High-tech utopianism: Chinese and Indian science parks in the neo-liberal turn

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Abstract. Science park developments have become ubiquitous in China and India in recent decades as both countries integrate further into the global economy. These exclusive high-tech spaces prioritize the partnership between industry, research and the government as a desirable mode of urbanization, economic growth and knowledge production. Contrary to the older form of industrial zone associated with big science and big industry for national mobilization during the Cold War, contemporary science parks constitute a network of global spaces that are designed to facilitate the circulation of technology, personnel and capital in the neo-liberal world. Similarly, science parks are closely linked to innovation, entrepreneurship and social exclusion rather than the collective social betterment. As utopian machines for the privileged, these exclusive spaces are about consumption, desire, hedging and speculation as much as about science, research and production.

One ubiquitous phenomenon of Asia's rapid urbanization is the proliferation of science parks. Also known as knowledge corridors,[1] high-tech enclaves, smart cities, technopolises, even special economic zones and so on, these exclusive spaces emphasized the partnership between industry, research and the government, and have displaced the older forms of industrial zone and traditional urban centres with a new urban typology that is closely associated with the contemporary technology- and information-based economy. As always, science parks enjoy special privileges granted by the local nation states but are subjected to elevated regulations. Much like global cities, they do not exist in isolation but as part of a global network. Moreover, apart from serving scientists, engineers and other professionals working at research laboratories and high-tech manufacturing plants, these spaces are also designed to attract businesses, venture capital, property investors and affluent urban citizens who long for a privileged lifestyle that is

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1 In this paper, the word 'knowledge' is used to largely denote production, circulation and consumption of services related to the contemporary tertiary economy, largely dominated by software development and management, data-driven R & D, and analysis of software information.

branded as technologically sophisticated, green and exclusive. As such, science parks are about desire, consumption and speculation as much as about production and research and development (R & D). Above all, this new geography of exclusion is inseparable from the neo-liberal political economy and sensitivity that define our times.[2]

While there has been no shortage of academic literature on science parks, most of these studies have so far come from the fields of urban planning, human geography and policy and business studies. However, science parks are also productive sites to think about science and technology in action. Specifically, as a category of infrastructure, science parks allow us to think about science not only as a knowledge system, but also as a social and political practice that involves ideologies, economic rationales, administrative techniques and even cultural fantasies and affects.

In this essay, we use specific examples to explicate the genealogy of science park development in China and India. Since 'science park' is a broad concept with outputs ranging from manufactured products to complex algorithmic computer codes, our attention is mainly on those that are associated with 'high-tech innovation', which has become a principal trope in science and economic policies in both countries under examination. In addition, we analyse how the contemporary science park phenomenon is derived, and yet different, from the kind of industrial zone developed within the context of the planned economy in socialist China and socialist-oriented India during the Cold War. Also, we discuss how these exclusive spaces designated for science and technology are themselves a technology of government that helps to mould the urban middle class into new political citizens and consumer subjects in the era of global capitalism.

Trajectories of industrial zones in China and India

Although science parks are products of the twentieth century, the idea of a dedicated industrial zone for facilitating production and economic growth can be traced back at least to the end of the nineteenth century. The British economist Alfred Marshall, for example, already mentioned the idea of the 'industrial district' in his influential *The Principles of Economics* in 1890.[3] By the early twentieth century, as intense industrialization and war efforts inaugurated an era of Big Science, industrial zones and industrial cities were also seen as vital to national survival. After the war, as reconstruction and Cold War mobilization took centre stage, designated and master-planned industrial zones continued to flourish and emerged as matters of national priority. This was particularly the case for closed or at least relatively insulated economies such as China, India and the Soviet Union where a disproportionate amount of resources was devoted to rapid industrialization drives.

In China, when the Communist Party came into power in 1949, the country was primarily an agrarian society. Heavy industries were concentrated only in a few areas such as the North East (occupied by imperial Japan during much of the early twentieth

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2 'Neo-liberal' and 'neo-liberalism' refer to a belief that argues for a society organized around self-regulating free markets without any state intervention. In this paper, the terms 'neo-liberal' and 'neo-liberalism' are used to denote, on the one hand, increasing state entrepreneurialism in both China and India in order to attract capital, and, on the other, increasing privatization and deregulation of the economy.

3 Alfred Marshall, *The Principles of Economics*, London: Macmillan and Company, 1890, p. 225.

century), Shanghai (a Western colonial outpost) and the adjoining lower Yangtze region, and Chongqing (China's wartime capital under the former Nationalist government) in the South West. Still, the state made every effort to invest in heavy industries based on its tenet of economic planning. Under this context, steel production and petroleum refining were some of the primary industries that were being seen as vital to China's industrialization and national security. As a result, the Anshan Steel Plant in the North East, which was based the Japanese Showa Steel Works founded in 1916, and other steel plants established with Soviet assistance were the People's Republic's earliest industrial zones.[4] Later, when the Daqing oilfield went into production in 1960, the Daqing industrial city instantly became a symbol of socialist modernity as well as the exemplar of national self-reliance, a top priority as defined by the Chinese leader, Mao Zedong.[5]

As the Cold War intensified in the 1960s, and especially after the worsening of relations with the Soviet Union, the Chinese government began to pour in resources in thirteen provinces and autonomous regions in the country's remote interior in what was called the Third Front Movement. Started in 1964, the Third Front project triggered large-scale scientific and technological investments in defence, heavy industries and infrastructural projects, creating essentially an industrial belt far from the so-called First Front region that included the Sino-Soviet borders and the eastern coastline.[6] In many cases, the Third Front Movement involved the relocation of industrial plants and research facilities, along with engineers, scientists and supporting personnel from the rest of the country. In other incidents, new factories and facilities were being introduced. At the time, the Third Front Movement represented China's largest ever top-down and campaign-style mobilization of science and technology by creating new designated districts and cities from scratch. Among the critical defence infrastructure being developed, for instance, was a research centre in the mountainous region in Xichang in Sichuan Province for China's then emerging space programme, which remains one of the country's major satellite launch centres today.

