advanced wireless technologies and the **MeraApp** mobile application developed by DEF so that **SoochnaPreneurs** can both deliver much-needed information about government entitlements available to people in their communities and pursue their own new entrepreneurial avenues to earn a livelihood.¹⁵
- The **Internet Saathi** program, rolled out in 2015 by **Google** and the **Tata Trusts** recruits, trains, and funds village women as “saathis”—friends—who are trained in using smart devices and navigating the internet. Upon completion of training, each saathi is given a tablet device, two smartphones for teaching, a power source to keep the devices running during lessons, and a bicycle to commute between villages so that she can pass on that training to other women.¹⁶ According to a May 2019 interview with Google Chief Internet

Saathi Neha Barjatya, 58,000 Internet Saathis have worked across 208,000 villages in 18 Indian states, and the program has benefitted 22 million women.¹⁷

- In urban tech centers, **PayPal India** launched the **Recharge** program in 2016 to help women who have temporarily left their careers return to the workforce. The program focuses on women with tech backgrounds who have taken career breaks of 1–5 years and have at least five years of work experience in product development and analytics. It offers opportunities to network with PayPal and industry leaders, assistance with tools to get back into the workforce, and training to get up to speed with the latest industry technologies. Once the program is completed, selected participants are offered opportunities to work at PayPal’s offices in either Chennai or Bangalore.¹⁸
- **VMware** launched a similar two-year program, **Project Taara**, in December 2018 in partnership with global non-profit Women Who Code. The data storage, network and cloud computing firm plans to offer free training to help 15,000 women in India upskill over the next two years in diverse cloud computing technology areas. Key industry partners such as Bharti Airtel and Cognizant say they will

consider women certified in VMware solutions as relevant IT openings become available.¹⁹

- The Bay Area-based **Wadhvani Foundation**, while not specifically focusing on women, supports a broad range of activities and programs in India focused on creating and supporting entrepreneurs through college courses, student start-up clubs, mentorship, and other services connecting entrepreneurs to the resources they need. It also works with already established small businesses with the potential to scale from the local to the regional and national levels, providing advisory and networking support. The foundation currently works with more than 500 schools and institutions across India and is active in thirty cities, with the goal of expanding to fifty. An additional focus is on teaching critical thinking, and other skills needed for entrepreneurial success, below the high school level, with approximately 6,000 schools currently participating at the 9th–12th grade levels. While the foundation’s programs don’t specifically focus on women, its president Ajay Kela points out that 50% of India’s college entrants are women and receive the same support: “They are entering a world that is very male dominated, with a male hierarchy. We want to diversify and democratize that.”²⁰



Healthcare/Life Sciences: Care in the Cloud

The Modi government plans to double healthcare spending by 2025, to bring care quality up to world-class standards, maintain affordability, and push preventive and wellness care out to underserved rural areas.

Accessible, quality healthcare presents both a major challenge and an opportunity for India. With demand growing strongly, its healthcare sector—including hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism, health insurance, and medical equipment—is expected to more than double in size between 2017 and 2022, from \$160 billion to \$372 billion, according to IBEF. The hospital industry alone, valued at nearly \$62 billion in 2017, is forecast to average 16–17% compound annual growth during that period.¹

India's healthcare delivery system is divided between public and private components. The government operates some 15,000 state hospitals² and a network of rural primary healthcare centers (PHCs); most hospitals in Tier I and II cities are privately run, with treatment priced beyond the reach of average Indians.³ The public sector accounts for 30% of health expenditure in India,

with the remaining 70% paid by consumers—95% of that out-of-pocket expenditures and just 5% paid by insurance. More than half of out-of-pocket spending is on medicines, with another 22% on hospital care, and 10% on diagnostic tests.⁴

The uneven distribution of healthcare services and lack of insurance forces many patients to use private hospitals. Research by experts at the Public Health Foundation of India, published in the *British Medical Journal* in May 2018, shows self-funded healthcare pushed as many as 55 million Indians below the poverty line in 2011–12, with 38 million from spending on medicines alone, driven in part by the rise of chronic lifestyle diseases like cancer, diabetes, and heart disease.⁵ Extrapolated World Health Organization/World Bank estimates in 2017 show 4–4.5% of the population, or more than 50 million citizens, impoverished by healthcare costs.⁶ More than a dozen states provide low-cost but inadequate insurance coverage; state hospitals face frequent medicine and supply shortages,⁷ sending patients to more expensive private pharmacies.

In February 2018, the Modi government rolled out the ambitious \$1.7 billion National Health Protection Mission (NHPM) to provide catastrophic hospitalization insurance for 100 million poor and “vulnerable” lower-middle class families—some 500 million Indians—and open 150,000 rural health and wellness centers focused on preventive care.⁸ The government has broadly committed to increase overall health-related public spending from 1.15% of Indian GDP today to 2.5% by 2025.⁹

In support of that broad mission, the government think tank NITI Aayog (National Institution for Transforming India) has unveiled plans for an integrated digital healthcare information system, called the National Health Stack (NHS), by 2022. NHS would digitize personal health and service provider records across all providers and make them accessible for secure, cloud-based appointment, diagnostic, prescription, billing, and other services via Aadhaar.¹⁰

Preventive care is a priority. The Intensified Mission Indradhanush (IMI) immunization program aims to vaccinate 90% of pregnant women and children under two years of age, with vaccines for diseases such as tetanus, diphtheria, whooping cough, tuberculosis, polio and measles.¹¹ A National Nutrition Mission (NNM), in partnership with World Bank, will monitor and supervise nationwide nutrition-related interventions to reduce malnutrition, low birth weight, anemia, and stunted growth.¹²

With an expanding middle class, a growing elderly patient population and government plans to provide baseline insurance coverage, it is expected that doctor visits, hospitalizations, affordable access to medicines, and preventive care will all increase. New markets are also opening up in areas like the \$3 billion home healthcare segment, which is expected to double to \$6 billion by 2020.¹³

The concept of digital health is critical to pushing services out to currently underserved populations that are often uninformed as healthcare consumers and likely to forego medical visits due to cost concerns. In some communities, distances to the nearest clinic and the cost or logistics of arranging transportation can be as daunting as the expected cost of care. An integral part of the plan for rural clinics is affiliation with larger hospital and physician networks and extensive use of telemedicine support for checkups, consultations, and diagnostic services.¹⁴

By western standards, India benefits from both a large pool of well-trained medical professionals and relatively low healthcare costs. Compared to US prices, cost savings for medical treatment can start from 65% and go up to 90%, with patients receiving quality care.¹⁵ An aging population, high treatment costs, long surgery

wait times, and renewed uncertainty around insurance coverage has increasingly driven US patients to explore overseas options. India's Minister of Tourism has reported that the number of medical tourists in 2017 was as high as 495,000,¹⁶ and the Ministry of Commerce forecasts that the medical tourism segment will grow to \$9 billion by 2020.¹⁷

India is widely viewed as a preferred destination for cancer treatment, cardiovascular, spine and orthopedic surgery, organ and bone marrow transplants, and in vitro fertilization (IVF), as well as for wellness, preventive, and alternative medicine.¹⁸ Advanced care is available through 34 hospitals accredited by Joint Commission International (JCI), a US-based standards certification group focused on healthcare quality and patient safety.¹⁹ Patients from Africa and the Middle East travel to India for premium private care unavailable at home. European and US tourists come mainly for elective procedures not covered by insurance, although US healthcare policy changes weakening coverage have driven more patients abroad for more serious surgery.

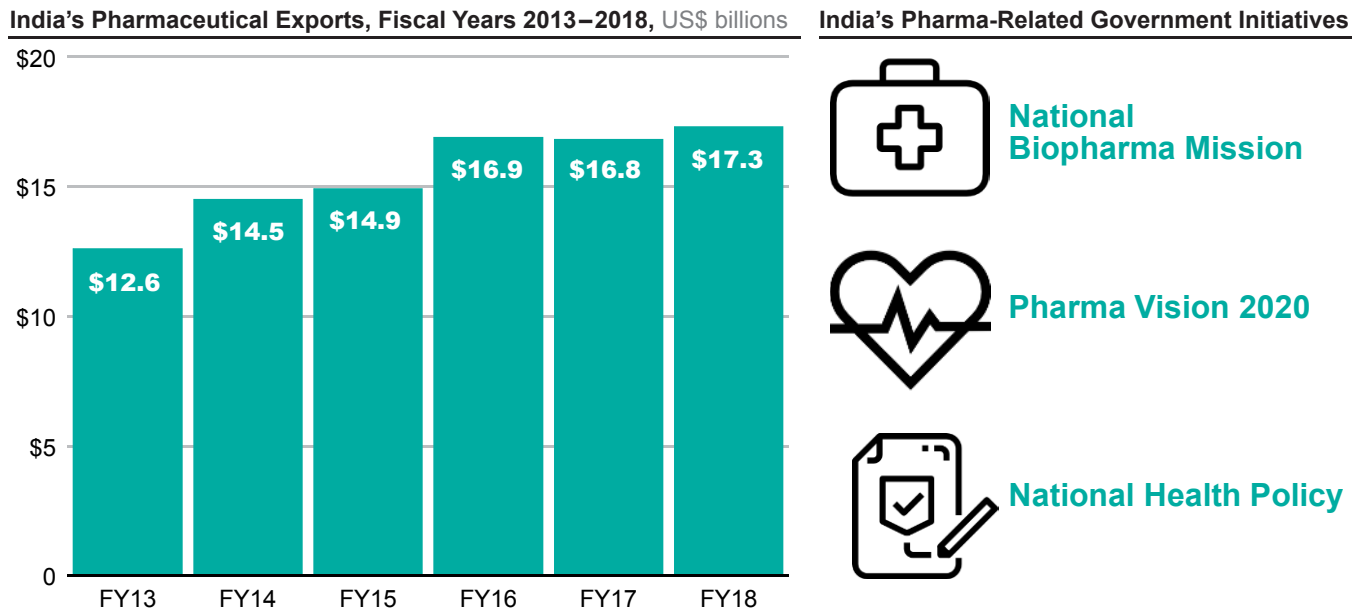
Pharmaceuticals

Generic drug development, production, and sales account for 71%²⁰ of India's \$35 billion pharmaceutical sector.²¹ India boasts the world's second largest pharmaceutical and biotech workforce,²² and the sector posted 10% year-on-year growth in February 2019.²³ Growth is expected to accelerate with an expanding middle class, improving medical infrastructure, and the increased penetration of health insurance.

India is the world's largest exporter of generic drugs, to some 200 countries, with \$17 billion in export sales in 2017–18 and a 20% share of the global market.²⁴ India ranks number three as a market for active pharmaceutical ingredients (APIs), number two in abbreviated new drug applications (ANDAs) filed with the US Food and Drug Administration to manufacture generics for the US market, and number one in drug master files (DMF) applications for FDA-certified facilities, processes, and ingredients.²⁵ Significantly, Indian compounding labs supply 40% of generic drugs in the US market, where \$55 billion in branded drugs will come off patent over 2017–2019.²⁶

EXHIBIT 23

India is the world's largest exporter of generic drugs, to some 200 countries, with \$17 billion in export sales in 2017–18 and a 20% share of the global market.



Source: India Brand Equity Foundation

Trends

India's pharmaceutical sector hit a low point in 2015, when market growth and foreign investment collided with a conflicted, inefficient regulatory framework. Indian drug makers and research labs were scaling up to meet rising domestic demand and compete globally. Meanwhile, foreign multinationals were jumping into the market with their own drugs going off-patent, and also using India as a platform for clinical trials and low-cost development of new treatments tailored to emerging markets.

This flood of activity strained research laboratory, manufacturing, and distribution capacity. It also overwhelmed regulators charged with enforcing quality standards, approving new drugs and patents, and licensing new lab facilities. India had 572 US Food and Drug Administration (USFDA)-certified laboratory and manufacturing facilities in 2017,²⁷ but that is out of some 7,000 small and large pharma manufacturing units nationwide, of which about 80% do not follow the baseline global standard of the World Health Organization's good manufacturing practices.²⁸

Industry and regulators labor under three goals that frequently come into conflict: 1) ensure product quality and safety; 2) attract investment in treatment innovation to move up the value chain; and 3) tightly control costs and prices to keep out-of-pocket healthcare payments affordable. India's regulatory framework makes balancing these goals extremely challenging for drug and device manufacturers and for investors.

Contract research and compounding labs operate on thin margins and compete on price under tight deadlines, increasing the risk of compromised clinical trial data and uneven quality in the manufacturing process. Lab and manufacturing facilities are state-regulated, by 36 state entities with varying levels of resources and training. That has slowed license approvals and weakened enforcement. A cumbersome drug and patent approval process delays innovative new drugs and treatments in getting to market; until it introduced product patents in 2005, India had resisted issuing pharmaceutical patents that it felt priced many essential treatments out of reach in an emerging market.²⁹ Drugs and devices deemed by the government

to be “essential” to baseline care are subject to price controls.³⁰ All of these constraints affect the interplay of quality, safety, price, innovation, and add investment risk.

In response to quality concerns, there were 272 drug facility inspections in 2015, and 50% of the US FDA’s warning letters were issued to India.³¹ Of the 42 warning letters issued by the FDA’s Office of Manufacturing Quality in 2016, nine (21%) went to Indian facilities.³² In 2017, there were 192 inspections, while 29% of the FDA’s warning letters went to India.³³ The state of Uttar Pradesh reported in 2015 that, of 4,723 samples of drugs seized in raids over a eight-month period, 506 were fake and only 2,902 met quality standards for effectiveness.³⁴ A 2017 WHO report analyzing the results of tests performed between 2007 and 2016 on 48,218 medicine samples collected from 88 countries, including India, found that 10.5% of the drugs were fake or substandard in meeting the needs for which they were intended.³⁵

The Organization of Pharmaceutical Producers of India (OPPI), a trade group, has called for the national government, industry, and regulators to adopt and enforce WHO Good Manufacturing Practices and quality standards from sourcing to pharmacy shelf.³⁶ And for manufacturers, there was good news in 2017 when domestic pharma companies received more than 300 generic drug approvals from the US FDA, up 43% from 211 in 2016.³⁷

Government Initiatives

The Modi government is taking steps to address industry concerns, in furtherance of its Invest India and Make in India initiatives.

- The Central Drugs Standard Control Organization (CDSCO) is building a national digital database consolidating licensing and company data, to track supply chains of manufacturers and branded drugs, from raw materials to final product.³⁸
- A 2017 Ministry of Health notice requires state FDAs and CDSCO to conduct bioequivalence studies—confirming that generic and branded drug active pharmaceutical ingredients (APIs) are equivalent in composition—and has proposed requiring

bioavailability studies showing that branded and generic APIs are absorbed into the system and take effect similarly.³⁹

- New CDSCO rules announced in 2018 are aimed at reducing approval times for clinical trials applications to 30–60 days.⁴⁰
- The Drug Controller General of India (DCGI) has proposed a “single-window facility” for startups and new drug innovators to apply for drug approvals and access central, state and local government services and information in one place.⁴¹

The Bay Area and India

The San Francisco Bay Area is home to a life sciences industry cluster that is second only to the Boston-Cambridge area, according to CBRE’s 2019 US Life Sciences Clusters report.⁴² According to the California Life Sciences Association, Bay Area life sciences jobs totaled 82,500 in 2018, up 15.7% from the previous year, largely due to the region’s strong “nexus of tech and biopharma.”⁴³

India presents significant opportunities for Bay Area healthcare and life sciences companies. Some are market-specific. For example, Bay Area molecular diagnostics company Cepheid plans to manufacture its Xpert MTB/RIF tuberculosis test cartridges in India. India accounts for one-quarter of global TB cases, and local production is expected to provide better access for patients, reduce inventory costs, and improve shelf life. In the last two years, over 1,200 of Cepheid’s GeneXpert systems have been installed at sites managed by the government’s Revised National Tuberculosis Control Program (RNTCP).⁴⁴ Patients’ access to advanced cancer care will also be increased by a partnership between Palo Alto-headquartered Varian and Tata Trusts to install radiation therapy treatment systems across India.⁴⁵

Big data analytics, another Bay Area strength, will be critical to ramping up an insurance infrastructure, digitizing patient records, and developing personalized care through the National Health Stack and other means. Hospital and clinic networks will need to redesign facilities, develop new patient transportation options, and

integrate their supply chains for medicines, equipment and basic supplies. Extending care to Tier II and III cities and to rural areas in less affluent states will require new forms of physical and digital infrastructure; low-cost diagnostic, monitoring, telemedicine, and wellness solutions will have huge potential to achieve scale quickly.

In this space, **Verily**, the life sciences arm of Google, is working with India's Aravind Eye Hospital to automate and speed the process for diagnosing diabetic retinopathy, a widespread in India, which can cause blindness if untreated. India currently lacks the doctors needed to screen the nearly 70 million diabetics who are susceptible to the disease, with only 11 eye doctors for every million people. Verily's system will use AI-based detection to increase testing speed and expand screening.⁴⁶

Innovations in providing digital and low-cost service in India, following India's model of "lean innovation", have potential carry-over to the US and California markets, where digitization has been slow and rising costs have reached critical levels. One example is New Delhi-based startup **HealthCubed**. The company has developed a medical-grade device that provides more than 40 measures and tests, including blood pressure, electrocardiography, blood oxygenation, heart-rate variability, blood sugar, blood hemoglobin, and urine protein and is able to diagnose diseases such as HIV AIDS, syphilis, dengue fever, and malaria. These tests are the same as those provided in hospitals, but at minimal cost, and with the data immediately uploadable to the cloud for evaluation by remote physicians.⁴⁷ Having such results immediately can enormously benefit India's rural health clinics, but the market is potentially global. Silicon Valley's **Latam Capital**, which focuses on Latin America, has invested,⁴⁸ along with Mexico's largest pharma company Grupo PiSA, which plans to take its services into Latin America. By the end of 2019, it is estimated that HealthCubed will have performed more than 100 million diagnostics, yielding a vast array of data that can be analyzed using artificial intelligence. The company plans to bring its technology to the US after consolidating its worldwide base. Potential benefits include access to a broad regimen of medical tests at home, within minutes, and at costs of under one dollar.

Slow Progress in Life Sciences Investment

Government is sending the right signals in promoting digitization, funding R&D and facility quality upgrades, working with states to enforce stricter standards, streamlining advanced drug approvals, and easing price controls. But across life sciences, progress remains slow and traditional venture and private equity capital are impatient. Expectations a decade ago that more discovery research would be taking place in India have not panned out. This has been for a number of reasons: discovery research is still heavily concentrated in the US and Europe, India is still more a domestic and regional market (with a range of price controls), and Indian companies are typically oriented toward copying a drug that's off-patent. As a result, investors, entrepreneurs, and established companies are taking a conservative, wait and see approach to India, says life sciences investor Dr. Anula Jayasuriya. "In life sciences, the focus is still on traditional hospital care, specialty services, generics, and proven 'me-too' devices, and on supplying the regional market. On new products, there are only a handful of companies developing new molecules, or even biologics and biosimilars."⁴⁹

Despite hopes for rapid growth in the Indian life sciences sector in 2005, Jayasuriya says, democratic India has been viewed as a chaotic, uncertain market relative to China, where the government can send clearer market signals by directing research funding and fast-tracking science park facilities. While conditions have improved, confidence needs to be rekindled.

Jayasuriya was a co-founder and managing director of the **Evolvement India Life Science Fund (EILSF I)**, established in 2007, a private equity fund which provided growth capital to eight companies in healthcare delivery, devices, and generics in India, among them Hyderabad API manufacturer Neuland Labs and Gland Pharma, a maker of small volume parenteral (SVP) solutions for delivering medication. EILSF I exited its investments in 2014 and launched a second fund, EILSF II, whose healthcare investments include Oasis Centre for Reproductive Medicine, an in vitro fertilization clinic chain, and stent/catheter maker Relisys Medical Devices.

Life sciences investment today is largely focused on private equity stakes in established public companies or co-investment in acquisitions of scalable companies that address significant unmet needs. Exits are problematic, requiring patient capital to scale companies for acquisition. Several VCs have shed their India portfolios; others remain:

- **Sequoia Capital's** India healthcare portfolio contains a diverse range of firms, among them Akumentis Healthcare, a branded women's health generics manufacturer; Cloud Nine, a maternity and neonatal clinic operator; rural hospital network Glocal; cancer drug developer Mitra Biotech; eye care and dental clinic chain Vasan Healthcare; and contract drug discovery and development firm Sai Life Sciences.⁵⁰
- Healthcare investments by **Accel Partners** include hemostatic device maker Axio Biosolutions; dental practice management SaaS developer CareStack; eye care screening technology firm Forus Health; online medical tourism search portal Medigo; in-home healthcare provider Portea; and next-generation oncology and immunology diagnostics drug delivery device platform Sayre.⁵¹
- **WestBridge Capital's** healthcare and life sciences investments include diagnostic laboratory chain Dr. Lal PathLabs.⁵²

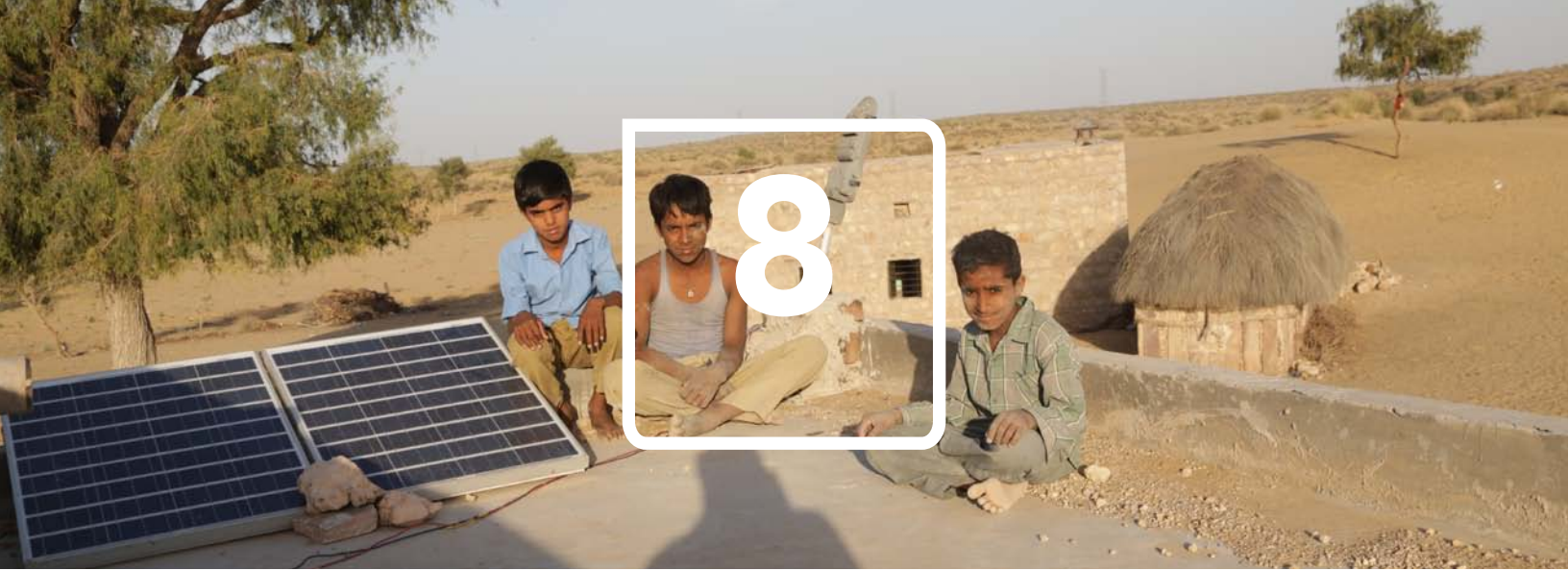
SPOTLIGHT

MedGenome A Case Study in Cross-Border Synergy

MedGenome Inc., headquartered in Foster City, with offices and labs in Bengaluru, Delhi, and Singapore, was founded in 2013 to provide a range of genetic prenatal, pediatric, and oncology diagnostic tests for clinicians and researchers at pharmaceutical and biotech firms as well as academic research centers.

A range of diagnostic tests is offered in India; the Foster City lab facility offers sequencing platforms, bioinformatics, computing, and big data analytics.¹ India offers a diverse population with more than 4,000 distinct groups that have remained largely segregated and homogenous over time, often leaving them more susceptible to hereditary diseases. At the same time, this enables researchers to more readily isolate mutant genes that may cause diseases.² The goal is non-invasive testing for early discovery and treatment of cancer, heart disease, diabetes, or genetic disorders passed down from parents to their children.

MedGenome has raised \$54 million, including a \$30 million Series C round in 2017 led by Sequoia Capital Partners and Sofina SA, with participation by Infosys co-founder Kris Gopalakrishnan and former Cognizant CEO Lakshmi Naranayan.³



Energy/Environment: Cleaner is Better

The vast scale of India's needs and its market potential in the energy and environmental sectors is attracting the notice of Bay Area companies and laboratories, though the scale of the connection is still small when compared to the challenges India faces and the investment they require.

The sheer scale of India's energy and environmental mitigation needs, the pressures of rapid economic growth, and an increasing willingness to embrace new ideas, are quietly turning the country into a laboratory for clean technology. Change can't come quickly enough.

Start with energy. India has the fifth largest power generation capacity in the world and is the world's third largest generator of electricity,¹ behind China and the US, with 350 gigawatts of installed generating capacity in February 2019. Of that, 56.4% is from coal-fired generation; 36.1% is from non-fossil fuel sources including renewables (21.2%), hydro (13%) and nuclear (1.9%).² But those numbers are deceptive: grid inefficiencies—in particular the inability to adequately store and distribute renewable power—result in a split for electricity generated of 75% from coal and a little

over 20% from cleaner, non-fossil fuel sources. India has little of its own oil or natural gas reserves, so those sources account for less than 8% of utility capacity and 4% of power generation, mostly for industrial users.³

Between 2000 and 2015, India's electricity demand had a compound annual growth rate of 6.9%, and that rate is expected to be 5.4–7.4% between 2015 and 2030.⁴ From a per capita perspective, this starts from a relatively low base: while India represents 18% of the world's population it accounts for only 6% of global energy consumption.⁵ To date, demand growth has been concentrated in urban and industrial areas in already prosperous states.

