

technopol es of i ndi a?

rob zand
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introduction

The evolution in information technology taking place around the world holds for the prospect of considerable economic gains for India both in domestic application of IT and in our economic interaction with the rest of the world. The spread of information technology in India is as yet inadequate, and urgent steps are needed to create a national network for information dissemination. ... India has the potential to become a software super power in the next ten years and it must be the objective of policy to realise this ambition. The government has already taken a number of steps in this area and it must be ready to do more.

From the Ninth Five Year Plan, 1997-2002
Planning Commission, Government of India

Simply put, India is infatuated with the Internet. The excerpt above is a milder form of the enthusiastic rhetoric found in statements of vision, objective, and policy emanating from Indian governments – both state and national – universities and private enterprise. But unlike other cities and countries across the globe, India's zest for technology predates 1995, the year private and commercial use of the Internet became widespread, and dates back to World War II. India's role as supplier of forces in the East focused their "attention on the importance of scientific and industrial research" (First Five Year Plan). In 1940, the Government of India (GOI) established the Board of Scientific and Industrial Research while Jawaharlal Nehru, the first prime minister, followed by inspiring the founding of the publicly funded, Indian Institute of Technology, modeled after Massachusetts Institute of Technology. India's pursuit of technological excellence is not merely for global economic gain, but also for domestic socio-economic benefit. India "intends to take all possible measures to ensure that benefits of this technology reach the common man even in the remotest part of the country", says Shri Pramod Mahajan, GOI Minister of Information Technology. It was a statement I hoped to verify in my research.

This paper documents the efforts of two Indian cities, Bangalore and Hyderabad, to establish themselves as global centers for high technology. Bangalore is known as the "Silicon Valley of India" and is the more established. Hyderabad, or "Cyberabad" as it aspires to be known, is a newcomer, and under Andhra Pradesh's techno-savvy chief minister, Chandrababu

Naidu, is predicted by some to over take Bangalore in the coming years. Before I begin, a few words about my background and methodology seem appropriate. I worked in the high-tech sector as an engineer, programmer, and marketing manager from 1991 to 1998 and during this time worked with many Indians, whether full-time employees continuing on after attending an American university or contractors living Spartan-like and creating Indian communities in America. While I do not claim to be the foremost authority on Internet technology, I am well grounded in its capabilities and limitations. Similarly, I have experienced the advantages and disadvantages associated with co-workers in different time zones, their colloquialisms, and their cultural heritage, American or otherwise. Beyond professional experience, the work of Annalee Saxenian, Peter Hall and Manuel Castells provided clues and insights into the development of technology centers, and in the case of Hall and Castells, their book Technopoles of the World provided the name for this paper. The tales they tell, especially Saxenian's, are not unfamiliar in India. A business school in Hyderabad is being established specifically to play the role Stanford did in Silicon Valley, networks and teamwork are stressed in all initiatives, and despite the historic central control by the Government of India, emphasis is placed on autonomy. This imitation raised the first question I sought to answer with this paper:

Is the widely coveted technological success of Silicon Valley replicable or is it a product of circumstances unique to place and time?

A second question, to which I alluded earlier, regards the polar nature of the global/information economy evident in the phrases "digital divide" and "Dual City"¹, further directed my research:

Is the tendency for success to come to those with knowledge and access while those without fall further behind a fait accompli or can developing regions learn from their predecessors and develop in a way that benefits more than a privileged minority?

This question takes on great significance in India, where, according to the World Bank's World Development Indicators, 35% of the national population lives below the poverty line and 44% of those ages 15 and higher are illiterate.

¹ The title of a book by John Mollenkopf and Manuel Castells that examines several interpretations of the phrase "Dual City" using New York City as a case study.

india

It seems natural to begin a study of two Indian cities by discussing the country where they exist. This seems even more appropriate given the vestiges of strong central control extant today, which according to industry and even some in government, act at cross purposes to the creation of an information society.

India is a constitutional republic, highly influenced by the British model of parliamentary democracy, consisting of 25 states and seven union territories. The current constitution went into effect in 1950 (independence from Britain was gained in 1947). The national government has exclusive authority over foreign policy, defense, communications, taxation on corporations and nonagricultural income, and railroads. State governments have the sole power to legislate on such subjects as law and order, public health and sanitation, local government, betting and gambling, and taxation on agricultural income, entertainment, and alcoholic beverages. Responsibility for contracts, economic and social planning, population control and family planning, trade unions, social security, and education, is shared. India's head of state is the president, who is elected to a five-year, renewable term, yet the powers of the president are largely ceremonial. The president normally acts on the advice of the prime minister whom he or she appoints. The prime minister heads the

Population²	846, 302, 688
Male	439, 230, 458
Female	407, 072, 230
Annual Growth (%)	2. 15
Density (persons/acre)	1. 11
% Urban	25. 73
Literacy² (%)	52. 21
Male	64. 13
Female	39. 29
Urban	73. 08
Male	81. 09
Female	64. 05
Rural	44. 69
Male	57. 87
Female	30. 62
Workers²	314, 131, 370
Cultivation	38. 7%
Agricultural labor	26. 1%
Livestock	2. 1%
Mining	. 6%
Manufacturing	2. 4%
Household Industries	7. 6%
Construction	1. 9%
Trade and Commerce	7. 4%
Transport, Storage and Communications	2. 8%
Other Services	10. 3%
Engineers produced yearly³	180, 000
Households with...	
A - Electricity	42. 4%
B - Safe Drinking Water	62. 3%
C - Toilet	23. 7%
A + B	30. 4%
B + C	18. 2%
A + C	20. 4%
A, B + C	16. 1%
Neither A, B or C	24. 5%
Phone ⁴	19. 4m (2%)
Cell Phone ⁵	2. 78m
Internet ⁶	1. 4m
Languages Spoken⁷	
Total	1652
Major	350
Official	18

² 1991 Census Numbers.