Regardless of their specialization, large-scale industrial zones in populated urban centres and remote regions alike were made up of closed compounds known as 'work units' or *danwei*, with their own housing, clinics, shops, schools, basic entertainment facilities and, no less importantly, party administrative organs. Given their exclusive nature, migrant experts, specialists, workers and their families in these gated compounds were generally quite detached from the surrounding neighbourhoods. Such a system was designed to provide security and efficiency for the Cold War mobilization and the deepening of the Communist revolution.[7]

4 I.Kh. Ovdiyenko, 'The new geography of industry of China', *Soviet Geography* (1960) 1, pp. 63–78.

5 Lianyong Feng, Yan Hu, Charles A.S. Hall and Jianliang Wang, *The Chinese Oil Industry: History and Future*, New York: Springer, 2013, pp. 5–6.

6 Barry Naughton, 'The Third Front: defence industrialization in the Chinese interior', *China Quarterly* (1988) 115, pp. 351–386.

7 During this time, as part of the social engineering project of the the Communist state, Chinese society was organized around the *danwei* or work unit, which was the foundational administrative and governing unit. But not all work units were created equal. Those work units associated with industrial zones were among the most rigid and disciplined. See David Bray, *Social Space and Governance in Urban China: The Danwei System from Origins to Reform*, Stanford, CA: Stanford University Press, 2005, pp. 145–146.

Similar to China, when India gained independence in 1947, the federal government used industrialization as a strategy to achieve economic growth and the overall development of the country. Although India was not a one-party state like China, the state advocated many socialist policies, and was wary of allowing the market to take over the industrialization process as it might have led to an increase in existing inequalities.[8] The Industrial Policy Resolution introduced by the federal government in 1956 was one example. This resolution divided industries into three categories, where the first two included heavy and strategic industries and fell under government-controlled public-sector enterprises or public-sector undertakings. The third category was branded light industry, where investments from the private sector were allowed.

Bangalore was one of the cities designated as a growth engine. From 1950s, the city witnessed the establishment of a few initial public-sector industries, including Bharat Electronics (BEL), Hindustan Aeronautics Limited (HAL) and Hindustan Machine Tools (HMT). Later on, several government research facilities were also established in and around the city. With the increasing importance of Bangalore as a strategic industrial hub, Jawaharlal Nehru, the first prime minister of India, stated in 1962 that Bangalore 'is on [*sic*] a picture of India of the future'.[9] By the 1970s, with the establishment of the Indian Space Research Organization's headquarters, Bangalore had become the official hub of high-tech industries and research centres in India. Along with these public-sector industries and research centres, small residential townships were established to cater to employees and their families. Located mainly near the research centres and industries, these townships were facilitated with centrally funded government schools, market areas, medical centres and extra security, making them essentially semi-gated communities, or the Indian version of company towns.

Similarities aside, industrial development in India differed from China in that it put great emphasis on the electrical and electronic sectors early on. In the early days, heavy electrical and electronic enterprises in the public sector dominated the domestic industrial scenario. Bangalore's HMT, HAL and BEL were among the most successful cases. Meanwhile, in the 1970s, the Department of Electronics (DoE) was established in order to accentuate policy directives to improve the country's electronics industry. Nevertheless, these public-sector enterprises failed to lift India's electronics industry for two main reasons. First, there was a lack of investment and excessive government intervention; second, firms from South Korea, Taiwan and other South East Asian nations have aggressively expanded their dominance in the electronics industry.[10] Moreover, unlike China, there was already the presence of limited foreign investment in India. For instance, in the 1970s, IBM was one of the few manufacturers that produced computers in India. Yet by 1978 IBM had left India altogether due to policy hurdles and logistic problems such as its constant inability to import needed computer equipment. In the meantime, DoE slowly shifted its emphasis towards software

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8 Balaji Parthasarathy, *Globalization and Agglomeration in Newly Industrializing Countries: The State and the Information Technology Industry in Bangalore, India*, Berkeley: University of California Press, 2000.

9 Parthasarathy, op. cit. (8).

10 Parthasarathy, op. cit. (8).

development and export. As a result, the Santa Cruz Electronics Export Processing Zone (SEEPZ) in Bombay (Mumbai) was established by DoE mainly to produce and export software. And this was where Tata Consultancy Services (TCS) began exporting software.[11] While the federal government also began attracting non-resident Indians to invest during the 1970s, delay in the import of computers continued to be a crucial obstacle in the development of the software sector.

All in all, in spite of the various problems such as the lack of efficiency and capital, state-driven industrialization projects did help to modernize the Chinese and Indian economies in a considerably way. Yet, starting around the late 1970s and early1980s, the rise of neo-liberalism has drastically altered the global economic and political landscape by prioritizing free markets and deregulation over the government and public sectors. Decades of socialist experiments in China and India subsequently also came to an abrupt end. As both countries respectively started their programmes of economic reforms in order to promote marketization and attract foreign investment, a new kind of urban space associated with the rising social and economic order began to emerge. Nowhere is this more evident than in the development of the Shenzhen Special Economic Zone (SEZ) in China, which evolved from a fishing town to a thriving metropolis, first as a manufacturing base and then as a high-tech innovation hub, in less than four decades. At the same time, as some of the large-scale industrial compounds and work units were shuttered permanently all over China; others were privatized or turned into state-backed and profit-seeking enterprises.[12] In short, even if some areas of the vast Third Front region have slowly become China's 'rust belt', dotted with derelict factories and depopulated cities, the practice of a special zone designated for technological and economic growth lives on, and the idea of a close compound with a closely supervised and disciplined workforce also found its way into those production-oriented science parks and factory spaces in the special economic zones of the post-socialist economy.

Meanwhile, unlike in China, where the shift to the market economy was linked to the rise of export manufacturing, the neo-liberal turn in India was very much connected to the development and export of software. In the 1980s, as part of the software development policy, the government shifted towards a more liberal approach to the import of computers in order to improve the software sector. Also, with an improved investment environment, Texas Instruments established its operations in Bangalore. By 1988, the federal Ministry of Commerce had established the Electronics and Software Promotion Council, and in the same year private software firms formed the National Association of Software and Services Companies.[13] In the process, the old industrial zones set up for public-sector industries immediately after Independence were transformed into a new kind of production space for the global economy. And the fast

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11 Parthasarathy, op. cit. (8).

