Chapter 1
Smart Economy in Smart Cities

T.M. Vinod Kumar and Bharat Dahiya

Abstract Emerging patterns of urbanization world over show differing scenarios in different continents, requiring diverse approaches, policies, and strategies. Amazing democratization of ICT around the world leads to a discussion on sustainable, resource-conserving, and resilient smart cities, and smart city economic development appropriate to different cities, countries, and continents. It can be possible that each city in a particular country and continent may possess differing challenges to smart city economic development. When ancient rural economy gives way to urban economy, which contributes a major share of national domestic product, the emerging question is what constitutes smart city economic development. How is it different from conventional urban economy? Is the theory and practice of conventional urban economy valid in a smart city economy or is it necessary to investigate newer theory and practice of smart city economic development? What is a food shed in a smart city economy in smart cities? What a smart city industry looks like? What constitutes smart city commerce services, transportation, and communication, and how they impact on smart city economy? How do smart cities fit in the urban dynamism and policy dialogue at the global, regional, and national levels? Can smart cities and smart economy be socially inclusive? How to strategize social inclusion in smart city development? What sort of governance and institutional support would smart cities require to fulfil their role with regard to smart economy? What may constitute a Sustainable Model of smart cities economic development, and what may be Smart Cities Standards? These are some of the questions addressed in this chapter.

Keywords Urbanizing world · Challenge of smart cities · Democratization of smart ICTs · Smart city system · Smart economy · Sustainable models of smart cities ·

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Smart cities standards · Smart economy unique in a smart city · Transition to smart economy in smart cities theory and practice · Collaborative research programme

1.1 Urbanizing World and the Challenge of Smart Cities

'We live in the times of a global urban transition' [1]. Historically, cities are considered as the highest forms of economic and sociocultural achievements in human civilization [2], and the location of non-primary economic activities. At present, cities are production centres for goods and services for both internal and external consumption. Cities embody a sense of unique human entrepreneurship, economic dynamism, and evolving multiculturalism—all aided by the incessant technological progress that we see unfolding every day. Today's city is a high-speed communication hub with strong modern information and communication technologies' (ICTs) infrastructure that connects the city with cities all over the world in real time. The communication devices are fast evolving from desktop computers to laptop and slate, and now they are moving towards wearable devices, such as mobile phones and other gadgets. Cities function as 'engines of economic growth' and dominate local and national economies [3–5]. Cities also act as 'magnets of hope' for a vast array of skilled and unskilled people who flock to them to find better livelihoods and lifestyles. Cities are able to perform these multifarious functions as they proclaim to have better infrastructure and services (compared to their rural counterparts), which aids their agglomeration economies and related creative and technology-driven production processes. City dwellers with comparatively higher Human Development Index of tomorrow can only survive if they are on the path of continuous learning, and can become never-exhausting storehouse of superior creativity and innovation to compete with their better-quality products and services around the world. It is due to all these factors that in recent decades cities-led economic growth has featured prominently in the national economic policies of many countries [3–7].

1.1.1 Urbanizing World

The first decade of twenty-first century has seen the world becoming 'urban' [8, 9]. *The Economist* declared in 2007, 'Wisely or not, *Homo sapiens* have become *Homo urbanus*' [10]. Seven years on, in 2014, 3.9 billion people or 53.6 % of world's population resided in urban areas (Fig. 1.1) [11]. Urbanization rates, i.e. proportion of population living in cities and towns, vary across the world's major regions. According to the most recent data available, urbanization rates in 2014 stood at 40.0 % in Africa, 47.5 % in Asia, 73.4 % in Europe, 79.5 % in Latin America and the Caribbean, 81.5 % in North America, and 70.8 % in Oceania [11]. With

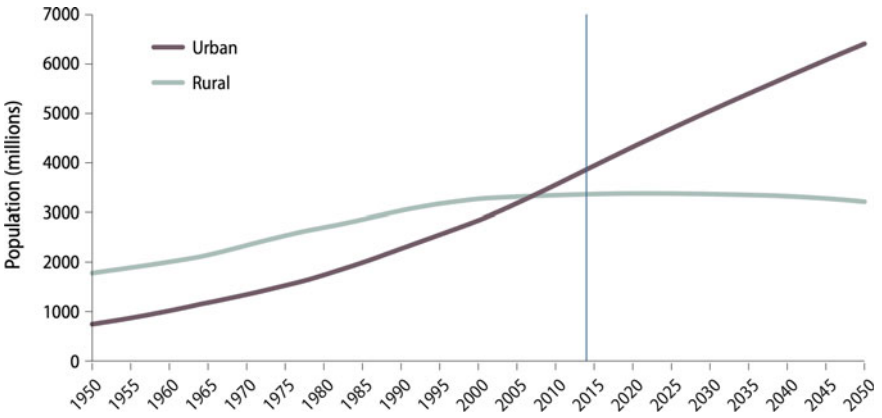

Fig. 1.1 Urban and rural population of the world, 1950–2050. *Source* United Nations, p. 7 [12]

positive urban demographic growth rates, the urbanization trend continues in all major regions. Among the three developing regions, urban demographic growth rates are highest in Africa and Asia followed by Latin America and the Caribbean.

Within our urbanizing world, the major regions show a diverse though converging trends with regard to urbanization process. Europe, North America, and Oceania already had crossed 50 % urbanization mark when demographic data keeping began by the United Nations in 1950; their urbanization rates in 2014 stood at 73.4, 81.5, and 70.8 %, respectively (Table 1.1; Figs. 1.2 and 1.3). Latin America and the Caribbean urbanized rapidly during 1950–2000 and, in 2014, reached an urbanization rate of 79.5 % that was much higher than that of Europe. These four regions are highly urbanized (over 70 %) with lower urban growth rates than the urbanizing regions of Africa and Asia.

In 1950, Africa and Asia started with less than 20 % urbanization rate, and this indicator measured 34.5 and 37.5 %, respectively, in 2000. Despite slow economic growth, Africa's urban population grew almost ninefold between 1950 and 2000. Although its urban population base is much smaller than that of Asia, Africa is growing rapidly and is estimated to reach 50 % urbanization rate by 2037. In recent decades, the urbanization process has accelerated in Asia on the back of sustained economic growth in the region. Between 1990 and 2010, Asian urban population increased by over 754 million, which was equal to the combined population of the European Union and the USA; no other continent has undergone such massive population growth in such a short span of time [4, 7]. With 47.5 % urbanization rate in 2014, Asia is estimated to hit 50 % urbanization mark in 2018.

Demographic record of the past 65 years confirms that the major regions have experienced diverse trends in the urbanization process. Looking towards the future, particularly from now in 2016, it is estimated that all major regions will undergo further urbanization until 2050 (Table 1.1; Figs. 1.2 and 1.3). This is mainly because cities are considered 'engines of economic growth' as they are able to

Table 1.1 Urban population (in million) and its proportion to total population, by major regions, 1950–2050

Major region	1950	1975	2000	2025	2050
Africa	32 *14.0*	103 *24.7*	279 *34.5*	659 *44.9*	1339 *55.9*
Asia	245 *17.5*	597 *25.0*	1,393 *37.5*	2,561 *53.9*	3313 *64.2*
Europe	283 *51.5*	443 *65.4*	517 *70.9*	562 *75.8*	581 *82.0*
Latin America and the Caribbean	69 *41.3*	197 *60.7*	396 *75.3*	567 *82.1*	674 *86.2*
North America	110 *63.9*	179 *73.8*	249 *79.1*	325 *83.4*	390 *87.4*
Oceania	8 *62.4*	15 *71.9*	22 *70.5*	32 *71.1*	42 *73.5*
World	764 *29.6*	1,535 *37.7*	2,856 *46.6*	4,706 *58.2*	6,339 *66.4*

Note Urban population is shown in millions. Proportion (%) is shown in *italics*
Source United Nations [11]

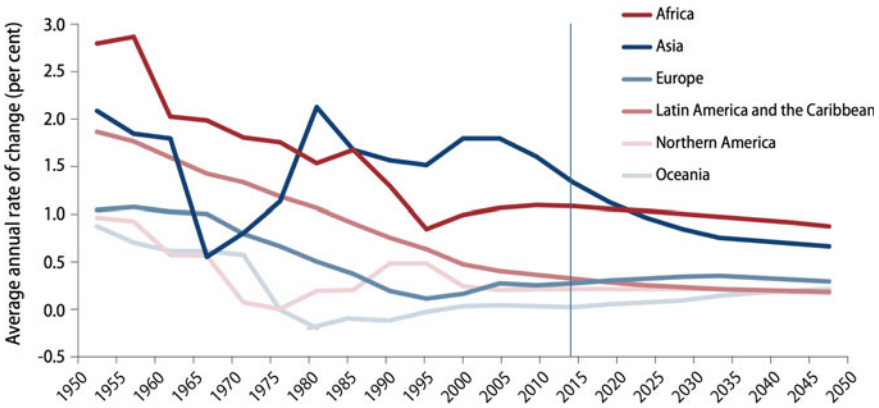

Fig. 1.2 Average annual rate of change of the percentage urban by major areas, 1950–2050. *Source* United Nations [12]

attract secondary and tertiary activities, skilled people, domestic and foreign direct investments and, in turn, contribute to national economic output.