³ Various estimates and sources put this number anywhere from 130,000 (Forbes) to 180,000 (Wired News). I include the most recent.

⁴ Wolcott, Peter, "The Global Diffusion of the Internet Project", December 1999.

⁵ "Race Among Cellular Cos. Hots Up"(sic), The Hindu, November 26, 2000.

⁶ "Maharashtra Tops in Internet Connections", The Hindu, August 5, 2000.

⁷ MapsOfIndia.com, <http://www.mapsindia.com/overview/majorlanguagesofindia.htm>

Council of Ministers, which holds effective executive power. Permanent ministries and other public service agencies perform the day-to-day functioning of the government. The government structure of the states, defined by the constitution, closely resembles that of the union.

In 1991, India undertook an effort to decentralize or “open up” their government, granting the states more power. This effort, combined with a global shift away from industrial economies, has impacted both the fortunes of India’s cities and regions. Historically, India’s dominant cities were Mumbai (Bombay), Delhi, Calcutta and Chennai (Madras). Each is a regional capital in a largely rural area. While their regional importance continues, they are now threatened by the emergence of new growth centers like Bangalore and more recently, Hyderabad. According to a study by Annapurna Shaw, the changing fortunes of these cities are best viewed regionally. Each of the four largest Indian cities is located in a different quadrant of the country. The opening up of the Indian economy affected them directly by reducing GOI’s role in the economic management of the states. Where once the central government attempted to balance disparities (although this resulted in some industries in sub-optimal locations) through its public enterprise location policy, the states are now freer to pursue their own economic goals. Quite predictably, some states are proving to be far better at this than others, and according to Shaw, the distance between relatively successful and unsuccessful states is widening. Cities in poorer regions, like Calcutta in the East, are increasingly unattractive to new investment. Cities in the South and West are succeeding, with large cities viewed as engines for economic growth. Two points are especially worth noting: 1) the new development, while focused in large cities, is not occurring within the core but in the larger metropolitan region; and 2) India’s informal economy plays a large (and sometimes larger) role in an individual city’s economy than the formal. In areas like Bangalore and Hyderabad the informal economy is being moved to newer, economically less desirable, areas in order to present a hospitable climate to potential investors. The social picture in these growth centers is similar to that of other global cities, with gentrification, environmental distress, and rising costs garnering greater attention.

Even with the opening up of the economy, GOI still plays an important role in the lives of the states. Numerous ministries and departments are dedicated to

technology and its surrounding issues. In order to give an idea of their breadth and to illustrate their historic significance, I include the following descriptions of relevant national government entities:

Ministry of Communications. Within the Ministry of Communications is the Department of Telecommunications (DOT), which until 1996 was the only licensed provider of domestic local communications services (except in Mumbai and New Delhi). It established the Indian Telephone Industries in 1948.

Videsh Sanchar Nigam Ltd. (VSNL). The monopoly international telecommunications service provider. From 1995 to 1998, VSNL was the only commercial ISP in India. Until 1999, it was the monopoly provider of international Internet gateways for private ISPs.

Ministry of Information Technology (MIT). Contains a broad array of departments including the National Informatics Center (NIC), the National Centre for Software Technology (NCST), Software Technology Parks of India (STPI), and the Working Group on Information Technology for the Masses. Its responsibilities include: policy formation, promotion of the technology sector, and coordination of efforts.

National Informatics Center (NIC). The NIC was established in 1975 by the Planning Commission to act as a central source of information and services for the government.

National Centre for Software Technology (NCST). NCST is an autonomous research and development center with offices in Mumbai and Bangalore. It performs “practical” research to support to the Information Technology (IT) industry and provides training to Indian IT professionals.

National Association of Software and Services Companies (NASSCOM). Not affiliated with the Government, this not-for-profit organization is the IT lobby. A very proactive group, its stated objective is “to act as a catalyst for the growth of the software; I.T. services and dotcom industry In India”.

Information Technology Act, 2000. Enacted June 9, 2000, the act officially sanctions electronic data interchange for business transactions (e-Commerce) and for storage of government and legal documents. It provides legal

recognition of electronic signatures and was heartily applauded by industry and analysts.

Planning Commission, Government of India. The Planning Commission, chaired by the Prime Minister, releases a five-year plan approximately every five years (certain exceptions have been made due to extraordinary national occurrences). The Planning Commission is responsible for assessing the country's resources, maximizing their use, and augmenting those found to be deficient. Presently, the Commission concerns itself more with building long-term strategic vision and setting national priorities over providing elements necessary to the country's well being. The current plan, the Ninth "recognizes the integral link between rapid economic growth and the quality of life of the mass of the people" and the need to couple high growth policies with policies that are "pro-poor" and "aimed at the correction of historical inequalities". India's economic growth is predicated on the success of the IT industry, even though it is a relatively small percentage of GDP. Software related services represent slightly more than one percent of GDP. By comparison, agriculture and industry are more than half of GDP (Economist, 3/4/2000). GOI believes technology will improve the productivity of these sectors in addition to becoming a powerful sector on its own.

