



The Infy hallmark pyramid. It serves as the multimedia studio for Infosys's headquarters in Bangalore. Source: *Wikimedia Commons* at <https://tinyurl.com/y4orqfx4>.

Introduction

North American readers of this journal, even if they are not especially tech savvy, are likely familiar with Silicon Valley, located in the San Francisco Bay area, and many of the companies like Apple and Google that make the region their home. Fewer are likely aware of India's own "Silicon Valley" and the various Indian private companies and startups that help to make the IT sector one of the more faster growing sectors of the economy and create the prospect of India becoming a world leader in technology companies.

According to the 2020 Global Innovation Index, an annual study of the most innovative countries across a series of industries published by World Intellectual Property Organization (WIPO), Cornell University and INSEAD, a top international private business school, India ranks as the world's top exporter of information technology (IT) and eighth in the number of science and engineering graduates. The IT industry is a highly significant part of the Indian economy today with the sector contributing 7.7% of India's total GDP by 2017, a most impressive increase from 1998 when IT accounted for only 1.2% of the nation's GDP. IT revenues in 2019 totaled US \$180 billion. As of 2020, India's IT workforce accounts for 4.36 million employees and the United States accounts for two-thirds of India's IT services exports.

Many readers have possibly interacted with an Indian IT company product or service without necessarily being aware of doing so, especially with numerous US tech company subsidiaries and outsourced operations also located in India. Assuming a return to national annual growth rates, the IT industry potentially has a bright future in a country of 1.3 billion people. India is the world's second-largest market for internet users at 560 million but that number is less than half of the country's population. As the number of internet users in the country grows as well as the number of skilled IT workers, the potential is there for India to possibly become the world's largest IT power and for Indian companies to become names as commonplace as those of the US's Silicon Valley.

Sources: "India: Distribution of gross domestic product (GDP) across economic sectors from 2009 to 2019," *Statista*, accessed December 11, 2020, <https://tinyurl.com/ya6c457c>; "Internet usage in India - statistics & facts," *Statista*, accessed December 11, 2020, <https://tinyurl.com/z5emzwa>; Catarina Walsh, "India is on the rise - but it already leads the world in these sectors," *World Economic Forum*, September 29, 2017, <https://tinyurl.com/ycujdbu5>; "Home market gets attractive for India's IT giants," *The Economic Times of India*, October 6, 2019, <https://tinyurl.com/ycu25cp2>; World Intellectual Property Organization, "Global Innovation Index 2020," accessed December 18, 2020, <https://tinyurl.com/y8qxvjy3>; "India's economy to return to normal faster than expected: Barclays," *The Economic Times of India*, November 19, 2020, <https://tinyurl.com/ybr3qo2r>.

The Major Tech Hubs of India

Much like the US, India has locations comparable to Silicon Valley and major cities that have become major tech hubs. Four of the largest Indian tech hubs include the cities of Bangalore, Hyderabad, Chennai, and Thiruvananthapuram's Technopark.



Aerial view of Thiruvananthapuram's Technopark. Source: *Wikimedia Commons* at <https://tinyurl.com/yypzymej>.

Bangalore

Bangalore (Bengaluru), located in the southern Indian state of Karnataka, is known as the Silicon Valley of India because of the large number of IT companies located in the city. Bangalore's IT industry is divided into three main clusters: Software Technology Parks of India (STPI); International Tech Park, Bangalore (ITPB); and Electronics City. Infosys and Wipro, India's second and third largest software companies, are headquartered in Bangalore. The city is also home to research and development centers for companies like Google, Microsoft, and Oracle and many American companies operate subsidiaries in the city like video game development company Rockstar Games, and IBM.

Hyderabad

Hyderabad, capital of the central state of Telangana, is a major global IT hub in India as well as the largest biotechnology hub in India. The city is known both as "India's Pharmaceutical Capital" and the "Genome Valley of India" due to this large biotech industry. Hyderabad is also a global center of IT and has the nickname, Cyberabad (Cyber City). The development of HITEC City, a Hyderabad township with extensive technological infrastructure, prompted multinational companies to establish facilities in Hyderabad. More than 1,300 foreign IT firms operate in the city including Microsoft, Apple, Amazon, Google, IBM, Yahoo!, Oracle Corporation, Dell, Facebook, CISCO, as well as major Indian companies including Tech Mahindra, Infosys, Tata Consultancy Services (TCS), Polaris, Cyient and Wipro.

Chennai

Chennai, a coastal city and capital of the southeast state of Tamil Nadu, is India's largest exporter of IT and business process outsourcing (BPO) services. When it was built, Tidel Park in Chennai was billed as Asia's largest IT park. Other notable tech parks in the city are International Tech Park, DLF SEZ, Mahindra World City, SIPCOT IT Park, Olympia Tech Park and Ramanujan IT City. The city has a specialized expressway called the "IT expressway" that links several major IT company offices together. Major software and electronics companies have established offices in this locale, with some of them making Chennai their largest base in India, including Samsung, Nokia Siemens, Motorola, Lenovo, Dell, Force10, Flextronics, and Siemens among others. Chennai is currently the largest electronics hardware exporter in India, accounting for 45 percent of the total exports in 2020. Telecom giants Ericsson and Alcatel-Lucent, pharmaceuticals giant Pfizer, and chemicals giant Dow Chemicals also have research and development facilities in Chennai.

