Chapter 3
Bangalore: Development Through Intercultural Interaction

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Abstract This chapter is an elaboration on a 4-stage model of cluster development (through *incubation, nucleation, agglomeration* and *attrition*) proposed in an earlier paper by the author based on an analysis of the inception and growth of the Bangalore ICT Cluster. Through a chronological analysis of several centuries of Bangalore's history, this chapter identifies 'intercultural interaction' as the principal means of 'incubation', which made a significant contribution to the human capital development of the region, especially in terms of its technological and entrepreneurial capabilities. The city was therefore ready to receive (nucleate) and nurture the ICT industry that landed there due to a series of 'negative pushes' it experienced elsewhere. Agglomeration, therefore, was a natural consequence. The chapter further explains the process of cluster formation and agglomeration using an analogy of the chemical process of crystal formation and growth. Both of these involve a fairly long period of preparation (incubation) and a rather sudden and unexpected change within (nucleation) induced by changes in the external environment. The new entity thus formed will attract similar entities to itself and achieve fast growth under the nourishment provided by the internal environment already prepared and enriched by the long period of incubation.

1 Bangalore: A City of Several Epithets

Bangalore (locally known as 'Bengaluru'), the Indian city located in the South-Central part of the Indian peninsula on the Deccan Plateau at an elevation of over 900 m (~3000 ft), is the capital of the Indian State of Karnataka. Its location makes

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it the highest of the major large cities of India and gives it pleasant and salubrious weather conditions throughout the year. Bangalore is a city of several epithets, the most prominent of which is the 'Silicon Valley of India'. While this is the most recently accorded epithet for the city—and probably the most appropriate one, given the information technology and information technology-enabled services (IT/ITES) entrepreneurial revolution that is taking place there—one cannot ignore the several others by which it has been known in the past and/or continues to be known today. These include: the Garden City of India, the Pensioners' Paradise, the Pub City of India, the Fashion Capital of India, the Fun City of India, and so on. Each denotes a special aspect of Bangalore's growth and development.

It is somewhat unusual for a single city to have so many epithets, which is probably an indication of the diversity it represents. Epithets such as 'Fashion Capital', 'Fun Capital' and 'Style Capital' could have been attached more legitimately to other (older) metro-cities of India like Mumbai (formerly Bombay), Kolkata (formerly Calcutta), Chennai (formerly Madras) and Delhi, which have more established initiatives and industries in the areas of film, music, art, culture and fashion. However, the recognition of Bangalore as pre-eminent in these sectors is not based merely on casual usage in the local communities, but is given by national and international agencies based on the perceptions of people who matter in the respective fields. For example, the 27 October 2003 issue of *Newsweek* included Bangalore among the 12 'Capitals of Style' on the planet, along with Paris, London and Los Angeles. The 'Fun Capital' epithet was given to the city by an Indian magazine (*The Week*) during the same period in an article entitled 'Thank God It's Bangalore'. An earlier (2001) issue of *Newsweek* had rated Bangalore as one of the 'Top 10 Hot Spots', while *Business Week* called it one of the 'Top 10 Tech Cities'. To cap it all, *Die Zeit* (the German weekly magazine) called Bangalore the 'City of the Future' (Yue et al. 2001).

The diversity reflected in the current epithets for Bangalore may well be attributable to its chequered history. The city has, at different periods, been under the control of various dynastic rulers, mostly outsiders or their representatives and, ironically, this has helped to build diversity and entrepreneurial spirit in its human capital, as we shall see in detail in the later sections of this chapter. Before taking a historical perspective of the development of Bangalore as a city of high-tech entrepreneurs and professionals, it will be useful to examine briefly the different stories told about the name of the city itself, as these also highlight the influence of various factors that have contributed to the development of this region into an entrepreneurial city.

2 What's in a Name? Quite a Lot

The different stories about how Bangalore got its name may suggest that there is no common agreement on the city's origin. As noted above, Bangalore is an anglicized version of the Kannada name Bengaluru (also written as 'Bengalooru'). A popular story associated with this name is that of King Veera Ballala II of the Hoysala Dynasty (1117–1343). During one of his hunting expeditions in 1120, King Ballala

lost his way in the forest and wandered into the hut of a poor old woman, who offered the tired and hungry hunter some boiled beans (‘bende-kaalu’) and water. Pleased with the woman’s hospitality, the grateful king named the place ‘Bende-Kaalu-Ooru’, which over time became shortened into ‘Bengaluru’.

While this story of hospitality (for which Bangalore is reknowned) is credible and creditable, the historical records show that the name ‘Bengaluru’ existed a few centuries earlier, as demonstrated by a ninth century stone inscription (‘veeragallu’, meaning ‘hero-stone’) in the Naganatheshwara (Lord Shiva) temple in Begur village, 15 km south of Bangalore. ‘Hero stones’ are memorial stones erected as a tribute to the heroes who died in battle defending the king, cattle or women in distress. The Begur hero-stone, erected by the Western Ganga dynasty, extols the virtues and exploits of a soldier who died in the ‘Bengaluru Yudha’ (‘Battle of Bangalore’), which was fought in the year 890 CE. Apparently the stone was erected more than 100 years after the Battle of Bangalore, because the inscription also states that the place was part of the Ganga Kingdom until 1004 (who ruled from Gangavadi in Talakadu from the second to the tenth century CE), and was known as ‘Bengavaluru’, which means the ‘City of Guards’ in Halegannada (Old Kannada). This then brings us another story about the origin of the city and its name. It is believed that, during the fifth century CE, the Ganga rulers constructed a hamlet near Kengeri, on the outskirts of the present city, for their security guards and this was known (in Kannada) as Bengavalu. Their dwelling place was popularly known as Bengavaluru, which later changed to Bengaluru.

In spite of such evidence for the prior existence of Bengaluru, the founding of modern Bangalore is credited to Hiriya Kempe Gowda (popularly known as Kempe Gowda I), a feudatory ruler under the Vijayanagara Empire, who built a mud-and-brick fort in 1537 in the central (market) area of present-day Bangalore. The choice of this site for the fort is also associated with a hunting legend. Kempe Gowda, who was Chieftain of Yelahanka Nadu, a principality under the Vijayanagara Empire, located towards the northern end of present-day Bangalore and hence known as Yelahanka Nadaprabhu, would go hunting in the southern forests. On one of these trips he was surprised to see that a rabbit was chasing his hound. He decided that a land that nourished such strong and healthy rabbits should be the site for a new fort. He called the place ‘gandubhoomi’ (the land of heroes). While having the ground prepared for the construction of the fort, he is said to have burned the forest, and so the area became known as ‘Bende-kaadu-uru’ (the ‘town of burnt forest’), later shortened to ‘Benkaduru’, and finally to ‘Bengaluru’.

This story is also unlikely to be true, because the name ‘Bengaluru’ was already in existence. In fact it was in the neighbourhood of Kempe Gowda’s headquarters (Yelahanka). There is a village there today, known as ‘Halebengalooru’ (‘Old Bangalore’), near Kodigehalli, south of Yelahanka. Legend has it that Kempe Gowda’s mother and wife hailed from this village. It is therefore likely that he named the newly built fort-city as ‘Bengaluru’ in honour of his mother and wife. Another association of the city’s name with Kempe Gowda is through the several temples he built for the deity Venkataramana Swamy, because of which the place began to be known as ‘Venkat-uru’ and later as ‘Benkat-uru’ and Bengaluru.