Software Technology Parks of India (STPI). Established in 1990, STPI is an autonomous organization under the administrative control of Department of Electronics (DOE) that seeks to "create a conducive environment to the software exporting community" by providing numerous incentives to the IT

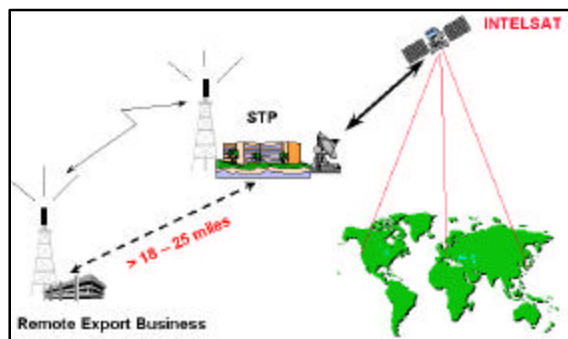


Figure 1. The satellite communications systems employed by the STPs require software exporters that locate outside the STP to locate within a given range. At the initial STP in Bangalore this distance was 30km (18.6m). In Hyderabad, technology has improved such that the distance has increased to 40km (24.8m).

sector, easing bureaucratic burdens, and performing research and marketing on their behalf. Eligibility for incentives requires a firm to locate in a Software Technology Park (STP) – best described as an enterprise zone exclusively for IT firms, where the zone may be anything from an individual building to an office complex – and that no more than 50% of the firms sales are domestic. Initially, STPs were set up by GOI and although they may be established anywhere in India, owing to politics they are found mostly

in capital cities. Increasingly, entities other than GOI, such as state governments, foreign countries, and real estate firms are establishing STPs, choosing to locate them elsewhere. For instance, four new STPs have been accepted in the state of Andhra Pradesh (capital city, Hyderabad) in Visakhapatnam, Vijayawada, Tirupati and Warangal, responding to a new national emphasis on locating STPs in rural areas (The Hindu, 4/15/2000). The location of an STP is a major influence on the land use within the surrounding area. Because of the technology used, firms that wish to use the communication link the STP provides must locate within a given radius of the park. This radius varies from 30 to 40 kilometers (18-25 miles). The major incentives (at the National level) given to those forming STPs are duty free imports and a five-year (consecutive) income tax exemption during the first eight years of operation. In turn, access to the centralized infrastructure must be granted to educational and research entities. A typical STP will

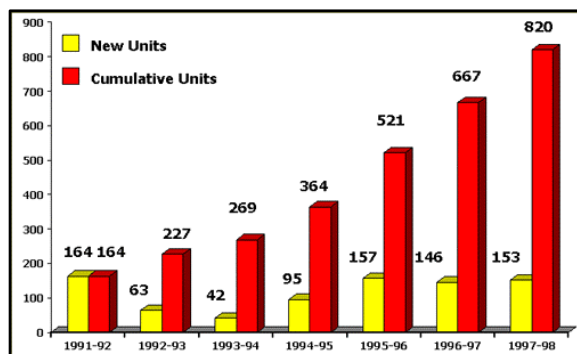


Figure 2. Annual STP growth since inception. Source: GOI.

include office space for the incubation of small businesses and some training facilities. Others are almost exclusively communications infrastructure. Exports occur mostly through electronic data transmission. Figure 2 shows the annual growth of STP units since the program's inception. GOI figures show that Bangalore and Hyderabad lead in attracting STP units.

Working Group on Information Technology for the Masses. Residing in the Ministry of Information Technology, the group held a series of meetings during the early part of 2000 with high-level national officials, state governments officials (especially those of rural and tech-laden areas), the Department of Education, the Ministry of Rural Development, academics, and private entities in order to assess current conditions and to develop a strategy with concrete objectives for providing information technology across all classes throughout India. The group admitted several obstacles, including a majority of its population's inability to afford Internet access devices, the lack of phone lines (the predominant form of Internet access from private residences), inadequate levels of education across much of the country, and strong regional differences both in education and language spoken (most

Indian Internet sites are available only in English). The group felt “e-Government” was especially important given that GOI is the largest service provider of its citizenry, requiring interaction on an almost daily basis. This claim is reinforced by a 1993 World Bank funded report by Samuel Paul of the Public Affairs Center in Bangalore, which found a high level of dissatisfaction amongst the middle class and urban poor for Bangalore’s public services. Service delays and the necessity of bribes to ensure satisfactory service were amongst the biggest complaints. The working group believed technology would enable them to provide timely, efficient, and auditable service. Among its recommendations were the provision of one million IT kiosks within all public utility outlets in the country (post offices, railway/bus stations, banks, schools, hospitals, etc.) by 2005; in-home Internet connections for the middle class by 2008; wired schools; the creation of training centers in rural areas; incentives and tax breaks for creating indigenous language software and for equipment donations by private firms to schools; and an IT training program to benefit underprivileged students. The group realized it would be impossible for GOI to fund these programs and therefore encouraged cooperation, elicited the support of private funding, and recommended revenue sharing amongst information providers so that communications infrastructure efforts would not be duplicated.



bangalore

Population⁸	
Metropolitan Area	4,130,288
City	2,660,088
Male ⁸	52.6%
Female ⁸	47.4%
Annual Growth (%) ⁹	4.14
City Density (persons/acre) ⁸	99.72
% Urban ¹⁰	74.31
IT professionals ¹¹	>55,000
Literacy (City)¹²	
	80.5%
Land Use	
Residential (Formal)	26.4%
Residential (Informal)	12.1%
Business	9.6%
Agricultural	0%
Transportation	28.4%
Other	23.4%
Communications	
Phone ¹³	.68m (10.5%)
Cell Phone ¹⁴	>.13m
Internet ¹⁵	85,000
Karnataka	
% Below Poverty Line ¹⁶	32.9

I mentioned in the introduction that Bangalore has recently emerged as the Silicon Valley of India and that the Silicon Valley story, or at least its pithy details, is well known. I briefly recount it here because it plays such an important role in Indian policy. Research occurred in the Silicon Valley area from at least as early as 1912 and during the 1920's, and at this time Stanford had an electrical engineering program of some repute. In 1924, and this is the most sensationalized part of the tale, Frederick Terman's completed his doctorate at MIT and returned to Palo Alto, where the favorable climate would ameliorate the conditions of his tuberculosis. Employed at Stanford, Terman wished to build an engineering program equal to those on the East Coast. He was convinced "of the critical need to link University and