12 The social and economic implications of this transition are vividly capture by the Chinese director Jia Zhangke's 2009 film *Er shi si cheng ji* (24 City), which blends documentary and fiction to show how a socialist *danwei* that once manufactured fighter aircraft is being turned into luxury apartments for the rising middle class.

13 Parthasarathy, op. cit. (8).

development of India's software industry prompted talks within China about the need to catch up with India's success.

Science parks and the new economy

But even if the ultimate development of Shenzhen and Bangalore into high-tech 'growth engines' was historically connected to the larger practice of the industrial zone from the Cold War era, the numerous science and technology parks that emerged in these new economic spaces were equally inseparable from the general history of the science park. In fact, significantly, the early versions of science parks were themselves close cousins of those industrial zones in socialist economies during the Cold War. For example, Silicon Valley, arguably the world's ultimate science park, was originally known as the Stanford Industrial Park when it opened in California in 1951. At the time, it was a designated industrial zone geared towards high-tech and 'smokeless' industries based on the earlier concept of the industrial zone. As Louise Mozingo argues, in spite of being a 'park', the emphasis on a green and campus-like environment, which has been considered an essential part of the creative narrative associated with science parks and especially with Silicon Valley, was mostly an afterthought that emerged in the late 1970s when Stanford University finally introduced vigorous standards and emphasized the green atmosphere as an effort to redefine the industrial park as a research park.[14] Nonetheless, according to Richard Barbrook and Andy Cameron, the convergence of West Coast bohemianism, networking and information technologies, and the post-industrial neo-liberal economy has ultimately created a lifestyle and a belief in the transformative and emancipatory power of new information technologies, or what they have referred to as the 'Californian ideology'.[15]

As science parks have increasingly been rebranded as spaces for economic and technological growth, they have also taken on new names and forms, such as knowledge corridors, high-tech enclaves, smart cities, special economic zones and technopolises. And this development is as true in the global South as in the global North. In the global South, science parks have indeed become so central to the thinking of science policy and economic development that in 1993 UNESCO launched a programme to promote greater collaboration between universities, industries and the scientific communities as the formula for its decades-long developmental initiatives. In the past decade, UNESCO has continued to issue directives on the governance of science parks as part of its programme for promoting effective science policies.[16] The emphasis on the importance of university and industry partnerships has also led the United Nations to introduce initiatives in selected locations of Africa and the Middle East where economic growth is desperately needed. Such initiatives, in other words, suggest that while investment in science and technology is considered vital in

14 Louise Mozingo, *Pastoral Capitalism: A History of Suburban Corporate Landscapes*, Cambridge, MA: MIT Press, 2014, p. 170.

15 Richard Barbrook and Andy Cameron, 'The Californian ideology', *Science as Culture* (1996) 6, pp. 44–72.

16 UNESCO, 'Science and state capacity', at www.unesco.org/new/en/natural-sciences/science-technology/university-industry-partnerships, accessed 12 August 2015.

the developing world, the specific urban and institutional configurations associated with this investment are no less important.

Meanwhile, scholars also seek to make sense of the significance of these spaces by highlighting their different functions. Some regard science parks as property developments with the aim of supporting a research-based economy.[17] Others see the production of space through these high-tech infrastructural developments as essential in relation to regional and national economic growth.[18] Science parks are also seen by some as the new industrial spaces in this globalized world.[19] But what becomes clear is that the proliferation of science parks also entails the dissemination of a certain lifestyle and tech-utopian fantasy associated the so-called 'Californian ideology' mentioned above.

Of the various aspects of this ever-proliferating science park phenomenon, three areas deserve our special attention. First and foremost, science parks are sites where the global and the national interact and negotiate with one another. For instance, we often see architects and planners from East Asian countries, such as Japan, Taiwan and Korea, using science parks to develop and implement new urban forms in their home countries. Science parks have been adopted by such South East Asian nations as Malaysia, which projects itself as a modern Muslim nation with the production of Putrajaya as the smart national capital and the Multimedia Super Corridor (MSC) as a new high-tech region, right on the periphery of Kuala Lumpur.[20] After the Asian financial crisis of the late 1990s, Singapore too began investing heavily in the 'knowledge-based economy' through the development of One-North, a technopole of nearly two hundred hectares strategically located near university and other educational institutions.[21] In other words, as is evident from the experience of East and South East Asia, science parks have been increasingly taken as national modernization projects in the narrative of the new knowledge-based economy.[22] Similarly, as China and India integrated rapidly into the global economy, science parks have also become a key to their claims of globality. In particular, the standardization of management and state-sanctioned privilege enjoyed by these exclusive spaces has provided much-needed predictability and legibility for the operation of global capital. As a global network of extraterritorial spaces, the system of science parks facilitates the efficient transfer of knowledge, personnel and

17 Paul Quintas, David Wield and Doreen Massey, 'Academic–industry links and innovation: questioning the science park model', *Technovation* (1992) 12, pp. 161–175. Paul Benneworth and Tiago Ratinho, 'Reframing the role of knowledge parks and science cities in knowledge-based urban development', *Environment and Planning C: Government and Policy* (2014) 32, pp. 784–808.

18 Nicholas A. Phelps and Sharifah R.S. Dawood, 'Untangling the spaces of high technology in Malaysia', *Environment and Planning C: Government and Policy* (2014) 32, pp. 896–915.

19 Manuel Castells, *The Informational City: Information Technology, Economic Restructuring and the Urban–Regional Process*, Oxford: Blackwell, 1989.

20 Sarah Moser, 'Putrajaya: Malaysia's new federal administrative capital', *Cities* (2010) 27, pp. 285–297. Tim Bunnell, 'Multimedia utopia? A geographical critique of high-tech development in Malaysia's Multimedia Super Corridor', *Antipode* (2002) 34, pp. 266–295.

21 Kai Wen Wong and Tim Bunnell, '"New economy" discourse and spaces in Singapore: a case study of one-north', *Environment and Planning A* (2006) 38, pp. 69–83.