These four stories about the origin of the city's name are based on human actions and their consequences; and, now, there are two more stories to add, which are based on nature. One is associated with a medicinal plant called 'Benge' in Kannada (also known as the Indian/Malabar Kino tree, whose botanical name is *Pterocarpus marsupium*), a deciduous species that grew abundantly in this region. The land of benge (Benge-uru) later became Bengaluru, according to one theory. The other theory based on nature is associated with the name of a quartz stone (Benachu Kallu) which is abundantly available in the region. 'Benachu-kallu-uru' later became Benkalluru and Bengaluru.

Among all these stories, only one is likely to be true, but all of them live in the minds of people as symbols of the aspirations of diverse segments of the city's population, which are many. This city is about human kindness and hospitality, valour and heroism, protection and patronage, nurture and nourishment, construction and development, respect and relationships, religion and rituals, nature and environment (both in terms of destruction of forests to build the city and the reintroduction of greenery with gardens) and so on. And, if we borrow some ideas from the epithets discussed above, many of these concepts are reinforced and a few others are added—and we get the Bangalore city of today, which has effectively combined fun, frolic, fashion and enjoyment with technology, entrepreneurship and futuristic development. The entrepreneurial renaissance that is happening in Bangalore may be attributed to intercultural interaction and the development of its human capital through an incubation process that has been going on for several centuries. A brief examination of the city's history will illustrate this phenomenon further.

3 Mysteries of the Early History

As in the case of the name, there is little unanimity about the early history of the city. There are claims that this area has had human settlements since 4000 BCE, supported by the discovery in 2001 of stone-age implements at Jalahalli, Sidhapura and Jadigenahalli, all of which are in the suburbs of present-day Bangalore. Similarly, the burial grounds discovered in Koramangala and Chikkajala on the outskirts of the city date back to the Iron Age (about 1000 BCE). More importantly, there is some evidence of entrepreneurship among the early settlers of the place (including evidence of overseas trade), as indicated by the discovery of Roman coins dating back to about 27 BCE to 51 CE (showing the emperors Augustus, Tiberius, Caligula and Claudius) during excavation work to lay the foundations of Yeshwantpur railway station in 1891 and the HAL (Hindustan Aircraft Limited) factory and airport in 1965. From the second century CE till the ninth, the area (identified as Bengaval-uru, after the residences built by the Gangas for their security men) was ruled by the Ganga dynasty belonging to the Ratti (now Reddi) tribe from the Kongu region (at present in the neighbouring state of Tamil Nadu) with their capital in Kolar (in the east of the current Bangalore region) until 350 CE and later from Talakad (in the west of the present Bangalore region) until they were defeated by the Cholas of Tanjavur in the eleventh century CE. However, the first

references to a predecessor of the present-day city date back to 850 CE, on a Mauryan Empire milestone, and 890 CE, on a hero-stone found in the Begur temple, both of which mention 'Bengaluru'.[1]

While a settlement with the present name seems to have existed in the area at least from the ninth century CE, there are no indications of the developmental status of the place until 1537. During the 500-odd years from 1004 to 1537, the area was under the rule of Chola, Hoysala and Vijayanagara kings. Of these, the last two are sentimentally remembered as contributors to the development of modern Bangalore. The Hoysalas (literal meaning: 'Strike, Sala', associated with the legend of the hero Sala killing a tiger) were Jains hailing from the Malnad (Hills) region of Karnataka and converted to Hinduism. They started their rule as subordinates of the Western Chalukyas, but later became independent rulers of present-day Karnataka and a few regions in Tamil Nadu, Andhra Pradesh and Telangana. They ruled initially from Belur in the Hasan district of Karnataka, and later shifted their capital to the nearby town of Halebid—both these places are of tourist interest today because of the temples built by the Hoysalas. This was the first time (after the Western Gangas, whose region of origin is disputed) that a dynasty from the Karnataka region had ruled the place, and thus the story about one of them (King Veera Bhallala II) naming the town as 'Bende-Kaalu-Uru' after eating the boiled beans offered to him by the poor old woman has become quite popular, despite the evidence that the name 'Bengaluru' predates his time. The present administration of Karnataka has recognized the 'contribution' of the Hoysalas to the development of Bangalore by naming the Bangalore City Police's (BCP) mobile patrol 'Hoysala'.

4 The Mud Fort and the Muddles of the Middle Ages

Although there is evidence for the existence of a place called 'Bengaluru' in the vicinity of the present city since the ninth century BCE, the foundations of the present city were laid in 1537 by Kempe Gowda I (a vassal of the Vijayanagara King, Achuta Devaraya), who was ruler of the Yelahanka region (north of the present-day city). Kempe Gowda I had the ambition of replicating the Vijayanagara capital of Hampi in this region; but the king, fearing the potential power of his vassals, did not permit him to build a stone fort, and so Kempe Gowda had to be content with a mud fort. There were two main streets inside the fort: Chikkapeté Street, which ran east–west, and Doddapeté Street, which ran north–south. Their intersection, Doddapeté Square, was the heart of the town. In addition, there were three other market places (little towns)—Balepet, Cottonpet and Chickpet—which exist with the same names today in the market area of the city.

[1] A few important events in the development of Bangalore as a city of entrepreneurs and technologists – including the governmental initiatives to set up industries and educational institutions – are extracted from a comprehensive list of events in chronological order from 4000 BCE to 2014 CE (prepared for an earlier version of this paper) and presented in Appendix 1.

In 1565, when the Vijayanagara Empire fell in the Battle of Talikota, Kempe Gowda I became the independent ruler of Bangalore. His successor, Gidde Gowda, had only a short tenure of 15 years (1570–1585), but his son, Kempe Gowda II, had a long and illustrious reign of 48 years (1585–1633), during which period he constructed temples, lakes, two forts (Magadi and Savanadurga) and watch-towers in the four corners of Bangalore city (at Lal Bagh, Kempambudhi Tank, Halasuru Tank and Mekhri Circle)—now known as the 'Kempe Gowda Towers'. Symbolically and commemoratively, the Bangalore City Corporation has chosen the watch-tower as its insignia.