Thiruvananthapuram's Technopark

Thiruvananthapuram, Kerala in the southwest is home to India's massive Technopark project, the largest IT park in India in terms of developed area. By 2015, Technopark had 10 million sq ft of area, and housed over 400 companies. Technopark is owned and administered by the State Government of Kerala and is headed by a chief executive officer. In addition to this, it has a Governing Council and a Project Implementation Board, both of which include top government officials. Technopark houses domestic firms, joint ventures, and subsidiaries of foreign companies engaged in a wide variety of activities, which include embedded software development, smart card technology, enterprise resource planning (ERP), process control software design, engineering and computer-aided design software development, IT Enabled Services (ITES), process re-engineering, animation, and e-business.

Sources: Mohamed Omar, "Bangalore the Silicon Valley' of India," *Medium*, July 11, 2019, <https://tinyurl.com/y7tgyonk>; George Iype, "Hyderabad: India's Genome Valley," *Rediff*, accessed December 11, 2020, <https://tinyurl.com/ycalo8ve>; Malini Goyal, "Chennai is quickly turning into the new hotbed for deep-tech startup," *The Economic Times of India*, August 8, 2019, <https://tinyurl.com/yxmrdmcp>; Government of Kerala, India, "Welcome to Technopark," accessed December 11, 2020, <https://www.technopark.org>.

The Top Indian IT companies



Screen capture of Tata Consultancy Services' homepage at www.tcs.com

The Largest Indian IT companies by revenue (in US dollars as of 2020)

1. Tata Consultancy Services (\$23 billion)
2. Infosys (\$13 billion)
3. Wipro (\$11 billion)
4. HCL Technologies (\$6 billion)
5. Tech Mahindra (\$5.3 billion)
6. Larsen & Toubro Infotech (\$1.3 billion)
7. Mphasis (\$1.1 billion)
8. Mindtree (\$1.1 billion)
9. Rolta (\$911 million)
10. Hexaware Technologies (\$878 million)

There are many IT companies in India, but three publicly traded companies stand out among the rest due to their massive size, operations, and financial success: Tata Consultancy Services, Infosys, and Wipro.

Tata Consultancy Services

Tata Consultancy Services (TCS) is an Indian multinational IT services and consulting company headquartered in Mumbai. It is a subsidiary of the Tata Group and operates in 149 locations across forty-six countries. The company is much older than one would assume as it was founded as "Tata Computer Systems" in 1968. Its early contracts included punched card services to sister company TISCO (now Tata Steel), working on an Inter-Branch Reconciliation System for the Central Bank of India, and providing bureau services to Unit Trust of India. Today, TCS and its sixty subsidiaries provides a wide range of IT-related products and services including application development, business process outsourcing (BPS), capacity planning, consulting, enterprise software, hardware sizing, payment processing, software management, and technology education services. TCS is the second-largest Indian company by market capitalization and the world's largest IT services provider.

Infosys

Established in 1981, Infosys provides business consulting, information technology, and outsourcing services. The company is headquartered in Bangalore and is the second-largest Indian IT company after TCS with operations in India, United States, China, Australia, Japan, the Middle East, and Europe. Infosys provides software development, maintenance, and independent validation services to companies in finance, insurance, manufacturing, and other industries. One of its major products is called Finacle, a financial software product that enables universal, global digital banking. Its other major products include NIA, an artificial intelligence platform; Infosys Consulting, a global management consulting service, and Infosys Information Platform (IIP), a data analytics platform. The company also has major operations in digital marketing, cloud computing, and logistics.

Wipro

Wipro was incorporated on December 29, 1945, initially setup as a manufacturer of vegetable and refined oils in the city of Amalner. During the 1970s and 1980s, the company shifted its focus to the IT and computing industry, which was at an early stage in India at the time. In 1977, the name of the company changed from Western India Vegetable Products Limited, to Wipro Products Limited. In 1982, the name was changed from Wipro Products Limited to Wipro Limited. Today, it is a major global IT, consulting and business process service provider headquartered in Bangalore—the third largest in India after TCS and Infosys. Wipro's businesses not only encompassed IT, but also a diverse array of industries including consumer care, lighting, furniture, and infrastructure engineering building upon its early founding in the food industry. These services were spun off into a separate company, Wipro Enterprises, in 2013 while its IT services remained as Wipro Limited.

The Top Indian Startups by Investor Funding (in US dollars as of 2020)

India has substantial IT entrepreneurial startups and several are major successes with large amounts of venture capital funding. India is rated as the third-best startup economy in the world according to the 2020 Global Innovation Index.

One97 Communications (\$4.4 billion)

One97 Communications is the company operating Paytm, a digital goods and mobile commerce platform providing a number of products and services including mobile recharge, bill payments, transport tickets, hotel reservations, games, and much more. It also operates Paytm Mall, an online e-commerce platform, which sells products ranging from men's and women's fashions to electronics, home and family products, groceries, cosmetics, and cars and other vehicles.