⁸ 1991 GOI Census Numbers, Thomas Brinkhoff, <http://www.citypopulation.de/cities.html>.
⁹ Global Urban Indicators Database, <http://www.urbanobservatory.org/indicators/database/>.
¹⁰ Embassy of India, India Information, India 2000, <http://www.indianembassy.org/indiainfo/index.html>.
¹¹ Karnataka State Government, 1997.
¹² <http://www.bangaloreit.com/html/aboutbng/bangprofile.htm>.
¹³ Figures are for the Bangalore Telecom District, which includes Bangalore and its metropolitan area. Karnataka Telecom Circle, 4/30/2000, <http://www.karnataka.dotindia.com/SSAs/Bangalore/bangalor.htm>.
¹⁴ "Race Among Cellular Cos. Hots Up"(sic), The Hindu, November 26, 2000.
¹⁵ "Maharashtra Tops in Internet Connections", The Hindu, August 5, 2000.
¹⁶ World Bank's *World Development Indicators*, March 2000.

industry” and therefore “used all his connections, his influence, and sometimes his own money to encourage his best students to start up electronics firms” (Hall and Castells). In addition, he created the Stanford Industrial Park. The small electronics firms that these efforts spawned were spurred by U. S. Government demand during World War II and later by the space program. Saxenian enriches this tale. She finds that the socialization of knowledge within the region coupled with the competitiveness and efficiency of its numerous small firms, which in turn spawned more small firms who supported their progenitors, catapulted the Valley to its position of technical superiority. The Indian version of this tale, reproduced by government ministries and boosters alike, goes like this:

“...the area's gentle climate and hydroelectric capacity led Indian industrialist Jamsetji Nasarwanji Tata to decree that a science and technology university be built on a 372-acre site in northwestern Bangalore. Founded in 1909, the institute is known today as the Indian Institute of Science. It is India's most important technical school; its graduates are the Brahmins of Indian science.

Educated in preparatory schools all over India, the cream of the Indian technical crop tended to like life in Bangalore, and many chose to stay. With independence in 1947, defense, electronics, and civil organizations were founded and, logically, located in Bangalore: Hindustan Aeronautics, the Indian Space Research Organization, the National Aeronautical Laboratory. These organizations, with the thousands of engineers and scientists who came to serve them, made Bangalore a natural center for Indian technology.”

from “Bangalore”, Richard Rapaport

A 1999 article by James Heitzman significantly embellishes Rapaport’s account. He includes Bangalore’s history as a textile production center and the introduction of large mills during the late 19th and early 20th centuries. More importantly, he defines four, post-Independence phases to the Bangalore economy: a government dominated phase during the 1950’s and 60’s, where public sector research and production facilities were established; a rapid growth of state government bureaucracy during the 70’s accompanied by a large growth in population; the introduction of privatization policies in the 80’s; and an influx of multinational corporations which began in the late 80’s and continues to this day. Texas Instruments was the first MNC to arrive (1986), influenced by a high-level executive whose alma mater was the Indian Institute of Science, but has been joined by over 94 others today (STPI-Bangalore). Heitzman concludes his report by pointing out that the industrial base of Bangalore remains textiles (home and factory made) and public sector

enterprises, but its promise for future growth is in doubt and, parroting GOI quite well, economic growth will depend on technology. With this as a backdrop, I will spin my Bangalore techno-tale around two firms that Heitzman includes in his history: Indian Telephone Industries (ITI) and Infosys Technologies Limited.

Indian Telephone Industries

The Ministry of Communications established ITI in 1948 and in 1950 it became a public sector company whose main function was to supply equipment to the Department of Telecommunications. Today, it is the largest manufacturer of telecom equipment in India (GOI, Press Information Bureau). Despite a return to profitability (after 3 years of losses), ITI is no longer creating employment opportunities. Employment has decreased every year since 1995. In fact, an Internet search on “Indian Telephone Industries” yields an overwhelming number of former ITI employee resumes, either of academics or of job seekers. These employees typically had a long tenure with ITI, as the government took care of their needs in many ways. Not until losses mounted, did ITI cast off employees into the free market. Despite this, ITI did have interactions with other firms outside its boundaries. It has served customers in Ireland, Malaysia, Rwanda, Switzerland, and Vietnam and has collaborated with ALCA TEL in France, Siemens in Germany and Nortel Networks of Canada. ITI created an entire township on Bangalore’s east side and provided housing in multiple locations for its employees. In addition it provided transportation, medical facilities, schools, parks, and even vegetable farms.

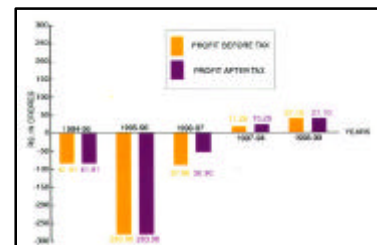
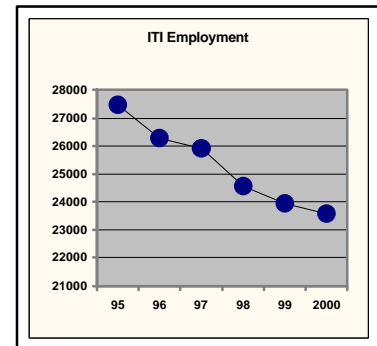


Figure 3. ITI employment & profitability for 1995-2000.