While urban economies grow in unprecedented ways, a significant proportion of urban workers in developing countries is engaged in vulnerable (often called informal) employment. Lack of skilled workers, especially with vocational education and training, inhibits the expansion of urban economies in a variety of growth avenues. Therefore, an environment of human transformation through continuous learning shall be inbuilt in cities to justify their very existence. By

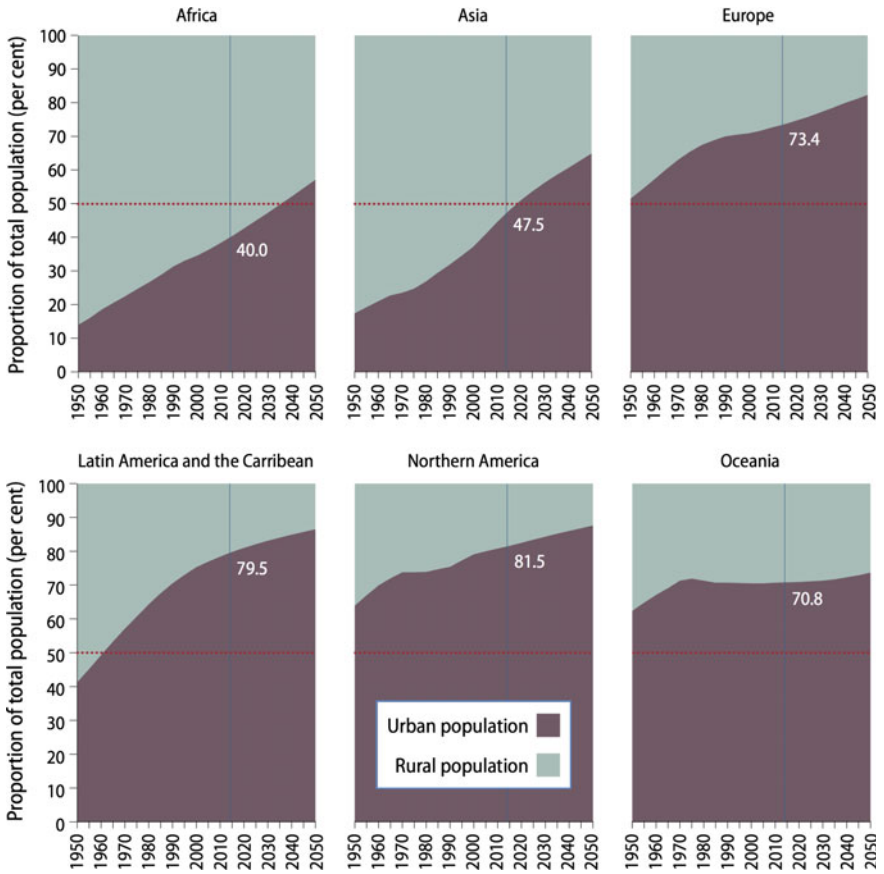

Fig. 1.3 Urban and rural population as proportion of total population, by major areas, 1950–2050. *Source* United Nations, p. 8 [12]

offering such learning activities in every city, skills of informal workers can be upgraded for them to become creative workforce with the capacity to innovate in all walks of life. There is vast scope for innovation in informal economic activities. Local businesses struggle to keep up with fast-evolving market conditions and new, tech-savvy competitors. Local entrepreneurs, keen to start new, small businesses, lack access to local or non-local customers. Relatively large, transnational corporations seem to benefit from social media rather than their smaller, local counterparts. In today's digital world, the economic losers seem to be those who are unable to capitalize on the modern ICTs.

The economic dimension of sustainable urban development is related to the overall challenge of sustainable development, which includes economic, social, and environmental dimensions. Sustainable development has been theorized and put in practice in many ways since late 1980s [13]. This concept has received renewed

attention due to the Rio+20 Conference held in Brazil in 2012, and the reformulation of 'Millennium Development Goals' into 'Sustainable Development Goals' (SDGs). Approved by the United Nations General Assembly in September 2015, the SDGs include '*Goal* 11—*Make Cities and Human Settlements inclusive, safe, resilient and sustainable*' [14, 15]. Economic development of cities and towns has huge implications for making cities safe, resilient, and sustainable. It is against this contextual backdrop that the idea of 'smart city' has been taking shape in recent years.

1.1.2 Information Age and Smart Cities

Since the late 1980s, almost parallel to the idea and practice of sustainable development, the world has seen the consolidation of the Information Age on the back of Internet and World Wide Web, the ever-expanding democratization of digital or ICTs, and the development of computer hardware and software industries. Although the earlier forms of Internet were in use since 1960s, its global usage received a boost after the invention of the World Wide Web (the Web) by Tim Berners-Lee in 1989. During the 1990s, the world witnessed a digital explosion in the use of Internet and the Web. As the practice of using e-mail spread, along with the advent of graphics-based Web browsers, Internet and the Web became part and parcel of people's daily lives. As large amounts of information started to be uploaded and made available on the Web, a series of search engines were designed and put to use, such as WebCrawler, Magellan, Excite, Infoseek, Inktomi, Northern Light, AltaVista, and Netscape, which were later joined by Google, Bing, and Yahoo! [16]. In 2001, Wikipedia was launched that added another, inclusive dimension to the use of the Web. The Internet and Web have become so commonplace now that for lots of people, especially youngsters, it is quite difficult to imagine how human life and the world were like without e-mail, Web search engines, online encyclopaedias and e-commerce, just to name a few!

The ever-increasing usage of the Internet and the Web has come hand in hand with the invention, development, and utilization of ICTs. Countless inventions have been made in the refinement of ICTs, such as personal computers (PCs), laptops and notebooks, far-away-Xerox (FAX) machines, digital and three-dimensional (3D) printers, scanners, and photocopiers. Wireless local area network (WLAN or Wi-Fi), teleconferencing, videoconferencing, and Web conferencing—including 'webinars' (Web seminars), webcasts, peer-level meetings—have become ordinary terms. Internet technologies support real-time, point-to-point communication that has transformed information flows, giving rise to new fields, for instance telemedicine. The consolidation of Information Age has been facilitated by the development of computer hardware and software industries, which have transformed the economies of cities and regions, particularly in the form of information technology (IT) parks and knowledge parks. Further, the Information Age builds on the continuing spread of—and facilitated by the progressive fall in the prices

of—ICTs, massive investments in the extension of IT infrastructure across nations, and the global spread of electronic literacy (e-literacy).

The arrival of smartphone in recent years has reenergized the Information Age and the world of ICTs. A combination of mobile or cell phone and handheld computer, smartphone is credited with creating the greatest technological revolution since the Internet [17]. A standard smartphone supports in addition to the basic telephone features such as Internet and Web access, e-mail and audio-visual communication, all sorts of digital applications (or apps), music and movie player, camera and camcorder, voice dictation, global positioning system or GPS navigation, among others. On the one hand, smart digital devices including smartphones, tablet computers, and phablets (PHonetABLET) are changing the ways in which people communicate, socialize, live, and work in villages, cities, regions, and nations. On the other hand, social media, which depends on mobile phone and Web-based technologies, has aided the spread of smart digital devices and their usage around the world and, in turn, demands further extension of IT infrastructure and development of ICTs.

All of this has led to a phenomenal growth in worldwide information flows on economy, society, culture, environment, and the like. Based on the analysis of such multitudinous flows, sociologist Manuel Castells proclaimed in the late 1990s the advent of *Network Society* through his famous trilogy on *The Information Age* [18–20]. More recently, Jeremy Rifkin has argued that the 'digitalized communication Internet is converging with a digitalized, renewable "Energy Internet" and a digitalized, automated "Transportation and Logistics Internet" to create a super "Internet of Things" (IoT) infrastructure' [21]. In Europe, IoT is increasingly viewed as 'the next revolution' [22]. For Rifkin, however, a super IoT—a combination of communication Internet, renewable 'Energy Internet', and automated 'Transportation and Logistics Internet'—goes further and is already acting as a harbinger of the 'Third Industrial Revolution' and a new economic paradigm of 'Collaborative Commons' [23]. An example of this is 'sharing economy' that has been expanding over the past few years [24], although the rules and regulations that govern it are yet to be fully devised. Further, sharing economy is understood to have interconnections with smart cities [25].

The notions of smart cities and smart economy have come when problems related to cities, their planned and sustainable development, efficient management, and effective and participatory governance abound, within the larger context of climate change [26] and global economic slowdown [27]. The smart city concept is built on a combination of ideas on how ICTs might contribute to improvements in the functioning of cities, improving their competitiveness, enhancing their efficiency, and finding new ways to tackle problems of poverty, social deprivation, and poor environmental management [28]. It is not surprising that the notion of smart city directly relates to the concept and international practice of sustainable urban development. It can therefore be surmised that the notion of smart cities and its implementation could potentially contribute to the concept and practice of sustainable urban development that includes economic, environmental, and equity concerns.

1.1.3 'New Urban Agenda' and Smart Cities

In October 2016, 'Habitat III' or the Third United Nations Conference on Housing and Sustainable Urban Development will take place in Quito, Ecuador. The United Nations General Assembly decided to convene the Habitat III Conference to reinvigorate the global commitment to sustainable urbanization, and to focus on the implementation of a 'New Urban Agenda' [29]. According to the 'Vision for Habitat III' document, the Conference will consider the following three key elements for creating a pattern of sustainable urban growth [30]:

(a) *National Urban Policy* that 'establishes a connection between the dynamics of urbanization and the overall process of national development'.
(b) *Laws, Institutions and Systems of Governance*, which 'create the normative basis of action, the operational principles, organizational structures, and institutional and societal relationships underlying the process of urbanization'.
(c) *Urban Economy*. 'While there is a strong positive correlation between economic growth and urbanization, this potential relationship is not spontaneous and self-generating. Habitat III could be the means to place the central pillars for robust urban economic development'. In today's urbanizing world and Information Age, this translates into an agenda for smart economy in smart cities, which will be detailed out later in this chapter. It will be a misconception that if governments beg and/or borrow, and pour billions of dollars in selected cities, smart cities will come up. It is again a misconception that if large capitalist and multinational companies locate industries in some cities smart economy will rise. On the contrary, the culture of Smart People in a smart city has to deliberately decide that they are changing over from conventional urban economy to smart economy and act in order to create a smart economy. The *sine qua non* for this transformation is the basic requirement of smart economy.