A National Energy Policy draft, published by the government think tank NITI Aayog (National Institution for Transforming India) in 2017, estimated that some 304 million Indians still lack adequate access to electricity; around 500 million rely mainly on coal, wood or biomass for cooking and heating.⁶ The Modi government, under its "Electricity for All" initiative claims to have electrified all of India's 600,000 villages, but "electrified" is defined as connecting public buildings and at least 10% of residences to a grid or independent power source.⁷

A Growing Need for Renewables

Despite vast coal reserves, India has in recent years become a net coal importer. Indian coal, with its high moisture and ash content, burns inefficiently; new reserves are located in remote, forested areas that entail high transportation costs and prohibitive environmental

impacts to extract and get to market—this at a time when natural gas and solar costs have fallen. But the main reason for shortages has to do with a 2014 ruling by India’s Supreme Court cancelling more than 200 coal mining licenses awarded to private companies without a transparent, competitive bid process. Reallocation of those licenses has been slow, leading to increased imports at higher prices.⁸

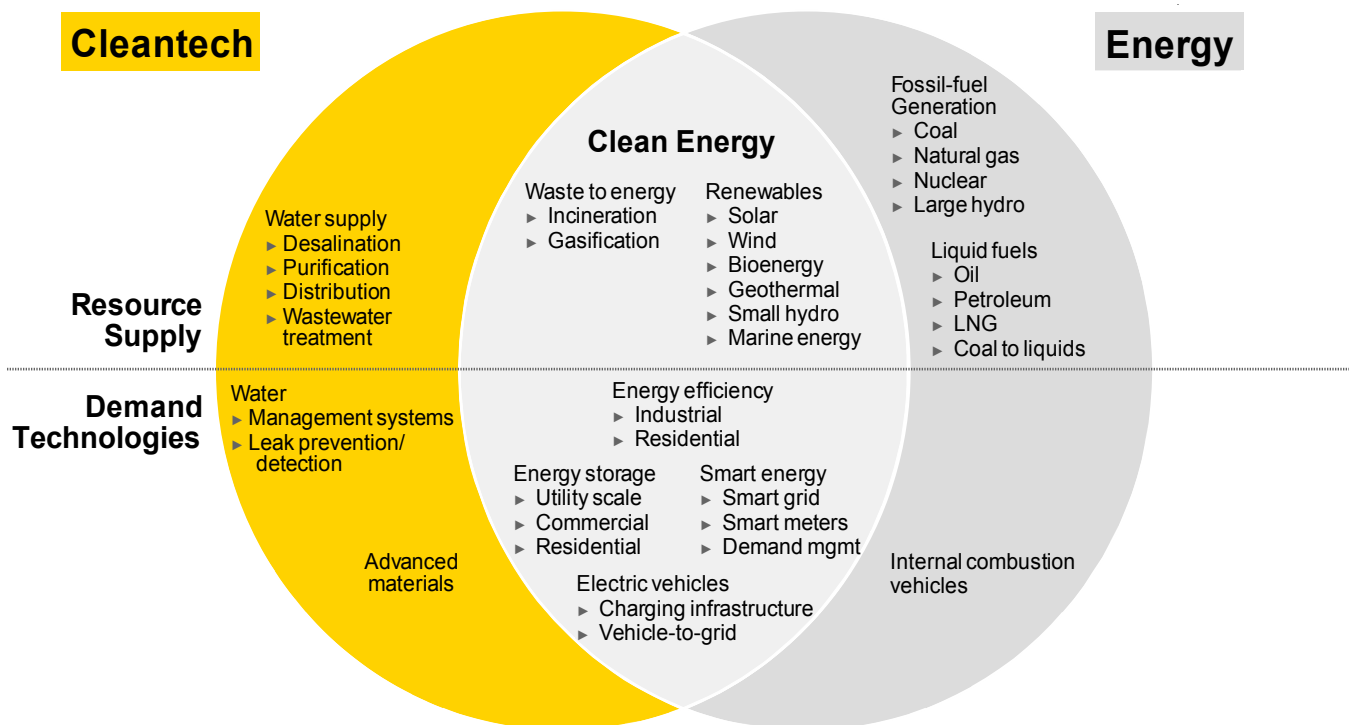
Hydropower has not been able to cover the shortfall; new, larger projects over 25 MW have been stalled by community jurisdictional disputes along rivers where dams are planned, and by protests over safety and environmental concerns. Previous to new recommendations approved by the Cabinet Committee on Economic Affairs in March 2019, large hydro projects had not been eligible for the same power purchase guarantees under medium-term contracts as solar or wind projects, because the government had been unwilling to classify large hydro as “renewable” and

banks were wary of lending to such projects due to price risks from cost overruns and delays. Hydro-rich states have maintained that, without renewable status and easing of price controls on power, new projects are uneconomical. The new hydropower policy now allowing large projects to be declared as renewable will make such projects more bankable, help tap concessional green financing, and result in competitive tariffs.⁹ In 2017, the Ministry of Power had been looking at soft loans and a lifting of price controls to bring down development costs,¹⁰ and the Ministry of New and Renewable Energy has encouraged decentralized “small hydro” projects up to 25MW,¹¹ funded either as wholly private projects or as public-private partnerships. Still, reviving hydro power growth in India after its slowdown in the last decade will not come quickly,¹² and for the long-term, the availability of new hydro resources at scale and the output of existing hydropower projects may be questionable due to effects of climate change such as reduced rainfall and stream flows.¹³

EXHIBIT 24

The Modi government sees energy from renewable sources as the way forward.

The Clean Energy Transformation



Source: EY / Federation of Indian Chambers of Commerce & Industry (FICCI)

With the government under pressure to fulfill its promise of clean, reliable power nationwide by 2022,¹⁴ renewable energy from solar, wind, and biomass has looked increasingly attractive in recent years—especially when taking into account climate change and India’s severe environmental challenges from pollution.

One possible roadblock: India imports more than 90% of its solar cells and modules, mostly from China, Malaysia, Singapore, and Taiwan.¹⁵ In an effort to support domestic manufacturers, the government imposed a safeguard duty on imports of solar modules and cells beginning July 30, 2018 at 25% for a first year and then phased down in a second year to 20% in the first half year and 15% in the second half. Domestic manufacturers operating from special economic zones (SEZs) must also pay the duty on the import of cells to make modules.¹⁶ According to solar consultancy Bridge To India, after the duty was imposed, the amount of solar modules manufactured in India rose from 500 MW to 650–750 MW per quarter.¹⁷

So far, the results of the safeguard strategy have been mixed. With the duty in place, the cost of an imported solar cell is about 12 cents and Indian manufacturers have to compete by selling at that price too, even though their input cost is 13.5 cents per cell. On the other hand, Indian manufacturers using imported cells to make solar modules have a cost of 25–27 cents, which is the same as the price of imported Chinese modules with the duty in place. In addition, because of the length of project lead times, solar project developers can simply wait to buy their component supplies until after the safeguard duty has been phased down.¹⁸ For their part, solar developers have objected to the duty on the grounds that it will raise tariffs and generally discourage new solar projects, making it impossible to meet the government’s target of 100 GW of electricity from solar by 2022.¹⁹ In addition to raising costs, the safeguard duty has led to international trade disputes.

Where Energy and the Environment Intersect

India’s decentralized industrial base of small, inefficient manufacturers and slow rural development have contributed to severe, widespread pollution. A May

2018 BBC analysis of World Health Organization data counted 14 Indian cities among the world’s top 20 cities for air pollution;²⁰ a year later, IQ Air’s multi-data-source AirVisual app showed a 15th Indian city among the top 20 and 22 Indian cities among the top 30 world’s most polluted cities.²¹ Delhi has inordinately high average annual rates of particulate matter at both the 2.5-micron (PM2.5) and 10-micron (PM10) levels,²² which are leading contributors to health problems, from heart disease and strokes to respiratory ailments and lung cancer.²³ Causes of pollution include power plant emissions, vehicle traffic, crop burning, construction dust, and millions of dirty cook stoves and kerosene lamps. Standards vary, but generally considered safe limits have been 60 microns per cubic meter of air for PM2.5 particulates and 100 for PM10;²⁴ levels in Delhi, a metro area of 19 million people, reach 143 and 292 respectively,²⁵ and more during peak periods.

Climate change only amplifies India’s problems: In May 2018 alone, thunderstorms, heavy winds, freak dust storms, and lightning claimed 200 lives.²⁶ All were attributed by meteorologists to a low-pressure system and cyclonic disturbance related to climate change.²⁷ Steadily rising temperatures across India, reaching 116 degrees Fahrenheit (46.8 degrees Celsius) in some places such as New Delhi,²⁸ have contributed to unusual weather events.

Heat waves have taken a toll on India’s agricultural sector, which accounts for 15% of GDP²⁹ but is the primary source of livelihood for 58% of the population.³⁰ Eight in 10 farmers are smallholders with two hectares of land or less, operating on thin margins growing wheat, maize, rice, millets, sugarcane, and oilseeds. Climate change is expected to cost Indian farmers 20–25% of their income over the medium term. Among the short-term solutions proposed are smart irrigation techniques; centralized, large-scale food processing to prevent waste; data-driven supply chain management; and crop insurance reform.³¹

More broadly, the Modi government sees energy from renewable sources as the way forward. Even before becoming Prime Minister, as Governor of Gujarat, Modi had developed programs to deploy new energy technologies. After taking office in 2014, the national focus on renewables shifted to overdrive: Modi

announced the ambitious goal of adding 160 GW of solar and wind energy to the existing 26 GW by 2022, and a study was commissioned to explore how India's entire fleet of vehicles could be made 100% electric by 2030.³² At the international level, India's position shifted from a stance that largely blamed developed countries for climate change, to one that more aggressively embraced the need for national commitments and global agreements to address the challenge.

India's 2015 Intended Nationally Determined Contribution (INDC) under the Paris Agreement on climate change builds on its goal of increasing installed capacity of renewables to 175 GW by 2022 (up from 75 GW in early 2019³³)—including 100 GW from solar, 60 GW from wind, 10 GW from biomass, and 5 GW from small hydro power³⁴—and commits to goals and mitigation strategies that include

- reducing greenhouse gas emissions per unit of GDP (emissions intensity) by 33–35% from 2005 levels by 2030 (following its earlier Copenhagen Accord commitment of a 20–25% reduction by 2020);³⁵
- achieving 40% cumulative electric power installed capacity from non-fossil-fuel-based energy resources by 2030, a goal dependent on the related commitment to reach 63 GW installed capacity from nuclear generation by 2032;³⁶ and
- adopting a smart grid strategy, energy conservation/efficiency programs, and stricter standards for LED lighting, fans, industrial equipment, and buildings.³⁷

India is making progress on many energy and climate change goals, but there are bottlenecks to be overcome. In fiscal year 2017, India added 5.5 GW of wind energy and exceeded its installed wind capacity target, but the 5.5 GW of solar energy it added weren't enough to meet its solar target. The needed growth has been impeded by slow progress on solar rooftop installations, poor transmission infrastructure, and lack of access to finance.³⁸ The renewable energy capacity added in recent years has been very unevenly distributed, with the vast majority concentrated only in southern and western parts of India while the eastern and northeastern parts received only about 10%.³⁹ Meanwhile, India's LED lighting initiatives have been

highly successful, with LED streetlights installed across 23 states and Union Territories and the distribution of 230 million LED bulbs, 800,000 energy-efficient fans, and 2.3 million LED tubelights cumulatively saving 32 billion kilowatt-hours of electricity and cutting carbon emissions by 25 million tonnes a year.⁴⁰

The US Department of Energy pledged a matching grant of \$7.5 million toward smart grid and storage development in 2017. A 3-to-1 match from India's Ministry of Science and Technology has brought total funding to \$30 million under the joint US-India Partnership to Advance Clean Energy (PACE) program. A cross-border team of universities, companies, grid operators, and national laboratories—including Lawrence Berkeley National Laboratory in the Bay Area—are contributing their expertise to US-India Joint Clean Energy Research and Development Center (JCERDC) projects to research and deploy new distributed energy resources such as microgrids and energy storage.⁴¹

A three-year energy action plan, and the follow-on draft National Energy Policy released by NITI Aayog in 2017 reaffirms, refines, and updates the Paris Agreement INDC. Together these two documents aim to

- assure 24/7 electricity for all;
- electrify cooking and vehicles, with mass adoption of electric vehicles by 2030;⁴²
- limit household propane tanks and extend City Gas Distribution lines in 326 cities by 2022;
- reform natural gas procurement and manage fuel price differentials to ensure affordability; and
- encourage decentralized small hydro and solar power in rural areas for farm and residential uses.⁴³

In 2016, members of the Modi government articulated the idea of making India a 100% electric vehicle nation by 2030, but that vision became more modest as the work of formulating specific EV policies got underway.⁴⁴ Nonetheless, the scale of India's planned transition to an electric, shared, and connected transportation infrastructure, outlined in the government's EV Mission 2030 and an earlier 2013 National Electric Mobility

Mission Plan 2020, is bold. The goal of the National Electric Mobility Mission Plan (NEMMP) is to achieve sales of 6–7 million hybrid and electric vehicles year-on-year from 2020 on, saving 60 million barrels of mostly imported crude oil annually.⁴⁵ NITI Aayog has encouraged state governments to achieve carbon footprint targets through electrification of public transport, and state transport corporations have already introduced EVs into their fleets in Tier I cities.⁴⁶ In 2018, Indian government officials cited a goal of at least 15% of vehicles on the road being electric in the next five years, with 30% targeted by 2030.⁴⁷

Achieving this, however, will require massive shifts, as India has to date not been a leader in EV deployment. According to McKinsey, only 2,352 electric vehicles were sold in India in 2017, and fewer than 1,000 charging stations were installed. But the next several years could see a changed landscape, as concerns over air pollution grow and more stringent emission standards take effect in 2020–21. The government's Energy Efficiency Services Limited agency recently ordered 20,000 electric vehicles, and orders for electric busses are growing. McKinsey believes that two- and three-wheeled vehicles, luxury passenger vehicles, and light commercial vehicles are a particularly promising market, estimating that by 2030 battery-electric vehicle penetration in those segments could reach 25–35%.⁴⁸ A plan approved by India's cabinet in February 2019 to allocate \$1.4 billion over three years to subsidize the sale of electric and hybrid vehicles using advanced batteries may accelerate the process.⁴⁹

India's lithium-ion battery market is expected to see 33% compound annual growth between 2017 and 2030,⁵⁰ creating a \$300 billion EV battery market.⁵¹ That represents about two fifths of the global battery demand, and NITI Aayog's vision is that 25–40% of that market can be captured via the "Make in India" initiative. The government think tank also supports a "feebate" incentive system of charges and rebates to support the auto sector's transition to mass production of electric vehicles; inefficient vehicles would incur a surcharge while efficient vehicles and shared mobility solutions would receive a rebate.⁵² In an effort to support the growth of EVs in India, in July 2018 the government reduced the goods and services tax

on lithium-ion batteries, from 28% to 18%, but it is important to note that in February 2018 it raised import duties on the batteries from 10% to 20%.⁵³

While progress is happening across many fronts, and in solar and wind production in particular—India has moved up to become the world's fourth largest wind energy producer⁵⁴—some renewable areas are not advancing as rapidly, pointing to both need and opportunity.

Pervasive Pollution

Bringing a nation of more than 1 billion people—with at least 240 million still currently lacking access to electricity⁵⁵ and 600 million people that have not known indoor plumbing and sanitation⁵⁶—into the modern world is an engineering and cultural challenge in both rural areas and cities.

India produces 62 million tons of solid waste annually, of which about 80% is collected. Less than 30% of that is treated or processed, according to the Ministry of Environment, Forests and Climate Change.⁵⁷ Most goes into landfills and open dump sites or is left on the ground and eventually washed into drains and rivers. Population growth, rapid urbanization, and rising middle-class consumption will increase the volume of solid waste five-fold by 2051, according to a 2016 paper published by researchers at the Delhi-based Jamia Millia Islamia university.⁵⁸

Every day, 2,000 tons of new trash are added to New Delhi's Ghazipur landfill, which is larger than 40 football fields, 213 feet tall, and rising more than 30 feet per year.⁵⁹ Similarly, Bengaluru generates at least 2,500 tons of waste daily.⁶⁰ Frequent landfill fires and release of methane gas exacerbate air pollution and related health hazards. Encroaching development near landfill sites exposes residents to skin and respiratory diseases, as well as dysentery.

Using data from UNICEF and the World Health Organization's Joint Monitoring Programme, a ranking of countries by number of people without access to basic sanitation published by NGO WaterAid in 2017 placed India as the #1 worst, with 56% of the population (more than 732 million) without such access,

even though the work of India's Swachh Bharat (Clean India) initiative has helped to place the country among the top 10 showing most improved basic sanitation access, with 52 million household toilets built between 2014 and 2017.⁶¹

India's sewage systems are meager and antiquated, resulting in the excessive pollution of the country's rivers. The Central Pollution Control Board (CPCB) reported to the National Green Tribunal in 2016 (the most recent year of available data) that 63% of sewage flowing into rivers daily is untreated in urban centers. Although the CPCB directs states to set up sewage treatment plants of adequate capacity, it reported that the 816 sewage treatment plants spread across the country were capable of processing only about 37.5% of the 62 billion liters of sewage generated daily.⁶²

A \$3 billion project to clean the River Ganga (Ganges), a water source for 400 million people, has stalled over land acquisition and an unwieldy bid process for new treatment plants along the 1,570-mile river, and much of the money has gone unspent. The National Mission for a Clean Ganga (NMCG) gathered data in 2017 indicating that some 760 industrial sites and 118 cities and towns dump 4.8 billion liters of sewage into the Ganga daily.⁶³ Reuters reported in January 2019 that existing treatment plants combined with additional plants that the government has cleared for construction will have the capacity to treat only 4.8 billion liters per day, leaving 37.5% of the total still untreated.⁶⁴

Meanwhile, a general shortage of water, its uneven distribution, and the threat posed by climate change to water supplies originating in the Himalayas is raising India's focus on water management, bulk metering, recycling, conservation, and groundwater recharge.

Trash for Cash

Experts agree that a mix of public education, government incentives and regulatory enforcement, household waste segregation, and application of new technologies can mobilize ordinary Indians around a centralized system of reuse, recycling, urban mining, and waste-to-energy schemes that generate jobs and profits. Such a mass mobilization is the focus of the Swachh Bharat initiative, and progress, while slow, has

been steady and has yielded some interesting results:

- Waste management startup Saahas Zero Waste collects and sorts trash from tech parks, office campuses, and housing complexes in Bengaluru and Chennai, sells to various recyclers, and then sells recycled products made from that waste. Launched in 2013, Saahas is moving into to four more cities, is branching out to include construction, food processing, and other waste streams, and has received angel and Series A funding to expand.⁶⁵
- Workers go door-to-door in Mysuru (Mysore), a city of 920,000, collecting separated compostable and non-compostable waste and delivering it for sorting to centers set up by residents or NGOs that cover their costs through the sale of scrap and compost. About a quarter of the 402 tons of waste produced daily in the city is processed by the centers, and about half is treated at a privately-operated fertilizer plant which is subsidized by a central government grant and a waste management levy attached to property taxes. Mysuru charges an annual fee for the waste-to-fertilizer plant and takes 5% of the finished compost as payment.⁶⁶
- Vengurla, a town of 15,000 in the state of Maharashtra adopted waste segregation at the source to process 100% of the 7 tons of waste it generates daily and converted its landfill to a waste management park. The park hosts a biogas plant which generates energy from wet waste, a briquette-making plant that utilizes horticultural waste, a segregation yard which sorts and recycles dry waste, and a crusher unit that shreds plastic for use in road building. The town earns about \$2,000 a month from processing its waste and also encourages reuse as well as recycling.⁶⁷

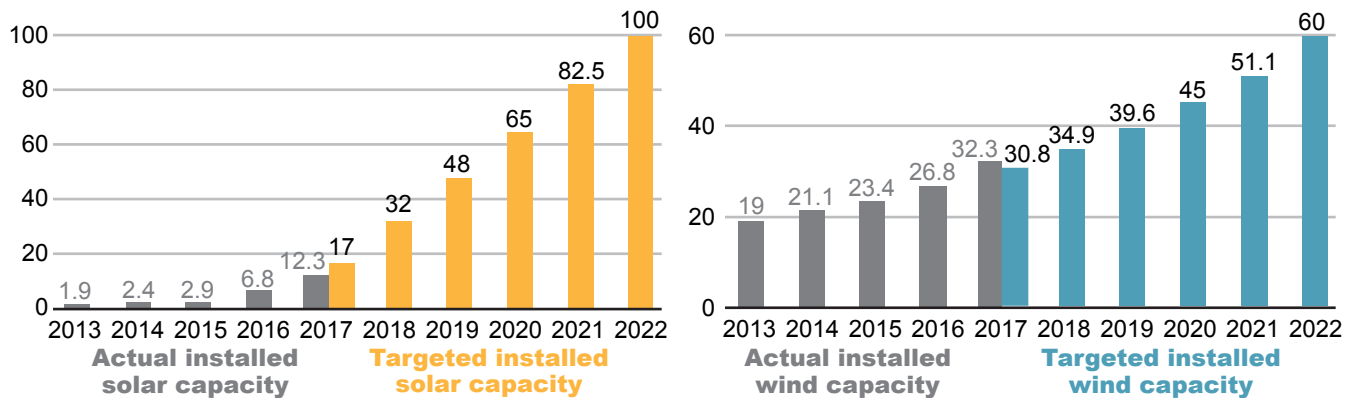
Bay Area Laboratories and Companies Address the Market

The vast scale of India's needs and its market potential in the energy and environmental sectors is attracting the notice of Bay Area companies and laboratories, though the scale of the connection is still small when compared to the challenges India faces and the investment they require.

EXHIBIT 25

India is on track to meet installed wind capacity goals but needs to pick up the pace for solar.

India's Year-on-Year Targets to Reach 100 GW Solar Goal and 60 GW Wind Goal by 2022, GW (Cumulative)



Note: All years are fiscal years: April 1 to March 31

Source: India's Ministry of New and Renewable Energy (MNRE) analyzed by World Resources Institute

"The way renewables have been implemented in California—how we integrate renewables into the grid with smart metering, digital technology for management of dispatch, storage—presents a big opportunity for India," explains **General Electric** South Asia CEO Vishal Wanchoo. GE's Hyderabad Technology Centre (HTC), part of its Energy Engineering Division, deploys a global engineering team of more than 700 in a hub dedicated to "exploration to utilization" of energy, including grid software solutions, electronics, embedded systems, and electromechanical design. GE employs about 6,000 engineers in Bengaluru and Hyderabad, developing energy efficiency and performance improvements in electric locomotives, gas and wind turbines, and grid solutions. The firm has 20 manufacturing facilities across India⁶⁸ and employs an overall workforce of 20,000 of which more than 5,000 are engaged in research and development.⁶⁹

Wanchoo says GE's commitment to India has translated into increased sales with the Modi government's willingness to invest in new infrastructure and its openness to foreign companies under the Make in India initiative. In return, GE has integrated India manufacturing output into its global supply chains, transferring advanced manufacturing technology and upgrading facilities, and has turned over management control of certain product lines to its India teams.

Small firms and investors are also assessing opportunities and placing bets.

Menlo Park VC firm **Bessemer Venture Partners (BVP)** was an early 2009 investor in Applied Solar Technologies (AST), a Delhi-based firm that provides decentralized off-grid solar power to business customers in sectors with networked assets such as telecommunications towers and base stations or bank ATMs that typically run off diesel generators. Successive 2010 and 2011 rounds of \$21 million and \$25 million brought in the World Bank's International Finance Corp. (IFC) and Capricorn Investment Group, a Palo Alto fund manager for the **Skoll Foundation**. A \$40 million fourth funding round came in 2015, led by the Australian government's sovereign wealth fund, Future Fund; BVP, IFC, and Capricorn participated. As of 2015, AST had supplied distributed solar power at 4,000 sites, including remote locations in Bihar, Jharkhand, Uttar Pradesh, and Rajasthan.⁷⁰

Stanford graduates Sam Goldman and Ned Tozun launched **d.light** in 2007 with a \$250,000 prize from a business plan competition. The San Francisco company began with an original design solar-powered lantern and now manufactures and sells low-cost solar lanterns, chargers and microgrid solutions for homes and small businesses in China, South Asia, and Africa. Its India

division is based in Gurgaon (Gurugram). Among d.light's investors over multiple funding rounds are the **Omidyar Network, Nexus Venture Partners, Mahindra Group, DFJ, and Garage Technology Ventures.**⁷¹

Gram Power was formed in 2010 by UC Berkeley engineering graduates Yashraj Khaitan and Jacob Dickinson, under the mentorship of Berkeley professor and Google vice president of infrastructure Eric Brewer. The company has locations in Turlock, California and Jaipur, Rajasthan. It installed India's first solar-powered smart microgrid in the tiny village of Khareda in Rajasthan in 2012, providing energy for lights, buttermilk machines, televisions, and fans. A Gram Power microgrid offers reliable, solar-generated power at a little over a third of the cost of kerosene and cell phone charging for customers without conventional grid supplies. Energy monitoring and smart metering options allow customers to buy power on prepaid plans. The company started with \$80,000 in seed grants from **Alibaba, Intel, and UC Berkeley.**⁷²

Bechtel Corp. has a strong presence in India of skilled engineers who support Bechtel projects around the world. Its wholly Indian subsidiary, Bechtel India Pvt. Ltd., oversees global supplier and multi-project program acquisition projects and is one of the company's six global contract execution units managing design, procurement and construction for projects that include the Reliance Jamnagar Refinery in Gujarat, the Dabhol Power Project in Maharashtra and the Haldia Petrochemicals Project in West Bengal.⁷³

Lawrence Berkeley National Laboratory's International Energy Studies (IES) Group has collaborated with Indian government and industry for more than two decades, providing technical and policy analysis on power generation, appliances, industrial and building energy efficiency, sustainable cities, and transportation. The group has memoranda of understanding (MoUs) with several government agencies in India that focus on energy efficiency and demand-side management, renewable energy, and grid planning.⁷⁴ Recent India activity has included

- studies of wind energy potential in India that revealed a potential 20 times higher than previously thought, and use of satellite mapping and imaging to identify renewable energy zones for transmission planning;

- analysis of the financial and emissions impact of grid-connected renewable energy and energy efficiency programs for India;
- cost assessments for renewable energy grid integration and its impact on transmission planning, using state-level power flow models for optimal grid dispatch and capacity expansion;
- support in developing demand-side management (DSM) regulations for state electricity regulatory commissions in India, technical assistance in designing upstream DSM incentives for super-efficient appliances, and utility cost-benefit analyses of efficiency measures; and
- analysis of the impact of full electrification of passenger vehicle sales (cars and two-wheelers) in India by 2030, including ownership costs, additional grid load from EV charging, power sector costs and revenue, renewable energy grid integration, crude oil imports, and greenhouse gas (GHG) emissions.⁷⁵

A number of specific initiatives grew out of a 2009 US-India bilateral agreement to accelerate joint clean energy R&D, including a 2009 collaboration on energy efficiency for commercial buildings and data centers, a 2010 exchange with a visiting delegation of utility regulators from 13 Indian states, and a 2011 study to measure the impact of pollution on the effectiveness of cool roofs.

In 2012, Lawrence Berkeley National Laboratory was chosen under the PACE (Partnership to Advance Clean Energy) program⁷⁶ to lead a joint US-India research center focusing on energy efficiency technologies for buildings—called the US-India Joint Center for Building Energy Research and Development (CBERD)—under a \$5 million, four-year US DOE grant. Third-party partners have included the California Energy Commission, UC Berkeley, Honeywell, Infosys, Autodesk, the Bay Area Photovoltaic Consortium, the City of San Jose, HOK Architects, the Lighting Research Center, and the Natural Resources Defense Council (NRDC). The lead Indian institution is CEPT University (formerly the Center for Environmental Planning and Technology) in Ahmedabad.⁷⁷ The result has been a Building Innovation Guide (BIG) that analyzes and recommends best practices for the design, construction and operation of

energy-efficient, high-performance buildings in India-specific climate zones. BIG is being publicly launched in the summer of 2019 at a series of events across five major Indian cities: New Delhi, Mumbai, Bangalore, Trivandrum, and Hyderabad. Participants will include US and Indian government officials, researchers, and building industry and cleantech companies. Presentations address Government of India initiatives such as the India Cooling Action Plan, the Energy Conservation Building Code, advanced metering infrastructure rollout, the Energy Storage Mission, and EV policy.

At the non-profit level, the Natural Resources Defense Council (NRDC) has supported active programs in India for more than ten years, with a particular focus on renewable energy finance, jobs, and access. It contributed to the development of the government's Solar Mission and supports a portfolio of projects across India on cooling and energy efficiency (including building efficiency, cool roofs, CFC reduction, and more efficient air conditioners). A third, more recent focus is on resiliency and how to address extreme heat, and includes the Ahmedabad Heat Action Plan in Gujarat. Initiated in 2013 as the first of its kind in South Asia and supported by extensive scientific research, the annually revised plan establishes an early warning system for heat waves—coordinating interagency communication, medical training, and public communication—with a primary focus on slum communities and outdoor workers. The Ahmedabad project also includes a Cool Roofs initiative encouraging the installation of roofs made from coconut husks and paper waste as

replacements for heat-trapping traditional tin and asbestos roofs.⁷⁸ NRDC and its partner the Public Health Foundation of India are ramping up efforts to scale the Heat Action Plan initiative across India. In 2019, the national government is working with 23 states and over 100 cities and districts to develop and implement heat action plans.⁷⁹ Other areas of NRDC activity in India include assistance with the development and adoption of energy efficiency building codes and compliance frameworks; Hyderabad launched a groundbreaking online system for mandatory energy efficiency codes for commercial buildings in 2017.⁸⁰

In the last five years, NRDC has also expanded its focus on clean air, working on issues such as strengthening air monitoring networks and regulatory compliance, the adoption of electric vehicles—by helping to integrate EV charging into grid and building codes—and the development of scalable village-level clean energy plans supported by links to private and government programs. Partners include real estate developers—to support changes to building codes aimed at net zero energy use—and industry-supported initiatives such as the Confederation of Indian Industry's Green Building Council. NRDC's most significant collaborators, however, are states, including Telangana, Gujarat, Maharashtra, Karnataka, Tamil Nadu, Orissa, and West Bengal. NRDC Senior Director, International Program—India Anjali Jaiswal explains, "The national government sets the policies, but the real impacts are at the state and city levels where your partners are more directly responsible to their constituents."⁸¹

EXHIBIT 26

“Smart cities add digital intelligence to the urban world and use it to solve public problems and achieve a higher quality of life.”