The local self-government of Bangalore by the Kempe Gowdas lasted for only 101 years (1537–1638), after which the area was constantly under attack, but paradoxically no one wanted to keep it. During the rule of Kempe Gowda III, the city was attacked and captured in 1638 by the army of the Bijapur Sultan (Adil Shah) under his chieftains Ranadulla Khan and Shahaji Bhonsale, but was gifted to Shahaji by the Sultan as jagir. Subsequently, the jagir was inherited by Shahaji's younger son Venkoji, but he took little interest in protecting it from attackers and gradually withdrew to Tanjavur in Tamil Nadu in 1675 to rule from there. The city was recaptured by Shivaji, Venkoji's older half-brother and the Maratha King ruling from Reighad, but he too had no interest in keeping it and gifted it to Venkoji's wife, Deepabai, as Choli-Bangdi (pin-money or pocket money given to a daughter!). Then came the Moghuls in 1687, when Aurangazeb's commander Khasim Khan captured the city, but they too had no interest in keeping it and sold it to the Mysore King, Chikkadevaraja Wodeyar, for 300,000 pagodas (local currency in gold, worth about 8 shillings per unit). Strangely, the Wodeyars too could not keep the territory for long, and in 1759 gifted it to Hyder Ali (their chieftain) as jagir, paving the way for the emergence of Hyder and his son Tipu as the *de facto* rulers of Mysore. During their rule, there was some attention to the development of Bangalore—it was Hyder Ali who took the initiative of building the Lal Bagh Botanical Gardens on the pattern of the Moghul Gardens in the nearby area. With subsequent developments, Lal Bagh (literally meaning 'Red Garden', then known for its collection of red roses) has become the subcontinent's largest collection of rare plants, harbouring about 673 genera and 1854 species of plants.

5 Bouncing with the British: Towards Modern Development

Although Hyder Ali and Tipu Sultan were aggressive fighters, they could not withstand the repeated onslaughts of the English East India Company, in spite of the alliance they made with the French. While the three Anglo–Mysore wars were concluded with treaties that were mostly favourable to the British, the fourth war ended with the death of Tipu Sultan (1799) and thus offered a decisive victory to the British. Even though the kingdom of Mysore, together with the city of Bangalore, was returned to the Mysore king (Krishnaraja Wodeyar III), the British established a 'Residency' at Mysore and controlled the administration through a Commissioner. The Residency was later shifted to Bangalore in 1804, and then onwards the British

were focused more on Bangalore than Mysore.[2] The many and varied institutions and facilities created by the British after 1799, either on their own or in collaboration with the local rulers and/or Indian entrepreneurs, which had a positive impact on the entrepreneurial and technological development of Bangalore are listed chronologically in Appendix 2.

Whilst it is often argued that the contribution of colonial rule to the economic development of India was negative, it cannot be denied that the foundations of the modern administrative and technological developments in India (and in Bangalore) were laid by the British. Starting with the establishment of the General Post Office in 1800 and ending with the City Improvement Trust in 1945 (towards the end of their rule in India), the British were (partly in some cases and solely in others) responsible for the introduction of new-technology-based products, facilities and administrative systems in Bangalore (see Appendix 2). The manpower introduced (often from outside the region and even outside the country) and developed to create and manage such technological products and facilities has contributed to the development of diverse capabilities and entrepreneurship.

6 India's Independence and Initiatives Galore

The democratic government that came to power in India after Independence (1947) believed in the development of all regions and hence in the equitable distribution of facilities and resources. Despite this, it would not be wrong to say that Bangalore received special considerations, for climatic, locational, historical and political reasons. Bangalore is the only large city in India with moderate and salubrious weather conditions throughout the year, a consequence of its elevated location on the Deccan Plateau.[3] The weather helps to make the place acceptable to people from diverse regions and countries. The location of the city away from the country's boundaries makes it an ideal choice for setting up strategic industries such as defence and space. The historical reasons relate to the various groups that have come into the city at different periods and the facilities and institutions they have created, which have made the place attractive to subsequent entrepreneurs and technologists. The political reason is that, for several decades after Independence, Karnataka had a government of the same party as that ruling at the Centre, whereas the 'more eligible' city in the south (Madras) was in a state (Tamil Nadu) ruled by a different party.

The collaboration between the Central and State governments and the many other congenial factors mentioned above led to the setting up of several public-sector undertakings (PSUs) and institutions of national importance in Bangalore. The more prominent among the PSUs established in Bangalore after Independence are listed in Table 3.1.

[2] Though the 'Residency' was permanently closed in 1947 in the wake of India's Independence, 'Residency Road' still remains in the heart of Bangalore.

[3] In fact, it is often suggested that the epithet 'Silicon Valley' is a misnomer for Bangalore; it should rather be called 'Silicon Plateau'!

Table 3.1 Prominent Public Sector Undertakings (PSUs) of national importance in Bangalore

PSU	Year
• Indian Telephone Industries (ITI)	1948
• Hindustan Machine Tools (HMT)	1953
• Bharat Electronics Limited (BEL)	1954
• National Aeronautical Research laboratory (NARL), restructured and renamed as National Aerospace Laboratories (NAL) in 1993	1960
• Hindustan Aeronautics Limited (HAL), a restructured and expanded version of Hindustan Aircraft Limited (HAL) originally set up by private entrepreneurs in 1940	1964
• Bharat Earth Movers Limited (BEML)	1964
• The Indian Space Research Organization (ISRO)	1969
• Bharat Heavy Electricals Limited (BHEL), Electronics Division	1972
• Electronics City (an industrial park in three phases exclusively for electronics and IT/ITES companies)	1978
• International Technology Park Limited (ITPL), in collaboration with the Government of Singapore	1994

In order to support industry, the government has also taken the initiative of setting up several educational institutions of national importance in Bangalore, including:

- Indian Institute of Management Bangalore (IIMB), 1973;
- National Institute of Mental Health and Neurosciences (NIMHANAS), 1974;
- National Institute of Fashion Technology (NIFT), 1986;
- National Law School of India (NLSI), 1987;
- International Institute of Information Technology-Bangalore (IIIT-B), 1999;
- Institute of Bio-informatics and Applied Bio-technology (IBAB), 2001; and
- National Institute of Design (NID), R&D Campus, 2006.

These are known as 'Institutions of Excellence' and aspire to maintain world-class standards in education.

It is often alleged that public-sector companies in India have not risen to the level of performance expected of them. While this is true of many PSUs, quite a few have excelled as role models in their respective fields, as have institutions such as the Indian Institutes of Science (IISc), Technology (IITs) and Management (IIMs). In fact, many of the Bangalore-based PSUs have made it to the 'excellence' list ('Maharatna', 'Navratna' and 'Miniratna', as they are called in India for something like an A–B–C grading). More importantly, a major but often unacknowledged contribution of a Central PSU or an institution of excellence to a region is the development of technology and human capital in and around its location. Many of these organizations engage in technological collaboration with world-class corporations and/or institutions, and this has a spillover effect on the local community. Moreover, recruitment to these companies and institutions is done from among the most qualified candidates across the country, thus contributing to the enhancement of quality and diversity of the region's human capital. Bangalore too has been a beneficiary of this process.

7 Life After Liberalization: Entrepreneurial Effervescence

By the mid-1980s, the processes of liberalization, privatization and globalization were slowly being unfolded in the Indian economy and were formally adopted as government policy in the early 1990s. This was a major opportunity for the new technology (IT/ITES) based firms that were slowly developing in the country. Although the Department of Electronics had initiated some special schemes for promoting software exports as early as 1972 (e.g., permitting the duty-free import of hardware in exchange for exporting software worth twice the import value), the real push for the sector came with the economic liberalization of the 1990s, when many changes were introduced in taxation and foreign exchange rules. Moreover, foreign companies were permitted to establish wholly owned subsidiaries in India. Similarly, Indian companies providing services abroad were permitted to spend up to 70% of their earnings on marketing and other expenses.