Habitat III will take into account three 'operational factors' that could help maximize the advantages of the urbanization process, which are (i) urban planning, (ii) local fiscal systems, and (iii) investment in urban basic services. Further, the Habitat III Vision document states that the Conference will offer the following [30]:

(1) 'Rethink the Urban Agenda. By embracing urbanization at all levels of human settlements, more appropriate policies can embrace urbanization across physical space, bridging urban, peri-urban and rural areas, and assist governments in addressing challenges through national and local development policy frameworks.
(2) Integrate Equity to the Development Agenda. Equity becomes an issue of social justice, ensures access to the public sphere, extends opportunities and increases the commons.
(3) Foster national urban planning and planned city extensions.
(4) Decide how relevant SDGs will be supported through sustainable urbanization.

(5) Align and strengthen institutional arrangements with the substantive outcomes of Habitat III, so as to ensure effective delivery of the new Urban Agenda.
(6) Revise and renew UN-Habitat's mandate to ensure that it is fit for purpose'.

In recent years, a large amount of literature has been generated on smart cities [31–45] as well as on how to understand them [46]. Habitat III Secretariat has brought out an Issue Paper on smart cities that provides an overview of the subject [47]. Scholars, practitioners, and policy makers are in the early stages of understanding smart cities and making policies and programmes to support their development, management, and governance. This is more so when it comes to smart economy in smart cities.

In view of foregoing discussion, there are nine pertinent questions and points that this international collaborative research programme aims to address:

(1) What is a Smart City System?
(2) What is the economic role of cities?
(3) What is the nature of conventional urban economy and local economic development models?
(4) What is current thinking on smart economy and smart cities?
(5) What can be a conceptual framework for smart economy in smart cities?
(6) Can smart cities and smart economy be Socially Inclusive? How to strategize social inclusion in smart city development?
(7) What sort of governance and institutional support would smart cities require to fulfil their role with regard to smart economy?
(8) Sustainable Model of Smart Cities, and Towards Smart Cities Standards?

These eight questions and themes are addressed in the next eight Sects. (1.2–1.9).

1.2 What Is a Smart City System?

1.2.1 Smart City System

A Smart City System comprises of six key building blocks: (i) smart people, (ii) smart city economy, (iii) smart mobility, (iv) smart environment, (v) smart living, and (vi) smart governance. These six building blocks are closely interlinked and contribute to the 'Smart City System', as illustrated in Fig. 1.4. Some authors treat the six elements of a Smart City System equally [35]. However, following Vinod Kumar [48], we give prominence to 'smart people' because without their active participation and involvement a Smart City System would not function in the first place. A Smart City System will risk its efficient functioning without Smart People (more on this in Sect. 1.7).

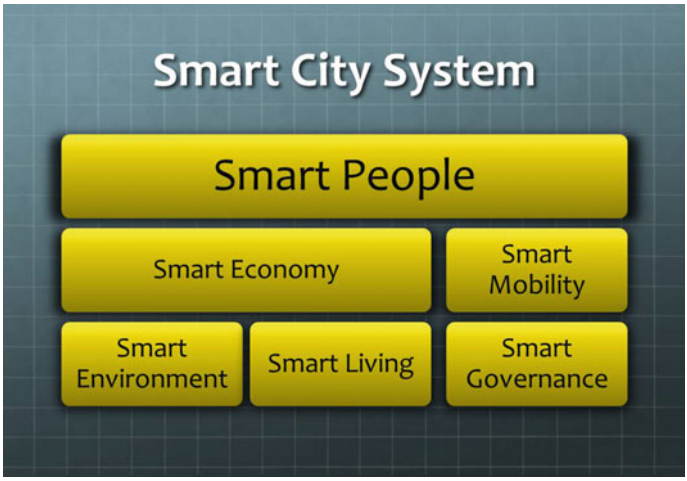

Fig. 1.4 Smart City System building blocks. *Source* Vinod Kumar, p. 19 [48]

1.2.2 Smart City System—Towards a Manifesto

As urbanization challenges continue to grow and further consolidation of the Information Age takes place around the world, it will become increasingly critical to utilize all possible ways to improve urban living along with social inclusion, economic development, and environmental sustainability. In this regard, it becomes pertinent to think through what constitutes and how to strengthen the various building blocks of a Smart City System. Below, an attempt is made to elaborate the six building blocks that could help develop a manifesto for a Smart City System.

1.2.2.1 Smart People

'Smart People', the fundamental building block of a Smart City System, require many crucial attributes as given.

(1) Smart people excel in what they do professionally.
(2) Smart people have a high Human Development Index [48].
(3) A smart city integrates its universities and colleges into all aspects of city life.
(4) It attracts high human capital, for example knowledge workers.
(5) A smart city maintains high Graduate Enrolment Ratio and has people with high level of qualifications and expertise.
(6) Its inhabitants opt for lifelong learning and use e-learning models.
(7) People in a smart city are highly flexible and resilient to the changing circumstances.

(8) Smart city inhabitants excel in creativity and find unique solutions to challenging issues.
(9) Smart people are cosmopolitan, are open-minded, and hold a multicultural perspective.
(10) Smart people maintain a healthy lifestyle.
(11) Smart people are actively involved in their city's sustainable development, its efficient and smooth functioning, its upkeep and management, and making it more liveable.

1.2.2.2 Smart City Economy

'Smart City Economy', the second building block, requires the following attributes.

(1) A smart city understands its economic DNA.
(2) A smart city is driven by innovation and supported by universities that focus on cutting-edge research, not only for science, industry, and business but also for cultural heritage, architecture, planning, development, and the like.
(3) A smart city highly values creativity and welcomes new ideas.
(4) A smart city has enlightened entrepreneurial leadership.
(5) A smart city offers its citizens diverse economic opportunities.
(6) A smart city knows that all economics works at the local level.
(7) A smart city is prepared for the challenges posed by and opportunities of economic globalization.
(8) A smart city experiments, supports, and promotes sharing economy.
(9) A smart city thinks locally, acts regionally, and competes globally.
(10) A smart city makes strategic investments on its strategic assets.
(11) A smart city develops and supports compelling national brand/s.
(12) A smart city insists on balanced and sustainable economic development (growth).
(13) A smart city is a destination that people want to visit (tourism).
(14) A smart city is nationally competitive on selected and significant factors.
(15) A smart city is resourceful, making the most of its assets while finding solutions to problems.
(16) A smart city excels in productivity.
(17) A smart city has high flexibility of labour market.
(18) A smart city welcomes human resources that enhance its wealth.
(19) A smart city's inhabitants strive for sustainable natural resource management and understand that without this its economy will not function indefinitely.

1.2.2.3 Smart Mobility

'Smart Mobility', the third building block of a Smart City System, includes the following features.

(1) A smart city focuses on the mobility of people, and not only that of vehicles [49, 50].
(2) A smart city will advocate walkability and cycling.
(3) A smart city has vibrant streets (at no additional cost).
(4) A smart city effectively manages vehicular and pedestrian traffic, and traffic congestion.
(5) A smart city has pleasurable (bicycle) routes.
(6) A smart city has balanced transportation options.
(7) A smart city will have mass rapid transit system, such as metro rail, light metro, monorail, or 'skytrain' for high-speed mobility.
(8) A smart city will have integrated high-mobility system linking residential areas, work places, recreational areas, and transport notes (e.g. bus/railway station/s and airport).
(9) A smart city will practice high-density living, such that benefit of high-speed mobility is uniformly available.
(10) A smart city has seamless mobility for differently-abled (often incorrectly called, disabled) people.

1.2.2.4 Smart Environment

'Smart Environment', the fourth building block, has the following attributes.

(1) A smart city lives with and protects the nature.
(2) A smart city is attractive and has a strong sense of place that is rooted in its natural setting.
(3) A smart city values its natural heritage, unique natural resources, biodiversity, and environment.
(4) A smart city conserves and preserves the ecological system in the city region.
(5) A smart city embraces and sustains biodiversity in the city region.
(6) A smart city efficiently and effectively manages its natural resource base.
(7) A smart city has recreational opportunities for people of all ages.
(8) A smart city is a green city.
(9) A smart city is a clean city.
(10) A smart city has adequate and accessible public green spaces.
(11) A smart city has an outdoor living room. Unlike the indoor living room in houses where we meet others, outdoor living rooms are aesthetically designed intimate, active, and dynamic urban realms where people meet face to face for a culturally and recreationally rich and enjoyable contact as part of living and work.

(12) A smart city has distinctive and vibrant neighbourhoods that encourage neighbourliness and a spirit of community.
(13) A smart city values and capitalizes on scenic resources without harming the ecological system, natural resources, and biodiversity.
(14) A smart city has an integrated system to manage its water resources, water supply system, wastewater, natural drainage, floods and inundation, especially in the watersheds where it is located, especially in view of the (impending) climate change.
(15) A smart city focuses on water conservation and minimizes the unnecessary consumption of water for residential, institutional, commercial, and industrial use, especially in the arid and semi-arid areas.
(16) A smart city has an efficient management system for the treatment and disposal of wastewater, and reuse of treated wastewater, particularly in the arid and semi-arid areas.
(17) A smart city has an efficient management system for the collection, treatment, and disposal of industrial wastewater.
(18) A smart city has an integrated and efficient management system for the collection, transfer, transportation, treatment, recycling, reuse, and disposal of municipal, hospital, industrial, and hazardous solid waste.
(19) A smart city has an efficient system to control air pollution and maintain clear air, especially in the air sheds where it is located.
(20) A smart city has an efficient and effective system for disaster risk reduction, response, recovery, and management.
(21) A smart city has and continually upgrades its urban resilience to the impacts of climate change.
(22) A smart city can create a low-carbon environment with focus on energy efficiency, renewable energy, and the like.

1.2.2.5 Smart Living

'Smart living', the fifth building block of a Smart City System, includes the following features.