Source: McKinsey Global Institute, “Smart Cities: Digital solutions for a more livable future”



Smart Cities: Order from Chaos

India launched a Smart Cities Mission in 2015, targeting 100 cities for infrastructure and services upgrades with partial funding support. Some 2,993 projects worth about \$20 billion were in play by early 2018.

As urbanization in India has accelerated, the process has been chaotic, without effective planning for infrastructure, transportation, waste, or water. A new strategy to address these shortcomings may come through smart cities. Smart cities mean different things to different people and vary according to citizen needs in different places. In a June 2018 report looking at the objectives and approaches of 50 cities worldwide, the McKinsey Global Institute characterizes them in this way:

“Smart cities add digital intelligence to existing urban systems, making it possible to do more with less. Connected applications put real-time, transparent information into the hands of users to help them make better choices. These tools can save lives, prevent crime, and reduce the disease burden. They can save time, reduce waste, and even help boost social connectedness. When cities function more efficiently, they also become more productive places to do business.”¹

The concept of “smartness” begins with sensors, scanners, connected devices, and high-speed, high-capacity communications layered over existing urban infrastructure to monitor systems and processes and collect operating data in real time. To that is added a layer of applications which enable access to, and real-time analysis of, the transmitted data. A final layer is user-driven: the critical mass of acceptance and adoption that provides the catalyst for the widespread changes in how individuals and the broader community make decisions and change behaviors (see Exhibit 26).

India’s Plan

No other country has the scale of need for smart city transformation—or the potential to benefit. This presents both opportunities and challenges at scale. McKinsey Global Institute has projected that by 2030, Mumbai’s economy will be larger than Malaysia’s, representing \$245 billion in consumption, and that India’s next four cities by market size (Delhi, Ahmedabad, Hyderabad, and Bengaluru) will each have annual consumption of \$80 billion to \$175 billion.² The ability of these and other cities to grow efficiently and sustainably will be critical to India’s ability to increase economic productivity, improve equity, tap more deeply into the country’s reservoirs of human capital, and absorb both foreign and domestic investment. Planning is a challenge; digital technology holds part of the answer, but Indian cities have a long way to go.

Only three Indian cities—Jaipur, Pune, and Mumbai—made the list of 50 cities around the world that a June

2018 McKinsey Global Institute report ranked according to their deployment of smart cities technologies. On a 37-point scale in terms of their strength of technology base—the extent of sensors and devices, the quality of communications networks, and the presence of open data portals—cities in Europe, the US, China and East Asia are the most developed (with Singapore achieving the highest score at 25 points), while cities in Latin America and Africa lagged behind, and the three Indian cities make up the bottom of the list with scores ranging from only 2.7 to 8.8. In a second 55-point scoring measuring each city's progress in implementing digital management applications for mobility, security, healthcare, economic development, housing, and community engagement, the three Indian cities did somewhat better with scores of 19.5 (Jaipur) and 20 (Pune and Mumbai) in a field in which New York and London ranked highest with 34.5 points and Lagos ranked lowest with 13.5 points.³

For its \$15 billion Smart Cities Mission launched in 2015,⁴ India's Ministry of Housing and Urban Affairs (MHUA) developed a comprehensive smart cities vision for the country. Its objective is to "promote cities that provide core infrastructure and give a decent quality of life to citizens, a clean and sustainable environment, and application of 'Smart' Solutions," with a focus on "sustainable and inclusive development."⁵ Core infrastructure elements include

- adequate water supply;
- assured electricity supply;
- sanitation, including solid waste management;
- efficient urban mobility and public transport;
- affordable housing, especially for the poor;
- robust IT connectivity and digitalization;
- good governance, especially e-governance and citizen participation;
- sustainable environment;
- safety and security of citizens, particularly women, children, and the elderly; and
- health and education.

Urban design elements of a smart city under the initiative include emphasis on more efficient mixed-use development; inclusive housing; walkable communities; preservation of open space; public transit, transit-oriented development and last-mile paratransit for children, the elderly, and disabled; online government services with opportunities for increased citizen engagement; and preservation of civic identity.

The government set an initial target of 100 cities to receive funding support, with each to receive approximately \$72 million in federal money⁶ over a five year period, to be supplemented with funding from the states and other investment sources.⁷ As of mid 2018, all 100 cities had been selected⁸ in four qualifying rounds⁹ that began in early 2016. According to MHUA's annual report for the fiscal year ending in March 2018, some 2,993 projects worth about \$20 billion were in play, of which 496 had begun work and 345 had started tendering.¹⁰

More than half of the cities have issued tenders for development of integrated command and control centers (ICCCs)¹¹ critical to managing data flows and coordinating functions from solid waste collection to traffic management to public CCTV systems. Global technology companies, along with major domestic firms, are responding. Centers in 10 cities—Ahmedabad, Vadodara, Surat, Pune, Nagpur, Rajkot, Visakhapatnam, Kakinada, Naya Raipur and Bhopal—are already operational.¹² While most projects are still in varying stages of completion, the initiative is producing results:

- In Rajkot, CCTV surveillance lowered crime by 18% over six months from October 2017 to April 2018, including traffic violations, littering, and nighttime burning of garbage.¹³
- Kakinada has deployed 6.2 km of fibre optic cable along the core path, and is installing smart streetlights, and access points for Wi-Fi and CCTV surveillance.¹⁴
- Pune has installed a flood warning and response system and a network of 120 emergency police call boxes.
- In Ahmedabad, free Wi-Fi along transit corridors increased ridership by 20,000 between February and March 2018 alone.¹⁵

- **Vishakhapatnam (Vizag)** has installed “smart classroom” upgrades at 27 high schools and four primary schools, and CCTV and GPS buses are being tracked online.¹⁶
- In **Bhopal**, online payment has increased property tax collections and the city is able to track its transport services online.¹⁷

How effective these initiatives will be at a national scale is an open question, as past efforts to develop model cities have foundered. Amaravati, the new capital of Andhra Pradesh with a planned population of 3.5 million, may be a test case. Amaravati was ultimately named the new capital of Andhra Pradesh after the Telangana region around the former capital Hyderabad separated from Andhra Pradesh and became a new state in 2013. Since then, more than \$3 billion in loan pledges have been received from the World Bank, Asian Infrastructure Investment Bank, and Indian state and federal government agencies for the purpose of creating Amaravati as a smart city from the ground up. The goal is a technologically advanced city with online government services, an underground power grid with smart meters, and self-driving trams and buses. Other new cities such as Gurugram (a suburb of New Delhi formerly known as Gurgaon) have developed, only to fall victim to poor planning and chaotic growth. Amaravati could be different, however. The driving force behind the city is the state’s chief minister N. Chandrababu Naidu,¹⁸ who helped make the state’s previous capital Hyderabad a high tech hub and India’s best city in terms of living standards.¹⁹

The Bay Area and India

Given the local complexities, it is understandable that most India smart city projects are still in their early stages. Participation by foreign technology and infrastructure companies has, to date, been limited to master planning and establishment of ICCCs, important first steps in the smart city process. Here, Bay Area firms with deep roots in India have stepped in to help.

Hewlett Packard Enterprise (HPE) has partnered with **Siemens** to set up the Bhopal ICCC, and has joined Cisco along with Schneider Electric and Bhubaneswar Power to build the ICCC in Naya Raipur.²⁰ HPE has also teamed with PwC on a center of excellence (CoE) in Kolkata that will develop strategies, best practices, and training for ICCCs nationwide. The Kolkata CoE, launched in September 2017, brings together advanced analytics and machine learning with HPE’s Universal IoT platform to help municipalities achieve enhanced civic engagement through effective connection and information exchange across a diverse range of devices and applications to coordinate and deliver secure digital public services such as pollution monitoring, traffic management, and intelligent waste management.²¹

Cisco Systems opened its Cisco Smart City showcase “campus-as-a-city” in Bengaluru in 2014, to highlight how IoT technology and infrastructure can deliver government services on demand via mobile devices; enable smart streets and buildings, smart parking, and smart meeting and work spaces; and connect users to education, healthcare, and transportation.²² In 2017, the firm announced a \$1 billion City Infrastructure Financing Acceleration Program, with private equity investor Digital Alpha Advisors and pension fund managers APG Asset Management and Whitehelm Capital, to help cities finance and deploy smart city improvements.²³

As of early 2017, Cisco’s smart city projects in India numbered 14 (and counting), among them Varanasi in Uttar Pradesh (in collaboration with Sunnyvale hybrid cloud data services firm **NetApp**,²⁴ German technology services firm Bosch, Austrian revenue collection and intelligent transportation systems software developer Efkon, and Mumbai-based IT solutions and big data analytics specialists Rolta);²⁵ Nagpur in Maharashtra state (with Mumbai engineering and technology firm Larsen & Toubro);²⁶ and Shendra-Bidkin along the Delhi-Mumbai Industrial Corridor (with Colorado engineering firm CH2M).²⁷ Separately, NetApp signed a smart city MoU with Karnal, in Haryana state, to provide data storage and security services.²⁸

EXHIBIT 27

India's Smart Cities Mission is a comprehensive vision to improve core infrastructure and quality of life.



Source: Smart Cities Mission, Ministry of Housing and Urban Affairs, Government of India



Fintech: Data Puts Money to Work

The Modi government sees mobile technology, fintech, and a cashless society as key to financial empowerment and business growth, providing access for ordinary Indians to credit, insurance, digital payments, and e-commerce.

Advances in financial technology (fintech) will be central to a rapidly growing Indian economy in coming years. The G20 endorsed Financial Stability Board defines fintech as “technologically-enabled financial innovation that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions and the provision of financial services.”¹ As such, it touches every segment of the economy and, importantly, is instrumental in fulfilling the political promises of broader economic opportunity and social inclusion.

Fintech is a relatively nascent sector in India but one that has seen rapid acceptance and growth. It offers convenient, affordable, and scalable solutions for a largely informal, cash-driven economy with low penetration rates for regulated banking and credit services and inadequate credit history or screening

capability. Online startups bring competition and innovative products to consumers and businesses, particularly those not part of the legacy banking system, and are forcing change in the offerings of traditional banks and non-bank lenders.

Several important forces are converging in India’s fintech sector to accelerate growth. In most major economies, an entrenched, risk-averse, financial services industry and fiscally conservative government policymakers and regulators together resist financial innovation. India, however, is a massive frontier market where 80% of commercial transactions are in cash and a large percentage of the population has no connection to the banking system.² Small businesses, which constitute 80% of the retail outlets in India, largely operate in a cash-driven informal economy and do not generate the financial records needed to apply for bank loans, forcing them to rely on the informal sector for credit at very high interest rates.³ A 2016 KPMG and NASSCOM joint report on the growth of fintech in India noted that the traditionally cash-driven Indian economy was responding well to the fintech opportunity, primarily triggered by the related surges in e-commerce and smartphone penetration.⁴

Technology is key to bringing more customers into the financial system quickly, in furtherance of the Modi government’s Pradhan Mantri Jan Dhan Yojana (PMJDY) financial inclusion scheme to expand access to financial and government services. Nearly 350 million accounts have been set up,⁵ allowing users to receive

remittances, credit, insurance, and other services digitally. Cashless transactions and instant mobile links to financial information and government transfer payments not only help fulfill the promise of PMJDY, but also serve as an equalizer by making services instantly available at low cost to anyone with a mobile phone.

The fintech sector is experiencing a unique convergence of interests that point to rapid acceptance and growth, offering an expanding customer base for incumbent institutions, new opportunities for startups to quickly launch and scale innovative products and services, and increased market efficiency, transparency, economic growth, and revenue for government. Among consumers, India’s adoption rate for fintech services is 87%, compared to the global average of 64%, according to EY’s Global FinTech Adoption Index 2019.⁶

The Modi government is actively pushing digital payments adoption by setting fiscal-year transactions targets for banks and digital wallet companies. For the year ending in March 2019, the target was 30 billion digital transactions, with banks expected to achieve 23.7 billion and wallets given a target of 6.3 billion.⁷ Overall, 90–95% of the FY 2019 target was met, and the government set a new target of 40 billion e-transactions for the year ending in March 2020. E-wallets saw rapid growth after demonetization in 2016, and the Unified Payments Interface (UPI) heated up and became key to digital payments success⁸ after the September 2018 Indian Supreme Court decision barring corporate entities from accessing the Aadhaar database due to concerns over privacy and security.⁹

From its database of 13,000 startups worldwide in 2019, fintech research and innovation platform MEDICI identified 2,035 fintech startups in India, working predominantly in the areas of payments, lending, wealthtech (retail), personal finance management, insurtech, regtech, and cybersecurity. The majority of those companies are headquartered in five cities—Mumbai, Bengaluru, New Delhi, Gurugram, and Hyderabad—with Mumbai and Bengaluru together accounting for 46%. The leading fintech subsector is payments, which accounted for 18.4% of the fintech startups and attracted \$708.9 million in venture capital and private equity funding across 21 deals in 2018.¹⁰

The combination of demonetization and regulatory uncertainty took a toll on India fintech investment in 2016, with funding falling to just \$388 million, compared to \$1.58 billion in 2015.¹¹ However, with demonetization leading to the large increase in the number of e-transactions managed by payments companies and wallet providers,¹² in 2017 the situation reversed itself. Accenture reported that fintech financing jumped to \$2.4 billion in 2017, a gain of more than 50% over the high in 2015. Although most of that dollar amount was due to a single \$1.4 billion investment in Indian mobile payment startup Paytm, overall India deal volume grew by 65%,¹³ suggesting a continuation in the trend toward smaller deals. KPMG reported that in 2018 the investment dollar amount attracted by Indian fintechs decreased to \$1.7 billion, but the number of deals increased to 111, compared to 108 in 2017.¹⁴

EXHIBIT 28

The Reserve Bank of India’s inter-regulatory Working Group on FinTech and Digital Banking breaks down fintech into five principal categories.

Categorization of Major Fintech Innovations

Payments, Clearing & Settlement	Deposits, Lending & Capital Raising	Market Provisioning	Investment Management	Data Analytics & Risk Management
Mobile/web payment	Crowd-funding	Smart contracts	Robo advice	Big data
Digital currencies	Peer-to-peer lending	Cloud compuring	Smart contracts	AI & Robotics
Distributed ledger	Digital currencies	e-Aggregators	e-Trading	
	Distributed ledger			

Source: Reserve Bank of India, Report of the Working Group on FinTech and Digital Banking, February 8, 2018

EXHIBIT 29

Glossary of Fintech Services

Bharat Interface for Money (BHIM)	A mobile app developed by the National Payments Corporation of India, based on the UPI, which allows users to manage accounts and transfer funds between other UPI payment addresses and between non-UPI accounts.
Block chain technology	A distributed ledger of related steps in a transaction, each stored as a block in the transaction chain. Blocks are added to a chain as they are completed and verified by the relevant parties, and they cannot be modified afterward, allowing full, real-time transaction visibility among the parties.
Centralized KYC/AML	Secure, standardized “know your client” and “anti-money laundering” protocols that streamline customer onboarding, transaction monitoring, global anti-corruption compliance, and audit processes.
Crowdfunding	A version of P2P lending in which borrowers solicit small donations from the public through a web-based platform or social networking site, for a specific project, business venture, or social cause.
Digital currencies (DCs)	Digital representations of value issued by private developers and denominated in their own unit of account (e.g., Bitcoin). DCs are obtained, stored, accessed, and transacted electronically and are not denominated in a sovereign currency or issued or backed by a government or central bank. Traded value is derived from agreement within the community of owners exchanging them for sovereign currency or goods and services.
Digital wallet	An application linked to a lender or non-bank third party prepaid instrument that allows instant P2P or commercial funds transfers without using bank or credit/debit card details.
Distributed ledger (DL)	DL platforms provide complete, secure, automated transaction records, updated and verified by users in real time, without third-party intermediation, enabling faster settlement time, simplified reporting, reduced counterparty risk, and improved privacy and fraud protection.
E-Aggregators	Developers and curators of internet portals that enable retail customers to compare prices and features of products like standardized insurance, mortgages, and deposit accounts.
Equity Funding Services	Crowdfunding platforms specifically targeting early-stage business financing, in competition with venture capital.
Peer-to-peer (P2P) lending	P2P platforms connect lenders and borrowers, using analytics to evaluate borrowers and expedite loan acceptance. They can connect individual lenders and borrowers or form lending pools of institutional and individual investors which borrowers access online for personal or small business loans.
Robo advice	Financial advice provided by automated money management services that use client information and algorithms to develop automated portfolio allocation and investment recommendations at lower cost by eliminating in-person financial advisors.
Smart contracts	Computer protocols that can self-execute, self-enforce, self-verify, and self-constrain the performance of a contract.
Unified Payment Interface (UPI)	A standardized interface developed by the National Payments Corporation of India (NPCI), an association of credit issuers, providing mobile interoperability for merchant and P2P payments. The UPI enables users to link bank accounts to mobile phone numbers and obtain a virtual address for making and receiving payments.

Compiled by Bay Area Council Economic Institute

For its India Fintech Opportunities Review Report 2017–18,¹⁵ YES Bank surveyed some 600 fintech companies in India, with added input from other fintech ecosystem members such as investors, academic experts, and incumbent banks. The resulting snapshot of the current fintech landscape included the following observations:

- 64% of companies surveyed have been operating for three years or less; the median workforce size is 14 employees; 25% of founders are under 30 years old; 35% of founders are between the ages of 31 and 40;
- 87% of founders identified employees focused on technology development and coding as the core of their workforces, with anywhere from a third to two-thirds of the workers doing coding;
- however, 71% of respondents cited lack of advanced tech skills and knowledge in the local talent pool as an impediment to growth, with many companies increasingly relying on coders from Russia, Poland, and Silicon Valley;
- 71% of pre-revenue-stage and 81% of idea-stage fintechs reported “severe difficulty” in raising funds; only 11% received any proof-of-concept (PoC) funding; 19% relied on industry partners to cover PoC costs;
- 79% of founders viewed incumbents in the financial sector as partners, while 8% viewed them as competitors;
- 74% of respondents were participants in one or more accelerator programs; and 85% cited PoC development and commercialization as the top reasons for enrolling in accelerator programs.

The Bay Area and India

Fintech saw a coming of age in the US following the global financial crisis. Since then, the US has led fintech development for more than a decade—with much of that leadership coming from the Bay Area.

San Francisco Business Times research in 2015, at the initial peak of fintech investment, revealed that the top 50 Bay Area fintech firms employed a combined workforce of 16,600, with nearly 10,000 working in digital

payment, 3,700 in personal finance and business financial management, 1,600 in lending, and 1,300 in investment.¹⁶

The Bay Area’s capacity in this field, and the active role played by Bay Area VCs and angel investors, points to another field of opportunity with India, where the shift to digital payments promises to revolutionize India’s economy, and in the process, transform the financial sector. Credit Suisse forecasts that digital payments will become a \$1 trillion market in India by 2023.¹⁷

Companies Make Inroads, but Some Face Headwinds

With the government’s easing of banking regulations to allow overseas companies greater leeway in setting up wholly-owned subsidiaries,¹⁸ the door has opened to Bay Area financial service and fintech companies to participate. Many are actively partnering with Indian counterparts to reach the country’s growing, digitally-enabled customer base.

In 2010, predating the Modi initiatives, Foster City-based **Visa** partnered with UK mobile payments fintech Monitise to offer mobile banking, bill payment, and other services in India.¹⁹ In 2014, it recruited about 120 network, product, and software engineers from eight IIT campuses,²⁰ and followed up in 2015 by opening a 100,000-square foot-technology center in Bengaluru. The objective: to open up Visa’s payment processing network to application developers and eventually offer payment solutions across a range of connected devices, including mobile phones, PCs, tablets, and even cars. In September 2015, Visa launched mVisa, a secure digital commerce service—designed for banks, merchants, and consumers in emerging markets—to enable consumers to use a mobile phone app to transfer funds from their Visa debit, credit, and prepaid accounts to pay bills or stores and online merchants, or to send funds to other Visa account holders. Initial trials were held in the Bengaluru area, in cooperation with Axis Bank, HDFC Bank, ICICI Bank, and State Bank India (SBI), with mVisa made available to 20,000 merchants.²¹

The government-endorsed unified payments interface (UPI, see Glossary, Exhibit 29) launched by Indian financial institutions gave retail users such as Jet Airways and store chain Big Bazaar, as well as internet platforms

such as Facebook and Amazon, direct mobile access to consumers. This, in turn, threatened the market shares of card-issuers.²² But mVisa was ultimately rolled out as a QR-based product and specification, allowing the scanning of merchants' QR codes displayed as a badge or sticker, and then pushing payment over Visa's network to the receiving merchant via the unified UPI-based Bharat payments app (BHIM, see Glossary, Exhibit 29),²³ without needing a separate UPI apps and virtual payment addresses for different banks.²⁴

In early 2017, a single QR standard, BharatQR, was launched across India, developed by Mastercard, Visa, and the National Payments Corporation of India (NPCI), with support from American Express and 14 national banks.²⁵ By September of that year, Visa and Indian electronic payments provider BillDesk announced that they had successfully enabled 50 large service providers for the BharatQR payments acceptance platform, potentially reaching some 300 million consumers with the simplified system that eliminates the need for divulging card details at the point of sale. Customers can simply log into the apps for their banks and scan the sellers' QR codes, enabling instant payment.²⁶

PayPal has offered cross-border remittance and other payments in India for a decade, accounting for as much as a third of India's B2C export payments. In November 2017, the company launched domestic operations in India, enabling merchants to process both local and global payments and connecting them to PayPal's customer base of more than 200 million worldwide. The company approached its domestic launch as a value-added payment aggregator, with its India implementation not allowing customers to store money in their PayPal accounts.²⁷

At the time, the company already had around 2,500 engineers across four India campuses, as well as an Indian call center subsidiary. Positioning itself as a premium service provider, PayPal targeted the e-commerce space with the hope of reducing cash-on-delivery (COD) transactions, which accounted for about 60% of e-commerce transactions in India in 2017. While its fees are higher, PayPal offers one-click payment, which reduces check-out times, and buyer and seller protection via a 180-day dispute settlement window, covering refunds to buyers if sellers don't send the

goods ordered and compensation to merchants if the customer doesn't end up paying for the goods. Among the initial merchants signed up were MakeMyTrip, Yatra, PVR Cinemas, BookMyShow, and FirstCry.²⁸

In April 2018, PayPal took a further step in simplifying payments into India by digitizing the application process for the foreign inward remittance certificate (FIRC), which acts as a testimonial verifying that an individual or business has received payment from outside the country in a foreign currency. With the new digitized process, Indian sellers or freelancers can apply for a FIRC and pay the associated fee online, versus having to visit a bank to complete a multi-step application process. Previously, PayPal had cut its FIRC fee by 50% and allowed consolidated FIRCs for multiple transactions.²⁹

Supporting these initiatives, the company launched innovation labs within its Chennai and Bengaluru tech centers in 2017 to upskill workers and build and refine advanced technologies, including machine learning, AI, and IoT.³⁰ In May 2018, PayPal teamed with Temasek to acquire a \$125 million minority stake in Pine Labs, an Indian provider of digital point-of-sale devices and customer interface and analytics services.³¹ According to data sourced from India's corporate defense ministry, PayPal reported \$37 million in revenue generated by its India payments subsidiary in 2018, a twelve-fold increase from the \$3 million generated the year before. The rise has been attributed to the opening of the domestic payments business, and the company has expanded its Indian workforce and opened a new office in Mumbai.³²

Facebook, with 230 million users in India, began beta testing its WhatsApp Pay service there in February 2018,³³ partnering with HDFC, ICICI and Axis Bank. The UPI-based service was challenged early on by Indian competitors, who argued that instead of building a walled garden around payments, WhatsApp, a widely used text messaging app across India, should be neutral and fully interoperable with all payment services in accordance with UPI policy. WhatsApp Pay was later modified to send payments to any UPI account, and to enable QR code scanning for non-UPI transfers.³⁴

The beta test attracted 1 million users³⁵ but full roll-out has been delayed by a bureaucratic dispute involving NPCI, the industry standards and implementing

group for the UPI interface; the Reserve Bank of India (RBI); and the Ministry of Electronics and Information Technology (MeitY). NPCI and RBI together grant operating authority to digital payment services, but MeitY has an advice and consent role because payments are sent and received via IT infrastructure. At issue are MeitY concerns about WhatsApp Pay's customer data storage policy, Facebook's potential ability to gain visibility on the payment behaviors of consumers, whether WhatsApp Pay meets RBI's two-factor ID security requirements, and RBI jurisdiction to ensure privacy of non-payment data.³⁶ RBI had further issued new guidance in April requiring that payment data be stored locally within India. And in August 2018, MeitY made its approval contingent on WhatsApp opening an office in India staffed by an India-specific team.³⁷ WhatsApp Pay's full-scale launch remained stalled in the first quarter of 2019, with Facebook saying that it had complied with the local data storage requirement, but RBI maintaining that the compliance was not complete because the app was using only data mirroring (i.e., storing data copies) in India.³⁸

Google rolled out its Tez UPI-based mobile payments service for India in September 2017. Partner banks include Axis, HDFC, ICICI and SBI. Jet Airways, redBus, and Dominos are among its merchant partners. Up to 20 money transfers per day are permitted, up to a combined limit of 100,000 rupees (about \$1,425). The app is supported in English, Hindi, Bengali, Gujarati, Kannada, Marathi, Tamil, and Telugu.³⁹

A unique feature the Tez service offers is "audio QR" (AQR), a technology that uses sounds for user authentication in transferring funds. Lava, Micromax, Nokia, and Panasonic sell phones with Tez pre-loaded.⁴⁰ The service launched with bank-based payments, followed up with the additions of bill and utility payments as well as messaging, and was rebranded as **Google Pay** in August 2018, at which time Google reported 55 million downloads of the app.⁴¹ In early 2019, Google Pay reached the milestone of 100 million installs and had received an average 4.5 rating in more than 1.6 million reviews on the Google Play Store.⁴²