22 Phelps and Dawood, op. cit. (18).

capital at unprecedented speed and scope. This represents a drastic reversal of the principle of self-reliance from the earlier days when the economies of both countries were generally insulated from the outside world. In this respect, science and technology, albeit still firmly connected to national modernization projects, are now also part of a larger globalizing process.

Second, the arrival of science parks is about science and technology as much as about neo-liberalism. Specifically, neither the Chinese nor the Indian state is now a developmental state in the traditional sense.[23] Instead of appointing itself the agent of progress, the state now urges individuals, groups and corporations to undertake innovative and entrepreneurial initiatives. In this new context, it is not just that innovation often implies small moves, as opposed to the large-scale transformations that often were implied in the idea of progress. By outsourcing responsibility to the individual and to groups, the state has also evacuated from its former role of cherishing the ideal of collective security and social betterment. Instead, it celebrates and normalizes the precarious condition of the entrepreneurial individual. Nothing captures the essence of this culture of innovation more accurately than the very concept of start-up, which became prevalent during the rapid and speculative proliferation of Internet companies known as the dot-com bubble in the 1990s. Today, start-up companies have linked closely with the discourse of innovation and entrepreneurship. A start-up, or start-up company, according to the self-styled start-up guru Steve Blank, is a temporary organization created for searching a profitable business model.[24] The idea of start-up, consequently, entails hope and promises on the one hand, but also risk and precariousness on the other. In this innovative epoch, to keep the creative edge is to be in a state of perpetual start-up. Not surprisingly, there also exists the concept of serial start-uppers and serial entrepreneurs. Likewise, on the flip side of this process are incubators, angel investors and venture capitalists. Whereas the first provide the basic ecology for start-up companies, the last two look for opportunities to invest, speculate and manage risk in the neo-liberal economy.

Last but not least, science parks exemplify and exacerbate the social and economic disparities that are symptomatic of neo-liberal capitalism, even though these exclusive spaces project a bright and attractive future. As urbanization intensifies in developing nations, so does the uneven urban development it entails. Generally located outside old city centres, the construction of science parks necessitates the destruction of former farmland and suburban neighbourhoods. And such routine displacement of local residents is done in the name of science and technology as well as in the name of innovation and progress. In addition, the building of science parks is also about real-estate development. As a result, concepts such as smart cities and knowledge enclaves are routinely used to brand the exclusive residential spaces that are for middle-class elites and expats who are associated with the new economy. The utopian fantasy and lifestyle associated with these spaces are evident in how imageries of sustainability,

23 For a discussion of the concepts of development and the developmental state see Meredith Woo-Cumings, *The Developmental State*, Ithaca, NY: Cornell University Press, 1999.
24 Steve Blank and Bob Dorf, *The Startup Owner's Manual*, Pescadero: K & S Ranch, 2010.

security, sophisticated design and creativity are used in branding these high-tech enclaves. Desire and aesthetics, in short, are always integral parts of science park development.[25]

  Still, hidden behind the fantastic 'images of the future' is often a dystopian reality.[26] In case after case, the development of these high-tech spaces has also led to the dispossession and polarization of society that is vastly visible in both the global North and South.[27] While privileged groups and individuals are able to connect to the new economic space, the less privileged ones are being marginalized, and they are finding it difficult to live in or relate to these high-tech spaces.[28] The newly developed Gujarat International Finance Tec-City (GIFT) near the historic commercial city of Ahmedabad in India is a case in point. According to one estimate, based on the projected population, the average cost of building the infrastructure for each resident alone is about fifteen times India's per capita income.[29] Moreover, even though the Indian government has committed to building a hundred such smart cities, it remains unclear whether there is sufficient demand for them. Likewise, in China, such overdevelopment of luxurious urban spaces divorced from any local context is commonplace, prompting the rise of so-called ghost cities.[30]

Having examined the development of science parks in China and India in a global historical context, in the following we will use four specific cases to illustrate how specific science park ecologies have unfolded in China and India. Our Chinese cases are drawn from Beijing's Zhongguancun and the Shenzhen Special Economic Zone. While the former began in a relatively organic manner and the latter was set up as a planned manufacturing base, both are now branded China's Silicon Valley. For India, we selected Bangalore and Hyderabad, the two most important science and technology hubs that make India a global IT superpower. Also, both cities are frequently nicknamed India's Silicon Valley. In short, regardless of their differences, all these sites are pivotal high-tech centres in their respective countries, and are among the most dynamic in the world. Moreover, although these tireless references to Silicon Valley seem to valorize the centrality of the California model, their specific histories and contexts point to diverse national and regional practices behind rhetorical performance of 'catching up' with the West. We argue, in other words, that the race towards the global neo-liberal order is not a natural progression, as if it represented the inevitable end point of history delivered by the market. Rather, aside from the capitalist logic, the outcome is

25 Keller Easterling, *Extrastatecraft: The Power of Infrastructure Space*, London: Verso, 2014.

26 Doreen Massey, Paul Quintas and David Wield, *High-Tech Fantasies: Science Parks in Society, Science and Space*, London: Routledge, 1992, p. 4; Diganta Das, 'Making of high-tech Hyderabad: mapping neoliberal networks and splintering effects', *Singapore Journal of Tropical Geography* (2015) 36, pp. 231–248.

27 Quintas, Wield and Massey, op. cit. (17).

28 Neil M. Coe and Phillip F. Kelly, 'Distance and discourse in the local labour market: the case of Singapore', *Area* (2000) 32, pp. 413–422; Coe and Kelly, 'Languages of labour: representational strategies in Singapore's labour control regime', *Political Geography* (2002) 21, pp. 341–371.

29 Shefali Anand, 'In India, a GIFT waiting to be opened', *Wall Street Journal*, 28 July 2015, available at www.wsj.com/articles/in-india-a-gift-waiting-to-be-opened-1438075981, accessed 1 September 2015.

30 Wade Shepard, *Ghost Cities of China*, London: Zed Books, 2015.

also driven by a long-standing belief in science, the ideology of progress, political determination and the mobilizing power of the bureaucratic state.