(1) A smart city has strong and shared values.
(2) A smart city records and celebrates local history, culture, and nature.
(3) A smart city has a vibrant downtown, 24 h and 7 days a week.
(4) A smart city can provide the necessary safety and security to women, children, and senior citizens.
(5) A smart city improves the urban way of life.
(6) A smart city builds natural and cultural assets to build a good quality of life.
(7) A smart city not only understands the big picture of urban liveability, but also pays attention to small details.
(8) A smart city has high-quality open and accessible public spaces.
(9) A smart city has high-quality public services and amenities.

(10) A smart city is an ideal place of living, especially for women, children, and senior citizens.
(11) A smart city organizes festivals that celebrate people, life, and nature in city.
(12) A smart city has a ritual event (or more) that symbolizes the values and aspirations of the community.
(13) A smart city celebrates and promotes art, cultural, and natural heritage in the city.
(14) A smart city engages artists to improve and enrich the aesthetics of daily life of the city.

1.2.2.6 Smart Governance

'Smart Governance', the six and final building block, has the following attributes.

(1) A smart city practices accountability, responsiveness, and transparency (ART) in its governance.
(2) A smart city uses big data, spatial decision support systems and related geospatial technologies in urban and city regional governance.
(3) A smart city constantly innovates e-governance for the benefit of all its residents.
(4) A smart city constantly improves its ability to deliver public services efficiently and effectively.
(5) A smart city practices participatory policy-making, planning, budgeting, implementation, and monitoring.
(6) A smart city has a clear sustainable urban development strategy and perspectives known to all.
(7) A smart city utilizes creative urban and regional planning with focus on the integration of economic, social, and environmental dimensions of urban development.
(8) A smart city features effective, efficient, and people-friendly urban management.
(9) A smart city practices E-Democracy to achieve better development outcomes for all.
(10) A smart city embraces a Triple Helix Model in which government, Academia and Business/Industry practice changing roles in Governance.

1.2.3 Evolving Conceptualization

The conceptualization of a Smart City System has evolved, initially presented in 'Geographical Information System for Smart Cities' [43], through 'E-governance for Smart Cities' [44], and to this chapter. For this international collaborative

research programme, the conceptualization of Smart City System elaborated above has been used. It is quite possible that this conceptualization may further evolve in the future as new challenges to smart city and Smart City System emerge, new knowledge is generated, and further empirical research is conducted. Moreover, the elaboration of the six building blocks could help develop a manifesto for a Smart City System, as noted above.

1.3 The Economic Role of Cities

1.3.1 Urbanization, Cities, and Economic Growth

University textbooks often underline the positive correlation between urbanization and economic growth within national economies. Based on the analysis of long-term statistics World Bank [51], UN-Habitat [5] noted that 'while the share of urban populations worldwide increased from 33 to 51 % between 1960 and 2010, per capita income increased by 152 %—from US $2382 to US $6006—over the same period' (p. 43). Backing from such statistics has repeatedly confirmed the notion that urbanization and economic growth go hand in hand [7]. This is especially true when it comes to aggregate figures, such as those highlighted above by UN-Habitat [5]. However, there are exceptions to this. For example, despite slower economic growth compared to other regions, Africa's urban population grew almost ninefold between 1950 and 2000; some have termed this phenomenon as 'urbanization without growth' [52].

Following from the general and positive correlation between urbanization and economic growth, cities are now recognized as engines of economic growth [3–5]. For example, cities in Asia generate over 80 % of national gross domestic product (GDP) [3, 4]. This has led governments to include urbanization as part of national economic development policies, such as in China and India in recent decades.

1.3.2 Size of Cities and Economic Growth

Cities are abode of prosperity, but their wealth depends on their population size and other factors. Statistics show that the city size matters a great deal in GDP generation of a city in a country. The Economist [53] found that in the USA 164 million people live in 50 major metropolitan areas, while in Europe there are only 102 million inhabitants in metropolitan area. The GDP of European metropolitan areas is of smaller size in comparison with those in the USA. The European metropolitan areas produce 72 % of the GDP of 50 largest cities of the USA. Further, in 31 American states, one or two metropolitan areas account for the vast majority of a state's economic production, and in 15 other states, a large metropolitan area alone produces most of the GDP [54]. Seventeen major

metropolitan areas generate 50 % of the USA's GDP. An article in The Wall Street Journal [55] explains how US major metropolitan areas produce a higher GDP than the economies of entire nations. Urbanization is also different in terms of city size classes in these two areas. In Europe, 67 % of urban inhabitants live in medium-sized urban centres (i.e. smaller than 500,000 inhabitants), while just 9.6 % are located in cities having more than five million inhabitants. In the USA, one out of five urban inhabitants lives in major cities having more than five million people. Thus, there is a strong indication that population size of a city matters with regard to its urban economy.

In 2011, India had 53 metropolitan cities (Fig. 1.5). Large metropolitan cities do have capacity to generate more wealth than smaller ones, as noted above. However,

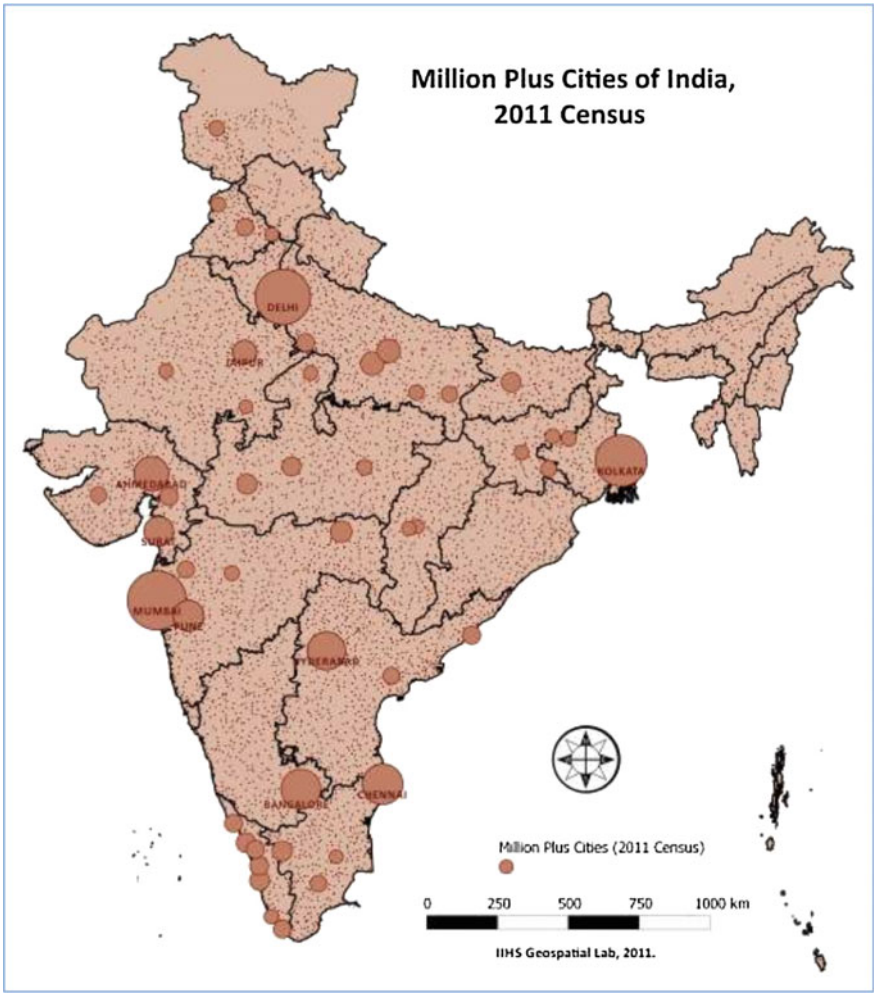

Fig. 1.5 Metropolitan cities in India, 2011. *Source* Indian Institute of Human Settlements [57, p. 10]

there are no or little data available in India on the GDP contribution of metropolitan (and other) cities. Mumbai and Delhi are two mega-cities in India. Delhi is growing fast and has already become the second largest populated mega-city in the world (after Tokyo). Mumbai generates more tax revenues for India through its vibrant economy than any other city probably because of its urban economy and population size. Delhi boasts of the highest per capita income in India.

It is also being documented in very limited scale that GDP creation of smart cities outpaces several times than of non-smart cities in many countries [36, 56]. These statistics are yet to be known to many.

1.3.3 Urbanization and Economic Development in India

Urbanization trend of India is given in Table 1.2. Urban India has grown at an unprecedented rate in the last two decades. A conservative estimate of India's population growth shows that by 2031 the total population is expected to reach about 1.5 billion, of which the urban population is estimated to be about 600 million, i.e. approximately 40 %. Growth of urban settlements as statutory towns, census towns, and urban agglomeration is shown in Table 1.3.