Infosys Technologies Limited

N. R. Narayana Murthy founded Infosys in 1981 with \$250 and six employees. Soon after, the company began providing offshore and onsite consultancy to U.S. corporations, a practice commonly, and often pejoratively, known as body-shopping. A “body-shop” serves as an intermediary between India’s highly

educated, highly skilled – the absence of cutting-edge technology due to a 70's era domestic protection program is credited with teaching Indian programmers to write highly efficient code – and relatively cheap workers and companies who need additional labor. The shop pays a percentage of the fee it collects from the firm it has negotiated with and may provide visas, travel and housing costs. Another arrangement allows work to be performed in India, taking advantage of the time zone differentials. Programmers in America will write code during the day and return to work the next morning to code that has been tested and debugged in India overnight. Testing and debugging are tasks considered unglamorous by many American programmers. Indian body-shops, including Infosys, earned a substantial portion of their revenue¹⁷ during the late nineties solving another mundane by American standards coding crisis: Y2K.

Infosys has built its business around high standards. It is ISO 9001 certified, has attained level five on the Software Engineering Institute's (SEI) process maturity model¹⁸, and boasts of its rigorous recruiting process, which in 1999 offered positions to 1.8% of its candidates (Infosys). At last count, Infosys employs 5,390 worldwide, one fourth the number employed by ITI. To retain these talented employees, who receive 14 weeks of training after their hire, Infosys has created many perks. Employees are known as "Infoscions" and receive stock options (in 1999, Infosys became the first Indian company listed on NASDAQ). The campus, located 15 miles outside the Bangalore core in



Figure 4. The 42-acre Infosys campus is located 15 miles outside the city. It includes manicured lawns, swimming pools, tennis courts, its own satellite links, power generators, and water recycling plants.

¹⁷ Infosys attributes 19% of its FY1999 revenues to Y2K solutions. Official policy attempted to keep this figure below 30% during the years of peak concern (97-98).

¹⁸ ISO 9000 is a set of five universal standards for a Quality Assurance system that is accepted around the world. Currently 90 countries have adopted ISO 9000 as national standards. The most comprehensive of the standards is ISO 9001. It applies to industries involved in the design and development, manufacturing, installation and servicing of products or services. The standards apply uniformly to companies in any industry and of any size.

The SEI process model defines 5 levels (1-initial, 2-repeatable, 3-defined, 4-managed, and 5-optimized) of maturity with regards to the ways software is created. In America, this model is taken seriously within the aerospace and defense industries. Many highly creative companies, of shorts, sandals, and caffeine lore, dismiss the model entirely.

Electronics City, includes manicured lawns, swimming pools, tennis courts, satellite links, power generators, and water recycling plants. Private power and water are supplied because the government provided services are quite irregular. The company retains its own fleet of buses to transport employees to and from campus along Hosur Road, a road that by all accounts is filled with potholes and stifling traffic. Electronics City is a 330-acre industrial park established in 1985 by the Karnataka State Electronics Development Corporation Limited (KEONICS), a State Government Enterprise, exclusively for the promotion of electronics in the State. It houses more than a hundred industries, including Infosys (“electronics” is quite loosely defined) and ITI. The park was initially divided into 110 plots of varying in size. 280 acres were reserved for development, with the remaining acres used for a green belt and right-of-ways. In June of 2000, the government announced a 300-acre expansion at Electronics City.

The International Tech Park (ITPL), located 12 miles outside of Bangalore, is based on the Electronics City model, but is dedicated to the software industry. It is part of the Karnataka government plan for a tech corridor including it and Electronics City. ITPL is a joint venture between Tata Industries Limited (India's largest business conglomerate), a Singapore consortium - led by JTC International, an international arm of Singapore's largest industrial developer, and the Karnataka Industrial Areas Development Board. It represents 55% of the total government investment in the city. Cigarette manufacture (13.6%), hotels (8%), computer software (7%), and aircraft manufacture (3.6%) are other leading investments. The balance is



Figure 5. ITPL is monitored “round-the-clock” by “a comprehensive security cover complete with fire alarms, fire-fighting systems, guard patrols and door alarm contacts”.

composed of snacks, footwear, and textiles (Shaw). The 68-acre park includes a VNSL satellite, phone service within 48 hours of arrival, nearly 1.2 million square feet of office, production and retail space, a country club, and a 51-unit luxury apartment building. The apartment units are available to the general public. A dedicated pipeline brings in water. Sewage treatment and power generation occur onsite, again because government supplied sources are inadequate. Park facilities are monitored “round-the-

clock” by “a comprehensive security cover complete with fire alarms, fire-fighting systems, guard patrols and door alarm contacts”. A major difference between the Infosys campus and ITPL is responsibility for the infrastructure. ITPL provides the infrastructure for its tenants. In contrast, Infosys must maintain its own infrastructure. The park is operating at over 90% capacity. An expansion creating 650,000 square feet of space, including plans for customized buildings, has been announced.

The Karnataka government provides many of its own inducements (beyond national benefits) to locate within or to establish a tech park. Here is an overview, extracted and summarized from “Karnataka - The Millennium It Policy, It For The Common Man”:

- Tax rate reduction to (.25%, lowest ever) on computers and computer peripherals.
- Sales tax exemption for a period of 10 years or deferment for a period of 12 years.
- Captive power generation sets installed by the Information Technology Industry are eligible for a total exemption from payment of electricity tax sales tax on fuel used for captive power generation.
- IT companies that use up to 5 KVA of power may locate in residential, industrial or commercial areas, without restriction.
- The Government is pleased to relax FAR (Floor Area Ratios) for all IT projects set up outside the limits of the municipal corporations in the state. A maximum relaxation of 50% of the existing FAR is available.
- New IT companies which create employment of more than 250 in Bangalore and 100 in other areas during the first year are eligible for rebate on the stamp duty and 15% of the land expenditure.