Bangalore

Bangalore is the state capital of Karnataka, a prominent southern Indian state. Geographically, Bangalore is located in a semi-arid region on the Deccan plateau with moderate climatic conditions. Due to the availability of abundant greenery, nature parks and natural water bodies with tree-lined roads, Bangalore was popularly known as the Garden City of India.[31] With the development of the software industry in recent decades, Bangalore is more popularly known as the Silicon Valley of India. Several significant public-sector enterprises have situated their industrial base in Bangalore since India's Independence in 1947, long before the establishment of the software industry in the city. Also, Bangalore is home to several premier academic and research institutes, such as the Indian Institute of Science (IISc), the Indian Institute of Management (IIM), the Tata Institute of Fundamental Research (TIFR), the Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR), the Indian Space Research Organization (ISRO), the National Aerospace Lab (NAL), the Defense Research and Development Organization (DRDO), the Indian Institute of Information Technology (IIIT) and the National Institute of Advanced Studies (NIAS), among others. The IISc, a premier research institution, was established in the city in 1909 and since then has produced thousands of quality science graduates. The population of Bangalore has increased significantly since the 1950s and reached nearly 7 million by 2007. Better employment opportunities since the establishment of numerous public-sector undertakings during the 1970s and the later software revolution during the 1990s led to the rapid increase in population of the city.[32] While the economy of the city is very much dominated by software development and export, the contribution of other high-tech sectors, such as aviation technology, space research and biotechnology, cannot be denied.[33]

Since the 1990s, private software firms have become attracted to Bangalore by cheaper real-estate prices (compared to expensive real estate in Mumbai), the availability of engineering graduates in the region (southern India produces more than 50 per cent of India's total engineering graduates) and the assurance of better power and Internet connectivity. Along with foreign software companies such as IBM, Oracle, Texas Instruments and so on, local entrepreneurial ventures such as Infosys, Wipro, HCL and TCS began operating software centres from Bangalore. Today, TCS, Infosys and Wipro are the three biggest software-producing firms in India. 'Electronic City' is one of the earliest science parks, established on nearly 330 acres of land on the southern periphery of Bangalore. Later, with increasing demand, several software companies established their businesses in Whitefield International Tech Park, another science park

31 H.S. Sudhira, T.V. Ramachandra and M.H. Bala Subrahmanya, 'City profile: Bangalore', *Cities* (2007) 24, pp. 379–390.

32 Sudhira, Ramachandra and Subrahmanya, op. cit. (31).

33 Christoph Dittrich, 'Bangalore: globalisation and fragmentation in India's hightech-capital', *ASIEN* (2007) 103, pp. 45–58.

situated on the south-eastern periphery of the city. To accommodate the ever-increasing number of software businesses, a twenty-five-kilometre 'information corridor' was planned connecting Electronic City and Whitefield Tech Park.[34]

As expected, the development of software industries and the ancillary services sector has led to the emergence of the middle-class population of Bangalore. As a result, the increased middle-class population has fuelled real-estate development and related land dynamics, especially on the peripheries of the city. While the city core of Bangalore and high-tech suburbs provide an image of globalized Bangalore with glitzy markets, designer condominiums and world-class high-tech buildings, rising land prices have further pushed the poor to distant peripheries and helped to exacerbate the city's fragmented and polarized landscape.[35]

Hyderabad

Hyderabad is the state capital of Telangana. Founded in 1591, Hyderabad has become one of the largest metropolitan cities in India, with a population of nearly eight million.[36] While the city covers nearly 650 square kilometres, the larger metropolitan region extends up to 7,228 square kilometres, making Hyderabad the second-largest metropolitan region after Bangalore metropolitan region (at eight thousand square kilometres). In 1994, when India was going through the economic liberalization phase, software-related services industries quickly became the main focus. This was especially so when Chandrababu Naidu became chief minister of the state of Andhra Pradesh (AP). Being an electrical engineer himself, Naidu was aware of the services-sector growth in his neighbouring state of Karnataka, and wanted his own state to follow a similar developmental trajectory. Particularly, Naidu wanted to create Hyderabad as a high-tech city similar to the Multimedia Super Corridor of Malaysia and Silicon Valley in the US.[37]

In addition to learning from the most successful science parks in Singapore and Malaysia, Naidu also employed McKinsey & Company to prepare the AP Vision 2020 document, which eventually led to the development of Hyderabad's own science park. The World Bank also encouraged Naidu's government to tread the neo-liberal path of development and promote Hyderabad as a high-tech destination, leveraging the availability of cheap technical labour, subsidized water and power supply, and the availability of cheap real estate. To attract foreign investment in the services sector and the additional developments of gated residential complexes, Naidu and other officials began visiting international forums and meetings such as the World Economic Forum, where they marketed the state and promoted the rebranding of Hyderabad.[38]

34 Elizabeth Chacko, 'From brain drain to brain gain: reverse migration to Bangalore and Hyderabad, India's globalizing high tech cities', *GeoJournal* (2007) 68, pp. 131–140.

35 Solomon Benjamin, 'Governance, economic settings and poverty in Bangalore', *Environment and Urbanization* (2000) 12, pp. 35–56; Dittrich, op. cit. (33).

36 Government of India, Census of India, 2011.

37 Diganta Das, 'Hyderabad: visioning, restructuring and making of a high-tech city', *Cities* (2015) 43, pp. 48–58.

38 Nara Chandrababu Naidu and Sevanti Ninan, *Plain Speaking*, New Delhi: Viking, 2000.

It is noteworthy that the role of the state, as well as the guiding ideologies of AP since 1994, became more entrepreneurial than managerial under the leadership of Naidu as chief minister.[39] This, at least in the Indian context, is a prime example of how these sub-national states became more and more entrepreneurial, and tried to compete with other subnational states for investment. In doing so, states such as AP and Karnataka began projecting their capital cities – Hyderabad and Bangalore respectively – as investment destinations, and in the process these newly emerged or rebranded urban centres became engines of innovation and subnational growth.