Until lately, it was believed that India lives in its villages. However, Census of India 2011 showed that more population addition took place in urban areas than in rural areas. It can be seen from Table 1.3 that greater number of settlements in India had transformed to Census Towns adding more of urban character to India. Also there is a rapid tendency to form urban agglomeration, and the decadal growth in urban agglomerations stood at 23.7 %. There are also instances in which two adjacent urban agglomerations merge into one big urban agglomeration. During the ten-year period (2001–2011), there was only 6.37 % increase in the number of statutory towns. This shows that in coming years urban agglomeration may become the unit of planning and replace the approach of preparing statutory plans for Municipalities and Municipal Corporations. More and more Metropolitan Planning

Table 1.2 Trends in India's urbanization: 1961–2011

Census year	Urban population (in million)	Proportion urban	Annual exponential growth rate (%)
1961	78.94	17.97	–
1971	209.11	19.91	3.23
1981	159.46	23.34	3.79
1991	217.18	25.72	3.09
2001	286.12	27.86	2.75
2011	377.10	31.16	2.76

Source Census of India, 2011 [58]

Note As the 1981 census was not conducted in Assam, and the 1991 census was not held in Jammu and Kashmir, the population of India includes projected figures for these states in those periods

Table 1.3 Number of urban agglomeration, towns, and outgrowths

No.	Type of towns	2001 census	2011 census	Percentage change (2001–2011)
1	Statutory towns	3799	4041	6.37
2	Census towns	1362	3894	185.9
3	Urban agglomerations	384	475	23.7

Source Census of India, 2011 [51]

Notes: The following definitions are based on Census of India 2011

1. All places within a municipality, corporation, cantonment board, or notified town area committee, etc., is reckoned as statutory towns
2. All other places which satisfied the following criteria (known as census town): a minimum population of 5000, at least 75 % of the male main workers engaged in non-agricultural pursuits, and a density of population of at least 400 persons per km^2
3. An urban agglomeration is a continuous urban spread constituting a town and its adjoining outgrowths (OGs), or two or more physically contiguous towns together with or without outgrowths of such towns
4. An outgrowth is a viable unit such as a village or a hamlet or an enumeration block made up of such village or hamlet and clearly identifiable in terms of its boundaries and location

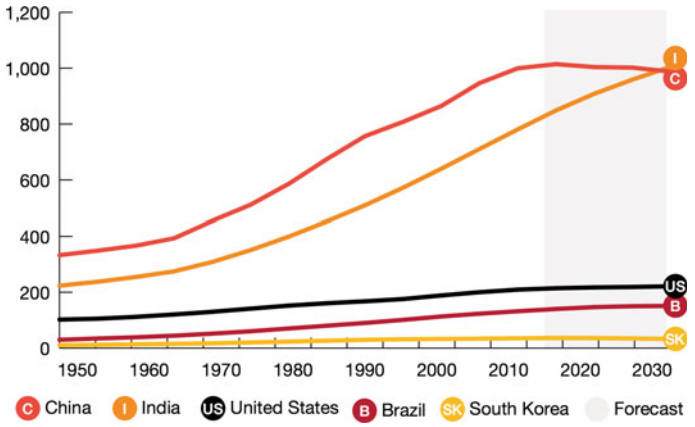

Fig. 1.6 Working-age population (15–64 years) in select countries. *Source* PwC [59, p. 20]

Committees (MPCs), with greater executing capacity, shall be formed for such urban agglomerations in the future.

Working population of India is growing as shown below in comparison with a few major economies (Fig. 1.6). China and India contributed maximum numbers of workers to their respective urban economies, and in all likelihood India will surpass China with regard to the number of workers by 2030.

Western and industrialized countries already have an urban population near 80 %, while developing countries to date come in at 47 %. Asia and Africa are expected to surpass an urban population of 50 % in 2020 and 2035, respectively. The global urban population is forecasted to increase by 72 % by 2050, growing from 3.6 billion people in 2011 to 6.3 billion in 2050 [11]. By 2020, China's urban population will reach 60 %, and more than 100 million people will migrate to metropolitan areas or contribute to the creation of new urban centres.

It has been observed in time series national statistics that contribution to GDP by urban centres in India is progressively increasing because of high generation of income and employment in cities and towns. Concurrently, the share of GDP creation in rural centres is diminishing in comparison with that of urban centres. Table 1.4 summarizes the performance of urban economy in India from 1970 to 2005.

As can be seen above, urban share of total NDP has grown from 38 % in 1970–1971 to 52 % in 2004–2005. The NDP share of industry is showing deceleration like agriculture, but there is some acceleration in NDP share of services. Availability of highly skilled workers and investment in skills and higher education as well as opening up industrial development and the ease of starting business can create more urban wealth in urban industries. Time series data and growth of urban share of GDP are shown in the graph (Fig. 1.7).

The contribution of urban areas to the national GDP is expected to increase from about 63 % in 2009–2010 to about 75 % in 2030. This 12 % increase in the urban share of GDP in 20 years is only possible with high investment in human resources for industrial skills, urban environment with highly efficient infrastructure—as shown in the benchmarking for smart cities in India (Sect. 1.9.2), and the ease of doing business. This in turn calls for reform in the Indian Administrative Service insisting on timely delivery of regulatory services for establishing new industries. A case in point is the sanction of industrial licenses often gets delayed due to red tape and corruption. In response to this phenomenon, for instance, the State of Telugu Desham (Is this Telangana now or Andhra Pradesh?) came out the policy of right for timely sanction of industrial license, and any official responsible for delay will be fined Rs 1000 for every day of delay. This shows signs of extreme dissatisfaction of the elected political leaders with the present administration system in the State of Telugu Desham (Is this Telangana now or Andhra Pradesh?).

The estimated increase of 12 % in the urban share of GDP needs to be looked against the targeted growth rate of India as projected by PricewaterhouseCoopers [59] (Table 1.5; Fig. 1.8). It can be seen that if we have to reach 9 % annual growth rate in GDP in the long run, we have to invest in urban centres aimed at creating more smart cities that can act as 'engines of smart economy'.

Table 1.4 Size of national domestic product (NDP) by sectors and per capita NDP in India

Year	Urban NDP as % of total	Value at current price					Value at (1999–2000 price)				
		(Rs in million)			(In Rs)		(Rs in million)			(In Rs)	
		Agriculture	Industry	Service	Total GDP	Per capita GDP	Agriculture	Industry	Service	Total NDP	Per capita GDP
1970–71	37.65	6.5 (4.7)	51.74 (37.4)	80.26 (57.9)	138.5 (100)	1294	74.34 (4.9)	594.2 (39.4)	839.8 (55.7)	1508.3 (100)	14142
1980–81	41.09	22.5 (5.0)	170.9 (37.7)	259.9 (57.3)	453.4 (100)	2888	114.8 (5.4)	801 (37.4)	1225.7 (57.2)	2141.6 (100)	13951
1993–94	45.73	139.4(4.4)	1046.9 (32.8)	2005.7 (62.8)	3192 (100)	13525	222.4 (4.6)	1583.9 (32.5)	3069.7 (63.0)	4875.9 (100)	20997
1999–00	51.7	291.4 (3.5)	2097.9 (25.3)	5911.1 (71.2)	8300.4 (100)	30183	291.4 (3.5)	2097.9 (25.3)	5911 (71.2)	8300.4 (100)	30183
2004–05	52.02	308.7 (2.2)	3649.7 (26.5)	9808.2 (71.2)	13766.5 (100)	44223	279.7 (2.4)	2942.1 (25.6)	8258.3 (71.9)	11480 (100)	37245

Note Figures in the parentheses are shares in per cent
Source National Accounts Statistics (various years)

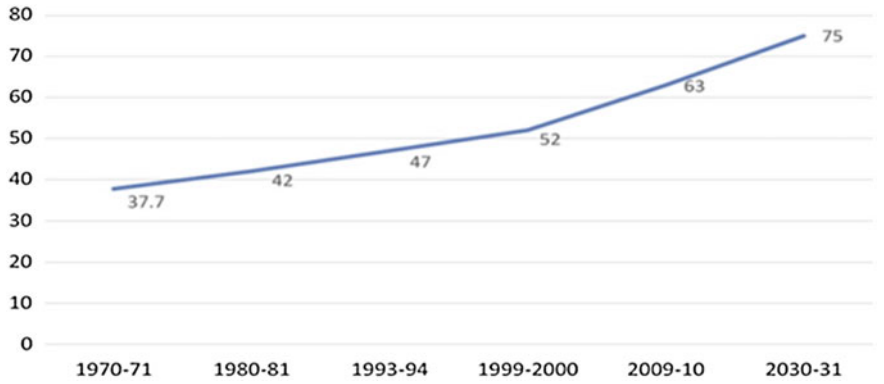

Fig. 1.7 Urban share of GDP in India, 1970–71 to 2030–31. *Source* Government of India [60]

Table 1.5 Three economic growth scenarios for India, 2014–2034

Scenario 1	Scenario 2	Scenario 3
Pushing old ways faster outlines a focus on investment in education, health, and other dimensions related to human capital. Our analysis suggests that in this scenario, India's GDP could see a 6.6 % compound annual growth rate (CAGR) between now and 2034	*Turbocharging investment* outlines the impact of rapid and significant investment in physical infrastructure and envisions a 7 trillion for GDP leading up to 2034.	*The Winning Leap* includes investment in both human and physical capital (as in the previous two scenarios), but also focuses on investment in R&D and innovation and envisions a 9.0 % CAGR for GDP between now and 2034. This scenario forecasts the most aggressive growth and is the only scenario that will generate the 240 million new jobs that India's growing population needs over the next 20 years

Source PwC [59, p. 15]

1.3.4 Urbanization and Urban Economy at Sub-National Level in India

As India is a large country with a big population, it is more meaningful to look at the state and, if possible, at urban agglomeration level. Unfortunately, economic data are not computed for urban agglomerations, but only up to the administrative unit of district, which has little relationship with urban agglomeration boundary. In India, there is wide variation in the level of urbanization of the various states and union territories, as shown in Fig. 1.9. It can be seen that Kerala, Tamil Nadu, Maharashtra, and Gujarat located in the south and west are highly urbanized states along with Manipur in the east. Adjacent to these regions are Karnataka and