Notes

Introduction

- 1 Mukherjee, Rohan and Karthik Sivaram, "Trust and Leadership: The Art of the US-India Nuclear Deal," *The Diplomat*, July 17, 2018, <https://thediplomat.com/2018/07/trust-and-leadership-the-art-of-the-us-india-nuclear-deal/>.
- 2 "Joint Statement on the Inaugural U.S.-India 2+2 Ministerial Dialogue," US Department of State, September 6, 2018, <https://www.state.gov/r/pa/prs/ps/2018/09/285729.htm>
- 3 Ibid.
- 4 Ayres, Alyssa, "What Next for US-India Military Ties?," Council on Foreign Relations, September 7, 2018, <https://www.cfr.org/article/what-next-us-india-military-ties>.
- 5 Lawder, David and David Brunnstrom, "U.S. eases export controls for high-tech sales to India: Ross," *Reuters*, July 30, 2018, <https://www.reuters.com/article/us-usa-trade-india/u-s-eases-export-controls-for-high-tech-sales-to-india-ross-idUSKBN1KK1S8>.
- 6 "Joint Statement on the Inaugural U.S.-India 2+2 Ministerial Dialogue," US Department of State, September 6, 2018, <https://www.state.gov/r/pa/prs/ps/2018/09/285729.htm>
- 7 Pubby, Manu. "India Finalizing Proposal to Send Defence Teams to Silicon Valley", *Economic Times*, August 30, 2018, <https://economictimes.indiatimes.com/news/defence/india-finalising-proposal-to-send-defence-teams-to-silicon-valley/articleshow/65601247.cms>.
- 8 Johns Hopkins Center for Health Security, *India-US Strategic Dialogue on Biosecurity, Report on the Second Dialogue Session Held Between the United States and India*, May 2017, <http://www.centerforhealthsecurity.org/our-work/events/2017%20India%20Dialogue/Event%20Documents/India%20Dialogue%20FINAL%20May%2010%202017.pdf>.
- 9 Mishra, Dr. Manoj Kumar, "The Indo-Pacific Thrust In The Indo-Strategic Partnership And India's Afghan Concerns—Analysis," *Eurasia Review*, January 9, 2019, <https://www.eurasiareview.com/09012019-the-indo-pacific-thrust-in-the-indo-strategic-partnership-and-new-delhis-afghan-concerns-analysis/>.
- 11 Trading Economics, "India—Labor force, total," and "India Unemployment Rate" accessed May 15, 2019, <https://tradingeconomics.com/india/labor-force-total-wb-data.html> and <https://tradingeconomics.com/india/unemployment-rate>.
- 12 Abrams, Corinne and Rosa de Acosta, "Modi's World: See What India's Economy Has Done in Five Years," *The Wall Street Journal*, April 22, 2019, <https://www.wsj.com/articles/modis-world-see-what-indias-economy-has-done-in-five-years-11555925401>.
- 13 Woetzel, Jonathan, Anu Madgavkar, and Shishir Gupta, "India's Labor Market: A New Emphasis on Gainful Employment," *McKinsey Global Institute*, June 2015, <https://www.mckinsey.com/~media/McKinsey/Global%20Themes/Employment%20and%20Growth/A%20new%20emphasis%20on%20gainful%20employment%20in%20India/Indias-labour-market-A-new-emphasis-on-gainful-employment.ashx>
- 14 Arora, Rohit, "Why India Is the Land of Rising Entrepreneurship," *Inc.*, January 27, 2015, <https://www.inc.com/rohit-arora/why-india-is-the-land-of-rising-entrepreneurship.html>.
- 15 Rao, Aprameya and Kishor Kadam, "25 years of liberalisation: A glimpse of India's growth in 14 charts," *Firstpost*, July 7, 2016, <https://www.firstpost.com/business/25-years-of-liberalisation-a-glimpse-of-indias-growth-in-14-charts-2877654.html>
- 16 Friesen, Garth, "Politics, Productivity & Population: Why The Chinese Economy flew and India's Just Grew," *Forbes*, March 21, 2019, <https://www.forbes.com/sites/garthfriesen/2019/03/21/politics-productivity-population-why-the-chinese-economy-flew-and-indias-just-grew/#45e6b15d2e7d>.
- 17 "Youth in India," Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India (Social Statistics Division), 2017, http://mospi.nic.in/sites/default/files/publication_reports/Youth_in_India-2017.pdf.
- 18 "The World Factbook: South Asia: India," US Central Intelligence Agency, <https://www.cia.gov/library/publications/the-world-factbook/geos/in.html>.
- 19 Spindle, Bill, "The Youth Bulge: India Struggles to Employ an Exploding Population," *The Wall Street Journal*, April 22, 2019, <https://www.wsj.com/articles/the-youth-bulge-india-struggles-to-employ-an-exploding-population-11555925401>.
- 20 "DataBank: World Development Indicators: Educational attainment, at least completed upper secondary, population 25+, total (%) (cumulative) (SE.SEC.CUAT.UP.ZS)," *The World Bank*, accessed April 4, 2019, <https://databank.worldbank.org>.
- 21 "DataBank: World Development Indicators: Share of youth not in education, employment or training, total (% of youth population) (SL.UEM.NEET.ZS)," *The World Bank*, accessed April 4, 2019, <https://databank.worldbank.org>.
- 22 "India: Distribution of the workforce across economic sectors from 2007 to 2017" *World Bank data*, Statista, 2019, <https://www.statista.com/statistics/271320/distribution-of-the-workforce-across-economic-sectors-in-india/>.
- 23 "The IT-BPM Sector in India: Strategic Review 2017," *NASSCOM*, February 2017, http://old.nasscom.in/download/summary_file/fid/140426.
- 24 Woetzel, Jonathan, Anu Madgavkar, and Shishir Gupta, "India's Labor Market: A New Emphasis on Gainful Employment," *McKinsey Global Institute*, June 2015, <https://www.mckinsey.com/~media/McKinsey/Global%20Themes/Employment%20and%20Growth/A%20new%20emphasis%20on%20gainful%20employment%20in%20India/Indias-labour-market-A-new-emphasis-on-gainful-employment.ashx>
- 25 "Skilling—Collaboration Towards Positive Systemic Change," *UnLtdIndia*, April 17, 2018, <http://unltdindia.org/2018/04/17/skilling-collaboration-towards-positive-systemic-change/>.
- 26 Interview with Nisha Rajan, Senior Policy Coordinator, US-India Strategic Partnership Forum (USISPF), Summer 2018.
- 27 Andres, Luis A. et al., "Precarious Drop: Reassessing Patterns of Female Labor Force Participation in India," *World Bank Group*, South Asia Region, Social Development Unit, April 2017, <http://documents.worldbank.org/curated/en/559511491319990632/pdf/WPS8024.pdf>.
- 28 "Women and Men in India," Social Statistics Division, Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India, 2018, http://www.mospi.gov.in/sites/default/files/publication_reports/Women%20and%20Men%20%20in%20India%202018.pdf
- 29 Shihabudeen Kunju S, "Men Outnumber Women In PhD Programmes In Indian Universities," *NDTV*, April 15, 2018, <https://www.ndtv.com/education/hrd-ministry-data-on-phd-more-male-candidates-pursue-phds-than-females-1837821>.
- 30 "Women and Men in India," Social Statistics Division, Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India, 2018, http://www.mospi.gov.in/sites/default/files/publication_reports/Women%20and%20Men%20%20in%20India%202018.pdf

CHAPTER 1

India's Economy: Poised for Takeoff

- 1 "World Economic Outlook Update, January 2019: A Weakening Global Expansion," *International Monetary Fund*, January 2019, <https://www.imf.org/en/Publications/WEO/Issues/2019/01/11/weo-update-january-2019>.
- 2 "DataBank: World Development Indicators: GDP (current US\$)," *The World Bank*, accessed April 4, 2019, <https://databank.worldbank.org/data/indicator/NY.GDP.MKTP.CD/1ff4a498/Popular-Indicators>.
- 3 Beniwal, Vrishi, "India Overtakes France to Become World's Sixth-Largest Economy," *Bloomberg Business*, July 11, 2018, <https://www.bloomberg.com/news/articles/2018-07-11/india-pips-france-to-become-world-s-sixth-largest-economy-chart>.
- 4 "DataBank: World Development Indicators: GNI per capita, PPP (current international \$)," *The World Bank*, accessed April 4, 2019, <https://databank.worldbank.org/data/indicator/NY.GNP.PCAP.PP.CD/1ff4a498/Popular-Indicators>.
- 5 Chakravarty, Praveen, "Has 70 Years of Redistribution From Rich States To Poor States Worked?," *Bloomberg Quint Opinion*, July 6, 2017, <https://www.bloombergquint.com/opinion/has-70-years-of-redistribution-from-rich-states-to-poor-states-worked>.
- 6 "India's per capita income grows by 8.6% to Rs 1.13 lakh in FY18," *The Times of India*, May 31, 2018, <https://timesofindia.indiatimes.com/business/india-business/indias-per-capita-income-grows-by-8-6-to-rs-1-13-lakh-in-fy18/articleshow/64403580.cms>.
- 7 "To end poverty, we need \$6000 per capita income: Raghuram Rajan," *The Times of India*, June 9, 2016, <https://timesofindia.indiatimes.com/business/india-business/To-end-poverty-we-need-6000-per-capita-income-Raghuram-Rajan/articleshow/52646585.cms>.
- 8 World Economic Forum and Bain & Company, "Future of Consumption in Fast-Growth Consumer Markets: INDIA," January 2019, http://www3.weforum.org/docs/WEF_Future_of_Consumption_Fast-Growth_Consumers_markets_India_report_2019.pdf.
- 9 Beniwal, Vrishi, "India Overtakes France to Become World's Sixth-Largest Economy," *Bloomberg Business*, July 11, 2018, <https://www.bloomberg.com/news/articles/2018-07-11/india-pips-france-to-become-world-s-sixth-largest-economy-chart>.
- 10 The Economist Intelligence Unit (@TheEIU), Twitter post, February 5, 2018, 10:00 p.m., <https://twitter.com/TheEIU/status/960755040985210886>.

- 31 "Gender pay gap still high, women in India earn 19% less than men: Report," The Times of India, March 7, 2019, <https://timesofindia.indiatimes.com/business/india-business/gender-pay-gap-still-high-women-in-india-earn-19-less-than-men-report/articleshow/68301331.cms>.
- 32 Woetzel, Jonathan et al., "The Power of Parity: Advancing Women's Equality in India." McKinsey Global Institute, November 2015, https://www.mckinsey.com/~media/McKinsey/Global%20Themes/Employment%20and%20Growth/The%20power%20of%20parity%20Advancing%20womens%20equality%20in%20India/MGI%20India%20parity_Full%20report_November%202015.ashx
- 33 Anand, Nupur, "India's central bank just proved demonetisation was for nothing," Quartz India, August 29, 2018, <https://qz.com/india/1373030/modis-demonetisation-did-nothing-for-india-shows-rbi-report/>.
- 34 "Why income tax payers in India are a small and shrinking breed," Economic Times, February 2, 2017, <https://economictimes.indiatimes.com/news/economy/policy/why-income-tax-payers-in-india-are-a-small-and-shrinking-breed/articleshow/56929550.cms>.
- 35 Kala, Anant Vijay, "This Was Supposed to Be India's Big Year, but Businesses Aren't Investing," Wall Street Journal, November 17, 2017, <https://www.wsj.com/articles/indias-businesses-have-lost-confidence-1509969600>.
- 36 Srivastava, Pragya, "Demonetisation effect! Direct tax collection rises dramatically after 2016; here's proof in 1 chart," Financial Express, May 29, 2018, <https://www.financialexpress.com/economy/demonetisation-effect-direct-tax-collection-rises-dramatically-after-2016-heres-proof-in-1-chart/1184986/>.
- 37 Chancel, Lucas and Thomas Piketty, "Indian income inequality, 1992–2014: From License Raj to Billionaire Raj?" WID.world Working Paper Series, No. 2017/11, World Inequality Lab, July 2017 <http://wid.world/document/chancelpiketty2017widworld/>.
- 38 "India's richest 1% get richer by 39% in 2018, just 3 percent rise for bottom half: Oxfam," The Economic Times, January 21, 2019, <https://economictimes.indiatimes.com/news/politics-and-nation/indias-richest-1-get-richer-by-39-percent-in-2018-just-3-percent-rise-for-bottom-half-oxfam/articleshow/67618779.cms>.
- 39 Knight Frank, "The Wealth Report 2019: 13th Edition," 2019, <https://content.knightfrank.com/resources/knightfrank.com/wealthreport/2019/the-wealth-report-2019.pdf>.
- 40 Kazmin, Amy, "Budget sweeteners see India backtrack on financial discipline," Financial Times, February 1, 2018, <https://www.ft.com/content/55732a56-073e-11e8-9650-9c0ad2d7c5b5>
- 41 National Judicial Data Grid (District and Taluka Courts of India), accessed May 16, 2019, <http://njdg.ecourts.gov.in/njdgnew/>.
- 42 Gupta, Arvind and Philip Auerswald, "The Ups and Downs of India's Digital Transformation," Harvard Business Review, May 6, 2019, 350
- 9 World Integrated Trade Solution (WITS), "Trade Summary for India 2017", World Bank, accessed May 17, 2019, <https://wits.worldbank.org/countrysnapshot/en/IND>.
- 10 "Services Trade Data," Ministry of Commerce and Industry, Government of India, 2018, <https://www.indiaservices.in/Service-Trade-Data>.
- 11 Mehta, Pradeep S. and Sanjay Kumar Mangla, "Can India Double its Services Exports in Five Years?" The Wire, October 27, 2017, <https://thewire.in/business/can-india-double-services-exports-five-years>.
- 12 "Performance & Contribution towards Exports by IT-ITeS Industry," Ministry of Electronics & Information Technology, 2018, <https://meity.gov.in/content/performance-contribution-towards-exports-it-ites-industry>.
- 13 "IT & ITeS," India Brand Equity Foundation (IBEF), February 2018, <https://www.ibef.org/download/IT-ITeS-Report-Feb-2018.pdf>.
- 14 "India Imports By Country," Trading Economics, 2017, <https://tradingeconomics.com/india/imports-by-country>.
- 15 "India Exports By Country," Trading Economics, 2017, <https://tradingeconomics.com/india/exports-by-country>.
- 16 World Integrated Trade Solution (WITS), "India exports, imports and trade balance By Country", World Bank, accessed May 17, 2019, <https://wits.worldbank.org/CountryProfile/en/Country/IND/Year/2017/TradeFlow/EXPIMP/Partner/by-country>.
- 17 "India: U.S.-India Bilateral Trade and Investment," Office of the United States Trade Representative, April 8, 2019, <https://ustr.gov/countries-regions/south-central-asia/india>
- 18 Ibid.
- 19 Ibid.
- 20 "India Matters for America/America Matters for India," East-West Center and the Federation of Indian Chambers of Commerce and Industry (FICCI), 2017, <https://www.eastwestcenter.org/system/tdf/private/indiamatters2017.pdf?file=1&type=node&id=36245>.
- 21 "USA Trade Online," US Census Bureau, 2017, <https://usatrade.census.gov/>.
- 22 Meltzer, Joshua P. and Harsha Vardhana Singh, "Growing the U.S.-India economic relationship: The only way forward," Brookings, June 22, 2017, <https://www.brookings.edu/blog/up-front/2017/06/22/growing-the-u-s-india-economic-relationship-the-only-way-forward/>.
- 23 "India Market Profile," Visit California, March 2019, <https://industry.visitcalifornia.com/Research/Global-Market-Profiles-Landing/India-Market-Profile>.
- 24 Schlappig, Ben, "Etihad Is Cutting San Francisco Flights in October 2017," One Mile at a Time (blog), June 14, 2017, <https://onemileatatime.com/etihad-discontinuing-san-francisco-flights/>.
- 25 Aggarwal, Varun, "Flying high: Air India sees bookings to US double after laptop ban," January 15, 2018, <https://www.thehindubusinessline.com/economy/logistics/flying-high-air-india-sees-bookings-to-us-double-after-laptop-ban/article9614126.ece>.
- 26 Awtaney, Ajay, "United will launch Delhi to San Francisco non-stop flights," Live from a Lounge (blog), December 13, 2018, <https://livefromalounge.boardingarea.com/2018/12/13/united-airlines-announces-delhi-san-francisco/>.
- 27 "San Francisco Travel Reports Record Breaking Tourism Levels for 2018, Gives Projections for 2019," San Francisco Travel Association, 2018, <https://www.sftravel.com/article/san-francisco-travel-reports-record-breaking-tourism-levels-2018-gives-projections-2019>.
- 28 "California Global Ready India," Visit California, 2018, <https://industry.visitcalifornia.com/~media/PDFs/Presentations/California-Global-Ready-India.pdf>.
- 29 US Citizenship and Immigration Services, "Characteristics of H-1B Specialty Occupation Workers: Fiscal Year 2017 Annual Report to Congress, October 1, 2016–September 30, 2017," US Department of Homeland Security, April 9, 2018, <https://www.uscis.gov/sites/default/files/reports-studies/Characteristics-of-Specialty-Occupation-Workers-H-1B-Fiscal-Year-2017.pdf>.
- 30 Baron, Ethan, "H-1B: Government reveals top reasons for visa delays in controversial program," The Mercury News, February 28, 2019, <https://www.mercurynews.com/2019/02/27/h-1b-government-reveals-top-reasons-for-visa-delays-in-controversial-program/>.
- 31 Balk, Gene, "More than half of Seattle's software developers were born outside the U.S.," The Seattle Times, January 19, 2018, <https://www.seattletimes.com/seattle-news/data/more-than-half-of-seattles-software-developers-were-born-outside-u-s/>.

CHAPTER 2

Trade and Investment: Flow Management

- 1 Woetzel, Johathan et al., "Outperformers: High-growth emerging economies and the companies that propel them," McKinsey Global Institute, September 2018, <https://www.mckinsey.com/featured-insights/innovation-and-growth/outperformers-high-growth-emerging-economies-and-the-companies-that-propel-them>.
- 2 World Integrated Trade Solution (WITS), "Trade Summary for India 2017", World Bank, accessed May 17, 2019, <https://wits.worldbank.org/countrysnapshot/en/IND>.
- 3 "World Trade Statistical Review," World Trade Organization (WTO), 2018, https://www.wto.org/english/res_e/status_e/wts2018_e/wts2018_e.pdf.
- 4 Chakraborty, Subhayan, "Only 5 states account for 70% of exports, Economic Survey shows," Business Standard, January 29, 2018, https://www.business-standard.com/budget/article/only-5-states-account-for-70-of-exports-economic-survey-shows-118012900344_1.html.
- 5 Srivastava, Pragya, "Economic Survey 2018: Top 1% exporting firms account for 38% of exports, but it may not be a bad thing," Financial Express, January 30, 2018, <https://www.financialexpress.com/economy/economic-survey-2018-top-1-exporting-firms-account-for-38-of-exports-but-it-may-not-be-a-bad-thing/1036346/>.
- 6 Arora, Isha, "India's Trade Deficit Nearly Doubles To \$87.2 Billion In FY18," Bloomberg | Quint, April 13, 2018, <https://www.bloomberquint.com/global-economics/indias-trade-deficit-nearly-doubles-to-872-billion-in-fy18>.
- 7 Workman, Daniel, "India's Top 10 Imports," WorldsToExports.com (WTE), May 4, 2019, <http://www.worldstopexports.com/indias-top-10-imports/>.
- 8 Workman, Danial, "India's Top 10 Exports," WorldsToExports.com (WTE), April 5, 2019, <http://www.worldstopexports.com/indias-top-10-exports/>.

- 32 US Citizenship and Immigration Services, "Characteristics of H-1B Specialty Occupation Workers: Fiscal Year 2017 Annual Report to Congress, October 1, 2016–September 30, 2017," US Department of Homeland Security, April 9, 2018, <https://www.uscis.gov/sites/default/files/reports-studies/Characteristics-of-Specialty-Occupation-Workers-H-1B-Fiscal-Year-2017.pdf>.
- 33 "India Country Commercial Guide: India—Trade Barriers," US International Trade Administration, October 10, 2018, <https://www.export.gov/article?id=India-Trade-Barriers>.
- 34 Chakraborty, Subhayan, "India braces for Donald Trump's reciprocal tax, may fight it in WTO," *Business Standard*, March 11, 2018, https://www.business-standard.com/article/economy-policy/india-braces-for-donald-trump-s-reciprocal-tax-may-fight-it-in-wto-118031000625_1.html.
- 35 Sampat, Bhaven N. and Kenneth C. Shadlen, "Indian pharmaceutical patent prosecution: The changing role of Section 3 (d)." *PLOS ONE*, April 2, 2018, <https://doi.org/10.1371/journal.pone.0194714>.
- 36 "India Takes First Step Toward Challenging U.S. Visa Policy At WTO," National Foundation for American Policy, March 10, 2016, <http://nfap.com/wp-content/uploads/2016/03/Inside-US-Trade.March-10-2016.pdf>.
- 37 "H-1B, L-1 visa fee hike coul cost IT firms\$400 mn per annum," *Financial Express*, December 18, 2015, <https://www.financialexpress.com/industry/us-doubles-fees-for-h-1b-l1-visas/180535/>.
- 38 Baron, Ethan, "H-1B visa: government says work ban for H-4 spouses coming this month," *The Mercury News*, May 22, 2019, <https://www.mercurynews.com/2019/05/22/h-1b-visa-government-says-work-ban-for-h-4-spouses-coming-this-month/>.
- 39 Dimitropoulos, Stav, "Feeling the impact of Trump's foreign worker squeeze," *BBC News*, May 22, 2019, <https://www.bbc.com/news/business-48351811>.
- 40 "H-1B Denial Rates: Past and Present," National Foundation for American Policy, April 2019, <https://nfap.com/wp-content/uploads/2019/04/H-1B-Denial-Rates-Past-and-Present.NFAP-Policy-Brief.April-2019.pdf>.
- 41 "United States Will Terminate GSP Designation of India and Turkey," Office of the United States Trade Representative, March 4, 2019, <https://ustr.gov/about-us/policy-offices/press-office/press-releases/2019/march/united-states-will-terminate-gsp>.
- 42 Sarda, Pranit, "US snub to India has 'minimal impact,'" *Forbes India*, March 13, 2019, <http://www.forbesindia.com/article/leaderboard/us-snub-to-india-has-minimal-impact/52783/1>.
- 43 "United States Will Terminate GSP Designation of India and Turkey," Office of the United States Trade Representative, March 4, 2019, <https://ustr.gov/about-us/policy-offices/press-office/press-releases/2019/march/united-states-will-terminate-gsp>.
- 44 "Trump terminates preferential trade status for India under GSP," *The Hindu Business Line*, June 1, 2019, <https://www.thehindubusinessline.com/economy/trump-terminates-preferential-trade-status-for-india-under-gsp/article27398318.ece>.
- 45 Sarda, Pranit, "US snub to India has 'minimal impact,'" *Forbes India*, March 13, 2019, <http://www.forbesindia.com/article/leaderboard/us-snub-to-india-has-minimal-impact/52783/1>.
- 46 Horsley, Scott, "Trump Formally Orders Tariffs On Steel, Aluminum Imports," *NPR*, March 8, 2018, <https://www.npr.org/2018/03/08/591744195/trump-expected-to-formally-order-tariffs-on-steel-aluminum-imports>.
- 47 Chakraborty, Subhayan, "India braces for Donald Trump's reciprocal tax, may fight it in WTO," *Business Standard*, March 11, 2018, https://www.business-standard.com/article/economy-policy/india-braces-for-donald-trump-s-reciprocal-tax-may-fight-it-in-wto-118031000625_1.html.
- 48 Abraham, Rohan, "Trump's plan to slap tariffs on steel and aluminium could affect Indian manufacturers," *The Hindu*, March 10, 2018, <https://www.thehindu.com/business/Economy/trumps-plan-to-slap-tariffs-on-steel-and-aluminium-could-affect-indian-manufacturers/article23032560.ece>.
- 49 Gowen, Annie, "India imposes retaliatory tariffs on U.S., widening global trade war," *The Washington Post*, June 21, 2018, https://www.washingtonpost.com/world/india-imposes-retaliatory-tariffs-on-us-as-global-trade-widens/2018/06/21/7c3a016b-1de0-497a-9635-a522bc55810a_story.html?noredirect=on&utm_term=.2a4c120e28ce.
- 50 Reuters, "India Delays Levying Retaliatory Taff on U.S. Goods to June 16," *The New York Times*, May 14, 2019, <https://www.nytimes.com/reuters/2019/05/14/business/14reuters-usa-trade-india.html>.
- 51 "Quarterly Fact Sheet: Fact Sheet on Foreign Direct Investment (FDI) from April 2000 to December 2017, Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, Government of India, February 21, 2018, https://dipp.gov.in/sites/default/files/FDI_FactSheet_21February2018.pdf.
- 52 "Quarterly Fact Sheet: Fact Sheet on Foreign Direct Investment (FDI) from April, 2000 to March, 2017, Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, Government of India, June 2018, https://dipp.gov.in/sites/default/files/FDI_FactSheet_29June2018.pdf.
- 53 "Fact Sheet on Foreign Direct Investment (FDI) from April, 2000 to March, 2015, Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, Government of India, March 2015, https://dipp.gov.in/sites/default/files/india_FDI_March2015_0.pdf.
- 54 "Quarterly Fact Sheet: Fact Sheet on Foreign Direct Investment (FDI) from April, 2000 to December, 2018," Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, Government of India, March 2019, https://dipp.gov.in/sites/default/files/FDI_Factsheet_12March2019.pdf.
- 55 Abrams, Corinne and Debiprasad Nayak (WSJ), "With a banner year for deals, India overtakes China as a favoured target," *Business Standard*, December 26, 2018, https://www.business-standard.com/article/economy-policy/with-a-banner-year-for-deals-india-overtakes-china-as-a-favoured-target-118122600070_1.html
- 56 "FDI Annual Issue 2017, Chapter 1.3.A.iii," Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, Government of India, n.d., https://dipp.gov.in/sites/default/files/FDI_AnnualIssue_2017_Chapter1.3.A.iii.pdf
- 57 Ibid.
- 58 "About FDI in India," India Brand Equity Foundation, April 2019, <https://www.ibef.org/economy/foreign-direct-investment.aspx>
- 59 Ibid.
- 60 Ibid.
- 61 Rossow, Richard M., "India's FDI Reforms Under Modi: Once a Fountain, Now a Drip," Center for Strategic and International Studies, August 15, 2017, <https://www.csis.org/analysis/india-s-fdi-reforms-under-modi-once-fountain-now-drip>.
- 62 "World Investment Report 2018," United Nations Conference on Trade and Development (UNCTAD), 2018, https://unctad.org/en/PublicationsLibrary/wir2018_en.pdf.
- 63 "World Investment Report: Annex Tables," United Nations Conference on Trade and Development, June 2018, https://unctad.org/Sections/dite_dir/docs/WIR2018/WIR18_tab02.xlsx.
- 64 Bhattacharya, A.K., "FDI outflows: Mauritius is India's largest overseas investment destination," *Business Standard*, May 2, 2017, https://www.business-standard.com/article/economy-policy/fdi-outflows-mauritius-is-india-s-largest-overseas-investment-destination-117043000425_1.html.
- 65 "Foreign direct investment (FDI) from India in the United States from 2000 to 2017 (in billion U.S. dollars, on a historical-cost basis)," *Statista*, 2019, <https://www.statista.com/statistics/188940/foreign-direct-investment-from-india-in-the-united-states/>.
- 66 "Foreign Direct Investment," 2018 e-Handbook of Statistics, United Nations Conference on Trade and Development, December 5, 2018, <https://stats.unctad.org/handbook/EconomicTrends/Fdi.html>.
- 67 "Foreign Direct Investment (FDI): India," *SelectUSA*, US Department of Commerce, May 2019, <https://www.selectusa.gov/servlet/servlet.FileDownload?file=015t00000000LKMV>
- 68 "India's IT giants Are Investing And Acquiring To Catch Up With Trends In Cloud, AI, And Automation," *CB Insights*, October 27, 2017, <https://www.cbinsights.com/research/india-it-investments-acquisitions/>.
- 69 "Infosys invests \$15. million in Waterline Data Science," *Livemint*, March 22, 2018, <https://www.livemint.com/Companies/Ahb1cBGV1IPgYw4ud3mDWO/Infosys-invests-15-million-in-Waterline-Data-Science.html>.
- 70 "Infosys Makes Additional Investment of US\$1.5 million in TidalScale Inc.," *Infosys press release*, September 17, 2018, <https://www.infosys.com/newsroom/press-releases/Pages/investment-software-defined-server-revolution.aspx>.
- 71 Mendonca, Jochelle, "Wipro invests undisclosed amount in Tradeshift," *The Economic Times*, January 30, 2017, <https://economictimes.indiatimes.com/tech/ites/wipro-invests-undisclosed-amount-in-tradeshift/articleshow/56875328.cms>.