Largely banking on the availability of cheap engineering labour, Naidu started a $350 million knowledge enclave on the south-western periphery of Hyderabad, known as 'HITEC City'.[40] A ten-storey intelligent building was inaugurated in 1998 as part of the first phase of HITEC City's development. The building was named 'Cyber Towers'. Although water and electric supply has remained inadequate even in major Indian cities, Cyber Towers was provided with uninterrupted power and water supply, dedicated satellite and Internet connections, a security service, and banking and shopping opportunities inside the building. Within a year of its operation, Hyderabad registered the largest number of software companies compared to Bangalore.[41] Development of Cyber Towers symbolized an investment-friendly entrepreneurial state government in AP.

With the initial success of the HITEC City development, other private real-estate developers began constructing more intelligent buildings, gated complexes and exotic shopping malls. The state government initiated its own IT policy to attract further foreign investment in the services sector. Along with the IT policy, the state government developed a biotechnology policy with a proposal for a 'Genome Valley' Science Park. These initiatives by the state authorities attracted the attention of national and international IT and other related services companies. Western IT industry and political leaders such as Bill Gates, Bill Clinton and Tony Blair, among others, visited Hyderabad and praised Naidu's achievements, leading to the establishment of one of the largest Microsoft R & D centres in the city.[42] With increasing demand, the AP government began to expand HITEC City to a fully fledged science zone of around fifty-two square kilometres and renamed it Cyberabad in 2001. As a utopia for innovation, this mega-knowledge-enclave houses IT firms, research centres and educational institutions, along with gated residential housing, shopping malls and lifestyle stores for engineers, scientists and other knowledge professionals.

According to Prasad and Ramachandraiah, Cyberabad was a development for special purposes.[43] Beyond the provision of optical fibre connectivity to the digerati community

39 David Harvey, 'From managerialism to entrepreurialism: the transformation in urban governance in late capitalism', *Geografiska Annaler* (1989) 71(1), pp. 3–17.

40 Das, op. cit. (37). S. Sen and F. Frankel, 'Andhra Pradesh's long march towards 2020: electoral detours in a developmentalist state', in *Doing Business in India: Political Social and Cultural Overview*, Philadelphia: Centre for the Advanced Study of India, University of Pennsylvania, 2005, pp. 1–40.

41 Naidu and Ninan, op. cit. (38).

42 S. Biswas, 'Reinventing chief ministership', in Biswas, *The Outlook*, New Delhi: Outlook India, 1998.

43 C. Ramachandraiah and Sheela Prasad., 'The makeover of Hyderabad: is it the "model" IT city?', in C. Ramachandraiah, A.C.M.v. Westen and Sheela Prasad (eds.), *High-Tech Urban Spaces: Asian and European Perspective*, New Delhi: Manohar, pp. 260–293.

working in Cyberabad, the knowledge enclave was further connected with a newly built international airport through a dedicated expressway, which makes it fully connected to other global nodes but detached from neighbouring communities. Also noteworthy is that the development of Cyberabad required the eviction of villagers from seventeen villages, leading to massive land dispossession.[44] Thus while the creation of Cyberabad has rebranded the city as a high-tech hub and grown the state's economy considerably, it has also exacerbated the inequality problem in the region.

Zhongguancun

Located in north-western Beijing, the Zhongguancun district is perhaps China's science park par excellence. In 1978, when the paramount leader Deng Xiaoping launched his 'Four Modernizations' project as a way to 'catch up' with the West after decades of Cold War isolation, the 'modernization of science and technology' was regarded as centrally important in ensuring China's security and self-reliance, which had been a priority since the beginning of the People's Republic.[45] Nevertheless, Deng's overall intention was to introduce a mixed economy that would gradually integrate China into the global world. Little wonder that David Harvey regards the rise of Deng Xiaoping, Ronald Reagan and Margaret Thatcher as the beginning of the neo-liberal turn.[46] By the 1980s, as a result of experimental economic reform, China was going through a decade of relative intellectual openness and cultural renaissance.[47] Amid the intense cultural and intellectual debates were also experiments carried out by some intellectuals to engage in business and entrepreneurship. Some researchers at the Chinese Academy of Sciences, for example, founded the first civilian-run scientific and technological institutions, in the Zhongguancun area. Among these researchers was Li Chuanzhi, who would eventually establish the Lenovo Group, a multinational computer technology company. Other major companies established in Zhongguancun in the mid-1980s that would eventually become global players in the IT industry include the Founder Group and the Stone Group.[48] Meanwhile, other universities followed this controversial experiment and encouraged their faculty members to market their expertise and to set up businesses. Parallel to this development was the emergence of a small cluster of electronic stores specializing in electronic retail and service-related businesses along the Zhongguancun Avenue. The area quickly became known as the 'electronic street' and emerged as a magnet not just for faculty members and students of China's leading universities in the area, but also as a national electronic market where buyers would come from outside the city.[49]

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44 David Harvey, *The New Imperialism*, Oxford: Oxford University Press, 2003.

45 Robert Suttmeier, 'Impact of modernization of science and technology on the political system', in Denis Simon and Merle Goldman (eds.), *China's New Technological Revolution*, Cambridge, MA: Harvard University Press, 1989, pp. 375–396.

46 David Harvey, *A Brief History of Neoliberalism*, Oxford: Oxford University Press, 2005.

47 Jing Wang, *High Culture Fever Politics, Aesthetics, and Ideology in Deng's China*, Berkeley: University of California Press, 1996.

48 Zhang Fusen, *Zhongguancun gage fengyun*, Beijing: Kexue chubanshe, 2008, pp. 117–129.

49 Zhang Fusen, op. cit. (48), pp. 128–142.

Given Deng Xiaoping's general policy of modernizing China by stepping up its foreign trade, as well as attracting foreign investment and technology, the innovative milieu of Silicon Valley became an inspiration for some Chinese academics and officials. Similarly to India, some of these inspirations were introduced through the science parks in Taiwan and Singapore, while others were drawn directly from the United States.[50] And even though Chinese scientists and engineers often occupied less significant managerial roles than their Indian counterparts both inside and outside Silicon Valley in the United States, these diasporic scientists and engineers played an equally vital role in transferring some of the basic practices of science and technology back to their home country. Yet, unlike their Indian counterparts, the wave of returnees from the United States was heavily facilitated by strategically designed government initiatives. For instance, in addition to cash bonuses and state-of-the-art laboratory facilities, returnees were given purpose-built housing and premier amenities that imitated their lifestyles in the US. This conviction that science and technology have to be nurtured by infusing the Silicon Valley ethos, as mentioned before, was equally shared by India, Singapore and Taiwan.