A major initiative of the Government of India in promoting India's IT industry was the setting up of the Software Technology Parks of India (STPI) in 1991 as an autonomous society under the Department of Electronics and Information Technology (DeitY) in the Ministry of Communications & Information Technology. The first STPI unit was established in Bangalore in 1991. The main objectives of STPI are to create and manage infrastructure facilities, promote the development and export of IT/ITES products and services, provide statutory and promotional services through the STPI and the Electronic Hardware Technology Park (EHTP) schemes, provide data communication and other services, such as technology assessment and professional training, and promote micro, small and medium-sized enterprises in the IT/ITES fields. Accordingly, companies located in STPI units were given special benefits (Sareen 2005) such as:

- 100% duty free imports;
- 100% foreign equity permitted;
- 100% Corporate Income Tax exemption till 2010;
- Excise duty exemption and reimbursement of Central Sales Tax;
- Dedicated data communication links;
- Single window clearance; and
- Custom bonding and export certification.

In designing the STPI scheme, the government's intention was to spread the IT industry to different parts of the country and thus to set up centres in more than 50 cities and towns. Similarly, it was also envisaged as a means of promoting software exports from India and so it was designed as a 100% export-oriented scheme. As of 2012–2013, there were 4534 operative units under STPI, of which 3755 units had exported software. In monetary terms, the value of exports in 2012–2013 was INR 2,514,980 million, which was about 11% higher than in the previous financial year. Bangalore is a major beneficiary of the STPI scheme, as it was the location of the first STPI, which now houses more than one-third of the STPI units in the country and has more exports than any other centre (https://www.stpi.in/).

While STPI is the crowning initiative of the Government of India (GoI) to promote the country's software industry, there have been various other initiatives by the Government and public institutions (Rajaraman 2012), some of which are listed in Table 3.2. Although these initiatives were intended for the country as a whole, with the projects being established in different regions, there were indirect benefits to Bangalore from all of them, as well as direct benefits from a few, for which the Indian Institute of Science (IISc), Bangalore, was a natural choice.

As can be seen from Table 3.2, initiatives for liberalizing the IT industry started about two decades before the formal introduction of economic liberalization policies in 1991. In fact, 1984 has become the watershed year for the liberalization of the IT industry, because it marked the beginning of a series of initiatives in quick succession for developing the hardware and software competencies of the country. It should be noted that 1984 was the year when Rajiv Gandhi became India's Prime Minister, and hence there is a tendency for historians to ascribe the IT liberalization to him. However, one should not forget that Rajiv Gandhi came to power towards the end of the year (in November), and so it is highly unlikely that all the initiatives listed above (and more) were conceived, developed and introduced in the last 2 months of the year. It seems that the credit for these initiatives should be shared with the previous governments, especially since they were active in the promotion of electronics and computers from as early as 1954 (when Bharat Electronics Limited—BEL—was established in the public sector in Bangalore) and 1955 (when the government facilitated the import of the first computer to India by the Indian Statistical Institute, Kolkata).

8 Bonus to Bangalore (B2B)

Although the Government of India's schemes for promoting the IT industry were intended for the whole country, Bangalore did get some 'bonus points', because it was the preferred location for many public-sector industries and institutions. A major initiative of this kind in the corporate sector, as far as the IT industry is concerned, was the setting up of BEL, the first electronics manufacturing company in India, in Bangalore in 1954. This is just one of the several public-sector companies and institutions of strategic importance in the high-tech areas of defence, space, aeronautics, electronics, and so on, set up by the GoI in Bangalore (see Table 3.1). Among those institutions, the most prominent is the Indian Institute of Science (IISc), originally set up in the pre-Independence period in the private sector by JN Tata in collaboration with the British and the Maharaja of Mysore, and later brought into the public sector and supported by the GoI. As we have seen, IISc was a natural choice for many of the IT-related initiatives of the government.

What, then, was so special about Bangalore that attracted the IT industry to the city? There are many hypotheses as to the factors that facilitated the growth of the IT industry in Bangalore, amongst which are the following.

Table 3.2 IT initiatives in Bangalore by Government and public institutions

Year	Initiative
1971	Electronics Commission was set up to promote the electronics and computer industries in India
1972	GoI permitted the duty-free import of hardware in exchange for exporting software of twice the import value
1975	Computer Management Corporation (CMC) Private Limited was launched as a fully-owned GoI company with its headquarters in Delhi. It was converted into a public limited company in 1977, renamed as Computer Maintenance Corporation Limited (CMC Limited) in 1984, and privatized in 2001 by selling its shares to Tata Consultancy Services (TCS)
1978	The first degree programme in Computer Science (CSc)—BTech (CSc)—was started by the Indian Institute of Technology, Kanpur (IIT-K), and was later introduced by all other IITs and many engineering colleges
1980	Electronics Commission recommended the introduction of a Master's level programme in computer applications (MCA—Master of Computer Applications), which could be pursued by any graduate so that computer expertise would also be accessible to non-engineers
1981	CMC Limited secured funding support from the United Nations Development Programme (UNDP) to train professionals in neighbouring countries on computer and software related issues. The INTERACT project (International Education and Research for the Application of Computer Technology) thus became India's first foray into the international arena in the field of IT
1984	Department of Electronics (DoE), GoI, obtained UNDP grants to set up the Computer-Aided Design (CAD) Programme at four national-level institutions, including IISc Bangalore, and the Computer-Assisted Management (CAM) Programme at the Administrative Staff College of India (ASCI) and three Indian Institutes of Management (IIMs), including IIM Bangalore
1984	Reserve Bank of India (RBI) stipulated that all commercial banks in India should computerize their 'back-office' work. This move was resisted by the trade unions, who observed 1984 as 'Anti-Computerization Year'! (Ironically, when the unions were expecting massive reductions in employment in the banks, the RBI stipulation created plenty of work for software companies and provided a lot of employment in the IT sector)
1984	IISc Bangalore was awarded a grant of Rs. 500 million by the Ministry of Human Resource Development (MHRD), GoI, to establish a Supercomputer Education and Research Centre (SERC). The plan could not be implemented fully because of a ban imposed by the US Government on the export of Cray Supercomputers to India (the ban was lifted in 2008 with the signing of the Civil Nuclear Deal between India and the USA), because the products were then classified as 'dual use technologies', which included high-performance computers and certain types of software, such as high end CAD/CAM tools, having the potential to be used in nuclear projects. GoI therefore set up the Centre for Development of Advanced Computing (C-DAC) during 1986–88 for the development of supercomputers in India (see below for the details), while IISc continued its efforts with the help of European collaborators
1984–86	Indian Railways (the world's seventh largest commercial or utility employer) computerized its reservation system with the help of CMC Limited, using only Indian engineers and indigenously developed software
1985	Texas Instruments (Bangalore Centre, established in 1984) was permitted by GoI to break the monopoly of the Department of Telecommunications (DoT) and to have its own dedicated satellite communication link to its Dallas Centre in the USA, thus laying the foundations for the development of off-shoring business and software exports from India