“Mega projects”, those employing 1,000 or more or investing beyond Rs. 100 crores (1 billion rupees) are eligible for increased benefits.



hyderabad

Population¹⁹	
Metropolitan Area	4,344,437
City	3,145,940
Male	1,627,250
Female	1,518,690
Annual Growth (%)	3.92
Density (persons/acre)	58.67
% Urban	100.00
Literacy¹⁹ (%)	
Male	78.90
Female	63.55
Workers¹⁹	
Agri culture	6,800
Mi ni ng	689
Manufacturing	159,665
Household Industries	4,304
Construction	65,329
Services	623,943
IT professionals ²⁰	~ 16-18,000
Communi cations	
Phone ²¹	.64m(20.4%)
Cell Phone ²²	>.13m
Internet ²³	45,000
Andhra Pradesh²⁴	
% Below Poverty Line	21.9

Despite its population, and its status as the fastest growing city in India, Hyderabad is still described by some as an “overgrown town” (Baru). Much of its current form was established during the reign (1911-1948) of Mir Osman Ali Khan, the last of a long line of sovereigns whose rule began in 1713. He oversaw the creation of Hyderabad’s basic infrastructure and numerous public buildings, gardens, textile mills and engineering companies. Following independence (when Hyderabad was named the state capital) several public sector companies were established. Of those, Bharat Heavy Electricals, whose customer list includes the power, defense, and oil sectors, HMT, a multi-unit, multi-product conglomerate in machine tools, and Electronics Corp. of India, who supplies inputs for use in infrastructure, required the work of highly skilled engineers. Others who are given credit for Hyderabad’s development are Ramoji Rao, a film producer and media baron, Ramalinga Raju, the chairman of Satyam Computers, and Anji Reddy, who founded Uniloid, a pharmaceutical in 1973, and expanded to Dr Reddy's Laboratories Limited and

¹⁹ 1991 GOI Census Numbers.

²⁰ “India -- Wired For Growth”, Omer Farooq, SiliconIndia.com

²¹ Andhra Pradesh Telecom Circle, 10/31/2000, <http://www.ap-telecom.gov.in/demographic.html>.

²² “Race Among Cellular Cos. Hots Up”(sic), The Hindu, November 26, 2000.

²³ “Maharashtra Tops in Internet Connections”, The Hindu, August 5, 2000.

²⁴ World Bank's *World Development Indicators*, March 2000.

Chemisor Drugs Limited in 1984. The last in the list of Hyderabad's "great men" is Chandrababu Naidu, who presently serves as the chief minister of Andhra Pradesh. To date he has overseen the creation of two new institutes (the Indian School of Business and IIIT, Hyderabad), the approval of an International airport, the construction of the largest technology park in Asia (HITEC - Hyderabad Information Technology Engineering Consultancy - City), and the launch of several e-Government initiatives.

The Hyderabad agglomeration's size has doubled²⁵ - from 95 square miles in 1971 to 202 square miles in 1991 - placing a strain on the local environment. V. K. Bawa, a prominent urban planner, characterizes Hyderabad's growth as "haphazard" and not according to the Hyderabad Urban Development Authority's (HUDA) master plan for the city. Water resources are stressed and green space has disappeared. As a result, in 1994 HUDA undertook the "Hyderabad Greenbelt Project", a pilot project that aimed to circumscribe the entire metropolitan area with a greenbelt. The Royal Netherlands Government provided nearly three-fourths of the funding, with the remainder contributed by the other agencies involved in the effort. The project hoped to serve as a model for other urban areas, provide employment to women and the economically disadvantaged, improve fuel wood and fodder supply to the rural poor and urban slum dwellers, and by working with NGOs and village groups, encourage community participation. A second effort called "Green Hyderabad" is being implemented based on the success of the project. Eight percent of government funding is being spent on upgrades to roadways, telephone communication services and airport expansion (Shaw). Naidu has learned at Bangalore's expense. Recently, high-tech workers have been leaving Bangalore because of its power outages, increasing rents, and traffic. Firms looking to locate in India for the first time are looking outside of Bangalore for the same reasons (McLaughlin). The World Bank has identified Andhra Pradesh as a "focus state"; its lending program in the state for nutrition, education, power reform and other improvements is about \$2.8m (Economist 9/2/2000).

The Indian Institute of Information Technology (IIIT) Hyderabad is an autonomous, self-supporting institution started in 1998 with seed money from the Government of Andhra Pradesh. The 60-acre campus is located less than two miles from HITEC City. Its initial class had fifty students who undertook a

²⁵ 1991 GOI Census Numbers.

curriculum stressing research in the areas of multi-lingual technologies, information security and cognitive science. Eventually the school hopes to serve 750 students annually and has plans to add masters and doctoral programs. The focal point of the institution is its corporate schools, which NASSCOM was active in attracting: the Microsoft School For Software Technology, the Oracle School for Advanced Software Technology, the Motorola School of Communication Technology, and the IBM School of Enterprise Wide Computing. The typical arrangement has the Government of Andhra Pradesh providing the land, buildings, water and electricity for these schools while the corporate leader furnishes the interiors and curriculums. Adjacent to the IIIT campus is the Indian School of Business (ISB). Its funding comes from several large corporate groups including Reliance, P Chatterjee Soros Fund, Hindustan Lever, and McKinsey. The Kellogg Graduate School of Management at Northwestern University and the Wharton School at the University of Pennsylvania are helping to design the curriculum, recruit and train faculty, and develop admission procedures. The ISB offers a one-year MBA program for candidates with at least two years full time work experience. In addition, PhD, and short-term executive development tracks are offered. ISB is located



Figure 6. Design sketch for the Indian School of Business.

on a 250-acre campus, featuring housing, student centers and athletic facilities. John Portman won a \$45 million contract to design the school, which he described as “cutting-edge in every way”. The school is being built out of sandstone, white marble is being laid in every classroom, and a sophisticated cooling system has been developed to mitigate Hyderabad’s hot weather. Classes are expected to begin in June 2001.