The unplanned era of Zhongguancun as a hub of science and technology came to an end in 1988, when the Beijing municipality officially designated the Zhongguancun science park area a special experimental zone for the development of high-tech products. As an indication of the importance of the project, as well as an acknowledgement of the need for flexibility in governing an uncharted territory, a special Office of the Experimental Zone was subsequently set up to manage the area.[51] The development of Zhongguancun science park was so vital that in spite of the Anti-bourgeois Liberalization Campaign of 1987 and the subsequent violent crackdown on the Tiananmen Uprising in 1989, the government gave a specific directive to ensure that the development of Zhongguancun science park, along with the broader economic reform, would not be interrupted.[52]

Throughout the 1990s, as the size and numbers of companies in Zhongguancun science park continued to expand, the numbers of returnees from the United States, many of them scientists and engineers from leading American universities and from Silicon Valley, also increased rapidly. The setup of Zhongguancun science park and the universities in the vicinity, predictably, absorbed disproportionately large numbers of these returnees. Meanwhile, luxury apartments, villas, upscale gated communities and high-end office towers also surged in the area. And this was often done by evicting the surrounding rural population from their once collectively owned farmlands. By 2011, Zhongguancun had firmly established itself as China's Silicon Valley, housing over 20,000 high-tech firms and numerous start-ups and incubators, and producing about 20 per cent of Beijing's GDP, or about 0.67 per cent of that of the whole country. Over close to five hundred square kilometres, the Zhongguancun National

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50 Wang Delu, Zhao Mulan and Zhang Hao, *Guigu Zhongguancun ren mai wang luo*, Beijing: Qing hua da xue chu ban she, 2012.

51 Hu Zhaoguang, *Pulu shi: Beijingshi xinjishu chanye kaifa shiyanou bangongshi huiyilu*, Beijing: Beijing daxue chubanshe, 2011, pp. 4–6.

52 Zhang Fusen, op. cit. (48), pp. 289–305.

Innovation Demonstration Zone, as it has been officially called since, is an exemplar of China's fifty-three national-level high-tech development zones.[53]

Shenzhen

In spite of the fact that Zhongguancun is regarded by many as China's Silicon Valley, among China's national-level science parks, Shenzhen is no less ambitious in claiming to be China's answer to Silicon Valley. Unlike Zhongguancun, which first began as an unplanned and humble 'electronic street', the southern Chinese Silicon Valley, Shenzhen, was a master-planned development zone from the start.[54] Created in 1980, Shenzhen was one of China's first Special Economic Zones (SEZs) that aimed at attracting foreign investment and technologies. Located on the east side of the Pearl River delta area in southern Guangdong Province just north of Hong Kong, Shenzhen has been at the very heart of China's 'economic miracle.' In just three decades, the city has evolved from a small fishing town to a metropolis of 15 million with state-of-the-art urban infrastructure and some of the world's biggest manufacturers, as well as some of the most dynamic start-ups.

In its first decade, however, Shenzhen was primarily made up of factory compounds of various sizes established mostly by overseas Chinese from Hong Kong and Taiwan. During that stage, most of these factories only manufactured low-end products or helped to assemble high-end components that were designed and made outside China. Because of the sheer size of the city and the numbers of factories, some scholars have come to call the special economic zone a 'factory territory'.[55] When the architect Rem Koolhaas formulated his theory of the 'generic city' as new urban form, many of his empirical observations were from Shenzhen and the surrounding Pearl River delta region. The generic city, according to Koolhaas, is a city without history and identity. Liberated from the rigid codes of the old city centre, the primary purposes of the generic city are post-Fordist flexible management, production and accumulation. Generic cities are therefore assembly-line cities with assembly-line buildings catering to the rise of global capitalism.[56] Standardized cities and buildings are nowhere more ubiquitous than in the Pearl delta region.

Since the 1990s, this standardization particularly took place in the form of science and industrial parks. One well-known example is the Foxconn plant founded by the Taiwan-based Hon Hai Precision Industrial Company in 1988. The Foxconn plant went through a period of rapid expansion in the 1990s, and by the 2010s it had evolved into a city with

53 Hu Zhaoguang, op. cit. (51).

54 Ng Mee Kam and Xu Jiang, 'Second metamorphosis? Urban restructuring and planning responses in Guangzhou and Shenzhen in the twenty-first century', in Uwe Altrock and Sonia Schoon (eds.), *Maturing Megacities*, New York: Springer, 2013, pp. 29–60.

55 Vinayak Bharne, *The Emerging Asian City: Concomitant Urbanities and Urbanisms*, New York: Routledge, 2012, pp. 206–207.

56 Rem Koolhaas, 'The generic city', in Rem Koolhaas and Bruce Bau (eds.), *S, M, L, XL*, New York: The Monacelli Press, 1995, pp. 1238–1264.

a formidable workforce of approximately 400,000.[57] Meanwhile, other similar walled and secretive Foxconn campuses on an equivalent scale began to emerge in other Chinese cities. In some ways at least, Foxconn's integrated manufacturing ecosystems have become a model that is often unimaginable and unduplicable elsewhere. Also, as a contact zone between foreign and domestic capital, Shenzhen hosts a vast number of Chinese technological firms. Huawei, for example, is another technological giant founded in the late 1980s. With close ties to the central government, including the People's Liberation Army, the company put great emphasis on its indigenous research during its early days, and it used reverse engineering as a method to develop telecommunication technologies. Since then, Huawei has become a major technological firm, not just dominating the Chinese market but also becoming a key player in the European and American markets.[58]