One97 Communications headquarters in New Delhi. Source: Glassdoor at <https://tinyurl.com/y3n86pv4>.

Ola Cabs (\$3.8 billion)

Ola operates a ride-hailing platform similar to Uber and Lyft in the US. It allows the booking of a range of cabs, bikes, and other vehicles through a single mobile app ensuring convenient, transparent, safe, and quick urban transportation. Besides India, Ola has expanded its activities to other countries including Australia, New Zealand, and the UK.

OYO (\$3.2 billion)

OYO is a hotel chain that offers a range of stay experiences across India. Relying upon standardization and the use of its technology platform, OYO revolutionizes budget hospitality with comfortable and affordable hotels. It also provides a portfolio of offers for all types of travelers in India and abroad, including China, Malaysia, Nepal, Indonesia, and UAE.

ReNew Power (\$2.8 billion)

ReNew Power is a company dedicated to renewable energy. It develops, builds, owns, and operates renewable energy production facilities with utility-scale wind, solar, and rooftop solar projects. The largest independent renewable energy company in India, it is dedicated to growing its production while supporting sustainable business practices.

Snapdeal (\$1.8 billion)

Snapdeal is a diversified online shopping platform, offering products ranging from electronics and fashion to home goods and appliances. Backed by famous investors, including Alibaba, Foxconn, and SoftBank, Snapdeal is gearing to-wards competition with the very top e-commerce sites of India.

Sources: "Top 10 IT Companies in India 2020," *Indian Companies*, accessed December 12, 2020, <https://tinyurl.com/y97wqb8r>; "Top 30 best-funded Indian startups 2020," *Disfold*, October 15, 2020, <https://tinyurl.com/yajwq2o7>; Main websites for Tata Consultancy Services, Infosys, and Wipro, accessed December 15, 2020: <https://www.tcs.com>, <https://www.infosys.com>, <https://www.wipro.com>.

Controversies

Clashes between IT moguls and municipal governments over infrastructure funding are common. In Bangalore, similar to Silicon Valley, the growth of major IT industries has led to rising prices for land and rent and forced out smaller, local enterprises. Bangalore is the largest city in the mostly rural state of Karnataka and is governed under a dated law, The Karnataka Municipal Corporations Act, that the city's size and economy have long outgrown. City and state governments continuously clash over management, infrastructure, and zoning for the city which has caused problems in passing needed reforms for issues such as public transportation and municipal limits. Startups and other tech companies have begun to expand more in other Indian cities as a result. The Karnataka State Government recently passed a law that overhauls the city's governance structure and expands its municipal limits, but many critics suggest it falls short of adequately addressing the city's needs.

Hyderabad is a rapidly growing city which more and more companies are investing in as costs in Bangalore remain much higher. The city alone added 8.9 million square feet of office space for tech companies in 2019. This investment comes at the expense of the city's other areas of need. Hyderabad suffered massive and destructive storm flooding in October 2020—a reminder of the city's longstanding need to overhaul its stormwater drainage and sewer network as investment in IT industries continues to grow.

As discussed earlier, most Indians still do not have access to quality broadband services, so less than half of the country's population does not have access to the internet. With such a large, untapped population of potential web users, large telecom and tech companies are waging a battle to provide services to people without internet access, but often not in a manner that supports a truly open and neutral web. In 2015, US social media giant Facebook introduced its "Basics" project designed to invest in local Indian telecoms and bring broadband to millions of underserved areas of India. While a seemingly altruistic ambition, Facebook's ultimate goal was to lock millions of new users into a version of the internet dominated by Facebook's own services. The project was rejected later that year by Telecom Regulatory Authority of India (TRAI) on the grounds it was anti-competitive as well as violated the country's net neutrality laws. Despite this setback, Facebook has recently invested \$5.7 billion in Indian telecom Reliance Industries in an attempt to restart the program. In response, Indian startups are emerging like WiFi Dabba with the goal of spreading internet access throughout India for individual and business use, while protecting the Indian's web open nature against private interests.

Sources: Swati Bharadwaj and Swati Ratho, "Hyderabad saw biggest surge in tech space absorption in 2019," *Times of India*, February 11, 2020, <https://tinyurl.com/yazwtzjq>; Swathi Vadlamudi, "Chronic issues plaguing Hyderabad beg for attention," *The Hindu*, November 24, 2020, <https://tinyurl.com/yyc3ymmww>; Rahul Batia, "The inside story of Facebook's biggest setback," *The Guardian*, May 12, 2016, <https://tinyurl.com/z28qrzw>; Tal Axelrod, "Facebook to invest \$5.7 billion in Indian telecom company," *The Hill*, April 21, 2020, <https://tinyurl.com/ybxz7kxx>; WiFi Dabba main website, accessed December 14, 2020, <https://www.wifidabba.com/about>; B V Shiva Shankar, "Karnataka govt, groups plan SC fight over BBMP," *The Times of India*, December 9, 2020, <https://tinyurl.com/ya24bt5r>.