(continued)

Table 3.2 (continued)

Year	Initiative
1985	DoE launched a scheme for training university and college teachers in computer science
1985	Using a UNDP grant, DoE set up the Knowledge-Based Computing Systems (KBCS) Development Programme in five academic institutions, including IISc Bangalore
1986	Supported by a UNDP grant, Department of Electronics, GoI, launched a networking project called 'Education and Research (in Computer) Networks (ERNET)' in seven national institutions, including IISc Bangalore. Currently it is the largest nationwide terrestrial and satellite network, with 15 points of presence at premier academic and research institutions
1986–88	Centre for Development of Advanced Computing (C-DAC) was set up by Department of Electronics and Information Technology, in collaboration with Russia, to develop indigenous supercomputers in India (to overcome the ban imposed by the USA in connection with the nuclear non-proliferation issue). The aim was to cater to the specialized computing needs of the country, such as: high-performance computing/computers; grid computing; information and cyber security; speech and natural language processing; ubiquitous computing; bioinformatics; geomatics; and digital forensics. The first indigenous supercomputer (PARAM 8000) was developed in 1991, and was rated as one of the fastest supercomputers then available. Among the many software products developed by C-DAC were an integrated circuit chip called GIST (Graphics and Intelligence based Script Technology) and a standard Indian Script Code for Information Interchange (ISCII), which together could process the content in Indian languages
1990	The Software Technology Parks of India (STPI) scheme was launched by DeitY, GoI, and its first unit was set up in Bangalore in 1991
1998	GoI constituted a National Task Force on Information Technology and Software Development (with 18 members, representing government and the industry) to make recommendations on a National Informatics Policy. The task force made 108 recommendations (see Appendix 3 for a list of 20 major ones), most of which were accepted and implemented by the government

An educated workforce (able to speak English), available in large numbers at relatively low wages. Bangalore is often mentioned as having an advantage in this respect, because the state of Karnataka—of which it is the capital—has been more active than other Indian states in permitting and promoting educational institutions in the private sector, so that it has proportionately more of such institutions, especially engineering colleges which number over 100.

A cosmopolitan culture, conducive to the Western life-style, and so perceived as comfortable by the foreign employees of MNCs. The development of such a culture in Bangalore is attributed to the relatively long period of direct rule by the British through the establishment of their Residency and Cantonment in the city, as against the indirect rule by the British through tributaries in many other regions.

Early introduction of science and technology-based industries and institutions and the 'modern' transport, communication, electric supply and healthcare infrastructure put in place by the British rulers. The city also witnessed the rare phenomenon of British and US professionals working with local entrepreneurs to found the

Indian Institute of Science in 1909, to develop innovative weaponry—the mine-clearance device called the Bangalore Torpedo—in 1912, and to provide repair and maintenance support to aircraft from the US '84th Air Depot' maintained in Bangalore by the US Air Force during the Second World War.

The Government of India's initiatives in the post-Independence period (1950s and 1960s) to set up high-tech strategic industries and institutions in Bangalore. These initiatives focused on Bangalore because of the city's 'interior' location away from the national boundaries and the political closeness of the State and Central governments. Initiatives in the areas of defence, space, aeronautics and electronics attracted high-quality technically qualified manpower to Bangalore from all over India and beyond.

Promotional schemes for the IT industry introduced by the Government of India during the 1970s and 1980s. Bangalore received a larger share of these because of the high-tech industries and institutions already in place there.

Special schemes of the Government of Karnataka to attract the IT industry to the state. These included: Entry tax exemption for IT equipment; power-tariff concessions; quick clearances by the Pollution Control Board for captive diesel generation sets to ensure uninterrupted power supplies for IT operations; concessions on registration charges, etc. (Karnataka was the first state in India to announce its IT Policy, which it did in 1997 within about 6 years of India's economic liberalization, and it launched its 'Millennium BPO Policy' at the India Business Roundtable in New York in 2002.[4]

Last, but not the least, the moderate weather of Bangalore. A temperature ranging between 13°C and 33°C in the 1970s and 1980s (although it has risen on average by a few degrees since) made it more comfortable, especially for foreign nationals.

9 'Negative Push' for the Positively Inclined

Among all of the above factors, it is customary for researchers to mention the 'low-cost labour' as the critical one that helped the development of IT industry in Bangalore. While this was a necessary condition, it was apparently not sufficient, as such labour was available in plenty in many other cities and towns in India and elsewhere. Even the combination of these factors may not provide a complete explanation, because it seems they were not able to produce any new technologies or substantive innovations in the pre-IT era. The movement of the IT industry to clusters outside its countries of origin is largely due to the 'negative push' at the origins. With the growth of the IT industry, there was a substantial increase in demand for trained professionals, and in the short-term the rate of supply could not be increased at the same pace. The resultant shortage of professionals pushed up salaries, and it

[4] BPO – business process outsourcing.

was natural for the industry to look for cheaper locations where qualified professionals were available at lower salaries.

For an industry like IT, such a move is not difficult, provided there is a data transfer facility from the new location to the parent company. So, when Texas Instruments (TI)—the first foreign IT company to set up shop in India—was considering the offshore options in India during the early 1980s, Bangalore was not initially on its list, because the city did not then have a data transfer facility. TI's options were limited to Delhi and Mumbai (formerly Bombay), each of which had data transfer connectivity as well as an international airport, two factors that TI considered critical for its operation from India. Later, when the company did move to Bangalore in 1984, it realized more acutely that the transport and communication infrastructure was not a major strength of Bangalore; the company was obliged to transport office equipment to its Miller's Road office in a bullock cart![5]

If Bangalore could not provide the critical resources that TI needed for its operation, why did the company move to Bangalore? If its move from the USA to India was due to a series of 'negative pushes' in its home country, similar negative pushes from the more eligible cities of India brought it to Bangalore. The costs of real estate in Delhi and Mumbai were as high as those in the USA. While the New Bombay area was relatively affordable, there were militant nationalist groups in Mumbai who resisted the entry of foreign companies. When the search for a location in India was almost at a dead end, a TI employee who had a Bangalore connection through IISc (his alma mater) suggested Bangalore as a possible choice, and his suggestion was accepted in spite of the city's 'deficiencies' in terms of international connectivity.

The much-needed data transfer facility was made available to TI only in 1989, 5 years after its arrival in Bangalore, and the Bangalore International Airport was not commissioned until 2008. The main problem in creating the data transfer facility was the need for a policy change at the level of the national government, which at that time did not permit private operators to have or provide such links; it was the monopoly of the government company Videsh Sanchar Nigam Limited (VSNL). These and many other issues were, however, gradually sorted out, not only for TI but also for many other companies that followed suit. Many Indian entrepreneurs and corporate organizations also moved to Bangalore and collectively they developed the entrepreneurial ecosystem that has now become a part of the virtuous cycle of entrepreneurs creating/attracting the ecosystem and the ecosystem then attracting further entrepreneurs to the region. Since most studies on clusters are carried out after the cluster is well developed, it is perhaps only natural for researchers to conclude that the ecosystem is responsible for developing entrepreneurship in a region. However, longitudinal analyses of clusters would show that the process is often reversed, and that entrepreneurs are instrumental in bringing about the ecosystem.[6]

The negative push is not within the control of the beneficiary region; it happens outside that region, and may even bypass a particular region. If and when the negative push happens, the recipient region should be prepared and should have the

[5] See: https://en.wikipedia.org/wiki/Software_industry_in_Karnataka.