CHAPTER 2 SPOTLIGHT

Trade Opportunities: Follow the Money

- 1 "India: U.S.-India Bilateral Trade and Investment," Office of the United States Trade Representative, April 8, 2019, <https://ustr.gov/countries-regions/south-central-asia/india>

- 2 "Modi, Obama target \$500 billion India-US trade," *The Times of India*, October 1, 2014, <https://timesofindia.indiatimes.com/business/india-business/Modi-Obama-target-500-billion-India-US-trade/articleshow/43974713.cms>.
- 3 "India's economy: Why the time for growth is now," McKinsey Global Institute, September 2016, <https://www.mckinsey.com/featured-insights/india/indias-economy-why-the-time-for-growth-is-now>.
- 4 Puri, Prof. Sandeep and Brij Mohan Taneja, "Food Retailing In India—The Way Forward," *Progressive Grocer India*, February 13, 2018, <https://www.indiaretailing.com/2018/02/13/food/food-grocery/food-retailing-india-way-forward/>.
- 5 "Connecting farm and industry: Through value Chain empowerment," EY and ASSOCHAM, 2018, [https://www.ey.com/Publication/vwLUAssets/ey-connecting-farm-and-industry/\\$File/ey-connecting-farm-and-industry.pdf](https://www.ey.com/Publication/vwLUAssets/ey-connecting-farm-and-industry/$File/ey-connecting-farm-and-industry.pdf)
- 6 Rais, M. and A. Sheoran, "Scope of Supply Chain Management in Fruits and Vegetables in India," *Journal of Food Processing and Technology* 6:427. doi:10.4172/2157-7110.1000427, February 23, 2015, <https://www.omicsonline.org/open-access/scope-of-supply-chain-management-in-fruits-and-vegetables-in-india-2157-7110-1000427.pdf>.
- 7 Singh, Joginder, "India is self-sufficient, but millions go hungry," *The Pioneer*, October 3, 2016, <https://www.dailypioneer.com/2016/columnists/india-is-self-sufficient-but-millions-go-hungry.html>.
- 8 "India Country Commercial Guide: India—Healthcare," US International Trade Administration, October 10, 2018, <https://www.export.gov/article?id=India-Healthcare-and-Medical-Equipment>.
- 9 Chakraborty, VMS, and Sohini Das, "Import of medical devices from US on the rise; here's all you need to know," *Business Standard*, June 11, 2018, https://www.business-standard.com/article/companies/import-of-medical-devices-from-us-on-the-rise-here-s-all-you-need-to-know-118061000756_1.html.
- 10 "India Country Commercial Guide: India—Energy," US International Trade Administration, October 10, 2018, <http://apps.export.gov/article?id=India-Energy>.
- 11 "India and U.S. collaborate to expand renewable energy grid," Wisconsin Economic Development Corporation, October 1, 2017, <https://wecdc.org/export/market-intelligence/posts/india-u-s-collaborate-expand-renewable-energy-grid/>.
- 12 Singh, Rajesh Kumar and Anindya Upadhyay, "With 1 million homes still in the dare, Modi government misses power goal," *The Economic Times* (by Bloomberg), January 1, 2019, <https://economictimes.indiatimes.com/industry/energy/power/with-1-million-homes-still-in-the-dark-modi-government-misses-power-goal/articleshow/67332253.cms>.
- 13 Sharma, Kiran, "Three years in, India's smart city program has a long way to go," *Nikkei Asian Review*, July 4, 2018, <https://asia.nikkei.com/Spotlight/Cover-Story/Three-years-in-India-s-smart-city-program-has-a-long-way-to-go>.
- 14 "Smart Cities," Economic Diplomacy Division, Ministry of External Affairs, Govt. of India, May 2017, https://www.eoilisbon.gov.in/business_files/Smart%20Cities%20Project.pptx.
- 15 Seetharaman, G., "Smart Cities Mission is still very much a work in progress post three years of its launch," *The Economic Times*, June 9, 2018, <https://economictimes.indiatimes.com/news/economy/infrastructure/smart-cities-mission-is-still-very-much-a-work-in-progress-post-three-years-of-its-launch/articleshow/64523035.cms>.
- 5 "Echoes of Freedom: South Asian Pioneers in California, 1899–1965: Chapter 13: A New Beginning," Berkeley Library, University of California, May 13, 2019, <https://guides.lib.berkeley.edu/echoes-of-freedom/chapter13>.
- 6 Newton, Benita, "Paten Name Has Long History of Success In Hospitality," *Hotel Online*, July 19, 2004, https://www.hotel-online.com/News/PR2004_3rd/Jul04_PatelHotel.html.
- 7 "School of Hospitality Leadership Exhibits at AAHOA Conference," East Carolina University College of Business, October 31, 2018, <https://blog.ecu.edu/sites/cob/blog/2018/10/31/school-of-hospitality-leadership-exhibits-at-aaoha-conference/>
- 8 Saxenian, AnnaLee, "Silicon Valley's New Immigrant Entrepreneurs," Public Policy Institute of California, 1999, https://www.ppic.org/content/pubs/report/R_699ASR.pdf.
- 9 Ibid.
- 10 Wadhwa, Vivek, AnnaLee Saxenian et al., "America's New Immigrant Entrepreneurs," Master of Engineering Management Program, Duke University; School of Information, UC Berkeley, January 4, 2007, http://people.ischool.berkeley.edu/~anno/Papers/Americas_new_immigrant_entrepreneurs_1.pdf.
- 11 Anderson, Stuart, "Immigrants and Billion-Dollar Startups: NFAP Policy Brief, October 2018," National Foundation for American Policy, 2018, <https://nfap.com/wp-content/uploads/2019/03/2018-BILLION-DOLLAR-STARTUPS.NFAP-Policy-Brief.2018.pdf>.
- 12 Zong, Jie and Jeanne Batalova, "Indian Immigrants in the United States," Migration Policy Institute, August 31, 2017, https://www.migrationpolicy.org/article/indian-immigrants-united-states#Distribution_by_State_and_Key_Cities.
- 13 "50201 Selected Population Profile in the United States, 2017 American Community Survey 1-Year Estimates, American Fact Finder, US Census Bureau, accessed May 28, 2019, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_1YR_S0201&prodType=table.
- 14 "U.S. Immigrant Population by Metropolitan Area" India Region of Origin, 2013–2017, Migration Policy Institute (MPI) Data Hub, accessed May 28, 2019, <https://www.migrationpolicy.org/programs/data-hub/charts/us-immigrant-population-metropolitan-area>.
- 15 Zong, Jie and Jeanne Batalova, "Indian Immigrants in the United States," Migration Policy Institute, August 31, 2017, https://www.migrationpolicy.org/article/indian-immigrants-united-states#Distribution_by_State_and_Key_Cities.
- 16 Ibid.
- 17 "Places of Origin," Research and Insights>Open Doors.Data>International Students, Institute of International Education, 2019, <https://www.iie.org/Research-and-Insights/Open-Doors/Data/International-Students/Places-of-Origin>.
- 18 "Chapter 3: Science and Engineering Labor Force," Science & Engineering Indicators 2018, National Science Board, January 2018, <https://www.nsf.gov/statistics/2018/nsb20181/report/sections/science-and-engineering-labor-force/immigration-and-the-s-e-workforce>.
- 19 Kably, Lubna, "In US, Indian STEM students bag 56% of job training slots," *The Times of India*, October 28, 2018, <https://timesofindia.indiatimes.com/india/in-us-indian-stem-students-bag-56-of-job-training-slots/articleshow/66407588.cms>.
- 20 Nanda, Prashant K., "Flow of Indian students to US grows at three-year low of 12.3%," *Live Mint*, November 14, 2017, <https://www.livemint.com/Education/qOxYg1Znfa2qRMRm6JZP/Indian-students-flow-to-US-grew-by-12-a-three-year-low.html>.
- 21 "Dramatic drop in F-1 visa student applications from India to the US, says survey," *News India Times*, March 16, 2017, <http://www.newsindiatimes.com/dramatic-drop-in-f-1-visa-student-applications-to-the-us-says-survey>.
- 22 Ibid.
- 23 "2018 Fact Sheet: California," Open Doors, International Educational Exchange, 2018, <https://www.iie.org/Research-and-Insights/Open-Doors/Fact-Sheets-and-Infographics/Data-by-State-Fact-Sheets>.
- 24 "International Student Enrollment," UC Berkeley International Office, Fall 2017, <https://internationaloffice.berkeley.edu/sites/default/files/student-statistics2017.pdf>.
- 25 "Stanford University International Student Report: India," College Factual, 2017, <https://www.collegefactual.com/colleges/stanford-university/student-life/international/>.
- 26 "University of California—Davis International Student Report," College Factual, 2017, <https://www.collegefactual.com/colleges/university-of-california-davis/student-life/international/>.
- 27 Ward, Jay, "International Student Statistical Summary, Fall 2017 (Final), Office of International Programs, San Francisco State University, 2017, https://oip.sfsu.edu/sites/default/files/OIPstatistics/FA17_statistics.pdf.

CHAPTER 3

The Bay Area Indian Community: A Cross-Border Success Story

- 1 "Chapter VII: Country of Birth of the Foreign-Born Population, 1910 Census: Volume 1. Population, General Report and Analysis," United States Census Bureau, April 1915, <https://www2.census.gov/library/publications/decennial/1910/volume-1/volume-1-p11.pdf>.
- 2 "18991922: Arrival & Early Years, Pioneering Punjabis Digital Archive," UC Davis and Punjabi American Heritage Society, 2016, <http://pioneeringpunjabis.ucdavis.edu/eras/1899-1922/>
- 3 "Echoes of Freedom: South Asian Pioneers in California, 1899–1965: Chapter 6: At the University," Berkeley Library, University of California, May 13, 2019, <http://guides.lib.berkeley.edu/echoes-of-freedom/chapter6>.
- 4 "Echoes of Freedom: South Asian Pioneers in California, 1899–1965: Chapter 7: Gadar," Berkeley Library, University of California, May 13, 2019, <https://guides.lib.berkeley.edu/echoes-of-freedom/chapter7>.

- 28 "Berkeley India Conference 2017," Institute for South Asia Studies, UC Berkeley, 2017, http://events.berkeley.edu/index.php/calendar/sn/csas?event_ID=110989.
- 29 "3rd US-India Conference, 07 September 2018, UC Berkeley, California, USA," All India Management Association, 2018, <https://www.aima.in/media-centre/events/3rd-us-india-conference-september-2018-berkeley-usa.html>.
- 30 "Stanford-India Biodesign," Stanford Byers Center for Biodesign, 2019, <http://biodesign.stanford.edu/programs/global-initiatives/stanford-india-biodesign.html>.
- 31 "Financial Initiatives to Help the Poor Manage Agriculture Risk in India," Feed the Future, UC Davis, accessed May 29, 2018, <https://basis.ucdavis.edu/project/financial-initiatives-help-poor-manage-agriculture-risk-india>.
- 32 "Board of Advisors Meeting," Energy Efficiency Center, UC Davis, April 24, 2017, <https://energy.ucdavis.edu/wp-content/uploads/2017/07/EEC-BOA-Packet-April2017-reduced.pdf>.
- 33 "India has made primary education universal, not good," The Economist, June 8, 2017, <https://www.economist.com/news/leaders/21723105-worlds-biggest-school-system-also-one-worst-india-has-made-primary-education>.
- 34 "History and Milestones," Indian School of Business, accessed May 29, 2019, <https://www.isb.edu/about-isb>.
- 35 Interview with Anita Manwani, Spring 2019.
- 36 "About Us," India-West, accessed May 29, 2019, <https://www.indiawest.com/site/about.html>.
- 37 "About," TIE Global, accessed May 29, 2019, <https://tie.org/about/>.
- 38 "About Indiaspora," Indiaspora, 2019, <http://www.indiaspora.org/about/>.
- 39 Interview with M.R. Rangaswami, June 6, 2018.
- 40 Singh, Kartikeya, "India's digitizing states: leaders and laggards," Live Mint, December 26, 2017, <https://www.livemint.com/Opinion/JLOWLSixmYuus5Olya7c6L/Indias-digitizing-states-leaders-and-laggards.html>.
- 41 Ibid.
- 42 Singh, Kartikeya, "Enterprising Indian states: leaders and laggards," Live Mint, March 27, 2018, <https://www.livemint.com/Opinion/IYM2nzPthUwJbJPCdvhcNO/Enterprising-Indian-states-leaders-and-laggards.html>.
- 43 Ibid.
- 44 Chaudhary, Suman, "Karnataka's New Startup Policy: ₹30,000 Per Month for Entrepreneurs, Elevate 100 Renamed to Elevate 500 and More," IndianWeb2, March 7, 2018, <https://www.indianweb2.com/2018/03/07/karnatakas-new-startup-policy-30000-per-month-entrepreneurs-elevate-100-renamed-elevate-500/>.
- 45 Singh, Kartikeya, "Enterprising Indian states: leaders and laggards," Live Mint, March 27, 2018, <https://www.livemint.com/Opinion/IYM2nzPthUwJbJPCdvhcNO/Enterprising-Indian-states-leaders-and-laggards.html>.
- 46 KaPoor, Amit, "India's Competitiveness: A Perspective from States," Institute for Competitiveness, 2018, <http://www2.itif.org/2018-gtipa-summit-amit-ka-poor.pdf>.
- 47 "Rural population (% of total population)," World Bank, 2018, <https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?end=2017&locations=IN-CN&start=1960>.
- 48 "Urban Population," World Bank, 2018, https://data.worldbank.org/indicator/SP.URB.TOTL?locations=IN-CN&most_recent_value_desc=true.
- 49 "Country Profiles: India," World Urbanization Prospects 2018, United Nations, 2018, <https://population.un.org/wup/Country-Profiles/>.
- 50 Kapoor, Amit, "City Competitiveness 2017," Institute for Competitiveness, January 5, 2018, <https://competitiveness.in/city-competitiveness-report-2017/>.
- 51 Kapoor, Amit, "Creative Economy of Indian Cities," Institute for Competitiveness, December 29, 2017, <https://competitiveness.in/creative-economy-of-indian-cities-2017/>.

CHAPTER 4

Indian States: Laboratories of Innovation

- 1 "Engaging Indian States," Center for Strategic & International Studies, 2019, <https://indianstates.csis.org/>.
- 2 "Haryana notifies bio-energy policy," The Pioneer, March 23, 2018, <https://www.dailypioneer.com/2018/state-editions/haryana-notifies-bio-energy-policy.html>.
- 3 Venugopal, Sruti, "Rural technology policy to create jobs," Telangana Today, May 13, 2017, <https://telanganatoday.com/rural-technology-policy-create-jobs>.
- 4 Krishna, Vishal, "Karnataka fast tracks Rs 18 crore fund for agri-startups," YourStory, January 6, 2018, <https://yourstory.com/2018/01/karnataka-fast-tracks-rs-18-crore-fund-agri-startups/>.
- 5 Pitchiah, Vijayakumar, "Karnataka govt grants \$1.5 mn to 26 biotech startups," VCCircle, May 10, 2017, <https://www.vccircle.com/get-the-ultimate-rummy-experience-and-ace-the-game-on-jungle-rummy>.
- 6 Rawat, Virendra Singh, "Yogi bovt to create 5,000 acres of land bank," Business Standard, October 4, 2017, https://www.business-standard.com/article/economy-policy/yogi-govt-to-create-5-000-acres-of-land-bank-117100401224_1.html.
- 7 Singh, Sarita, "The Economic Times," October 2, 2017, <https://economictimes.indiatimes.com/industry/services/property/-construction/odisha-govt-creating-land-bank-for-industrial-allocation/articleshow/60905858.cms>.
- 8 Mondal, Debapriya, "Govt, EESL to install 10 lakh LED lights in seven Andhra districts," ET Energyworld.com, The Economic Times, April 10, 2019, <https://energy.economictimes.indiatimes.com/news/power/govt-eesl-to-install-10-lakh-led-lights-in-seven-andhra-districts/58999252>.
- 9 "All 114 Urban Local Bodies in Odisha will have LED street lights," United News of India, November 9, 2018, <http://www.uniindia.com/all-114-urban-local-bodies-in-odisha-will-have-led-street-lights/east/news/1401107.html>.
- 10 Singh, Kartikeya, "India's digitizing states: leaders and laggards," Live Mint, December 26, 2017, <https://www.livemint.com/Opinion/JLOWLSixmYuus5Olya7c6L/Indias-digitizing-states-leaders-and-laggards.html>.
- 11 "Telangana aggregates all G2C apps in T App Folio," Business Line, February 28, 2018, <https://www.thehindubusinessline.com/news/telangana-aggregates-all-g2c-apps-in-t-app-folio/article22881845.ece>.
- 12 Kumar, Sajjan C., "New Tamil Nadu e-governance policy aims to offer all services online by 2023," Financial Express, January 11, 2018, <https://www.financialexpress.com/india-news/new-tamil-nadu-e-governance-policy-aims-to-offer-all-services-online-by-2023/1010098/>.
- 13 "UP Nivesh Mitra," India Filings, 2018, <https://www.indiafilings.com/learn/up-nivesh-mitra/>.

CHAPTER 5

Innovation, Startups and Investment: Poised for Breakthrough

- 1 World Bank "Doing Business" reports for 2017, 2018, and 2019, <http://www.doingbusiness.org/content/dam/doingBusiness/media/Annual-Reports/English/DB17-Report.pdf>, <http://www.doingbusiness.org/content/dam/doingBusiness/media/Annual-Reports/English/DB2018-Full-Report.pdf>, https://www.worldbank.org/content/dam/doingBusiness/media/Annual-Reports/English/DB2019-report_web-version.pdf.
- 2 Ravi Kathm "India Posts Highest Growth in Patent Applications in 2018", Live Mint, March 20, 2019, <https://www.livemint.com/politics/policy/india-postst-highest-growth-in-patent-applications-in-2018-1553021506627.html>
- 3 "Startup ecosystem in India—Growing or matured?" KPMG, December 2018, <https://assets.kpmg/content/dam/kpmg/in/pdf/2019/01/startup-landscape-ecosystem-growing-mature.pdf>.
- 4 "Global Innovation Index 2018: Energizing the World with Innovation," Cornell University, INSEAD, and WIPO, 2018, <https://www.globalinnovationindex.org/gii-2018-report>.
- 5 Ibid.
- 6 "Global Tech Hubs Report: Global metro areas and their tech companies," CB Insights, 2018, https://www.cbinsights.com/reports/CB-Insights_Global-Tech-Hubs.pdf.
- 7 "As Early-Stage Deals Fall In India, Unicorns Continue To Raise Mega-Rounds," CB Insights, November 19, 2018, <https://www.cbinsights.com/research/india-unicorns-investment-trends/>.
- 8 "\$1B+ Market Map: The World's 326 Unicorn Companies in One Infographic," CB Insights, June 12, 2019, <https://app.cbinsights.com/research/unicorn-startup-market-map>.
- 9 "The Most Active Investors In India Tech," CB Insights, July 13, 2017, <https://www.cbinsights.com/research/india-most-active-investors/>.
- 10 "As Early-Stage Deals Fall In India, Unicorns Continue To Raise Mega-Rounds," CB Insights, November 19, 2018, <https://www.cbinsights.com/research/india-unicorns-investment-trends/>.
- 11 Dalal, Mihir, "Exit Blues," Live Mint, January 18, 2018, <https://www.livemint.com/Companies/6vScDFRsDvkbjPwt9AFnO/Exit-blues.html>.

- 12 Interview with Dr. Anula Jayasuriya, Founder and Managing Director, EXXclaim Capital, Fall 2018.
- 13 "Walmart to open 50 new stores in India in 4-5 years," The Hindu, May 10, 2018, <https://www.thehindu.com/business/walmart-to-open-50-new-stores-in-india-in-4-5-years/article23834109.ece>.
- 14 "Flipkart is India's Biggest VC-Backed Tech Exit by a Mile," CB Insights, May 10, 2018, <https://www.cbinsights.com/research/flipkart-walmart-india-top-tech-exits/>
- 15 Goyal, Malini, "It's springtime for India's startup financing industry and here's what made it happen," The Economic Times, May 21, 2019, <https://economictimes.indiatimes.com/small-biz/startups/features/spring-is-here-for-indias-startup-financing-industry-and-heres-what-made-it-happen/articleshow/69390913.cms>.
- 16 Panday, "New Enterprise Associates veering away from investment in India," Qrius, September 16, 2017, <https://qrius.com/new-enterprise-associates-veering-away-investment-india/> and Shalini, Kolodny, Lora, "Tim Draper is backing Indian startups again with Blume Ventures Alliance," TechCrunch, February 2017, <https://techcrunch.com/2017/02/13/tim-draper-is-backing-indian-startups-again-with-blume-ventures-alliance/>.
- 17 Rai, Joseph, "Sequoia Capital raises sixth India VC fund, loses another managing director," VCCircle, August 21, 2018, <https://www.vccircle.com/sequoia-capital-raises-sixth-india-vc-fund-loses-another-managing-director>.
- 18 "Falcon Edge, Maverick, existing investors to invest in Bounce at \$200 million valuation," Live Mint, April 24, 2019, <https://www.livemint.com/companies/start-ups/bounce-closing-a-80-million-funding-round-backed-by-sequoia-others-1555996304294.html>.
- 19 "About Surge," Surge, Sequoia Capital Operations LLC, 2019, <https://www.surgeahead.com>.
- 20 Sen, Anirban and Mihir Dalai, "Accel Partners raises \$450 million India fund," Live Mint, December 1, 2016, <https://www.livemint.com/Companies/EnEmvgP4mH1jWQLj7pflQM/Accel-Partners-raises-450-million-India-fund.html>.
- 21 Schleifer, Theodore, "Here are the big winners from Flipkart's \$16 billion deal with Walmart," Vox, May 9 2018, <https://www.vox.com/2018/5/9/17336790/flipkart-walmart-deal-winners-tiger-global-softbank-accel>.
- 22 Anand J, "Accel Partners reveals why it invested in Flipkart at a time when it had no backers," VCCircle, May 10, 2018, <https://www.vccircle.com/flipkarts-first-vc-backer-reveals-why-it-invested-when-no-else-wanted-to/>.
- 23 "Matrix Partners India fund raises \$300 million," Financial Express, August 17, 2018, <https://www.financialexpress.com/industry/matrix-partners-india-fund-raises-300-million/1283207/>.
- 24 Mishra, Digbijay, "Video startup Clipp App gets \$6 million from Matrix, others," The Times of India, December 14, 2017, <https://timesofindia.indiatimes.com/venture-capital/video-startup-clip-app-gets-6-million-from-matrix-others/articleshow/62061407.cms>.
- 25 Transit: Motorbike rental firms compete with Uber in India, San Francisco Chronicle, May 13, 2019, <https://www.pressreader.com/usa/san-francisco-chronicle/20190513/281938839361436>.
- 26 Interview with Sumir Chadha, Managing Director, WestBridge Capital, Spring 2019.
- 27 Chanchani, Madhav, "IDG Ventures India becomes Chiratae, to raise \$300mn for fourth fund," The Economic Times, October 10, 2018, <https://economictimes.indiatimes.com/small-biz/startups/newsbuzz/for-a-big-leap-idg-ventures-india-to-become-chiratae-eyes-300-million/articleshow/66142302.cms>.
- 28 Hector, Dearton Thomas, "IDG Ventures India renames itself as Chiratae Ventures," VCCircle, October 10, 2018, <https://www.vccircle.com/idg-ventures-india-renames-itself-as-chiratae-ventures>.
- 29 Chanchani, Madhav, "IDG Ventures India closes Rs 1,360-cr fund," The Economic Times, January 30, 2017, <https://economictimes.indiatimes.com/small-biz/money/idg-ventures-india-closes-rs-1360-cr-fund/articleshow/56864079.cms>.
- 30 Chanchani, Madhav, "IDG Ventures India becomes Chiratae, to raise \$300mn for fourth fund," The Economic Times, October 10, 2018, <https://economictimes.indiatimes.com/small-biz/startups/newsbuzz/for-a-big-leap-idg-ventures-india-to-become-chiratae-eyes-300-million/articleshow/66142302.cms>.
- 31 Ibid.
- 32 Interview with Krish Panu, Managing Director, PointGuard Ventures, Spring 2019.
- 33 Pitchiah, Vijayakumar, "Nexus Venture Partners leads Series A round in Observe.ai," VCCircle, August 14, 2018, <https://www.vccircle.com/nexus-venture-partners-leads-series-a-round-in-observe-ai/>.
- 34 Hector, Dearton Thomas, "Lightspeed US leads fresh investment in hyperlocal discovery startup Magicpin," VCCircle, November 23, 2018, <https://www.vccircle.com/lightspeed-us-leads-fresh-investment-in-hyperlocal-discovery-startup-magicpin/>.
- 35 Dutta, Vishal, "John Chambers sets up plans take Indian startups global," Rise, The Economic Times, January 21, 2019, <https://economictimes.indiatimes.com/small-biz/startups/newsbuzz/john-chambers-sets-up-plans-take-indian-startups-global/articleshow/67618324.cms>.
- 36 "Mohanjit Jolly-Investment Committee Member," Unreasonable, 2018, <https://unreasonablecapital.com/portfolio/mohanjit-jolly/>.
- 37 Dhanjal, Swaraj Singh and Shrija Agrawal, "IronPillar makes final close of \$90 million fund," Live Mint, October 4, 2018, <https://www.livemint.com/Companies/Sxv5v6ehSulGP0FzSRS8pO/IronPillar-makes-final-close-of-90-million-fund.html>.
- 38 Interview with Mohanjit Jolly, Partner, Iron Pillar, Spring 2019.
- 39 "SVB Financial Group Opens Venture Lending Operation in India," Silicon Valley Bank press release, Auguts 18, 2008, <https://www.svb.com/news/company-news/svb-financial-group-opens-venture-lending-operation-in-india>.
- 40 Chanchani, Madhav, "Saama raiser \$100m for contrarian bets," The Economic Times, April 5, 2018, <https://economictimes.indiatimes.com/small-biz/startups/newsbuzz/saama-raises-100m-for-contrarian-bets/articleshow/63633587.cms>.
- 41 Sarkar, Ranju, "Why investors like Sachin Bansal are putting their money on venture debt," Business Standard, April 30, 2019, https://www.business-standard.com/article/specials/why-investors-like-sachin-bansal-are-putting-their-money-on-venture-debt-119043000891_1.html.
- 42 "Our Companies," Saama Capital, accessed June 3, 2019, <https://www.saamacapital.com/companies/>.
- 43 Interview with Andy Tsao, Managing Director, SVB Global Gateway.

CHAPTER 6

Information Technology: Upward Mobility

- 1 "Strategic Review: IT-BPM Sector In India 2019: Decoding Digital," NASSCOM, 2019, <https://www.nasscom.in/knowledge-center/publications/strategic-review-it-bpm-sector-india-2019-decoding-digital>.
- 2 "Jobs and Skills: The Imperative to reinvent and disrupt," NASSCOM, May 18, 2017, https://www.nasscom.in/sites/default/files/Jobs_and_Skills.pdf
- 3 "Industry Performance: 2018-19 and what lies ahead," NASSCOM, 2019, https://www.nasscom.in/sites/default/files/Industry-Performance2018-19-and-what-lies-ahead_0.pdf
- 4 "IT & ITeS Industry in India," India Brand Equity Foundation, March 2019, <https://www.ibef.org/industry/information-technology-india.aspx>.
- 5 "Industry Performance: 2018-19 and what lies ahead," NASSCOM, 2019, https://www.nasscom.in/sites/default/files/Industry-Performance2018-19-and-what-lies-ahead_0.pdf
- 6 "It & ITeS," India Brand Equity Foundation, November 2018, <https://www.ibef.org/industry/information-technology-india/infographic>.
- 7 "Indian IT, ITeS & BPM Industry Analysis," India Brand Equity Foundation, May 2019, <https://www.ibef.org/industry/indian-it-and-iteS-industry-analysis-presentation>.
- 8 Singhi, Abheek and Parul Bajaj, "Decoding Digital Consumers in India," Boston Consulting Group, July 27, 2017, <https://www.bcg.com/publications/2017/globalization-consumer-products-decoding-digital-consumers-india.aspx>.
- 9 "Innovating for the Next Half Billion," Omidyar Network, December 18, 2017, <https://www.omidyar.com/insights/innovating-next-half-billion>.
- 10 Tandon, Rajguru, "Emerging Technologies To Add 1.4 Million IT Jobs In India By 2027," BW BusinessWorld, November 2018, <http://www.businessworld.in/article/Emerging-Technologies-To-Add-1-4-Million-IT-Jobs-In-India-By-2027/15-11-2018-164207/>.
- 11 "India Workforce Report - Professional Edition | India | H2 2018," LinkedIn, April 10, 2019 <https://economicgraph.linkedin.com/resources/linkedin-india-workforce-professional-report-2018-h2>.
- 12 Pacheco, Shrey, "Modi in US: Tech CEOs Express Support for Digital India, Make in India, GST," Digit, June 27, 2017, <https://www.digit.in/news/general/modi-in-us-tech-ceos-express-support-for-digital-india-make-in-india-gst-35770.html>
- 13 Nidhi, Sai, "Here's what you need to know about Digital India initiative," DNA India, September 28, 2015, <https://www.dnaindia.com/business/report-here-s-what-you-need-to-know-about-the-digital-india-initiative-2129525>.