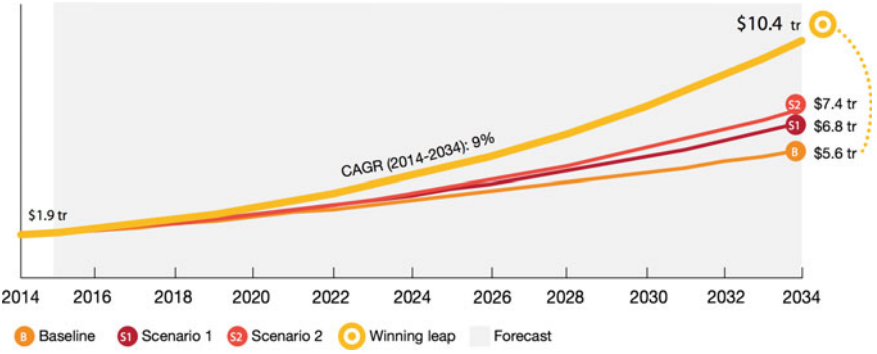

Fig. 1.8 Three economic growth scenarios for India, 2014–2034. *Source* PwC [59, p. 15]

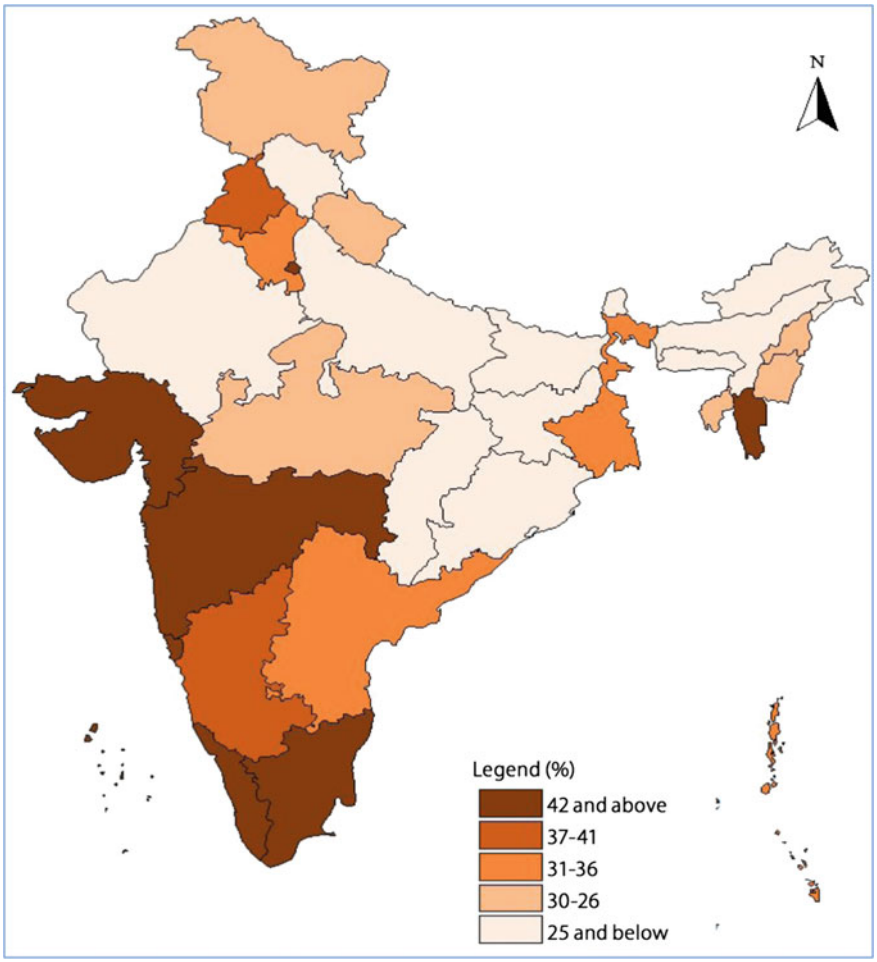

Fig. 1.9 Level of urbanization in India, 2011. *Source* Bhagat [61, p. 11]

(old) Andhra Pradesh with slightly lower proportion of urban population. Other states follow random distribution in the level of urbanization.

1.3.4.1 State Economy and Urbanization Level

State contribution to national domestic product and per capita income is plotted in Fig. 1.10. The graph plots the states into high-performing state, laggard state, and others. It can be seen that Delhi has highest per capita income and there are many states above mean per capita income. Maharashtra is the biggest contributor of GDP. Other southern states, such as Kerala, Karnataka, Gujarat, Tamil Nadu, and Andhra Pradesh, are above the average per capita income. States are again graphed based on state highway density and contribution of national domestic product (Fig. 1.11).

It can be seen that high-performing states feature more national and state highways per square kms of their land area. Now all these states are mapped based on economic performance indicated by the share of state income to national income as below (Fig. 1.12).

If this map is compared with the map of urbanization, it can be seen that there is correlation between the two. This clearly states that the share of National Income is highly correlated with urban percentage of the state. The more urbanized a state, the higher the likelihood of its percentage share to increase in National Income.

The theory of smart city economic development is not known today. However, it is observed that the dynamics of smart city GDP creation take a 'different path' which needs empirical study, hypothesis testing, and mathematical modelling to understand the urban dynamics of smart city economic development. A research

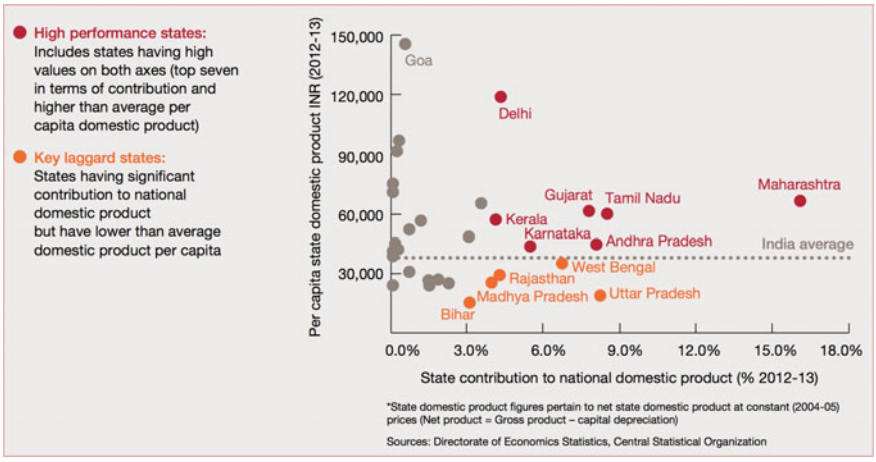

Fig. 1.10 State contribution to national domestic product and per capita income in India, 2012–13. *Source* PwC [59, p. 23]

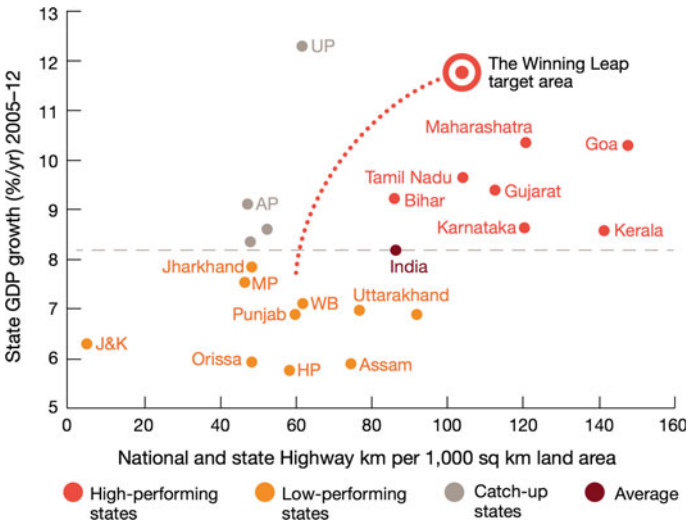

Fig. 1.11 Correlation between highway connectivity and growth. *Source* PwC [59, p. 59]

report by Bank of Boston in 1997 sent shockwaves when it noted that innovative, knowledge-based companies created by the Massachusetts Institute of Technology (MIT) alumni would collectively rank as the 24th largest world economy because the US $232 billion in world sales was (then) 'roughly equal to a GDP of $116 billion, which is a little less than the GDP of South Africa and more than the GDP of Thailand' [62]. More recently, another study noted that Stanford University alumni headquartered an estimated 18,000 firms in California State alone, 'generating annual worldwide sales of about $1.27 trillion and employing more than 3 million people' [63]. Therefore, it is important to do empirical quantitative research on some of the emerging smart cities.

1.3.5 Smart Cities Mission of India

The Government of India launched its Smart Cities Mission with focus on 'sustainable and inclusive development' in order to 'create a replicable model which will act like a light house to other aspiring cities' [64, p. 5]. Under the Mission, the core infrastructure elements of a smart city would include: (i) adequate water supply, (ii) assured electricity supply, (iii) sanitation, including solid waste management, (iv) efficient urban mobility and public transport, (v) affordable housing, especially for the poor, (vi) robust IT connectivity and digitalization, (vii) good governance, especially e-governance and citizen participation, (viii) sustainable environment, (ix) safety and security of citizens, particularly women, children, and the elderly, and (x) health and education. The mission has indicated an illustrative