[6] A longitudinal analysis of the development of the Bangalore ICT Cluster is available elsewhere—see Manimala (2008)

capability to take advantage of it. Bangalore did have such preparation, as a result (as described above) of several centuries of intercultural interaction. Paraphrasing the famous words of Louis Pasteur, 'Fortune favours the prepared mind', one could say that IT clusters flourish on prepared ground, and Bangalore had prepared the ground.

10 Development Through Intercultural Interaction

A fundamental proposition that emerges from this analysis of regional development is that the development of regional capabilities is primarily a function of intercultural interaction, which happens not only through the arrival of outsiders in a region but also through the people of the region going beyond it. Such interaction can be positive (trade, tourism, education, etc.) or negative (invasion, colonization, etc.). The prevalence of 'aspirationalism' in the material world is easily understood. People of a particular level of affluence will hardly think of the thousands of people below their level, but will start worrying about moving up when they observe even one other individual with a higher standard of life. While culture is often associated with rigidities (such that it is almost impossible to change it in the short run), 'cultural aspirationalism' is a fact of life in the long run, and cultures do change by adopting the better features of other interacting cultures. In fact, it may not be wrong to state that all developments happen because of intercultural interaction. The reason for the underdeveloped state of isolated tribes is not hard to find. The rigidities and aspirationalism of cultures may be compared to the centripetal and centrifugal forces in physics, although with the difference that in the circular physical motion the real force, which will be the ultimate winner, is centripetal, whereas in cultural movements aspirationalism (equivalent to the centrifugal force) is a periodic winner and thereby manages to enhance the circle by including many desirable features from other cultures.

Even a superficial examination of the developed regions of a country would show that the more developed areas are those that are in contact with people of other regions/countries. It is strange but true that the developmental impact can be positive in the long run even if the interaction is of a 'negative' type, as in the case of invasion and colonization. As an example, one could examine the developmental history of India. In ancient India, the better developed regions were the places on the borders, especially on the sea coast where there were contacts from traders and other visitors from abroad and on the main travel routes within the country, whereas the interior places remained underdeveloped. Modern development started in India in the places occupied by the British, such as Calcutta (now Kolkata), Madras (Chennai), Bombay (Mumbai) and Delhi. In fact, the city of Bombay would not have been in existence today but for the work done by the British in dredging the sea and connecting the seven fishing villages near the western coast of India to make a harbour in between these islands and the mainland. It is worth mentioning here that the first rail link in India was made by the British in 1852 on this strip of land, connecting it with Thane on the mainland (mainly for moving goods to and from the

harbour), which they later expanded to the whole country, thus facilitating greater movement of people and goods within the country, which resulted in further interaction and development; and Bangalore, too, was a beneficiary of this rail network.

Similarly, there is the case of English-language education in India, which was introduced by the British (through its champion, Thomas Macaulay) in 1835 as an instrument of 'cultural colonization' (to develop loyal servants for the British administration). It was not perceived to be in the best interest of the country, because it was intended to replace the indigenous education through the medium of Indian languages. However, in later years, knowledge of English by India's educated workforce became a major reason for the arrival of IT companies in the country (resulting in the development of the Bangalore ICT cluster), and for the capability of Indian IT companies to do business more easily with Western and other international (English-speaking) clients.

In this context, it is interesting to note that the English language is also a product of an invasion. It was born in the fifth century CE by the hybridization of the Celtic and Germanic languages, when the Germanic tribes invaded the Celtic settlements of the British Isles. This hybrid language was subsequently enriched by the French invasions, and finally it overtook the invaders themselves as the 'lingua franca'. The story of the kingdom is similar to that of the language. The British monarchy traces its ancestry to William the Conqueror, who came from the province of Brittany in France, and the name of the island kingdom (Great Britain) can be traced to the province of the conqueror (Brittany).

These examples may appear unrelated to the Bangalore story, but they are offered here to illustrate the critical role of intercultural interaction in bringing about development through a process of cultural aspirationalism. Returning to Indian history, India has been invaded more than 50 times by various groups, and all of these invasions happened through the Khyber and Bolan passes in the North-West. In comparison, the North-East of India has had a relatively peaceful existence, with hardly any invasions. However, in terms of development, the North-West is far more advanced than the North-East. While there are many more such examples to illustrate the critical role played by intercultural interaction—positive or negative—in developing the human capital of a region and thereby bringing about economic and social development, suffice it here to reinforce this hypothesis with the story of Bangalore.

One reason why I have provided a brief chronological narrative of the development of Bangalore as a modern city, starting with its early history, is to demonstrate the diversity of cultural groups that have moved into the region at various periods and helped to weave a multicultural web. Until India's Independence, the region was never ruled by 'local' chieftains, except for a brief period of 101 years from 1537 to 1638. It was periodically occupied by the Gangas, the Cholas, the Hoysalas, the Vijayanagara Empire, the Wodeyars (whose origins are traced to the 'Yadavas' of Dwaraka in Gujarat and who started ruling the area in 1399 as feudatories of Vijayanagara), the Bijapur Sultans, the Moghuls, the Marathas, Hyder Ali and his son Tippu, and the British. During the period until India's Independence in 1947, the region that included Bangalore was subjected to several invasions, occupations

and colonization, and was ruled by more than ten different 'foreign' groups (most of which may be classified as 'negative' interactions).

These rulers brought their chieftains, soldiers, associates, assistants, craftsmen and labourers with them, all of whom contributed to the diversity of the available human capabilities. They also vied with one another to create institutions and infrastructural facilities, which directly or indirectly contributed to the future development of the region. One such institution that may be mentioned in the context of the ICT cluster in Bangalore is the Indian Institute of Science, which was created in 1909 through a collaboration of three 'outsiders': the entrepreneur JN Tata who hailed from Navsari in Gujarat and belonged to a community (Parsee) that migrated to India from Iran over 1000 years ago; the Maharaja of Mysore (Wodeyar), whose ancestors were also from Gujarat (Dwaraka); and the British (represented by two viceroys, Lord Curzon and Lord Minto), who provided the legal and academic support to the new institute, for which the British Nobel Laureate William Ramsay (of noble gases fame) suggested Bangalore as the location because he had once stayed there, and Morris Travers, Ramsay's research-collaborator, who became the first director. A small but relevant additional fact is that it was an alumnus of this institute who gave the critical 'positive push' in favour of Bangalore to Texas Instruments, which was drifting around in India under the negative pushes from the USA and two Indian cities. It may be a strange coincidence that a foreigner recommended Bangalore as the location for the institute, and 75 years later an alumnus of that institute recommended the same city to a foreign company as the location for its offshore facility. Both of these, however, are instances of development through intercultural interaction.