Naidu’s e-Government initiative has been just as aggressive. First, he created a public technology face by requiring all government officials to undergo computer training and by publishing much information on the Internet. Then he implemented several pilot programs, which are now being rolled out throughout the state. The TWINS project created a chain of computerized service centers to improve government efficiency in handling official documents and transactions. The centers provide electronic bill payment including taxes; issue birth, caste, and death certificates, driver’s

licenses, vehicle registration, and building permits; and facilitate change of address and vehicle transfers. Simpler services will be offered over the Internet and through public Internet kiosks. A second project electronically registers property statewide. It has reduced a process that formerly took days to less than an hour. The Multipurpose Household Survey Project is creating a database of socio-economic data and land records. It will be used to direct poverty alleviation programs to areas of greatest need and for forecasting, trend analysis and policy decisions. Finally, the Andhra Pradesh Development Monitoring System is being used to collect satellite data for all the mandals, villages and habitations. It also aids welfare programs by providing support for research, analysis, project design and monitoring.

While all these efforts have helped in the marketing of Hyderabad, its public relations coup came on March 24, 1998 when Microsoft chairman Bill Gates announced his decision to locate a software development center, only its second outside the United States, at HITEC City. Following Microsoft were multinationals Oracle, GE Capital, and Baan, and domestic leaders Metamor Global Solutions, Satyam Computers, and Wipro Technologies. HITEC City, which opened in December of 1998, is a joint venture between the Andhra Pradesh Industrial Infrastructure Corporation (11% equity) and Larsen & Toubro (89% equity) - India's largest construction company. The 158-acre development provides over 1.3 million square feet of office space in two buildings: the newly opened Cyber Gateway, and Cyber Towers. Areas have been reserved for a hotel and convention center, a medical center, parks and a nursery. Like ITPL in Bangalore, water, power, and communications facilities are provided to all tenants. The state incentives to tech firms are slightly more aggressive than in Karnataka, but quite similar. Lying just outside the park is Madhapur, an 87-acre residential area of freestanding homes, duplexes, apartments, and condominiums. Madhapur and HITEC represent 72% of the total government investment in Hyderabad (Shaw).



Figure 7. Cyber Towers at HITEC City.

conclusion

I opened this paper by asking two questions, and it is near time for me to answer them; however, before I begin I must admit some trepidation in the task. I have never been to India (and therefore fear the facile errors of the armchair critic) and while I know a good deal more now than when I started, it is only a beginning. I certainly seem to have more questions than I do answers. For instance, while Shaw reports the growing disparities between states and the developmental shift away from the core, what is the impact of this trend on the cities involved? Is there a similar equity gap, and if so, what is its size and who exactly is affected? Is the development of technology parks away from the core adding to urban sprawl or is it just part of a larger trend? And what is the impact of multinationals on the local economies of the cities where they locate? Recently, the Times of India reported that the managing director of Texas Instruments stepped down to begin a startup business in a sector related to his work at TI. Saxenian found this type of movement and the cross fertilization it engendered crucial to the success of Silicon Valley, yet can it overcome the control held by organizations headquartered outside the region who do not feel obliged to act in the best interest of their host? I console myself with the knowledge that these same questions could be asked of any city aggressively trying to attract companies with various incentives and therefore I am not unjustly singling out a country other than my own.

I arranged this paper in sections, and used each to tell a story. I have omitted much and tried not to repeat ideas. In the Bangalore section, I hinted at the creative synergy that exists in Silicon Valley, what Hall and Castells call the "innovative milieu", and that which creates its true economic advantage. The tableau of Bangalore that I painted attempted to locate an "innovative milieu" there. It is difficult to perceive such an environment at this distance, although reports of high rates of turnover at different levels of employment and the joint efforts of NASSCOM and NCST between the universities and industry provide clues. Clearly, India's engineering talent is internationally respected. My research into Hyderabad looked at their efforts to seed such an environment, as in their nascent state one would not expect to see a developed community. Similarly, I

emphasized the incentives provided by the Karnataka government and only paid them lip service in Andhra Pradesh. I did this because the policies were quite similar. In the Hyderabad section, I focused on their e-Government initiative. From my research, they appear to lead in this area, and my omission in Bangalore is intentional. Andhra Pradesh also appears to lead in establishing infrastructure to support the growth they are attracting; however, questions regarding the availability of funding to sustain these efforts circulate the Indian press. Finally, I opened each section with a table of demographics, yet until now have not referenced them. It was my hope that these tables would reveal a second story, providing a hint of the reality that many Indians confront on a day-to-day basis. It is a story quite different from the manicured campuses of the elite schools and tech firms.