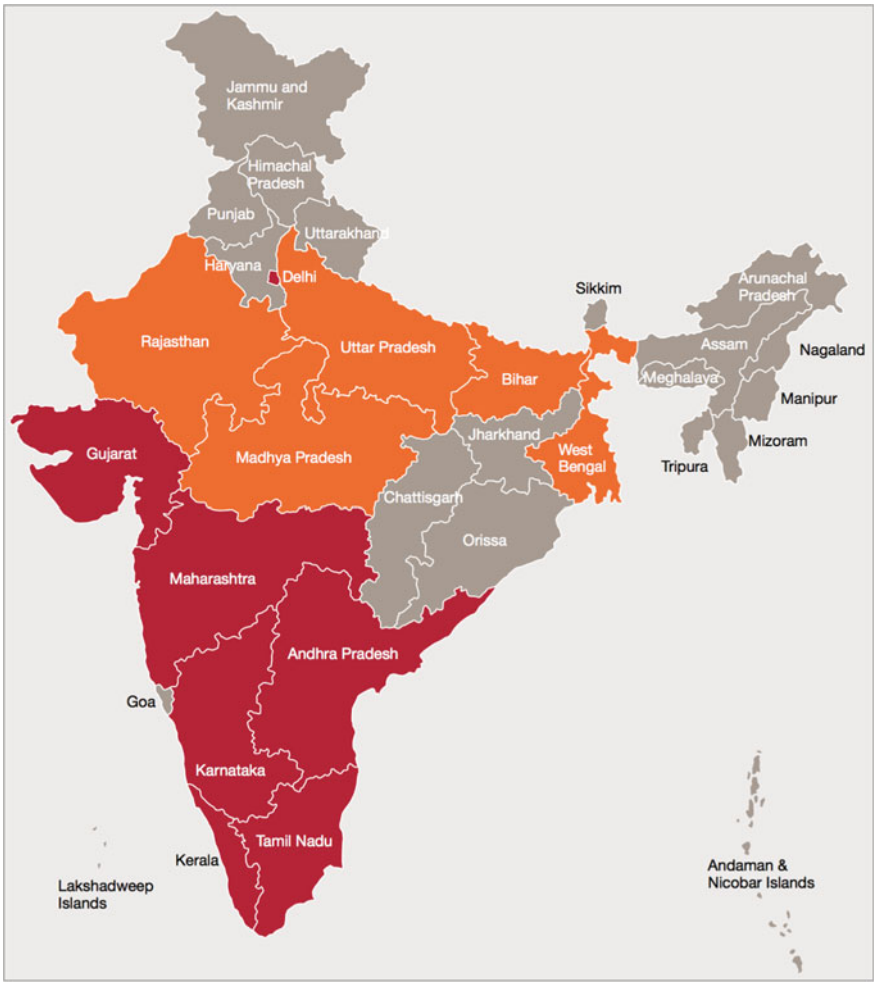

Fig. 1.12 State-level performance in income and disparity in India. Source: PwC [59, p. 15]

list of 'Smart Solutions' to be supported: (a) e-governance and citizen services, (b) waste management, (c) water management, (d) energy management, (e) urban mobility, and (d) others, such as telemedicine and tele-education, incubation/trade facilitation centres, and skill development centres. Further, the Smart Cities Mission focuses on four strategic components of 'area-based development' that are: (i) city improvement (retrofitting), (ii) city renewal (redevelopment), (iii) city extension (greenfield development), and (iv) pan-city initiative in which smart solutions will be applied covering larger parts of a city. With an initial endowment of Indian Rupees 3205 crores [65], the Smart Cities Mission is 'meant to set examples that

can be replicated both within and outside the smart city, catalysing the creation of similar smart cities in various regions and parts of the country' [64, p. 5].

1.4 Local Economic Development Models in the Twenty-First Century

1.4.1 Conventional Urban Economy

Like in cities of the twenty-first century, the conventional urban economy in the past was built on secondary and tertiary activities. But a careful look shows that the urban-based secondary and tertiary activities have been changing and evolving over time. The evolution of urban economy is briefly discussed under the two historical phases of pre-industrial age, and industrial age.

1.4.1.1 Pre-industrial Urban Economy

The pre-historic remains of Dholavira, Harappa, Lothal, and Mohenjo-daro cities of Indus Valley Civilization show the possibility of an open urban economy with outside trade connections along with the importance of citizens in the town as against king and priests in medieval times when walled cities came up for security reasons. In the medieval times, urban economy was contained within its the physical boundaries of a human settlement. Most of the manufacturing was undertaken by artisans and managed by their respective guilds wherever necessary. Artisanal manufacturing used local materials and resources and those from the immediate countryside. The planned medieval city of Shahjahanabad, which is part of Delhi now, had different quarters and even streets specializing in artisanal manufacturing and trade, some of which still thrive. Thus, cities and towns specialized in the production of unique goods and artefacts. However, geography played an important role in restricting the growth of manufacturing over a multi-centric urban system as it is today. In addition to the affairs of the state and religion, tertiary activities included trade and commerce. Apart from local barter and exchange, manufactured goods were traded within countries and abroad, such as silk and precious stones. Natural products, such as spices, were also traded across countries and continents. Cities and towns thrived on maritime trade routes such as Óc Eo in lower Mekong delta region (in modern-day Vietnam), Zanzibar (Tanzania), Kozhikode (also called Calicut in Kerala, India), and those along Silk Road such as Turfan (China) and Bukhara (Uzbekistan). Trading and commerce prospered as far as the limits of wind-powered ships allowed. Geography and technology had limits on trade and commerce too.

1.4.1.2 Industrial Urban Economy

The advent of industrial age revolutionized the way in which goods were manufactured and transported, giving rise to the so-called modern cities and industrial landscapes that we see today in most places. Steam-powered manufacturing produced cheap goods that could be transported over land by steam-powered trains. In the industrial age, economies of those cities developed which were located near sources of raw material, such as iron ore. Coal could now be transported over long distance using trains. All of this led to some unprecedented developments. First, industrial production led to urban demographic growth and the expansion of cities. Industries needed labour and people migrated from rural areas to work in cities and towns. Larger population base of cities resulted in increased demand for industrial products. This was the case of cities and towns in the industrial belts and regions that developed in Europe in the nineteenth century. Second, as central city areas became congested with growing population and increasing industrial pollution, a polycentric, nature-based, and people-friendly urban system was invented. Thus, the 'garden city movement' was born in 1898, with Ebenezer Howard's book *To-morrow: A Peaceful Path to Real Reform*, which was reissued in 1902 as *Garden Cities of To-morrow* [66]. In other words, this gave rise to the modern town and country planning (or urban and regional planning) that emphasized a polycentric urban system with focus on infrastructure development, satellite towns, locational specialization, green belts, and so on, as it is practiced now. Third, the international trade of industrially manufactured goods, aided by colonialism, destroyed the traditional artisanal manufacturing in the pre-industrial societies around the world. This led to the spread of industrial development as demand grew for modern manufactured goods, which went hand in hand with urbanization of rural societies in countries around the world, a process that is still ongoing. This has further added to the replication of industrial age economic and spatial planning in the so-called developing countries continued to the present day.

1.4.2 'Supply-Side' Approaches to Local Economic Development

The industrial age economic and spatial planning evolved to focus on economic specialization. The principle of *comparative advantage*, originally developed with regard to international trade, was brought into urban and regional development planning. The state was expected to support the process of local economic specialization, based on comparative advantage with regard to natural resources, labour, capital and infrastructure. This approach to local economic development is termed as 'supply-side approach' and focuses on building infrastructure and

industrial estates, keeping production and labour costs low, and attracting investment [67]. Drawing on the review framework used by Choe and Roberts [67], the following provides a brief overview of the 'supply-side' spatial planning approaches to fostering economic development of urban regions.

1.4.2.1 Spatial and Economic Planning

In order to promote urban and economic development, the use of national, regional, urban master, or strategic plans has become a common practice. While economic plans help in allocating and tracking funds for economic development, spatial plans support the process of land use and management. However, there is often little connection between spatial and economic plans. In Asia, for example, master planning has often failed due to the following reasons: 'Most plans are unrealistic or overly optimistic. They assume that the resources needed to implement the plans will be available; Planning is not backed by solid economic and financial analyses; Most master plans lack mechanisms for implementing projects for financing or through public-private partnerships (PPPs)' [67, p. 34].

Some cities use urban master planning, as their governments understand the relationship between planning and economics of development, such as Singapore and Hong Kong in Asia. They are able to enforce building byelaws and land use regulations through their well-organized planning and development systems.

1.4.2.2 Growth Poles

The 'Growth Pole' theory [68] considers that economic development is not uniform over a region, and it is concentrated around one or more centres or 'growth poles'. A growth pole may comprise of a major industry or a cluster of industrial units. Supported by spatially focused incentives, industrial development in growth poles would lead to the expansion of economic output and increase in employment, which may further attract more investments and trigger industrial diversification. It was argued that the development of such industrial centres might also result in the emergence of 'secondary growth poles' where secondary industrial sector and its linked industries may be located. Many countries used the growth pole theory to provide spatially focused incentives to stimulate or support industrial development in economically backward or lagging regions, for instance in India [69, 70]. In recent years, growth poles have been promoted in Kratie in the northeast Cambodia [71], Savannakhet in the south Lao PDR [72], and Chu Lai in Quang Nam Province of Vietnam. A common critique of growth poles is that they are not demand-oriented, but are supply-driven policy tools to correct regional economic imbalance.

1.4.2.3 New Satellite Towns

Satellite towns have become part and parcel of the urban and regional planning vocabulary. As part of the polycentric spatial strategy, they are proposed as part of urban and regional plans to deconcentrate central city areas, decentralize industrial and commercial activities, and create specialized economic zones. Pudong in Shanghai urban region, Noida in Delhi national capital region, and Cyber Jaya near Kuala Lumpur are some of the successful examples of new satellite towns in Asia. The key to their success is diversity of economic activities. However, when the economic base of satellite towns is a single, large industry, for instance automobile or steel manufacturing, they become vulnerable to economic cycles, such as the Asian financial crisis of 1997. Particularly vulnerable are those new towns that are focused on export-oriented growth industry.

1.4.2.4 Economic Enterprise Zones, Industrial Estates, and Business Parks

Thanks to globalization, export-oriented growth policies are important to promote urban economic development. Many central governments have built economic enterprise zones to attract foreign direct investment through reduced land costs, subsidized infrastructure, and tax rebates. Often called special economic zones (SEZs), they provide state-of-the-art infrastructure and services required to support a wide range of manufacturing-related enterprises. In Asia, SEZs have been built in China, India, the Philippines, Thailand, and Vietnam. Two sets of problems confront the development of economic enterprise zones. First, some of the SEZs were planned without much economic analysis. Built hurriedly, their development lacked proper implementation of construction standards or environmental and safety regulations. Some of them lacked important infrastructure, business support services, or even affordable housing [73, 74]. Second, some of the SEZs function simply as islands of factories. 'Companies in economic enterprise zones in Asian cities tend not to innovate, often because they are part of larger multinational companies that do the R&D [research and development] elsewhere. Neither do many companies seek to join clusters that could add value to their supply and distribution chains… They fail to see the benefits of sharing common services with competitors to bring down local transaction costs' [67, p. 37].