The post-Independence period in India offered many 'positive pushes' to Bangalore. The capital of the region (Karnataka State) was shifted from Mysore to Bangalore because of the facilities already created there by the successive rulers, especially by the British. This newly acquired status helped the city to be perceived as an alternative to Madras in the south for locating the facilities allocated to the south by the Central Government. Apart from the policy of diversifying the facilities to different places, there was another kind of negative push in favour of Bangalore, which was the fact that the same political party was in power in both Karnataka and the Centre, whereas in Madras it was a different political party that ran the government. Besides, there was an added advantage to Bangalore; it was located away from the national borders and was therefore considered suitable for locating strategic industries in the areas of defence, space and aeronautics, especially the R&D institutions in these and other areas. Thus Bangalore became the preferred location for several central public-sector companies and Central Government institutions of strategic importance as well as for R&D institutions in new and high-tech areas. While the direct benefits expected to arise from these companies and institutions were the developmental work done and the foreign collaborators working with them, they did contribute to the human capital development of the city by bringing the best brains from all over the country through the PSUs' nationwide recruitment based on educational qualifications, competencies and achievements.

The within-country movement of people to Bangalore was also helped by the fact that the city is located on the border of Karnataka State. The state of Tamil Nadu

is about an hour by road to the south-east; Andhra Pradesh is about 2 h to the north-east; and Kerala is about 6 h to the south-west. People from these three states, especially Tamil Nadu and Andhra Pradesh, used to move to Bangalore in large numbers, thereby contributing to its cultural diversity. Many Tamil-speaking people moved to Bangalore, especially during the British rule, because the southern headquarters of the British (Madras) was in Tamil Nadu. In fact, some of the old settlements in the inner-city areas (e.g., Kalasipalaya*m*, the market area, and Malleshwara*m*, where IISc is located) have place-names with non-Kannada endings, probably suggesting that they were originally settlements of Tamil people. Similarly, the inner-city area called 'Shivajinagar' suggests the influence of the Marathas. It was the periodic movement of people from the neighbouring regions, from the rest of the country and from other countries, which helped the human capital development of Bangalore, which in turn prepared it for hosting the IT industry from abroad, when it was experiencing a negative push from its country of origin.

11 The Crystal Growth Model of Cluster Development

I suggested elsewhere (Manimala 2008) that the process of cluster development was very similar to the chemical process of crystal formation and growth. The first crystal is formed in a concentrated solution (prepared by adding the solute under progressive increases of the solvent temperature) when there is a sudden drop in the temperature in the external environment. Once a crystal is formed, it has a tendency to grow by attracting the same solute material from the environment to itself.

The process of cluster development is, I contend, somewhat similar to this chemical process of crystal growth. The preparation of the 'solution' may take a while, and the process is that of integrating diverse types of human capabilities into the region through a flexible and accommodative system of intercultural interaction. (Even when the process of intercultural interaction turns out to be aggressive and negative, it may produce beneficial effects in the long run, either by strengthening the competencies of the existing system or by integrating the special competencies of the 'aggressor' into the existing system). When the human capabilities of a region are sufficiently diversified and developed, changes in the external environment may precipitate a new entity (often by negative pushes) into the region, which it has the capability to accept, adapt and develop further. While the entry of the new entity often depends on a single dominant factor, its survival and growth both depend largely on the availability of the other essential elements of the ecosystem or the internal or external capability to create such an ecosystem as and when required. Perceiving the synergies available with the capabilities of the existing entity and the support and facilitation provided by the progressively improving ecosystem, new entities flock around, triggering the process of cluster development.

While a new arrival to the region is initially welcomed by those already there and by the ecosystem because of the synergies it offers, such a welcoming situation is unlikely to go on forever. Too many players in the region will increase the competi-

tion for resources and will thereby increase costs, which will then act as a negative push in favour of other regions. In other words, clusters will experience 'attrition' in the long run either because of the shifting of activities to other regions or because of changes in the technology or in any of the critical dimensions of the ecosystem. One example of a cluster that has gone through the attrition stage is the textile cluster of Manchester in the UK. Similarly, the automobile cluster of Detroit in the USA is at the declining stage.[7]

The model of clustering described above may be summarized as a four-stage process consisting of: (1) incubation, (2) nucleation, (3) agglomeration and (4) attrition (Manimala 2008). Of these, the longest and the most complex is the incubation period which, in the case of Bangalore, lasted for several centuries. The main process involved in this stage is the development of the human capabilities of the region through intercultural interaction. Nucleation, for the Bangalore ICT cluster, happened when Texas Instruments and a few other foreign companies moved some of their operations to Bangalore, which was also a process of intercultural interaction. In the third stage, agglomeration, there is a flourish of entrepreneurship—an entrepreneurial renaissance—which also occurs through intercultural interaction, as small and large entrepreneurs come—as in the example of Bangalore, from all over India and abroad—and do business with one another as well as with firms outside the cluster, both within and outside the country. Bangalore is currently in the agglomeration stage and at its entrepreneurial peak, although there are occasional signs of 'attrition' trends, as indicated by firms moving out or an entrepreneur deciding to go elsewhere because of factors such as cost and competition. However, these instances are few and far between, and the attrition stage for the Bangalore ICT cluster seems still to be quite far off. Even if the cluster suffers this fate in the distant future, entrepreneurship will continue to thrive in the city through a process of flexible recycling of resources (Bahrami and Evans, 1995), supported by the human capabilities that are being continuously developed through ongoing intercultural interaction.

Appendix 1

Chronology of selected major events in the development of Bangalore, with a special focus on entrepreneurial, industrial and technological (especially IT) initiatives[8]

Year(s)	Events
Second–sixteenth century CE	The region containing the Bangalore area was under the rule of various dynasties: Ganga, Maurya, Chola, Hoysala and Vijayanagara

(continued)

[7] It is somewhat ironic that Osaka in Japan is known as the 'Manchester of Japan' and Ahmedabad in India as the 'Manchester of India' because of their textile clusters, when there are no longer any textile mills in Manchester, England!

[8] A more elaborate chronology of the history of Bangalore is available in an earlier version of this paper.

Appendix 1 (continued)