My first question dealt with the replication of Silicon Valley. By this I did not mean the dangling of tax incentives and the adoption of a swell moniker. Too many come to mind without pause, to wit the Silicon's Alley, Fen, Glen, Desert, Harbor, Pasture, etc. Their success is dubious at best. While in the short term they may lure jobs from one region to another, their long-term ability to create an environment so mentally attractive that firms locate there regardless of cost, a Marshallian or Neo-Marshallian node, is, in my mind, suspect. At the same time, these nodes exist the world over, from movies and entertainment in L. A.; furniture in North Carolina; carpet in Dalton, Georgia; and fine clothes in Italy. The relevant question is then, not can Silicon Valley be replicated, but has India done so? On this, I'm somewhat nonplussed. India's advantage is that they are not Silicon Valley. They have a national goal: to be the best, to surpass the Valley in technical achievement. This affords them the opportunity to build significant social capital through the process of becoming an IT leader and it is social capital that drives Silicon Valley. At the same time, Silicon Valley has the advantage of being first to market, and therefore enjoys international recognition and a momentum that is not easily exceeded. India's challenge is difficult, and dependent on their ability to exploit and retain their wellspring of indigenous talent. Their challenging social conditions provide ample opportunity to create universally desired offerings, whether they overcome environmental problems, language barriers, or abject poverty. Imagine if India were to find an efficient and replicable means of creating indigenous Internet content, it would be a boon to all areas where language barriers create social and economic disparity. The same could be said of a

technology that “leapfrogs” what is now state of the art. India, by creating a cheap means of disseminating information to their entire population, would solve many problems other countries are either unable or unwilling to create.

Unfortunately, India’s zest to become a global leader seems, at times, to conflict with their goals of solving domestic social crises and to date, this has prevented them from creating true Marshallian nodes. Instead they have created temporal labor nodes. Body-shopping remains quite prevalent, and appears to be morphing into new forms like “Customer Relationship Management”, where college graduates are employed by firms located in STPs, and use their telecommunications infrastructure to provide real time help to Americans shopping on the Internet (“Dial India for E-Tailing Support”). Medical transcribers are yet another form of body-shop, here, doctors send their dictations to India each night and receive a hard copy the next day (Filkins). While these businesses are beneficial in that they provide jobs to relatively low-skilled workers, premising their location decisions on tax incentives only makes them vulnerable to other regions that offer even greater perks. Exhibit A is Hyderabad’s very real threat to Bangalore. In Silicon Valley, California, the social capital is so strong, so essential to business that firms locate there despite its negative externalities. Recently, Carnegie Mellon and the Wharton School of Business have announced intentions of locating branches there (Manjoo, Shuchman). Not only are some of the jobs being created of dubious national benefit, the initial results at IIIT also deserve attention. 25% of IIIT’s first graduating class secured post-graduation employment in the United States²⁶. While the school intended this statistic to demonstrate the quality of the students they are producing, what it demonstrates to me is a continuing process of “brain drain”. Some blame this outcome on the ignorance of liberal arts within the school’s curriculum, and ask if these technological geniuses have the capacity to give back to their communities (Sarvate). Others question the makeup of the schools governing boards, which a Hindu Business Line editorial identified ISB’s board as having 34 of 46 positions filled by non-Indians. Still others question whether autonomous research can be performed in schools run by corporations. Hall and Castells define three roles for the university with regard to the “innovative milieu”: 1) to generate new knowledge; 2) to train a labor force, especially for the local market; and 3) to play a direct

²⁶ IIIT publications.

entrepreneurial role. It will be essential for the new universities to meet these goals if India is to be successful in the long term.

The second question, regarding the inevitability of the dual city, is a bit trickier, for I believe the answer is yes, but I do not believe, despite the lessons Minister Naidu appears to have learned from Bangalore, that I found compelling evidence in India to lead me to this conclusion. For all their technical knowledge, India seems mired in attempts to imitate, and in so doing misses the latest trends in their efforts. As I have mentioned more than enough, India knows the Silicon Valley story. If anything they know it too well. The Karnataka IT Policy refers to a NASSCOM-McKinsey generated checklist of Silicon Valley ingredients. Loosely translated, it reads:

- Anchor companies?
- Research centers?
- University?
- Venture Capital?

This list bears an uncomfortable resemblance to a recipe for instant oatmeal - just add water and voila! What this checklist ignores are the social problems which have come to fore in the Valley and the actions taken by various entities in order to solve them. In August of this year, Hewlett-Packard donated \$1 million to the Housing Trust of Santa Clara County especially for teachers, a group who has been priced out of the region and therefore has difficulty making mortgage payments. In San Francisco, two non-profit housing developers have launched an idea for a mixed-use complex, housing a dot-com on the lower floors, and lower-income housing on the upper. In November, here in New York, School Chancellor Harold Levy proposed that public-private partnerships build schools in mixed-use office buildings. In fairness to India, two of these three initiatives are merely proposals, and moreover, Silicon Valley leaders tend to “come together quickly to deal with the issue ... but then they disband until the next problem surfaces”, creating problems for long-term community initiatives (Bartindale and Ostrom). Yet, what all these proposals demonstrate is an attempt to de-stratify regions which have benefited from economic agglomeration and to spread the region’s burden more evenly. Adding such ideas to their checklists, India could skip the “de-stratification” process when creating technology parks like the International Technology Park in Bangalore. Unfortunately, ITPL is

essentially a high-tech gated community. Tom Field and Cheryl Bentsen described HITEC City as “reminiscent of Celebration, the planned community spawned at Walt Disney World in Florida” in its attempts to insulate its denizens from the reality at its borders. It seems preposterous that in a region that suffers from severe lack of basic infrastructure, governments are offering huge incentives and spending a large portion of their budgets on efforts that benefit such a small number of their citizenry. IT professionals represent 1.3% of Bangalore’s population, in Hyderabad, they are even less, 0.4%. To me, it seems eminently logical to require some public housing and even job training – the San Francisco mixed use project proposes this – within these technology parks. Unfortunately, India’s national efforts are extremely vertical. On the one hand, they seek to eliminate poverty, on the other, they want technical prowess. The ideas are not integrated. Perhaps they feel their attempts to provide for their citizenry through the towns they established around public sector firms like ITI were a failure. Or maybe they believe that in a cutthroat global economy they cannot afford these additional investments. How ironic is it that just as India is abandoning its socialist ideas, others in Silicon Valley, the region India so desperately wants to imitate, are beginning to take them on?

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