- 14 Chambers, John, "Cisco's John Chambers Explains How Leaders Can Cross the Digital Divide," *Fortune*, September 14, 2016, <http://fortune.com/2016/09/14/cisco-john-chambers-digital-age/>.
- 15 Kaka, Noshir, Anu Madgavkar, Alok Kshirsagar, Rajat Gupta, James Manyika, Kushe Bahl, and Shishir Gupta, "Digital India: Technology to transform a connected nation," McKinsey Global Institute, March 2019, <https://www.mckinsey.com/~media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/digital%20india%20technology%20to%20transform%20a%20connected%20nation/digital-india-technology-to-transform-a-connected-nation-full-report.ashx>.
- 16 Ibid.
- 17 Sengupta, Devina, "Consumption to double: Data usagess to turn upwardly mobile in 2019," *The Economic Times*, January 3, 2019, <https://economictimes.indiatimes.com/tech/internet/data-usage-to-turn-upwardly-mobile-in-2019/articleshow/67358232.cms?from=mdr>.
- 18 Purnell, Newley, "Two Years Ago, India Lacked Fast, Cheap Internet—One Billionaire changed All That," *The Wall Street Journal*, September 5, 2018, <https://www.wsj.com/articles/two-years-ago-india-lacked-fast-cheap-internet-one-billionaire-changed-all-that-1536159916>.
- 19 "IT & TeS Industry in India," India Brand Equity Foundation, April 2018, <https://www.ibef.org/archives/detail/b3ZlcnZpZCxmMzc5MTcmODk=>.
- 20 "IT & TeS Industry in India," India Brand Equity Foundation, " March 2019, <https://www.ibef.org/industry/information-technology-india.aspx>.
- 21 "E-commerce and consumer internet companies have raised over US\$7 billion in PE/VC capital in 2018: EY report", EY press release, March 8, 2019, <https://www.ey.com/in/en/newsroom/news-releases/news-e-commerce-and-consumer-internet-companies-have-raised-over-usd-7-billion-in-pe-vc-capital-in-2018-ey-report>.
- 22 Davies, Jamie, "Indian government greenlights plan to increase broadband penetration," *Telecoms.com*, September 27, 2018, <http://telecoms.com/492455/indian-government-greenlights-plan-to-increase-broadband-penetration/#>.
- 23 Goel, Vindu, "U.S. Credit Card Giants Flout India's New Law on Personal Data," *The New York Times*, October 15, 2018.
- 24 Martin F.R., "India's Data Protection Bill Will Now Be Tabled in June," *Analytics India Magazine*, January 4, 2019, <https://www.analyticsindiamag.com/indias-data-protection-bill-in-june/>.
- 25 Mendonca, Jochelle, "As government tightens data rules, IT firms flag risks," *The Economic Times*, March 13, 2019, <https://economictimes.indiatimes.com/tech/ites/as-government-tightens-data-rules-it-firms-flag-risks/printarticle/68384442.cms>.
- 26 Mankotia, Anandita Singh, "Ravi Shankar Prasad to 'quickly' table data protection bill, notify norms," *The Economic Times*, June 1, 2019, <https://economictimes.indiatimes.com/tech/internet/priority-to-quickly-take-data-protection-bill-to-parliament-new-it-minister-ravi-shankar-prasad/articleshow/69596440.cms>.
- 27 Mishra, Asit Ranjan, "India warns WTO about EU's proposal for e-commerce rules," *Live Mint*, May 5, 2019, <https://livemint.com/companies/news/india-warns-wto-about-eu-s-proposal-for-e-commerce-rules-155707953297.html>.
- 28 Purnell, Newby and Rajesh Roy, "Amazon, Facebook and Walmart Need to Watch Their Backs in India," *The Wall Street Journal*, January 29, 2019, <https://www.wsj.com/articles/as-amazon-walmart-and-other-foreign-players-dominate-india-to-promote-domestic-tech-companies-11548766862>.
- 29 Arakali, Harichandan, "Indian IT services sector: Time for a reboot," *Forbes India*, March 14, 2018, <http://www.forbesindia.com/article/leaderboard/indian-it-services-sector-time-for-a-reboot/496711>.
- 30 Talgeri, Kunal and Jochelle Mendonca, "How Infosys' Vishal Sikka disrupted organisation by moving CEO's office from Bengaluru to Palo Alto," *The Economic Times*, February 16, 2017, <https://economictimes.indiatimes.com/tech/ites/how-infosys-vishal-sikka-disrupted-organisation-by-moving-ceos-office-from-bengaluru-to-palo-alto/articleshow/57175307.cms>.
- 31 "Palo Alto Studio," Infosys Digital Studio, accessed June 18, 2018, <https://www.infosys.com/navigate-your-next/agile-digital-scale/digital-studios/Pages/san-francisco.aspx>.
- 32 Landy, Heather, "Infosys, on a 10,000-job hiring sprint in the US, is 75% of the way there," *Quartz at Work*, February 17, 2019, <https://qz.com/work/1552468/infosys-closing-in-on-us-hiring-target-opens-design-hub-in-providence/>.
- 33 Interview with Anurug Varma, Vice President, Infosys Ltd., Summer 2018.
- 34 "Wipro Launches Silicon Valley Innovation Center in Mountain View," Wipro press release, August 1, 2017, <https://www.wipro.com/en-US/digital/news/wipro-launches-silicon-valley-innovation-center-in-mountain-view/>.
- 35 Sood, Varun, "Wipro startup investments help win 100 deals in 4 years," *Live Mint*, February 5, 2019, <https://www.livemint.com/companies/news/wipro-startup-investments-help-win-100-deals-in-4-years-1549386775568.html>.
- 36 Sunkara, Keshav, "Wipro Digital to acquire Alan Cooper's design consultancy firm for \$8.5 mn," *VCCircle*, October 5, 2017, <https://www.vccircle.com/wipro-digital-to-acquire-alan-coopers-design-consultancy-firm-for-8-5-mn/>.
- 37 "TCS Inaugurates Silicon Valley Customer Collaboration Center in Santa Clara, California," Tata Consultancy Services press release, January 31, 2012, <https://www.tcs.com/tcs-silicon-valley-customer-collaboration-center-santa-clara-california>.
- 38 "TCS Launches its Digital Reimagination Studio in Silicon Valley," Tata Consultancy Services press release, February 17, 2016, <https://www.tcs.com/tcs-digital-reimagination-studio-in-silicon-valley>.
- 39 Interview with Harshul Asnani, Senior Vice President, Tech Mahindra, Spring 2018.
- 40 Singh, Shelley, "Google wants to bring everyone online in India through its next billion plan," *The Economic Times*, June 5, 2018, <https://economictimes.indiatimes.com/tech/internet/google-wants-to-bring-everyone-online-in-india-through-its-next-billion-plan/articleshow/64457134.cms>.
- 41 "India accounts for 36.9 billion downloads on Google Play Store, tops list ahead of the US," *Financial Express*, October 24, 2018, <https://www.financialexpress.com/industry/technology/india-accounts-for-36-9-billion-downloads-on-google-play-store-tops-list-ahead-of-the-us/1359260/>.
- 42 Singh, Shelley, "Google wants to bring everyone online in India through its next billion plan," *The Economic Times*, June 5, 2018, <https://economictimes.indiatimes.com/tech/internet/google-wants-to-bring-everyone-online-in-india-through-its-next-billion-plan/articleshow/64457134.cms>.
- 43 Shah, Saqib, "Alphabet tries internet lasers instead of balloons for India," *Engadget*, December 15, 2017, <https://www.engadget.com/2017/12/15/alphabet-x-internet-india-andhra-pradesh/>.
- 44 Singh, Shelley, "Google wants to bring everyone online in India through its next billion plan," *The Economic Times*, June 5, 2018, <https://economictimes.indiatimes.com/tech/internet/google-wants-to-bring-everyone-online-in-india-through-its-next-billion-plan/articleshow/64457134.cms>.
- 45 Iyengar, Rishi, "Google rolls out Neighbourly, a new app just for India," *CNN Business*, November 21, 2018, <https://www.cnn.com/2018/11/21/tech/google-india-neighbourly-app/index.html>.
- 46 "Google Neighbourly now present in 5 more cities to answer your hyperlocal queries," *Firstpost Tech2*, September 12, 2018, <https://www.firstpost.com/tech/news-analysis/google-neighbourly-now-present-in-5-more-cities-to-answer-your-hyperlocal-queries-5170111.html>.
- 47 Singh, Shelley, "Google wants to bring everyone online in India through its next billion plan," *The Economic Times*, June 5, 2018, <https://economictimes.indiatimes.com/tech/internet/google-wants-to-bring-everyone-online-in-india-through-its-next-billion-plan/articleshow/64457134.cms>.
- 48 "All the Numbers You Need," *DataReportal*, January 2019, <https://datareportal.com/>
- 49 Zucchi, Kristina, "Why Facebook Is Banned in China & How to Access It," *Investopedia*, April 30, 2019, <https://www.investopedia.com/articles/investing/042915/why-facebook-banned-china.asp>.
- 50 Hutchinson, Andrew, "Facebook Reaches 2.38 Billion Users, Beats Revenue Estimates in Latest Update," *Social Media Today*, April 24, 2019, <https://www.socialmediatoday.com/news/facebook-reaches-238-billion-users-beats-revenue-estimates-in-latest-upda/553403/>.
- 51 Lardinois, Frederic, "Facebook's Express Wi-Fi launches commercially in India," *TechCrunch*, May 4, 2017, <https://techcrunch.com/2017/05/04/facebooks-express-wi-fi-launches-commercially-in-india/>.
- 52 Bhatia, Rahul, "The inside story of Facebook's biggest setback," *The Guardian*, May 12, 2016, <https://www.theguardian.com/technology/2016/may/12/facebook-free-basics-india-zuckerberg>.
- 53 Lardinois, Frederic, "Facebook's Express Wi-Fi launches commercially in India," *TechCrunch*, May 4, 2017, <https://techcrunch.com/2017/05/04/facebooks-express-wi-fi-launches-commercially-in-india/>.
- 54 Iyengar, Rishi, "WhatsApp has been linked to lynchings in India. Facebook is trying to contain the crisis," *CNN Business*, July 27, 2018, <https://www.cnn.com/2018/09/30/tech/facebook-whatsapp-india-misinformation/index.html>.
- 55 Ong, Thuy, "Facebook begins fact-checking news for users in India, one of its largest markets," *The Verge*, April 17, 2018, <https://www.theverge.com/2018/4/17/17246658/facebook-third-party-fact-checking-india>.

The Bay Area-Silicon Valley and India: Convergence and Alignment in the Innovation Age

- 56 Purnell, Newly, "Facebook Removes Hundreds of Fake Accounts Ahead of India Elections," *The Wall Street Journal*, April 1, 2019, <https://www.wsj.com/articles/facebook-removes-hundreds-of-fake-accounts-ahead-of-indian-elections-11554129628>.
- 57 "Oracle India Private Limited," *India Brand Equity Foundation*, 2005, <https://www.ibef.org/download/Oracle.pdf>.
- 58 Martin F.R., "Oracle Set To Launch Its First Indian Data Center IN Mumbai," *Analytics India Magazine*, January 23, 2019, <https://www.analyticsindiamag.com/oracle-launch-data-centre-mumbai/>.
- 59 Nair, Prajeet, "What's cooking in Oracle India's labs: AI, blockchain, IoT and cloud," *ComputerWorld from IDG*, March 7, 2019, <https://www.computerworld.in/interview/whats-cooking-oracle-indias-labs-ai-blockchain-iot-and-cloud>.
- 60 "Oracle lays off 100 employee in India in its restructuring drive," *TechGig*, March 23, 2019, <https://content.techgig.com/oracle-lays-off-100-employees-in-india-in-its-restructuring-drive/articleshow/68532385.cms>.
- 61 Nair, Prajeet, "What's cooking in Oracle India's labs: AI, blockchain, IoT and cloud," *ComputerWorld from IDG*, March 7, 2019, <https://www.computerworld.in/interview/whats-cooking-oracle-indias-labs-ai-blockchain-iot-and-cloud>.
- 62 "Center for Railway Information Systems Delivers High-Performance e-Ticketing System to Support 200,000 Concurrent Users and Double Daily Peak-Hour Sales," *Oracle*, accessed June 18, 2019, <https://www.oracle.com/in/customers/cris-1-weblogic.html>.
- 63 "Oracle to endow worth \$400 million in India," *The Silicon Review*, February 20, 2016, <https://thesiliconreview.com/2016/2/oracle-to-endow-worth-400-million-in-india/>.
- 64 "Oracle opens its first Digital Hub in Bengaluru," *Express Tech*, *The Indian Express*, July 7, 2017, <https://indianexpress.com/article/technology/tech-news-technology/oracle-opens-its-first-digital-hub-in-bengaluru-4740375/>.
- 65 Martin F.R., "Oracle Set To Launch Its First Indian Data Center IN Mumbai," *Analytics India Magazine*, January 23, 2019, <https://www.analyticsindiamag.com/oracle-launch-data-centre-mumbai/>.
- 66 Kumar, Ankush, "Oracle is bullish on supplying Blockchain tech for Oil and Gas companies: Niraj Prakash, Oracle India," *Energyworld.com from The Economic Times*, June 6, 2018, <https://energy.economictimes.indiatimes.com/news/power/oracle-is-bullish-on-supplying-blockchain-tech-for-oil-gas-companies-niraj-prakash-oracle-india/64477075>.
- 67 Maru, Pankaj, "From Sales Cloud to AI backed smart Einstein: The Salesforce saga," *CIO.com from The Economic Times*, November 8, 2017, <https://cio.economictimes.indiatimes.com/news/corporate-news/from-sales-cloud-to-ai-backed-smart-einstein-the-salesforce-saga/61555834>.
- 68 Giriprakash, G., "Salesforce.com puts India expansion on fast track," *Hindu Business Line*, February 12, 2018, <https://www.thehindubusinessline.com/info-tech/salesforcecom-puts-india-expansion-on-fast-track/article22733765.ece>.
- 69 Phadnis, Shilpa, "Salesforce.com signals India focus with appointment of country head," *The Times of India*, July 14, 2007, <https://timesofindia.indiatimes.com/business/india-business/salesforce-com-signals-india-focus-with-appointment-of-country-head/articleshow/59589835.cms>.
- 70 Kalavalapalli, Yogendra, "Salesforce to open centre in Hyderabad," *Live Mint*, June 7, 2016, <https://www.livemint.com/Industry/mUM8PgkfpCKEavB2VsrLRL/Salesforce-to-open-centre-in-Hyderabad.html>.
- 71 Ahmad, Ibrahim, "Biggest Change the Industry is Facing is Changing Customer Expectations: Sunil Jose, Salesforce India," *DataQuest*, March 19, 2019, <https://www.dqindia.com/biggest-change-industry-facing-changing-customer-expectations-sunil-jose-salesforce-india/>.
- 72 "SpringML opens new offices in Indianapolis and Hyderabad," *News India Times*, May 18, 2018, <http://www.newsindiatimes.com/springml-opens-new-offices-in-indianapolis-and-hyderabad>.
- 73 "India is one of the fastest growing regions for salesforce," *SME Channels*, December 22, 2018, <http://www.smechannels.com/india-is-one-of-the-fastest-growing-regions-for-salesforce/>.
- 74 Abrar, Peerzada, "Salesforce will create 1.1 mn India jobs," *The Hindu*, May 20, 2018, <https://www.thehindu.com/business/Industry/salesforce-will-create-1-1-mn-india-jobs/article23943605.ece>.
- 75 "Salesforce Trailhead is democratizing skills for the workforce of the future," *YourStory*, April 30, 2019, <https://yourstory.com/2019/04/salesforce-trailhead-democratizing-skills>.
- 76 Krishna, Vishal, "Salesforce targets Indian SMBs with Essentials, a suite of intelligent apps," *YourStory*, March 16, 2018, <https://yourstory.com/2018/03/salesforce-targets-indian-smbs-essentials-suite-intelligent-apps/>.
- 77 "About Zendesk," *Zendesk*, accessed June 17, 2019, <https://www.zendesk.com/company/press/#about>.
- 78 Sindhu, M.V., "Why Zendesk co-founder Morten Primdahl thinks India is an exciting market," *YourStory*, September 28, 2016, <https://yourstory.com/2016/09/india-zendesk-morten-primdahl/>.
- 79 Ibid.
- 80 "Big boost for PM Modi's Digital India dream! Indian banks, insurance companies increasingly embracing digitisation, says US tech expert," *Financial Express*, August 17, 2018, <https://www.financialexpress.com/industry/banking-finance/big-boost-for-pm-modis-digital-india-dream-indian-banks-insurance-companies-increasingly-embracing-digitisation-says-us-tech-expert/1283756/>.
- 81 "We See New Opportunities In India's Enterprise Market: Zendesk CEO," *Communications Today*, May 21, 2018, <https://www.communicationstoday.co.in/we-see-new-opportunities-in-indias-enterprise-market-zendesk-ceo/>.
- 82 Sindhu, M.V., "Why Zendesk co-founder Morten Primdahl thinks India is an exciting market," *YourStory*, September 28, 2016, <https://yourstory.com/2016/09/india-zendesk-morten-primdahl/>.
- 83 Srinivasan, Supraja, "Zendesk to focus on India to push global growth," *The Economic Times*, May 22, 2018, <https://economictimes.indiatimes.com/tech/ites/zendesk-to-focus-on-india-to-push-global-growth/articleshow/64266920.cms.h>
- 84 Sindhu, M.V., "Why Zendesk co-founder Morten Primdahl thinks India is an exciting market," *YourStory*, September 28, 2016, <https://yourstory.com/2016/09/india-zendesk-morten-primdahl/>.
- 85 Stangel, Luke, "Report: Threatened with new tariffs, Apple contractor to build iPhone X in India," *Silicon Valley Business Journal*, December 27, 2018, <https://www.bizjournals.com/sanjose/news/2018/12/27/apple-india-foxconn-iphone-x-manufacturing.html>.
- 86 Ghosh, Durba, "Why is Apple looking to assemble the older iPhone 7 in India?" *Quartz India*, April 3, 2019, <https://qz.com/india/1586001/apple-to-make-iphone-7-in-india-to-take-on-xiaomi-vivo-others/>.
- 87 "Apple iPhone X to be made locally in India from July 2019: Report," *BGR*, April 11, 2019, <https://www.bgr.in/news/apple-iphone-x-to-be-made-locally-in-india-from-july-2019-report/>.
- 88 "Cisco India Overview," *Cisco Systems website and detailed fact sheet*, accessed June 6, 2019, https://www.cisco.com/c/en_in/about/company-overview.html and https://www.cisco.com/c/dam/global/en_in/assets/pdfs/detailed_fact_sheet.pdf
- 89 Reichert, Corinne, "Jio and Rakuten are pioneers: Cisco," *ZDNet*, March 7, 2019, <https://www.zdnet.com/article/jio-and-rakuten-are-pioneers-cisco/>.
- 90 Thaker, Aria, "Reliance Jio has the best 4G coverage in India, but Airtel's the fastest," *Quartz India*, February 11, 2019, <https://qz.com/india/1548198/reliance-jio-tops-4g-coverage-in-india-but-airtel-s-the-fastest/>.
- 91 Reichert, Corinne, "Jio and Rakuten are pioneers: Cisco," *ZDNet*, March 7, 2019, <https://www.zdnet.com/article/jio-and-rakuten-are-pioneers-cisco/>.
- 92 "VMware Seeks Government Push To Increase Its Footprint In India," *Express Computer*, July 25, 2018, <https://www.expresscomputer.in/news/vmware-seeks-government-push-to-increase-its-footprint-in-india/22259/>.
- 93 Mathur, Nathan, "VMware plans to invest \$2 billion in India over next 5 years," *Live Mint*, October 17, 2018, <https://www.livemint.com/Companies/Lxeny6JbHqjvoh9B4Ak0L/VMware-plans-to-invest-2-billion-in-India-over-next-5-years.html>.
- 94 D'Monte, Leslie, "VMware: Taking the smart cloud to where data resides," *Live Mint*, September 23, 2018, <https://www.livemint.com/Companies/zl8khLy5upUYXtshYcTmWL/VMware-Taking-the-smart-cloud-to-where-data-resides.html>.
- 95 "VMware opens \$120 million campus in Bengaluru," *Live Mint*, April 14, 2015, <https://www.livemint.com/Industry/pXMfk7DXYSYQ4YBxLqOxSM/VMware-opens-120-million-campus-in-Bengaluru.html>.
- 96 John, Sujit and Shilpa Phadnis, "India's in everything we do: VMware CEO," *The Times of India*, November 28, 2016, <https://timesofindia.indiatimes.com/business/india-business/Indias-in-everything-we-do-VMware-CEO/articleshow/55661908.cms>.
- 97 "Cows In The Cloud: How A Family Farm Transformed Rural India," *Forbes*, February 24, 2017, <https://www.forbes.com/sites/vmware/2017/02/24/cows-in-the-cloud-how-a-family-farm-transformed-rural-india/#14537e4b5aff>.
- 98 "The Best Show in India, Assisted by VMware," *VMware*, assessed June 7, 2019, <https://www.vmware.com/content/microsites/possible/stories/book-my-show.html>.

- 99 Christopher, Niles, "VMware spots \$1 billion in cloud network," *The Economic Times*, August 22, 2018, <https://economictimes.indiatimes.com/tech/internet/vmware-spots-1-billion-in-cloud-network/articleshow/65497527.cms?from=mdr>.
- 100 "The amazing story of the birth of HCL," *Rediff India Abroad*, June 9, 2007, <https://www.rediff.com/money/2007/jun/09bspec1.htm>.
- 101 Hall, Mark, "Hewlett-Packard Company," *Encyclopedia Britannica*, April, 29, 2019, <https://www.britannica.com/topic/Hewlett-Packard-Company>.
- 102 Layak, Suman, "How a split turned into a boon for HP's laptop and printer businesses," *The Economic Times*, December 24, 2017, HP, <https://economictimes.indiatimes.com/tech/hardware/how-a-split-turned-into-a-boon-for-hps-laptop-and-printer-businesses/articleshow/62226009.cms?from=mdr>
- 103 Anand, Shivani, "Weak consumer demand in Q4 results in a 2.8% decline in Indian Traditional PC Market in CY2018: IDC India Report," IDC, February 14, 2019, <https://www.idc.com/getdoc.jsp?containerId=prAP44865919>.
- 104 "HP India to give education a big push in 2019: MD Sumeer Chandra," *The Economic Times*, December 13, 2016, <https://economictimes.indiatimes.com/tech/hardware/hp-india-to-give-education-a-big-push-in-2019-md-sumeer-chandra/articleshow/67072492.cms?from=mdr>.
- 105 Mohan, Raghu, "Uber enters India; rools out first in Bangalore," *YourStory*, August 30, 2013, <https://yourstory.com/2013/08/uber-enters-india-rolls-out-first-in-bangalore>.
- 106 "Uber folls into its 40th city in India," *Uber Newsroom*, April 8, 2019, <https://www.uber.com/en-IN/newsroom/uber-rolls-into-its-40th-city-in-india/>.
- 107 Karnik, Madhura, "Uber in India is fundamentally different from Uber in the West," *Quartz India*, March 16, 2017, <https://qz.com/india/926220/uber-in-india-is-fundamentally-different-from-uber-in-the-west/>.
- 108 Shah, Aditi, "Uber doubling down on India investments after exiting Southeast Asia," *Reuters*, April 18, 2018, <https://www.reuters.com/article/us-uber-india-coo/uber-doubling-down-on-india-investments-after-exiting-southeast-asia-idUSKBN1HP1OR>.
- 109 Purnell, Newley, "Uber's Latest Retreat Leaves Brasil, India as the Key Battlegrounds," *The Wall Street Journal*, March 26, 2018, <https://www.wsj.com/articles/ubers-latest-retreat-leaves-brazil-india-as-the-key-battlegrounds-1522067884>.
- 110 Bhattacharya, Ananya, "Ola vs Uber: The latest score in the great Indian taxi-app game," *Quartz India*, February 11, 2019, <https://qz.com/india/1545042/ola-vs-uber-the-latest-score-in-the-great-indian-taxi-app-game/>.
- 111 Purnell, Newley, "Uber's Latest Retreat Leaves Brasil, India as the Key Battlegrounds," *The Wall Street Journal*, March 26, 2018, <https://www.wsj.com/articles/ubers-latest-retreat-leaves-brazil-india-as-the-key-battlegrounds-1522067884>.
- 112 Abrams, Corinne and Newley Purnell, "Airbnb Takes Stake in Indian Hotel-Booking Startup Oyo," *The Wall Street Journal*, April 1, 2019, <https://www.wsj.com/articles/airbnb-takes-stake-in-indian-hotel-startup-oyo-11554112029>.
- 113 Purnell, Newley, "Netflix and Amazon Trail a Local Video Rival in India That's Now Disney-Owned," *The Wall Street Journal*, June 4, 2019, <https://www.wsj.com/articles/netflix-and-amazon-trail-a-local-video-rival-in-india-thats-now-disney-owned-11559646003>.
- 114 Vena, Danny, "Netflix Subscribers Could More Than Double by 2023," *The Motley Fool*, September 24, 2018, <https://www.fool.com/investing/2018/09/24/netflix-subscribers-could-more-than-double-by-2023.aspx>.

SPOTLIGHT

Aadhaar and Internet Privacy

- 1 "123 crore Aadhaar cards issues to people: Govt tells Rajya Sabha," *Live Mint*, January 2, 2019, <https://www.livemint.com/Politics/FFd5f7BIL42zJ9H0jt9T6O/123-crore-Aadhaar-cards-issued-to-people-Govt-tells-Rajya-S.html>.
- 2 "Aadhaar-privacy debate: How the 12-digit number went from personal identifier to all pervasive transaction tool," *Firstpost*, January 18, 2018, <https://www.firstpost.com/india/aadhaar-privacy-debate-how-the-12-digit-number-went-from-personal-identifier-to-all-pervasive-transaction-tool-4308043.html>.
- 3 Bhattacharya, Ananya and Nupur Anand, "Aadhaar is voluntary—but millions of Indians are already trapped," *Quartz India*, September 25, 2018, <https://qz.com/india/1351263/supreme-court-verdict-how-indias-aadhaar-id-became-mandatory/>.
- 4 "Govt withdraws "social media hub" plan after SC's surveillance state remark," *The Indian Express*, June 5, 2019, <https://indianexpress.com/article/india/govt-withdraws-proposal-to-create-social-media-hub-after-snooping-allegations/>

SPOTLIGHT

Digital India: Ubiquitous Data

- 1 "Number Of Smartphone Users In India Likely To Double To 859 Million By 2022," *Business Standard*, May 10, 2019, https://www.business-standard.com/article/news-cm/number-of-smartphone-users-in-india-likely-to-double-to-859-million-by-2022-119051000458_1.html.
- 2 "Inadequate Optical Fibre Network May Roadblock 5G Rollout in India," *INDVSTRVS*, March 7, 2019, <https://indvstrvs.com/inadequate-optical-fibre-network-may-roadblock-5g-rollout-in-india/>.
- 3 Mankotia, Anandita Singh, "Ravi Shankar Prasad to 'quickly' table data protection bill, notify norms," *The Economic Times*, June 1, 2019, <https://economictimes.indiatimes.com/tech/internet/priority-to-quickly-take-data-protection-bill-to-parliament-new-it-minister-ravi-shankar-prasad/articleshow/69596440.cms>.
- 4 Gupta, Arvind and Philip Auerwald, "The Ups and Downs of India's Digital Transformation," *Harvard Business Review*, May 6, 2019, <https://hbr.org/2019/05/the-ups-and-downs-of-indias-digital-transformation>.
- 5 Bhakta, Pratik, "Separate target for institutions: Govt. eyes 30 billion digital payments in FY 2018-19," *ET Rise*, *The Economic Times*, April 25, 2018, <https://economictimes.indiatimes.com/small-biz/money/separate-targets-for-institutions-govt-eyes-30-billion-digital-payments-in-fy-2018-19/articleshow/63903950.cms>.
- 6 "Aadhaar Dashboard," Unique Identification Authority of India, accessed June 17, 2019, https://uidai.gov.in/aadhaar_dashboard/auth_trend.php.
- 7 Dhillon, Amrit, "It's a godsend": the healthcare scheme bringing hope to India's sick," *The Guardian*, March 21, 2019, <https://www.theguardian.com/global-development/2019/mar/21/godsend-healthcare-scheme-bringing-hope-india-sick-ayushman-bharat>.
- 8 McCarthy, Julie, "Indian Supreme Court Declares Privacy A Fundamental Right," *The Two-Way*, NPR, August 24, 2017.
- 9 Rai, Pranav, "The Indian Supreme Court's Aadhaar judgement—A privacy analysis," *IAPP*, October 9, 2018, <https://iapp.org/news/a/the-indian-supreme-courts-aadhaar-judgement-a-privacy-perspective/>.
- 10 Briefing with Ravi Shankar Prasad, Union Minister for Law & Justice, Telecommunications, Communications, and Electronics & IT, Government of India, August 28, 2018.