In spite of their marked departure from the socialist industrial compounds, the oversized factories in Shenzhen appropriated and refined some of the practices from the socialist era. This includes the intense discipline of workers' docile bodies, the creation of production sites as exclusive and sealed compounds, and the use of economies of scale to achieve efficiency.[59] In a way, old methods are now being perfected and deployed to serve a new political-economic logic. Likewise, the insistence on the importance of science and technology is at least partially derived from the intense campaign for industrialization during the Cold War. As a case in point, Foxconn's integrated manufacturing ecosystems, which are central to Foxconn's business success, are very much made possible by their ability to employ sophisticated disciplinary and managerial techniques. Yet, whereas the reorganization of the industrial workforce and factories into closely supervised and confined work units during the socialist era was geared toward production and ideological control, science parks in the era of the state-guided market economy are designed to foster efficiency, flexible accumulation and innovation. In Shenzhen, for instance, the dormitories built for young migrant workers, who make up the bulk of the workforce that includes assembly line workers, low-level engineers and so on, are very much part of this science park spatial regime. In addition to putting workers under constant surveillance, these dormitory spaces also create alienation and discourage the formation of group activities.[60]

Significantly, to the extent that China has been regarded as the 'manufacturer of the world', Shenzhen has mostly been known by the outside world, if at all, as a manufacturing hub that produces cheap knock-offs. But the government's ambition and relentless

57 While there are no reliable statistics about the size of Foxconn's workforce, most observers believe it is about 400,000 or above. See also Jenny Chan and Ngai Pun, 'Suicide as protest for the new generation of Chinese migrant workers: Foxconn, global capital, and the state', *Asia–Pacific Journal* (2010) 8, at www.japanfocus.org/-Pun-Ngai/3408/article.html, accessed 11 August 2015.

58 Yingying Zhang and Yajun Wu, 'Huawei and Zhengfei Ren: leadership in a technology-innovative firm', in Claudio Petti (ed.), *Technological Entrepreneurship in China*, Cheltenham: Edward Elgar Publishing, 2012, pp. 103–122.

59 Ngai Pun and Chris Smith, 'Putting transnational labour process in its place: the dormitory labour regime in post-socialist China', *Work Employment Society* (2007) 21, pp. 27–45.

60 Ngai Pun and Jenny Chan, 'The spatial politics of labor in China: life, labor, and a new generation of migrant workers', *South Atlantic Quarterly* (2013) 112, pp. 179–190.

efforts to move China away from manufacturing to high-tech innovation has been evident in the founding of a twelve-square-kilometre Shenzhen Hi-Tech Industrial Park in 1996. Although this new industrial park continues to build on the existing manufacturing strengths by including basic industries such as the production of building materials and industrial equipment, much of its emphasis is on biotechnology, software, electronics and other hi-tech-oriented products. The science park as a mode of governance, in this respect, has not only functioned as a primary instrument for developing and spreading standardized and flexible urban forms, but has also become an engine for moving up the value chain by means of high-tech innovation.[61] In recent years, increasingly, Shenzhen has begun to host many of the most successful domestic and foreign high-tech companies in China. For insiders, Shenzhen has now become a place where hardware start-ups, entrepreneurs and global hackers congregate and explore. And it is these explorative energies, more so than the earlier wave of indigenous research and development, that have prompted some observers to refer to it rather than Zhongguancun as China's Silicon Valley.[62] And, as with Zhongguancun, along with Shenzhen's new identity as a high-tech territory is the exponential growth of real-estate developments amid the substandard residential spaces for workers who are being marginalized by the very system that they helped to create.

Conclusion

In his famous utopian fiction *Looking Backward: 2000–1887*, the American socialist author Edward Bellamy imagines a world of eternal growth and prosperity, where happy and fulfilled citizens enjoy the abundance of material goods and leisure time made possible by technological and industrial advancement.[63] In that world, class and privilege have disappeared and capital is publicly owned. Such belief that advances in science, technology and industry would quickly bring about economic growth and social transformation, not surprisingly, were shared by many developing countries in the post-war decolonizing era. In the 1950s, soon after the establishment of China and India as new and independent sovereign states, leaders of both countries also advocated the importance of science and technology in their national efforts to 'catch up' with the industrial West. By enabling a fast track to modernity, science and technology were seen as an elixir that could help to restore civilizational glories and bring about a utopian future.

In this sense, even if socialism carried different connotations in China and India, the rise of dedicated industrial zones behind the geopolitical and ideological divide of the Cold War in both countries was driven by shared logics of mobilization, development

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61 Fangfang Cheng, Frank van Oort, Stan Geertman and Pieter Hooimeijer, 'Science parks and the co-location of high-tech small- and medium-sized firms in China's Shenzhen', *Urban Studies* (2014) 51, pp. 1073–1089.

62 Tom Whitwell, 'Inside Shenzhen: China's Silicon Valley', *The Guardian*, 13 June 2014, available at www.theguardian.com/cities/2014/jun/13/inside-shenzen-china-silicon-valley-tech-nirvana-pearl-river, accessed 23 September 2015.

63 Edward Bellamy, *Looking Backward: 2000–1887*, Boston: Ticknor & Co., 1888.

and collective social betterment. Also, in both cases, the massive industrial zones and cities that housed big science and big industry were powerful symbols of progress and loci of technological development. Nevertheless, with the arrival of a new era of a state-guided neo-liberal order, innovation rather than progress has increasingly become the new mandate and logic of governance. And this shift, manifested partially in the rise of the science park as an urban typology and governing technique, has profound social and political implications. Among other things, it stipulates a new model of economic development that overtly relegates social equality and public participation. Indeed, even in a democracy, the special power and privileges given to these exclusive zones could mean that these spaces can bypass the judicial and administrative oversight of the state. Consequently, business and labour practices, as well as laboratory processes, can potentially be evacuated from the normal process of public participation and democratic governance. Inspired by the urban development in China and elsewhere, Indian prime minister Narendra Modi's recent announcement of the building of a hundred smart cities is perhaps the latest urbanizing frenzy in this direction.

These smart cities and science park spaces may promise everything about the future. Yet, unlike Bellamy's dream of a utopian society for all, these new techno-utopias are built on the premise that any 'un-smart' elements, including poor and undesirable populations, will be excluded but not eradicated. Guided by the neo-liberal logics and impelled by the force of the state, these science park spaces are not just about science and technology; they are also about production, innovation, entrepreneurship, investment, speculation, hedging and social exclusion. In a way, these exclusive spaces are like utopian machines that turn science fictions into a physical world, even though it is only a confined world surrounded by dystopian realities.