Year(s)	Events
1537	Kempe Gowda I (Yelahanka's ruler under Vijayanagara King, Achuta Devaraya, whose capital was Hampi in northern Karnataka) designed and built a mud fort with the King's support; within the fort there were two streets (East–West and North–South) and four 'petes' (markets). Kempe Gowda II (grandson of Kempe Gowda I) later built the four watch-towers in the four corners of the town, and a few lakes and temples
1638–1799	Under the rule of: Bijapur Sultan, Marathas, Moghuls, Wodeyars, Hyder Ali and Tipu Sultan, and the British.
1806	The British set up their cantonment in the Ulsoor area of Bangalore (shifting it from Srirangapatna because of the rampant malarial epidemic there), which started the development of Bangalore as a modern city. (With the military settlement of the British came educational institutions, roads, railway lines, water supply, sewage system, hospitals, telephone and electricity supply)
1864	First train from Bangalore ('Bangalore Mail') rolled out on a metre-gauge line from Bangalore Cantonment to Jolarpettai on the Bombay–Madras line
1882	The Whitefield Farm was developed for the Eurasian and Anglo-Indian community in the suburbs of Bangalore by David White. It later became the location for the International Technology Park Ltd. (ITPL)
1898–1905	Bangalore gets telephone, hospital, motor car and electricity
1909	Indian Institute of Science (IISc) was built with an endowment from Sir Jamshetji Tata. The location was suggested by Nobel Laureate William Ramsay who had stayed in Bangalore earlier, and the land (372 acres, ~150 ha) was donated by the Maharaja of Mysore
1912	The 'Bangalore Torpedo' (a mine-clearing device) was developed in Bangalore by Captain McClintock of the British Indian Army unit (headquartered at Madras)
1940	First flight departed from Bangalore (to Bombay), operated by Hindustan Aircraft Ltd. (HAL), which was set up in Bangalore by the managing agency Walchand-Tulsidas-Khatau Ltd. under the patronage and investment support of the Maharaja of Mysore and with technical support from the International Aircraft Corporation of New York
1947	India's Independence; Bangalore was chosen as the capital of the newly formed Mysore State (later renamed as Karnataka state)
1950–1980	Government of India established various public-sector companies and educational institutions of a strategic and technical nature in Bangalore
1978	Electronics City (an industrial park divided into three phases and spread over more than 330 acres of land) was created in the south-east suburb of Bangalore by Keonics (Karnataka Electronics), Govt of Karnataka
1983	Infosys Limited (now India's second largest IT Services company after TCS) shifted its headquarters from Pune to Bangalore
1984	Texas Instruments became the first IT MNC to establish a unit in Bangalore, which kick-started the 'IT Entrepreneurial Revolution' in Bangalore
1984	Government of India approved the setting up of a National Supercomputer Centre at the Indian Institute of Science, Bangalore, with a grant of Rs. 500 million
1990	The first Internet service in Bangalore was provided by STPI (Software Technology Parks of India), which was then restricted to corporate organizations

(continued)

Year(s)	Events
1993	The Motorola (India) Software Team (located in Bagmane Tech Park, Bangalore) became the first team in the world to attain the Software Engineering Institute's (SEI) Capability Maturity Model (CMM) Level-5 certification
1994	The International Technology Park Limited (ITPL) was set up near Whitefield in Bangalore as a joint venture of the Governments of India and Singapore
1996	WIPRO, a diversified company, with a major portfolio in the IT hardware and software/services businesses (the third largest IT company in India after TCS and Infosys), shifted its registered office from Mumbai to Bangalore
1998	Tata Consultancy Services (TCS) Ltd., established in 1968 with its registered office in Mumbai, started setting up offices (currently 16 of them) in Bangalore. TCS is the largest IT services company in India (tenth largest in the world) with more than 300,000 employees and operations in more than 40 countries
1998	At the Bangalore-IT.Com 1998 Conference, the then Prime Minister of India, Shri A.B. Vajpayee, made a prophetic declaration that 'IT is India's tomorrow'
1999	International Institute of Information Technology-Bangalore (IIIT-B) was established in Electronics City, Bangalore
2000	HP Global set up BPO in Bangalore
2001	Dell set up its R&D Centre in Bangalore
2003	Yahoo set up its first R&D Centre outside the USA in Bangalore
2004	Google set up its first R&D Centre outside the USA in Bangalore
2006	CISCO established its 'Globalization Centre East' in Bangalore
2008	Accenture opened Technology Lab in Bangalore (its fourth in the world after two in the USA and one in France)
2009	SAP's third CoInnovation Lab (COIL) was set up in Bangalore (the first two labs being in Palo Alto, USA, and Tokyo, Japan)
2014	The first free Wi-Fi service in India (Namma Wifi) started operating in the central areas of Bangalore; the service is operated by D-VoiS and is paid for by the Karnataka Government

Source: Compiled from various websites (see References Section: Sources for Bangalore's history).

Appendix 2

Institutions and facilities created by the British after 1799 having a positive effect on the entrepreneurial and technological development of Bangalore (chronological order)

- General Post Office (1800)
- St Mark's Cathedral (1808)
- The Bangalore Cantonment together with its roads, residences, industries and educational institutions (1809)
- A printing press (1840)
- The railway line and trains (1864)
- Bangalore Palace and the Palace Gardens (1864–1884)

- An administrative building for 18 departments, called Attara Kacheri, built in 1867 and currently housing the Karnataka High Court
- Cubbon Park (1870)
- The Whitefield settlement, established in 1882, which today is a hub of technology parks housing high-tech multinational corporations (MNCs)
- Binny Mills (1884), which (though closed down in 1996) laid the foundations for Bangalore's garment cluster (the largest in India)
- The telephone (1898)
- The Victoria Hospital (1900)
- The motor car (1903)
- Connection of electricity supply (1905)—the second in India after Calcutta
- The Indian Institute of Science (1909)
- The 'Bangalore Torpedo', a mine-clearing device, designed and manufactured in Bangalore by Captain McClintock of the British Indian Army unit in Madras (1912)
- Hindustan Aircraft Limited (HAL) and the first flight from Bangalore to Bombay (1940) in collaboration with private entrepreneurs; HAL developed as a major overhaul and repair facility for the US Airforce (1942–1945)
- The City Improvement Trust formed for developing and improving Bangalore (1945)

Appendix 3

National Task Force on Information Technology and Software Development (1998): 20 major recommendations[9]

1. Provision of high bandwidth communication links to IT industries.
2. Zero licence fees to start Internet services.
3. Removal of the monopoly of VSNL (a public-sector company) to provide international gateways for the Internet.
4. Allowing private Software Technology Parks to provide infrastructure to small and medium-sized IT companies.
5. Allowing Public Call Offices to provide Internet services to the public in addition to telecommunication services.
6. Expanding the definition of IT to include IT enabled services (ITeS) and BPO besides software development.
7. Eliminating import duty on disks, displays and many other items.
8. Eliminating import duty on capital goods used to manufacture IT products.
9. Freeing software companies from inspection by numerous government and local body inspectors, such as boiler, excise, labour, environment/pollution control inspectors, a source of irritation and corruption (realizing their irrelevance to the IT industry).

[9] Adapted from Rajaraman (2012).

10. Enabling state-controlled banks to provide venture capital to IT industries without collateral.
11. Requiring nationalized banks to provide working capital requirements to the IT industry on concessional terms, treating them as priority industry.
12. Allowing 'sweat equity' and 'employees' stock option plans', which were alien to other industries in India. (This required change in company laws.)
13. Easing the use of foreign exchange earned by software companies for business purposes without getting prior approval from the Reserve Bank of India.
14. Providing government subsidies for IT companies to participate in international trade shows.
15. Setting up a National Council on IT education to improve education standards and to create a pool of good educators.
16. Setting up one Indian Institute of Information Technology (IIIT) in each state to increase the availability of pools of IT-trained human resources.
17. Providing Internet connectivity to all universities, colleges, hospitals and selected high schools.
18. Stipulating IT literacy as an essential requirement for all future jobs in the government and providing training for existing staff in government departments.
19. Framing of a national policy on information security, privacy and data protection.
20. Enactment of cyber laws by Parliament.

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