SPOTLIGHT

GE's Digital Vote of Confidence for India

- 1 Ayres, Alyssa, "Can Indian Manufacturing Be the Next Chinese Manufacturing?" *The Atlantic*, January 4, 2018, <https://www.theatlantic.com/business/archive/2018/01/india-manufacturing-tata-alyssa-ayres/549263/>
- 2 "Predix: the Industrial IoT Application Platform," *GE*, 2018, https://www.ge.com/digital/sites/default/files/download_assets/Predix-The-Industrial-Internet-Platform-Brief.pdf.
- 3 Kellner, Tomas, "An Engineer's Dream: GE Unveils A Huge 3D Printer For Metals," *GE Reports*, November 14, 2017, <https://www.ge.com/reports/an-engineers-dream-ge-unveils-a-huge-3d-printer-for-metals/>.
- 4 "Creation of GE Digital," *GE press release*, *BusinessWire*, September 14, 2015, <https://www.businesswire.com/news/home/20150914006029/en/Creation-GE-Digital>.
- 5 Kellner, "GE's Brilliant Advanced Manufacturing Plant in Pund, India," *GE Reports*, February 15, 2015, <https://www.ge.com/reports/post/110927997125/ges-brilliant-advanced-manufacturing-plant-in/>.
- 6 "GE opens global Digital Hub in Bengaluru, to hire 1,000 techies," *Live Mint*, December 2, 2016, <https://www.livemint.com/Industry/mkUvvp1xldfWYAADktxcP/GE-opens-global-Digital-Hub-in-Bengaluru-to-hire-1000-tech.html>.
- 7 Goyal, Malini, "India's potential is finally turning into results: Vishal Wanchoo, CEO, GE South Asia," *The Economic Times*, September 23, 2018, <https://economictimes.indiatimes.com/industry/indl-goods/svs/engineering/indias-potential-is-finally-turning-into-results-vishal-wanchoo-ceo-ge-south-asia/articleshow/65916029.cms>.

SPOTLIGHT

Women and Technology: Connecting to a Better Life

- 1 Woetzel, Jonathan, et al., "The Power of Parity: Advancing Women's Equality in Asia Pacific | Focus: India," McKinsey Globa Institute, May 2018, <https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Gender%20Equality/The%20power%20of%20parity%20Advancing%20womens%20equality%20in%20India%202018/India%20power%20of%20parity%20report.ashx>.
- 2 "Mastercard Index of Women Entrepreneurs (MIWE) 2018," Mastercard, March 2018, https://newsroom.mastercard.com/wp-content/uploads/2018/03/MIWE_2018_Final_Report.pdf.
- 3 "Women in tech: There are 3 times more male engineers to females," Journey to Belong blog, Belong.co, accessed June 7, 2019, <http://blog.belong.co/gender-diversity-indian-tech-companies>.
- 4 Woetzel, Jonathan, et al., "The Power of Parity: Advancing Women's Equality in Asia Pacific | Focus: India," McKinsey Globa Institute, May 2018, <https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Gender%20Equality/The%20power%20of%20parity%20Advancing%20womens%20equality%20in%20India%202018/India%20power%20of%20parity%20report.ashx>.
- 5 "Chapter 6: State of Literacy," Census 2011, Government of India, http://censusindia.gov.in/2011-prov-results/data_files/india/Final_PPT_2011_chapter6.pdf.
- 6 "India Ranks Among Lowest in Women's Access to Mobiles, Internet," The Quint, September 8, 2018, <https://www.thequint.com/news/india/study-on-internet-and-mobile-phone-use-in-india-reveals-gender-gaps>.
- 7 "Internet in India 2017," Internet and Mobile Association Of India and Kantar IMRB, January 2018, <https://cms.iamai.in/Content/ResearchPapers/15c3c84c-128a-4ea9-9cf2-a50a6d18f21c.pdf>.
- 8 Briefing with Debjani Ghosh, President, NASSCOM, August 28, 2018.
- 9 "Mahila e-Haat", an online marketing platform for women launched by Smt Maneka Sanjay Gandhi , " Press Information Bureau, Government of India, Ministry of Women and Child Development, March 7, 2016, <http://pib.nic.in/newsite/PrintRelease.aspx?relid=137415>.
- 10 "Support to Training and Employment Programme for Women (STEP), Ministry of Women and Child Development, Government of India, accessed Jun 8, 2019, <https://wcd.nic.in/schemes/support-training-and-employment-programme-women-step>
- 11 "NASSCOM Launches Women Wizards Rule Tech Program for Women Technologists," NASSCOM media release, June 19, 2018, <https://www.nasscom.in/press/nasscom-launches-women-wizards-rule-tech-program-women-technologists>.
- 12 Rai, Saritha, "Debjani Ghosh to take charge at Nasscom, will be the first woman to head tech body in 30 yrs," The Economic Times, February 21, 2018, <https://economictimes.indiatimes.com/magazines/panache/debjani-ghosh-to-take-charge-at-nasscom-will-be-the-first-woman-to-head-tech-body-in-30-yrs/articleshow/63013189.cms?from=mdr>.
- 13 "Women and IT Scorecard—India, 2018" NASSCOM and The Open University UK, March 2018, https://www.researchgate.net/publication/328603083_Women_and_IT_Scorecard_-_India_2018.
- 14 "Wireless Women for Entrepreneurship & Empowerment," Wireless for Communities, Digital Empowerment Foundation, accessed June 8, 2019, <http://wforc.in/w2e2-2/>.
- 15 "India SoochnaPreneur program," Qualcomm Wireless Reach, August 24, 2016, <http://www.innovationinsights.ch/sites/default/files/resources/india-soochnapreneur-program.pdf>.
- 16 Moray, Deepali, "International Women's Day 2017: How google's ambitious Internet Saathi program is digitally empowering women in rural India," BGR, March 8, 2017, <https://www.bgr.in/news/international-womens-day-2017-how-googles-ambitious-internet-saathi-program-is-digitally-empowering-women-in-rural-india>.
- 17 Paul, Mathures, "Google India's biggest success story: Internet Saathi," The Telegraph, May 15, 2019, <https://www.telegraphindia.com/technology/google-indias-biggest-success-story-internet-saathi/cid/1690532>.
- 18 "PayPal launched second edition of Recharge: opens registrations," PayPal India, March 19, 2017, <https://www.paypal.com/stories/in/paypal-launches-second-edition-of-recharge-opens-registrations>.
- 19 "VMware and Women Who Code to train 15,000 women in India for free," The New Indian Express, November 10, 2018, <http://www.newindianexpress.com/lifestyle/tech/2018/nov/10/vmware-and-women-who-code-to-train-15000-women-in-india-for-free-1896388.html>.
- 20 Interview with Ajay Kela, President & CEO, Wadhvani Foundation, Summer 2018.

CHAPTER 7

Healthcare/Life Sciences: Care in the Cloud

- 1 "Healthcare Industry in India," India Brand Equity Foundation, February 2018, <https://www.ibef.org/industry/healthcare-india.aspx>.
- 2 Wilkinson, Bard, "'Modicare': India's PM promises free health care for half a billion," CNN, September 24, 2018, <https://www.cnn.com/2018/09/24/asia/modi-healthcare-election-intl/index.html>.
- 3 Agarwal, Gauree, "Healthcare Landscape in India: Challenges versus Emerging Technologies (Part I)," Medium, September 26, 2018, <https://medium.com/asha-impact/healthcare-landscape-in-india-challenges-versus-emerging-technologies-part-i-6aabc1312c66>.
- 4 Rao, Nivedita, "Who is paying for India's Healthcare?" The Wire, April 14, 2018, <https://thewire.in/health/who-is-paying-for-indias-healthcare>.
- 5 Sevaraj, Sakthivel, Habib Hasan Farooqui, and Anup Karan, "Quantifying the financial burden of households' out-of-pocket payments on medicines in India: a repeated cross-sectional analysis of National Sample Survey data, 1994–2014," British Medical Journal, May 31, 2018, <http://bmjopen.bmj.com/content/bmjopen/8/5/e018020.full.pdf>.
- 6 Jadhav, Radheshyam, "Healthcare costs land 5 crore Indians in poverty," Times of India, December 15, 2017. <https://timesofindia.indiatimes.com/india/healthcare-costs-land-5cr-indians-in-poverty/articleshow/62076906.cms>.
- 7 Nagarajan, Rema, "Health spending pushed 55 million into poverty in a year: Study," The Economic Times, June 13, 2018, <https://economictimes.indiatimes.com/news/politics-and-nation/health-spending-pushed-55-million-into-poverty-in-a-year-study/articleshow/64568199.cms>.
- 8 Biswas, Soutik, "India healthcare: Will the 'world's largest' public scheme work?" BBC News, February 4, 2018, <https://www.bbc.com/news/world-asia-india-42914071>.
- 9 "India to increase public health spending to 2.5% of GDP: PM Modi," The Economic Times, December 12, 2018, <https://economictimes.indiatimes.com/news/economy/policy/india-to-increase-public-health-spending-to-2-5-of-gdp-pm-modi/articleshow/67055735.cms>.
- 10 "National Health Stack: Strategy and Approach," NITI Aayog, July 2018, https://niti.gov.in/writereaddata/files/document_publication/NHS-Strategy-and-Approach-Document-for-consultation.pdf.
- 11 Singh, Arun, "Mission Indradhanush (MI) and Intensified Mission Indradhanush (IMI): The Immunization Programmes in India—A Brief Review," Gut Gastroenterol 1:001-002, Volume 1(1): 2018, [http://sciaeon.org/articles/Mission-Indradhanush-\(MI\)-and-Intensified-Mission-Indradhanush-\(IMI\)-The-Immunization-Programmes-in-India.pdf](http://sciaeon.org/articles/Mission-Indradhanush-(MI)-and-Intensified-Mission-Indradhanush-(IMI)-The-Immunization-Programmes-in-India.pdf).
- 12 "Project Signing : Government of India and World Bank Sign Agreement for Additional Financing to India's National Nutrition Mission (POSHAN Abhiyaan) to 315 Districts across all States and UTs," The World Bank press release, May 7, 2018, <https://www.worldbank.org/en/news/press-release/2018/05/07/government-india-world-bank-sign-agreement-additional-financing-indias-national-nutrition-mission-to-315districts-across-all-states>.
- 13 "India's home healthcare services sector all set for growth," CNBC TV18, June 7, 2018, <https://www.cnbctv18.com/healthcare/indias-home-healthcare-services-sector-all-set-for-growth-109939.htm>
- 14 Mishra, Ayush, "How telemedicine is transforming health care in India," YourStory, July 31, 2018, <https://yourstory.com/2018/07/telemedicine-transforming-india-healthcare>.
- 15 "Suri, Manveena, "India wants to make medical tourism a \$9 billion industry by 2020," CNN, February 15, 2019, <https://www.cnn.com/2019/02/13/health/india-medical-tourism-industry-intl/index.html>.
- 16 Bhargava, Yuthika, "Medical tourists flocking to India," The Hindu, July 23, 2018," <https://www.thehindu.com/news/national/medical-tourists-flocking-to-india/article24497896.ece>.
- 17 "India Among Fastest Growing Medical Tourism Destinations," News18, October 1, 2017, <https://www.news18.com/news/lifestyle/travel-india-among-fastest-growing-medical-tourism-destinations-1545187.html>.
- 18 "Suri, Manveena, "India wants to make medical tourism a \$9 billion industry by 2020," CNN, February 15, 2019, <https://www.cnn.com/2019/02/13/health/india-medical-tourism-industry-intl/index.html>.
- 19 "List of JCI Accredited Hospitals in India," MedPort, May 2, 2018 updated September 1, 2018, <https://medport.in/list-jci-accredited-hospitals-india/>
- 20 "Indian Pharmaceuticals Industry Analysis," India Brand Equity Foundation, May 2019, <https://www.ibef.org/industry/indian-pharmaceuticals-industry-analysis-presentation>.

- 21 Khorakiwala, Dr. Murtaza, "Budget 2018 expectation: Govt's facilitation a vital cog in pharma industry growth," ET Markets, The Economic Times, January 22, 2018, <https://economictimes.indiatimes.com/markets/stocks/news/govts-facilitation-a-vital-cog-in-pharma-industry-growth/articleshow/62602530.cms?from=mdr>
- 22 "Pharmaceuticals," India Brand Equity Foundation, February 2018, <https://www.ibef.org/download/Pharmaceuticals-February-2018.pdf>.
- 23 "Indian Pharmaceutical Industry," India Brand Equity Foundation, April 2019, <https://www.ibef.org/industry/pharmaceutical-india.aspx>.
- 24 "Indian Pharmaceuticals Industry Analysis," India Brand Equity Foundation, May 2019, <https://www.ibef.org/industry/indian-pharmaceuticals-industry-analysis-presentation>.
- 25 "Pharmaceuticals," India Brand Equity Foundation, March 2018, <https://www.ibef.org/download/Pharmaceuticals-March-2018.pdf>.
- 26 "Indian Pharmaceutical Industry," India Brand Equity Foundation, April 2019, <https://www.ibef.org/industry/pharmaceutical-india.aspx>.
- 27 Trivedi, Isha, "Indian drug makers need to raise quality bar as US strengthens audits," LiveMint, September 4, 2017, <https://www.livemint.com/Industry/mYpJCf3YoxLSv3P9UdxQK/Indian-drug-makers-need-to-raise-quality-bar-as-US-strengthen.html>.
- 28 Das, Sohini, "Soon, uniform inspection norms for pharma units: govt to form advisory body," Business Standard, September 20, 2018, https://www.business-standard.com/article/economy-policy/soon-uniform-inspection-norms-for-pharma-units-govt-to-form-advisory-body-118091901066_1.html.
- 29 Sampat, Bhaven N. and Kenneth C. Shadlen, "Indian pharmaceutical patent prosecution: The changing role of Section 3 (d)." PLOS ONE, April 2, 2018, <https://doi.org/10.1371/journal.pone.0194714>.
- 30 Narayan, S., "Price Controls on Pharmaceutical Products in India," Institute of South Asian Studies, ISAS Working Paper, No. 20-Date: 19 March 2007, https://www.isas.nus.edu.sg/wp-content/uploads/media/isas_papers/20.pdf.
- 31 Das, Sohini, "Pharmaceutical industry improving inspection skills for better compliance," Business Standard, April 8, 2018, https://www.business-standard.com/article/companies/pharmaceutical-industry-improving-inspection-skills-for-better-compliance-118040800024_1.html.
- 32 Valdez, Mary Lou, "FDA in India—championing a culture of quality," Drug Delivery Business News, March 31, 2017, <https://www.drugdeliverybusiness.com/fda-india-championing-culture-quality/>.
- 33 Das, Sohini, "Pharmaceutical industry improving inspection skills for better compliance," Business Standard, April 8, 2018, https://www.business-standard.com/article/companies/pharmaceutical-industry-improving-inspection-skills-for-better-compliance-118040800024_1.html.
- 34 Think Change India, "Majority of the drugs found in India are either fake or ineffective," YourStory, June 6, 2017, <https://yourstory.com/2017/06/india-fake-drugs>
- 35 Sharma, Neetu Chandra, "India among countries where 10% of drugs are substandard: WHO," Live Mint, November 29, 2017, <https://www.livemint.com/Industry/6i5W6D4n07yGwmZDV2JalN/India-among-countries-where-10-of-drugs-are-substandard-WH.html>.
- 36 "Pharma industry needs to adopt global quality standards: OPPI," Business Standard, June 6, 2018, https://www.business-standard.com/article/pti-stories/pharma-industry-needs-to-adopt-global-quality-standards-opp-118060601000_1.html.
- 37 Mukherjee, Rupali, "Indian pharma cos get record 300 USFDA generic drug nods in 2017," Times of India, January 25, 2018, <https://timesofindia.indiatimes.com/business/india-business/indian-pharma-cos-get-record-300-usfda-generic-drug-nods-in-2017/articleshow/62641793.cms>.
- 38 Kumar, Sanjay, "India creates national drugs database to address supply and quality issues," Chemistry World, April 17, 2018, <https://www.chemistryworld.com/news/india-creates-national-drugs-database-to-address-supply-and-quality-issues/3008904.article>,
- 39 Venkatasubramanian, K.V., "India amends law to make generic drugs safer," C&EN, May 1, 2017, <https://pubs.acs.org/doi/full/10.1021/cen-09518-govcon003>.
- 40 Siddiqui, Zeba, "India's drug regulator expects to finalize new clinical trial rules in two months," Reuters, May 30, 2018, <https://www.reuters.com/article/us-india-clinical-trials-regulations/indias-drug-regulator-expects-to-finalize-new-clinical-trial-rules-in-two-months-idUSKCN11V1JX>.
- 41 Thaker, Teena, "India to overhaul drug price system," LiveMint, April 5, 2018, <https://www.livemint.com/Industry/T4Wo4fu1ZRdPLWnWdeyQJ/India-to-overhaul-drug-price-control-system.html>.
- 42 "2019 U.S. Life Sciences Clusters," CBRE, February 13, 2019, <https://www.cbre.us/research-and-reports/US-Life-Sciences-Clusters-2019>.
- 43 Keown, Alex, "Interview: Survey Numbers Show California's Life Science Industry Is an Economic Powerhouse," BioSpace, November 20, 2018, <https://www.biospace.com/article/survey-numbers-show-california-s-life-science-industry-is-an-economic-powerhouse/>.
- 44 Datta, PT Jyothi, "US Company Cepheid to make top-end TB-detection cartridges in India," The Hindu Business Line, July 12, 2018, <https://www.thehindubusinessline.com/news/us-company-cepheid-to-make-top-end-tb-detection-cartridges-in-india/article24400989.ece>.
- 45 "USISPF Applauds Varian, Tata Trusts on Their Agreement to Provide Advanced Cancer Care Solutions," United News of India, March 12, 2019, <https://www.uniindia.com/usispf-applauds-varian-tata-trusts-on-their-agreement-to-provide-advanced-cancer-care-solutions/south/news/1525871.html>
- 46 Metz, Cade, "Fighting Blindness, with Help from AI," San Francisco Chronicle, March 15, 2019, <https://www.pressreader.com/usa/san-francisco-chronicle/20190315/281968904012273>.
- 47 Wadhwa, Vivek, "Why India's investors need to get over their inferiority complex," May 23, 2018, <http://wadhwa.com/2018/05/23/why-indias-investors-need-to-get-over-their-inferiority-complex/>.
- 48 "Portfolio: Healthcube," SV Latam Capital, 2018, <https://www.svlatamcap.com/portfolio/healthcube>.
- 49 Interview with Dr. Anula Jayasuriya, Founder and Managing Director, EXXclaim Capital, Fall 2018.
- 50 "Our Portfolio," Sequoia Capital, accessed June 19, 2019, <https://www.sequoiacap.com/india/companies/>.
- 51 "All Companies," Accel, accessed June 19, 2019, <https://www.accel.com/companies/all>.
- 52 "Companies," WestBridge Capital, accessed June 19, 2019, <http://www.westbridgecap.com/companies.html>.

SPOTLIGHT

MedGenome: A Case Study in Cross-Border Synergy

- Magistretti, Bérénice, "Sequoia co-leads \$30 million investment in MedGenome's research and diagnostics testing," VentureBeat, August 28, 2017, <https://venturebeat.com/2017/08/28/sequoia-co-leads-30-million-investment-in-medgenomes-research-and-diagnostics-testing/>.
- Samthosh, Sam, "India: A Wellspring of Untapped Genetic Knowledge," Techonomy, January 10, 2018, <https://techonomy.com/2018/01/india-wellspring-untapped-genetic-knowledge/>.
- "MedGenome Secures \$30M in Series C Funding led by Sequoia India and Sofina," Seeking Alpha, August 28, 2017, <https://seekingalpha.com/pr/16924583-medgenome-secures-30-million-series-c-funding-led-sequoia-india-sofina>.

CHAPTER 8

Energy/Environment: Cleaner is Better

- "Indian Power Sector Analysis," India Brand Equity Foundation, April 2019, <https://www.ibef.org/industry/indian-power-industry-analysis-presentation>.
- "Power Sector at a Glance ALL INDIA," Ministry of Power, Government of India, February 28, 2019, <https://powermin.nic.in/en/content/power-sector-glance-all-india>.
- "India shows how hard it is to move beyond fossil fuels," The Economist, August 2, 2018, <https://www.economist.com/briefing/2018/08/02/india-shows-how-hard-it-is-to-move-beyond-fossil-fuels>.
- Ali, Sahil, "The Future of Indian Electricity Demand: How much, by whom, and under what conditions?" Brookings India, October 2018, <https://www.brookings.edu/wp-content/uploads/2018/10/The-future-of-Indian-electricity-demand.pdf>.
- "BP Energy Outlook—2019: Insights from the Evolving transition scenario—India," BP, 2019, <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019-country-insight-india.pdf>.
- "Draft National Energy Policy," NITI Aayog. Government of India, June 27, 2017, https://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017.pdf.
- Wu, Huizhong, "India says 100% of villages have electricity. Millions of people remain in the dark," CNN Money, April 30, 2018, <https://money.cnn.com/2018/04/30/news/india/india-electricity-villages-modi/index.html>.

The Bay Area-Silicon Valley and India: Convergence and Alignment in the Innovation Age

- 8 Chatterjee, Anupam, "Scrapped captive coal mines: Production around half the Financial Year 2015 peak," *Financial Express*, April 2, 2018, <https://www.financialexpress.com/industry/scrapped-captive-coal-mines-production-around-half-the-financial-year-2015-peak/1118007/>.
- 9 Bhaskar, Utpal, "Cabinet offers relief to struggling power firms," *Live Mint*, March 8, 2019, <https://www.livemint.com/industry/energy/union-cabinet-approves-power-sector-revival-package-1551963600553.html>.
- 10 Aggarwat, Kartik, "Revival of Hydro Power in India," *LinkedIn*, "October 13, 2018, <https://www.linkedin.com/pulse/revival-hydro-power-india-kartik-aggarwal>.
- 11 "Small Hydro," Ministry of New and Renewable Energy, Government of India, August 2017, <https://mnre.gov.in/small-hydro>.
- 12 Seetharaman, G., "Hydel power in India is growing at the slowest pace," *The Economic Times*, January 27, 2019, <https://economictimes.indiatimes.com/industry/energy/power/hydel-power-in-india-is-growing-at-the-slowest-pace/articleshow/67704776.cms?from=mdr>.
- 13 Sharma, Dinesh C., "Climate change affecting hydropower generation in India: study," *DownToEarth*, August 20, 2018, <https://www.downtoearth.org.in/news/climate-change/climate-change-affecting-hydropower-generation-in-india-study-61419>,
- 14 "Accelerating India's Clean Energy Transition," *Bloomberg New Energy Finance*, November 28, 2017, https://data.bloomberglp.com/professional/sites/10/BNEF_Accelerating-Indias-Clean-Energy-Transition_Nov-2017.pdf.
- 15 "Government imposes safeguard duty on solar cells import for 2 years," *The Economic Times*, July 30, 2018, <https://economictimes.indiatimes.com/news/economy/policy/government-imposes-safeguard-duty-on-solar-cells-import-for-2-years/articleshow/65203361.cms>.
- 16 Pratek, Saamy, "Extension of Solar Safeguard Duty Imposition Period Unlikely," *Mercom India*, April 1, 2019, <https://mercomindia.com/extension-solar-safeguard-duty-imposition-unlikely/>.
- 17 Chandrasekaran, Kaaya, "Safeguard Duty Fails to Help Local Solar Cell Manufacturers," *The Economic Times*, Jan 3, 2019, <https://economictimes.indiatimes.com/industry/energy/power/safeguard-duty-on-imported-solar-components-fails-to-help-local-manufacturers/articleshow/67358418.cms?from=mdr>.
- 18 Ibid.
- 19 "Government imposes safeguard duty on solar cells import for 2 years," *The Economic Times*, July 30, 2018, <https://economictimes.indiatimes.com/news/economy/policy/government-imposes-safeguard-duty-on-solar-cells-import-for-2-years/articleshow/65203361.cms>.
- 20 "India cities dominate world air pollution list," *BBC News*, May 2, 2018. <https://www.bbc.com/news/world-asia-india-43972155>
- 21 "World most polluted cities 2018 (PM2.5)," *IQAir AirVisual*, accessed June 9, 2019, <https://www.airvisual.com/world-most-polluted-cities>.
- 22 Irfan, Umair, "Why India's air pollution is so horrendous," *Vox*, October 31, 2018.
- 23 "Ambient (outdoor) air quality and health," *World Health Organization*, May 2, 2018, [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health).<https://www.vox.com/2018/5/8/17316978/india-pollution-levels-air-delhi-health>.
- 24 "New Delhi's Air Is Now So toxic, Schools Are Closing and Expats Are Fleeing," *ScienceAlert*, November 7, 2016, <https://www.sciencealert.com/new-delhi-s-air-is-now-so-toxic-schools-are-closing-and-expats-are-fleeing>.
- 25 Irfan, Umair, "Why India's air pollution is so horrendous," *Vox*, October 31, 2018,
- 26 Agence France-Presse, "At least 70 killed as powerful dust storm and heavy rain slam India," *South China Morning Post*, May 14, 2018, <https://www.scmp.com/news/asia/south-asia/article/2145945/23-killed-powerful-dust-storm-heavy-rain-slam-india>.
- 27 "Weeks of Extreme Weather in India," *NASA Earth Observatory*, May 14, 2018, <https://earthobservatory.nasa.gov/images/92196/weeks-of-extreme-weather-in-india>.
- 28 Leister, Eric and Adam Douty, "India: Monsoon reached the south while dangerous heat wave continues in the north," *AccuWeather*, June 9, 2019, <https://www.accuweather.com/en/weather-news/dangerous-india-heat-wave-to-worsen-with-temperatures-to-approach-all-time-record-in-new-delhi-this-weekend/70008472>.
- 29 Rao, Aprameya and Kishor Kadam, "25 years of liberalisation: A glimpse of India's growth in 14 charts," *Firstpost*, July 7, 2016, <https://www.firstpost.com/business/25-years-of-liberalisation-a-glimpse-of-indias-growth-in-14-charts-2877654.html>.
- 30 "Agriculture in India: Information About Indian Agriculture & Its Importance," *India Brand Equity Foundation*, March 2019, <https://www.ibef.org/industry/agriculture-india.aspx>.
- 31 Piniseti, Ravi, "Five ways India must help its farmers face the threat of climate change," *The Conversation*, February 19, 2018, <https://theconversation.com/five-ways-india-must-help-its-farmers-face-the-threat-of-climate-change-91587>.
- 32 Leahy, Stephen, "India Launches Massive Push for Clean Power, Lighting, and Cars," *National Geographic*, May 22, 2017, <https://news.nationalgeographic.com/2017/05/india-solar-wind-renewable-power-electric-cars-leds/>.
- 33 Seetharaman, G. "Coal here to stay despite India's ambitious goals for renewable energy," *The Economic Times*, May 12, 2019, <https://economictimes.indiatimes.com/industry/energy/power/india-will-not-be-able-to-achieve-its-renewable-energy-targets-anytime-soon/articleshow/69286279.cms?from=mdr>.
- 34 "Government is on its way to achieving 175 GW target for installed Renewable Energy capacity by 2020," *Business Standard*, December 27, 2017, https://www.business-standard.com/article/news-cm/government-is-on-its-way-to-achieving-175-gw-target-for-installed-renewable-energy-capacity-by-2022-117122700308_1.html.
- 35 Mohan, Vishwa, "India on track to meet all its climate action targets, says Union minister Harsh Vardhan," *The Economic Times*, february 12, 2019, <https://economictimes.indiatimes.com/news/environment/developmental-issues/india-on-track-to-meet-all-its-climate-action-targets-says-union-minister-harsh-varadhan/articleshow/67963907.cms?from=mdr>.
- 36 Grower, R.B., "India must achieve the target of 63 GW nuclear-installed capacity by 2032," *The Economic Times*, July 15, 2017, <https://economictimes.indiatimes.com/blogs/et-commentary/india-must-achieve-the-target-of-63-gw-nuclear-installed-capacity-by-2032/>.
- 37 "India's Intended Nationally Determined Contribution: Working Towards Climate Justice," *Government of India*, 2015, <http://nmhs.org.in/pdf/INDIA%20INDC%20TO%20UNFCCC.pdf>.
- 38 Ross, Katherine and Rhys Gerholdt, "Achieving India's Ambitious Renewable Energy Goals: A Progress Report," *World Resources Institute*, May 12, 2017, <https://www.wri.org/blog/2017/05/achieving-indias-ambitious-renewable-energy-goals-progress-report>.
- 39 Gopal, Sapna, "Will India be able to meet its renewable energy targets by 2022?" *Mongabay-India*, March 5, 2018, <https://india.mongabay.com/2018/03/will-india-be-able-to-meet-its-renewable-energy-targets-by-2022/>.
- 40 "Lighting up India: India's LED Revolution," *ELE Times*, January 3, 2019, <https://www.eletimes.com/lighting-up-india-indias-led-revolution>.
- 41 "US announces \$7.5 million to advance India's power grid," *The Economic Times*, June 22, 2017, <https://economictimes.indiatimes.com/industry/energy/power/us-announces-7-5-million-to-advance-indias-power-grid/articleshow/59267660.cms>.
- 42 Sood, Jyotika, "Govt's electric vehicle campaign can create \$300 billion domestic battery market: NITI Aayog," *Live Mint*, November 23, 2017, <https://www.livemint.com/Industry/CQjREFzAOvTXJ9l4UERgM/Move-to-100-electric-vehicles-can-create-300-billion-domes.html>.
- 43 "NITI Aayog pitches for 24x7 power for all families, electric vehicles," *Business Standard*, August 24, 2017, https://www.business-standard.com/article/economy-policy/niti-aayog-pitches-for-24x7-power-for-all-families-electric-vehicles-117082401253_1.html.
- 44 Sen, Sunny and Anand Murali, "The story of India's flip-flops on its electric vehicle policy—and how it will hurt," *Factor Daily*, March 19, 2018, <https://factordaily.com/india-u-turn-on-electric-vehicles-policy/>.
- 45 "Electric Vehicles & Lithium Ion Battery Market, India, 2017," *Frost & Sullivan*, March 12, 2018, <https://ww2.frost.com/frost-perspectives/electric-vehicles-lithium-ion-battery-market-india-2017/>.
- 46 Dutta, Dipayan, "More Electric buses coming soon in India: NITI Aayog to set EV Target for states!," *Financial Express*, July 9, 2018, <https://www.financialexpress.com/auto/car-news/more-electric-buses-coming-soon-in-india-niti-aayog-to-set-ev-target-for-states/1236890/>.
- 47 "Future of Electric Vehicles In India," *Medium*, November 8, 2018, <https://medium.com/decodein/future-of-electric-vehicles-in-india-bb2d936e2c07>.
- 48 Dhawan, Rajat, Shivanshu Gupta, and Björn Hagemann, "The road less traveled: Brazil and India's electric vehicle journey," in "Snapshots of the global mobility revolution," *McKinsey Insights*, March 2019, <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/snapshots-of-the-global-mobility-revolution>.
- 49 Shah, Aditi, "India Approves \$1.4 Billion Electric Vehicle Incentive Scheme," *Reuters*, February 28, 2019, <https://www.reuters.com/article/us-india-electric-policy/india-approves-14-billion-electric-vehicle-incentive-scheme-idUSKCN1QH29F>.
- 50 "Electric Vehicles & Lithium Ion Battery Market, India, 2017," *Frost & Sullivan*, March 12, 2018, <https://ww2.frost.com/frost-perspectives/electric-vehicles-lithium-ion-battery-market-india-2017/>.

- 51 "India Leaps Ahead: India's EV Battery Market Could Be Worth \$300 Billion by 2030," Rocky Mountain Institute, 2017, <https://rmi.org/insight/india-leaps-ahead-transformative-electric-vehicle-battery-fee-bate-solutions/>.
- 52 Sood, Jyotika, "Govt's electric vehicle campaign can create \$300 billion domestic battery market: NITI Aayog," Live Mint, November 23, 2017, <https://www.livemint.com/Industry/CQjREFzAOvT1XJ9l4UERgM/Move-to-100-electric-vehicles-can-create-300-billion-domes.html>.
- 53 Rajeshwari, Ankita, "GST on Li-Ion Batteries Reduced from 28 to 18 Percent," Mercom India, July 23, 2018, <https://mercomindia.com/gst-li-ion-batteries-reduced-from-28-to-18-percent/>.
- 54 "India ranks 4th globally in wind power installation: Survey," The Hindu, January 31, 2017, <https://www.thehindu.com/sci-tech/energy-and-environment/India-ranks-4th-globally-in-wind-power-installation-Survey/article17124280.ece>.
- 55 Wu, Huizhong, "India says 100% of villages have electricity. Millions of people remain in the dark," CNN Money, April 30, 2018, <https://money.cnn.com/2018/04/30/news/india/india-electricity-villages-modi/index.html>.
- 56 Nathoo, Leila, "India's trouble with toilets," Government sanitation drives fail to sway those who believe going outdoors is more wholesome," Independent, August 21, 2015, <https://www.independent.co.uk/news/world/asia/india-rejects-the-toilet-how-government-sanitation-drives-have-failed-to-sway-those-who-believe-10466041.html>.
- 57 D'Cunha, Suparna Dutt, "This Startup Is Making India's Garbage Its Business," Forbes, June 21, 2017, <https://www.forbes.com/sites/suparnadutt/2017/06/21/this-startup-is-making-indias-garbage-its-business/#7ff9aa1c5512>.
- 58 Pradan, Bibhudatta, "Here's one city turning India's mountain of trash into cash," Los Angeles Times, January 3, 2018, <https://www.latimes.com/business/la-fi-india-trash-20180103-story.html>.
- 59 Romm, Joe, "India's Taj Mahal of trash is a toxic nightmare," ThinkProgress, June 6, 2019, <https://thinkprogress.org/indias-213-foot-trash-pile-will-be-taller-than-the-taj-mahal-in-2020-b4d6826eef10/>.
- 60 Kadidal, Akhil, "A rising dilemma over Bengaluru's mounting trash," Deccan Herald, May 11, 2019, <https://www.deccanherald.com/city/top-bengaluru-stories/a-rising-dilemma-over-bengalurus-mounting-trash-733253.html>.
- 61 "Out of Order: The State of the World's Toilets 2017," WaterAid, November 2017, <https://washmatters.wateraid.org/sites/g/files/jkxooof256/files/Out%20of%20Order%20report%202017.pdf>.
- 62 Dev, Aditya, "63% of sewage flows into rivers untreated every day: Central Pollution Control Board, The Times of India, September 26, 2016, <https://timesofindia.indiatimes.com/city/agra/63-of-sewage-flows-into-rivers-untreated-every-day-Central-Pollution-Control-Board/articleshow/54531095.cms>.
- 63 Wilkes, Tommy and Aditya Kalra, "Exclusive—India's Ganges clean-up in a shambles, Modi intervenes," Reuters, April 7, 2017, <https://www.reuters.com/article/india-ganges/exclusive-indias-ganges-clean-up-in-a-shambles-modi-intervenes-idUSKBN1780ZC>.
- 64 Scarr, Simon et al., "The race to save the river Ganges," Reuters, January 18, 2019, <https://graphics.reuters.com/INDIA-RIVER/010081TW39P/index.html>.
- 65 D'Cunha, Suparna Dutt, "This Startup is Making India's Garbage Its Business," Forbes, June 21, 2017, <https://www.forbes.com/sites/suparnadutt/2017/06/21/this-startup-is-making-indias-garbage-its-business/#29964df65512>.
- 66 Pradhan, Bibhudatta, "Here's one city turning India's mountain of trash into cash," Bloomberg published by Los Angeles Times, January 3, 2018, <https://www.latimes.com/business/la-fi-india-trash-20180103-story.html>.
- 67 Agarwal, Richa, "A waste management model for small towns," DownToEarth, October 3, 2017, <https://www.downtoearth.org.in/news/waste/a-waste-management-model-for-small-towns-58771>.
- 68 Interview with Vishal Wanchoo, CEO, GE South Asia, fall 2018.
- 69 Chand, Abhigyan, "LinkedIn Top Companies 2018: Where India wants to work now," LinkedIn, March 21, 2018, <https://www.linkedin.com/pulse/linkedin-top-companies-2018-where-india-wants-work-now-abhigyan-chand>.
- 70 Sengupta, Applied Solar Technologies raises \$40 million," Live Mint, June 8, 2015, <https://www.livemint.com/Companies/TOVP4QvpyKbNN99Pr6oqHl/Applied-Solar-Technologies-raises-40-mn.html>.
- 71 Chanchani, Madhav A., "D.Light Raises \$5.5 Mn Series A Round," VCCircle, November 6, 2008.
- 72 Abrar, Peerzada, "Gram Power: Yashraj Khaitan's 'smart microgrid' produces, stores renewable energy on location," ET Rise, The Economic Times, July 6, 2012, <https://economictimes.indiatimes.com/small-biz/entrepreneurship/gram-power-yashraj-khaitans-smart-microgrid-produces-stores-renewable-energy-on-location/articleshow/14704235.cms>.
- 73 "Bechtel in India," Bechtel, accessed June 11, 2019, <https://www.bechtel.com/about-us/offices/india/>.
- 74 "India," International Energy Studies Group, Berkeley Lab, accessed June 11, 2019, <https://ies.lbl.gov/region/india>.
- 75 Abhyankar, Nikit et al., "Techno-Economic Assessment of Deep Electrification of Passenger Vehicles in India," Berkeley Lab, May 2017, http://eta-publications.lbl.gov/sites/default/files/lbnl-1007121_presentation_1.pdf.
- 76 "U.S.-India Partnership to Advance Clean Energy (PACE): A Progress Report," US Department of Energy, June 2012, https://www.energy.gov/sites/prod/files/PAACEProgressReport_Final.pdf.
- 77 Chao, Julie, "Berkeley Lab to Lead a US-India Clean Energy Research Center," Lawrence Berkeley National Laboratory news release, April 13, 2012, <https://newscenter.lbl.gov/2012/04/13/berkeley-lab-to-lead-a-u-s-india-clean-energy-research-center/>.
- 78 "Ahmedabad Heat Action Plan: 2019 Update," Ahmedabad Municipal Corporation, 2019, <https://www.nrdc.org/sites/default/files/ahmedabad-heat-action-plan-2018.pdf>.
- 79 "Expanding Heat Resilience Across India," National Resources Defense Council, May 2019, <https://www.nrdc.org/sites/default/files/india-heat-resilient-cities-ib.pdf>.
- 80 Jaiswal, Anjali, and Nehmat Kaur, "India's 1st Online Building Efficiency Compliance System," National Resource Defence Council, December 20, 2017, <https://www.nrdc.org/experts/anjali-jaiswal/indias-1st-online-building-efficiency-compliance-system>.
- 81 Interview with Anjali Jaiswal, Senior Director, International Program—India, National Resources Defense Council (NRDC), spring 2019.

CHAPTER 9

Smart Cities: Order from Chaos

- 1 Woetzel, Jonathan et al., "Smart Cities: Digital solutions for a more livable future," McKinsey Global Institute, June 2018, <https://www.mckinsey.com/~media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Smart%20cities%20Digital%20solutions%20for%20a%20more%20livable%20future/MGI-Smart-Cities-Full-Report.ashx>.
- 2 Kak, Noshir et al., "India's Ascent: Five opportunities for growth and transformation," McKinsey Global Institute, August 2016, <https://www.mckinsey.com/~media/mckinsey/featured%20insights/employment%20and%20growth/indias%20ascent%20five%20opportunities%20for%20growth%20and%20transformation/indias-ascent-executive-briefing.ashx>.
- 3 Woetzel, Jonathan, "Smart Cities: Digital solutions for a more livable future," McKinsey Global Institute, June 2018, <https://www.mckinsey.com/~media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Smart%20cities%20Digital%20solutions%20for%20a%20more%20livable%20future/MGI-Smart-Cities-Full-Report.ashx>.
- 4 Charles, Alice, "How can India make smart cities a reality?" World Economic Forum, November 16, 2015, <https://www.weforum.org/agenda/2015/11/how-can-india-make-smart-cities-a-reality/>.
- 5 "Smart Cities: Mission Statement & Guidelines," Ministry of Urban Development, Government of India, June 2015, [http://smartcities.gov.in/upload/uploadfiles/files/SmartCityGuidelines\(1\).pdf](http://smartcities.gov.in/upload/uploadfiles/files/SmartCityGuidelines(1).pdf).
- 6 Meghani, Varsha, "Taking the vitals of India's Smart Cities Mission," Forbes, June 1, 2018, <http://www.forbesindia.com/article/sustainability-special/taking-the-vitals-of-indias-smart-cities-mission/50353/1>.
- 7 "Annual Report 2017–18," Ministry of Housing and Urban Affairs, Government of India, [http://mohua.gov.in/upload/uploadfiles/files/new_AR-2017-18%20\(Eng\)-Website.pdf](http://mohua.gov.in/upload/uploadfiles/files/new_AR-2017-18%20(Eng)-Website.pdf).
- 8 Sharma, Kiran, "Three years in, India's smart city program has a long way to go," Nikkei Asian Review, July 4, 2018, <https://asia.nikkei.com/Spotlight/Cover-Story/Three-years-in-India-s-smart-city-program-has-a-long-way-to-go>.
- 9 "Smart cities also need smart people: Puri," The Hindu BusinessLine, February 26, 2019, <https://www.thehindubusinessline.com/economy/smart-cities-also-need-smart-people-puri/article26373756.ece>.
- 10 "Annual Report 2017–18," Ministry of Housing and Urban Affairs, Government of India, [http://mohua.gov.in/upload/uploadfiles/files/new_AR-2017-18%20\(Eng\)-Website.pdf](http://mohua.gov.in/upload/uploadfiles/files/new_AR-2017-18%20(Eng)-Website.pdf).
- 11 Ramnani, Vandand, "50 smart cities integrated command and control centres to be ready by 2019: Hardeep Singh Puri," moneycontrol.com, November 5, 2018, <https://www.moneycontrol.com/news/business/real-estate/50-smart-cities-integrated-command-and-control-centres-to-be-ready-by-2019-hardeep-singh-puri-3133781.html>.

- 12 "Naya Raipur smart city operational, becomes 10th on list; check out facilities, features," Zee Business, June 15, 2018, <https://www.zeebiz.com/india/news-naya-raipur-smart-city-operational-becomes-10th-on-list-check-out-facilities-features-51319>.
- 13 Puri, Hardeep S., "How the smart cities project is transforming India's urban governance," Hindustan Times, July 4, 2018, <https://www.hindustantimes.com/analysis/india-s-urban-landscape-is-changing/story-4Q2gmRjHjGwRrdtv9ToTMN.html>.
- 14 Sankar, K N Murali, "Smart City works gain momentum in Kakinada," The Hindu, September 22, 2017, <https://www.thehindu.com/news/national/andhra-pradesh/smart-city-works-gain-momentum-in-kakinada/article19730848.ece>.
- 15 Puri, Hardeep S., "How the smart cities project is transforming India's urban governance," Hindustan Times, July 4, 2018, <https://www.hindustantimes.com/analysis/india-s-urban-landscape-is-changing/story-4Q2gmRjHjGwRrdtv9ToTMN.html>.
- 16 Rao, Umamaheswara, "Municipal schools don new avatar with smart campuses," The Times of India, July 27, 2018, <https://timesofindia.indiatimes.com/city/vijayawada/municipal-schools-don-new-avatar-with-smart-campus/articleshow/65170768.cms>.
- 17 Puri, Hardeep S., "How the smart cities project is transforming India's urban governance," Hindustan Times, July 4, 2018, <https://www.hindustantimes.com/analysis/india-s-urban-landscape-is-changing/story-4Q2gmRjHjGwRrdtv9ToTMN.html>.
- 18 Stacey, Daniel, "New 'Smart City' Hatches Solutions to India's Urban Chaos," The Wall Street Journal, October 18, 2017, <https://www.wsj.com/articles/new-smart-city-hatches-solutions-to-indias-urban-chaos-1508319004>.
- 19 "Hyderabad best Indian city in living standards: Mercer," The Economic Times, March 15, 2017, <https://economictimes.indiatimes.com/magazines/panache/hyderabad-best-indian-city-in-living-standards-mercera/articleshow/57653013.cms?from=mdr>.
- 20 "Smart City Mission: Tech giants showing interest in setting up smart city centres," The Hindu BusinessLine, April 29, 2018, <https://www.thehindubusinessline.com/info-tech/smart-city-mission-tech-giants-showing-interest-in-setting-up-smart-city-centres/article23719938.ece>.
- 21 "HPE and PwC Expand Partnership to Power Future Cities," Hewlett Packard Enterprise News Advisory, September 12, 2017, <https://www.hpe.com/us/en/newsroom/news-advisory/2017/09/hpe-and-pwc-expand-partnership-to-power-future-cities.html>.
- 22 "Cisco Unveils 'Cisco Smart City' as Model for India; Marks Next Phase of Expansion in India," Cisco News Release, September 23, 2014, <https://newsroom.cisco.com/press-release-content?articleId=1492392>.
- 23 "Cisco Announces \$1 Billion Program for Smart Cities," Cisco News Release, November 14, 2017, <https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1895705>.
- 24 Sarkhel, Aritra, "NetApp signs deal with Varanasi & Karnal for their Smart City initiatives," ET Tech, The Economic Times, July 28, 2016, <https://tech.economictimes.indiatimes.com/news/technology/netapp-signs-deal-with-varanasi-karnal-for-their-smart-city-initiatives/53425977>.
- 25 "Global tech giants (IBM, Cisco & Bosch) to invest in setting up smart city centers," Smart Cities Council India, May 2, 2018, <https://india.smartcitiescouncil.com/article/global-tech-giants-ibm-cisco-bosch-invest-setting-smart-city-centers>.
- 26 Ujaley, Mohd, "Cisco to help Nagpur become Smart City," Financial Express, October 13, 2016, <https://www.financialexpress.com/economy/cisco-to-help-nagpur-become-smart-city/416132/>.
- 27 "Cisco and CH2M Form Global Smart City Partnership, Active Telecoms, March 20, 2016, http://www.activetelecoms.com/index.php?option=com_k2&view=item&id=70:cisco-ch2m-form-global-smart-city-partnership&Itemid=107.
- 28 Sarkhel, Aritra, "NetApp signs deal with Varanasi and Karnal for their Smart City initiatives," ET Tech, The Economic Times, July 28, 2016, <https://tech.economictimes.indiatimes.com/news/technology/netapp-signs-deal-with-varanasi-karnal-for-their-smart-city-initiatives/53425977>.
- 3 Kaka, Noshir, Anu Madgavkar, Alok Kshirsagar, Rajat Gupta, James Manyika, Kushe Bahl, and Shishir Gupta, "Digital India: Technology to transform a connected nation," McKinsey Global Institute, March 2019, <https://www.mckinsey.com/~/media/mckinsey/global%20functions/mckinsey%20digital/our%20insights/digital%20india%20technology%20to%20transform%20a%20connected%20nation/digital-india-technology-to-transform-a-connected-nation-full-report.ashx>.
- 4 "Fintech in India: A global growth story," KPMG and NASSCOM 10,000 Startups, June 2016, <https://assets.kpmg/content/dam/kpmg/pdf/2016/06/FinTech-new.pdf>.
- 5 Gupta, Arvind and Philip Auerwald, "The Ups and Downs of India's Digital Transformation," Harvard Business Review, May 6, 2019, <https://hbr.org/2019/05/the-ups-and-downs-of-indias-digital-transformation>.
- 6 "Global FinTech Adoption Index 2019," EY, 2019, https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/banking-and-capital-markets/ey-global-fintech-adoption-index.pdf.
- 7 Bhakta, Pratik, "Government likely to meet FY19 digital payments target," The Economic Times, December 18, 2018, <https://economictimes.indiatimes.com/industry/banking/finance/banking/government-likely-to-meet-fy19-digital-payments-target/articleshow/67034904.cms?from=mdr>.
- 8 "Government eyes 40 billion e-transactions in FY20," The Times of India, May 28, 2019, <https://timesofindia.indiatimes.com/business/india-business/govt-eyes-40bn-e-transactions-in-fy20/articleshowprint/69528900.cms>.
- 9 Bhakta, Pratik, "India's fintech companies struggle for an alternative to Aadhaar," ET Rise, The Economic Times, December 21, 2018, <https://economictimes.indiatimes.com/small-biz/startups/features/indias-fintech-companies-struggle-for-an-alternative-to-aadhaar/articleshow/67186586.cms>.
- 10 "India Fintech Report 2019: Executive Summary," MEDICI, March 2019, https://medicinercircle.com/wp-content/uploads/2019/03/FintegrateReport_ExecutiveSummary_Final.pdf.
- 11 "Fintech Trends Report: India 2017," PwC and Startupbootcamp, 2017, <https://www.pwc.in/assets/pdfs/publications/2017/fintech-india-report-2017.pdf>.
- 12 "Investments in fintech companies in India declines in 2016: Report," ET Rise, The Economic Times, February 22, 2017, <https://economictimes.indiatimes.com/small-biz/policy-trends/investments-in-fintech-companies-in-india-declines-in-2016-report/articleshow/57288807.cms>.
- 13 "Global Venture Capital Investment in Fintech Industry Set Record in 2017, Driven by Surge in India, US and UK, Accenture Analysis Finds," Accenture news release, February 28, 2018, <https://newsroom.accenture.com/news/global-venture-capital-investment-in-fintech-industry-set-record-in-2017-driven-by-surge-in-india-us-and-uk-accenture-analysis-finds.htm>.
- 14 Ghosh, Durba, "If fintech in India had a crappy 2018, blame the new regulations," Quartz India, February 22, 2019, <https://qz.com/india/1556915/paytm-policybazaar-aside-2018-was-crappy-for-fintech-in-india/>.
- 15 "India FinTech Opportunities Review, YES Bank, 2018, <http://www.yesfintech.com/data/cms/for-report-2018.pdf>.
- 16 Cooper, Julie, "Visa, PayPal top largest Bay Area financial tech list," San Francisco Business Times, February 13, 2015, <https://www.bizjournals.com/sanfrancisco/subscriber-only/2015/02/13/financial-tech-companies.html?s=print>.
- 17 Bose, Shritama, "Digital payments to grow to \$1 trillion by 2023," Financial Express, February 7, 2018, <https://www.financialexpress.com/industry/technology/digital-payments-to-grow-to-1-trillion-by-2023-credit-suisse/1055252/>.
- 18 "RBI eases rules for foreign banks' subsidiarisation," The Economic Times, November 27, 2013, <https://yourstory.com/2016/09/india-zendesk-morten-primdahl/>.
- 19 "Annual Report 2010," VISA Inc., 2010, http://www.annualreports.com/HostedData/AnnualReportArchive/v/NYSE_V_2010.pdf.
- 20 Basu, Sreeradha D., "Visa Inc to enter IITs with 120 offers, Rs 22 lakh pay package, The Economic Times, November 26, 2014, <https://economictimes.indiatimes.com/jobs/visa-inc-to-enter-iits-with-120-offers-rs-22-lakh-pay-package/articleshow/45277183.cms>.
- 21 "Visa Opens Technology Center in Bangalore; Accelerates Digital Commerce Globally," Visa news release, August 5, 2015, <https://investor.visa.com/news/news-details/2015/Visa-Opens-Technology-Center-in-Bangalore-Accelerates-Digital-Commerce-Globally/default.aspx>.
- 22 "Narendra Modi's UPI massive success; Mastercard, Visa Inc lose market share in India," Bloomberg/Financial Express, March 26, 2018, <https://www.financialexpress.com/industry/banking-finance/narendra-modis-upi-massive-success-mastercard-visa-inc-lose-market-share-in-india/1111088/>.

CHAPTER 10

Fintech: Data Puts Money to Work

- 1 Carney, Mark, "The promise of FinTech—something new under the sun?" speech at the Deutsche Bundesbank G20 Conference on Digitizing finance, financial inclusion and financial literacy, Bank of England, January 25, 2017, <https://www.bankofengland.co.uk/~/media/boe/files/speech/2017/the-promise-of-fintech-something-new-under-the-sun.pdf>.
- 2 "What's Driving India's Fintech Boom?" Knowledge@Wharton, February 11, 2018, <https://knowledge.wharton.upenn.edu/article/whats-driving-indias-fintech-boom/>.

- 23 "Visa releases new details on India's Bharat QR payments," Pymnts.com, February 27, 2017, <https://www.pymnts.com/news/payment-methods/2017/visa-releases-new-details-on-indias-bharat-qr-payments/>.
- 24 Sarkar, Debshis, "BHIM vs UPI: This App is Modi Govt's Paytm With One Major Advantage," News18.com, December 31, 2016, <https://www.news18.com/news/tech/bhim-vs-upi-this-is-narendra-modi-governments-paytm-with-one-major-advantage-1329801.html>.
- 25 Boden, Rian, "NPCI, Mastercard and Visa unveil standardised QR code mobile payments for India," NFC World, February 21, 2017, <https://www.nfcworld.com/2017/02/21/350341/government-backed-bharatqr-launches-india-take-country-one-step-closer-mobile-payments/>.
- 26 "Visa And BillDesk Bring Bharat QR To More Than 300M Consumers," Pymnts.com, September 7, 2017, <https://www.pymnts.com/news/payment-methods/2017/visa-billdesk-bharat-qr-digital-payments/>.
- 27 Aggarwal, Varun, "PayPal launches domestic payments in India," Hindu BusinessLine, November 8, 2017, <https://www.thehindubusinessline.com/money-and-banking/paypal-launches-domestic-payments-in-india/article9949289.ece>.
- 28 Ibid.
- 29 "PayPal makes it easier for Indian sellers and freelancers to receive payments from abroad," Tech2, FirstPost, April 4, 2018, <https://www.firstpost.com/tech/news-analysis/paypal-makes-it-easier-for-indian-sellers-and-freelancers-to-receive-payments-from-abroad-4418369.html>.
- 30 "PayPal launches innovation labs in Chennai, Bengaluru," The Hindu Business Line, August 2, 2017, <https://www.thehindubusinessline.com/info-tech/paypal-launches-innovation-labs-in-chennai-bengaluru/article9798089.ece>.
- 31 Russell, Jon, "PayPal and Singapore's Temasek invest \$125M in Indian payment startup Pine Labs," TechCrunch, May 31, 2018, <https://techcrunch.com/2018/05/31/paypal-temasek-pine-labs/>.
- 32 Bhakta, Pratik, "PayPal's revenue jumps 12x, thanks to its India arm," The Economic Times, January 3, 2019, <https://economictimes.indiatimes.com/small-biz/startups/newsbuzz/paypals-revenue-jumps-12x-thanks-to-its-india-arm/articleshow/67359017.cms>.
- 33 Rai, Saritha, "Facebook Faces Delay to WhatsApp Payments in India," Bloomberg, July 19, 2018, <https://www.bloomberg.com/news/articles/2018-07-20/facebook-is-said-to-face-delay-to-whatsapp-payments-in-india>.
- 34 Mukherjee, Sukanya, "WhatsApp Inches Closer To Full UPI Compliance, enables Scan QR Code Feature," Inc42, March 27, 2018, <https://inc42.com/buzz/whatsapp-payments-upi-scan-qr-code/>.
- 35 "WhatsApp is said to hasten payments push for 200 million Indians," ET Rise, The Economic Times, May 30, 2018, <https://economictimes.indiatimes.com/small-biz/startups/newsbuzz/whatsapp-is-said-to-hasten-payments-push-for-200-million-indians/articleshow/64371408.cms>.
- 36 Bhakta, Pratik, "Here's why WhatsApp is yet to start its payment service in India," Economic Times, June 28, 2018, <https://economictimes.indiatimes.com/industry/banking/finance/banking/npci-meity-still-not-in-same-whatsapp-group/articleshow/64772196.cms>.
- 37 "WhatsApp must have an office in India to launch its payments service says MeitY," FirstPost, August 1, 2018, <https://www.firstpost.com/tech/news-analysis/whatsapp-must-have-an-office-in-india-to-launch-its-payments-service-says-meity-4870391.html>.
- 38 Anand, Nupur, "What's preventing WhatsApp Pay's full-fledged launch in India?" Quartz India, March 26, 2019, <https://qz.com/india/1579789/why-whatsapp-pay-is-lagging-behind-paytm-amazon-google-in-india/>.
- 39 Lunden, Ingrid, "Google debuts Tez, a mobile payments app for India that uses Audio QR to transfer money," TechCrunch, September 17, 2017. <https://techcrunch.com/2017/09/17/google-debuts-tez-a-mobile-wallet-and-payments-app-for-india/>.
- 40 Ibid.
- 41 Russell, Jon, "Google is supercharging its Tez payment service in India ahead of global expansion," TechCrunch, August 28, 2018, <https://techcrunch.com/2018/08/28/google-is-supercharging-its-tez-payment-service/>.
- 42 El Khoury, Rita, "Tez, aka Google Pay for India, reaches 100 million installs on the Play Store," Android Police, January 30, 2019, <https://www.androidpolice.com/2019/01/30/tez-aka-google-pay-for-india-reaches-100-million-installs-on-the-play-store/>.

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