1.4.2.5 Technopoles

The idea of 'technopolis' or 'technopoles' goes back to 1958 when Tsukuba originated as a satellite Science City of Tokyo [75]. In 1994, Castells and Hall [76] argued that technopoles had become 'a key feature of national economic development worldwide'. They conducted a systematic survey of technopoles that are 'planned centres for the promotion for high-technology industry'. As 'mines and foundries of the Information Age', technopoles are built as science parks, science

cities, technobelt programmes, or national technopoles [Castells and Hall]. They are 'designed to promote interactions among high-tech firms, research centres, and often universities to create synergy that generates knowledge, innovation, products, firms, and thus regional growth and development' [77]. Technopoles have been developed worldwide, for instance in Brazil, China, Germany, India, Italy, Japan, Republic of Korea, Malaysia, the Netherlands, the UK, and the USA [75, 76, 78–81]. Many technopoles have succeeded, such as the famed Silicon Valley in the USA. However, several others have had limited success as: (i) they aimed at importing technologies instead of developing them locally; and (ii) with the goal of generating higher value-added and employment multipliers, they promoted manufacturing and processing industries as in growth poles [67, p. 39].

1.4.2.6 Provision of Infrastructure

The State of Asian Cities 2010/11 report noted that Asian cities will require close to US $10 trillion over 10 years in order to meet their requirements for physical and institutional infrastructure [3]. According to an estimate by the Asian Development Bank, annual infrastructure needs in the ASEAN (Association of South East Asian Nations) region between 2010 and 2020 are US $60 billion, not taking into account additional national projects with significant cross-border impacts such as airports, seaports, and roads to borders [2]. Neither are many governments able to make such investments in urban infrastructure nor do exist international banks able to lend such large amounts of capital. Private sector investment, especially in the form of PPPs, is expected to fill the infrastructure investment gap. However, it is easier said than done. For instance, during the 1990s, 219 projects were initiated at the World Bank to provide urban water supply with private capital flows of US $37 billion. Between 2001 and 2010, while the number of new projects at the World Bank climbed to 533, the private capital flows to urban water sector declined to US $25 billion [82]. In Asia, these are some of the reasons that have resulted in the establishment of the Asian Infrastructure Investment Bank.

This brief overview shows that the 'supply-side' spatial planning approaches to fostering economic development of urban regions focus on comparative advantage of cities and regions to unlock which they emphasize urban master planning and the development of growth poles, new satellite towns, economic enterprise zones, industrial estates, business parks, and technopoles to be supported by extensive infrastructure development. Some of these approaches support public policies for balanced development across regions, while others aim to trigger and sustain export-led growth. In all these approaches, the policy intervention with regard to investments, technological progress, and physical development are *external* to the urban and regional locations. Many of these approaches focus on economically exploiting the *comparative advantage* with regard to land, labour, infrastructure, natural resources, or geographical connectivity. The conceptualization of smart economy in smart cities will take into account the lessons learnt from the implementation of 'supply-side' spatial planning approaches to fostering economic development of urban regions (Sect. 1.5).

1.4.3 'Demand-Side' Approaches to Local Economic Development

There are a number of strategies and approaches to and factors behind what is called 'demand-driven economic development'. These strategies and approaches include endogenous growth approach; industry attraction approach; science and technology, and innovation policy; and growth triangles [67]. The factors behind demand-driven economic development include: knowledge-based economies, catalysts for collaboration, strategic infrastructure, living standards, and good governance as the foundation of enabling business environments [67]. While all these strategies and factors are relevant, the two most relevant to smart economy in smart cities are discussed here.

Endogenous Growth Approach. Developed during the 1980s, the 'endogenous growth theory' argues that economic growth is governed by internal factors within a national economy [83]. This theory came in response to criticism from the neoclassical growth model that considers technological progress as 'exogenous' to economic progress. The endogenous growth theory argues 'the enhancement of a nation's human capital will lead to economic growth by means of the development of new forms of technology and efficient and effective means of production' [84], which is relevant to (the conceptualization of) smart economy. This approach emphasizes the role of innovation and, therefore, is also called 'endogenous innovation growth theory' [85].

Knowledge-based Economies. In the Information Age, the importance of knowledge in economic growth cannot be overemphasized. What is more significant is the way in which knowledge is generated, shared, and utilized for local economic development. The key to the success of knowledge-based economies is knowledge networks and learning communities. For regional knowledge development, the mass participation of employees is considered important for which cities and sub-national regions must develop a learning infrastructure [86]. Knowledge itself has been classified into two: *tacit knowledge* that people gain from experience and collegial learning, which is carried in people's minds, and *explicit knowledge* that can be documented and shared using print and/or audio-visual media. 'Cities and urban regions that have high explicit and tacit knowledge tend to lead in ICT and innovation' [67, p. 47].

1.4.4 Theory of National Competitive Advantage

Michael Porter's theory of 'national competitive advantage' [87] is of direct relevance to the conceptualization of smart economy in smart cities. The competitiveness of local firms and industries directly contributes to economic vitality. Thus, a nation's competitiveness is based on local conditions, but these are not simply related to factors of comparative advantage, such as availability of natural resources or low costs of land and labour. According to Porter, the four-pointed *diamond model of competitiveness* is characterized by as many broad determinants of the

competitive environment for business: (i) *factor conditions*: skilled labour, resources, technology, and infrastructure; (ii) *demand conditions*: local and overseas demand for products and services; (iii) *related supporting industries*: suppliers and distributors in support of the industry sectors or clusters; and (iv) *firm strategy, structure, and rivalry*: conditions that govern how companies are created, organized, and management, and the nature of domestic rivalry. As part of a system, these four elements shape the competitive elements of the strategy that helps to gain competitive advantage:

> These determinants individually, and as a system, create the context in which a nation's firms are born and compete: the availability of resources and skills necessary for competitive advantage in an industry; the information that shapes where opportunities are perceived and the directions in which resources and skills are deployed; the goals of the owners, managers and employees that are involved in and carry out competition; and most importantly the pressures on firms to invest and innovate. The determinants in the 'diamond' and interaction amongst them create the forces that shape the likelihood, direction and speed of improvement and innovation by a nation's firms in an industry [87, p. 321].

In addition, two other factors in the 'diamond model' affect competitive advantage. First is 'government' that formulates and implements public policies. For example, in the development of ICT Cluster in Bangalore, government granted tax exemptions for five years to export-oriented software firms. Second is 'chance'—unforeseen or unanticipated opportunities, such as a sudden and favourable change in international currency exchange rates.

1.4.5 Principles of Competitiveness in New Urban Economies

Asia has become the engine of economic growth in the world. To support the cities-led economic growth process, the Asian Development Bank detailed out its urban development agenda, which is broadly divided into three areas of focus: competitiveness, environmental sustainability, and inclusiveness [88]. Choe and Roberts [67] have outlined the Asian Development Bank's 'competitive cities' agenda along with three rich case studies. In this major work, they discuss the three principles of competitiveness in new urban economies as follows.

A Long-term, Strategic Vision for Urban Economic Development is the first principle. To sustain development of the local economy, an economic vision should be agreeable to the civil society, inspire collective effort by those involved, and build and strengthen confidence to outcompete the rivals. Such collective understanding can go a long way in energizing cities and their economic clusters to achieve their development goals. Identification and agreement on local economic development goals, and how they should be achieved will guide government policy, business strategies, investment, and development decisions.

Endogenous Growth and Industry Cluster Development. In order to engender endogenous economic growth, governments need to promote innovation. This in

Table 1.6 Elements of competitiveness: comparative, competitive, and collaborative advantage

Comparative Advantage	Competitive Advantage	Collaborative Advantage
Land costs	Research and development	Networks
Infrastructure	Technology	Industry clusters
Taxation	Regulation	Strategic alliances
Labour costs	Labour productivity	Public–private partnerships
Proximity to raw materials	Skills base	Intermodalities
Transport	Core competencies	Trust and empowerment
Cost of capital	Quality of life	Open governance
Location of markets	Social capital	Smart systems
Economies of scale	Economies of scope	

Source Choe and Roberts [67, p. 6]

turn requires public policies aimed at clustering competitive industrial units that will create rivalry and therefore stimulate innovation. Putting together intellectual (research and innovation), human and physical capital in industry clusters will catalyse localized form of *competitive advantage* (Table 1.6). In this process, attention needs to be paid to labour productivity, skills base, and core competencies. Efforts must be made to strengthen social capital across local communities and sustain a good quality of life for all. Thus, clusters can contribute to the expansion of 'economies of scope' and, in turn, to endogenous growth.

Collaboration and Partnerships for Local Economic Development. Globalization and global competition has changed the ways in which local economic development takes place. Governments are increasingly realizing that *comparative advantage* has limitations when it comes to inviting foreign direct investments. Similarly, private companies face the fact that *competitive advantage* is not always enough when it comes to developing successful a business. 'Former rivals are seeking to collaborate through alliances, partnerships, and other forms of cooperation to win and expand their business. The new theory of *collaborative advantage* has thus emerged' [67, p. 7; emphasis original]. The elements of collaborative advantage include business networks, industry clusters, local government associations, and public–private partnerships. It is argued that greater collaboration among governments, businesses, and local communities will result in 'more competitive business and enabling environments, and hence more sustainable economic growth'.

1.5 Smart Cities, Smart Economy—Contours of Current Thinking

1.5.1 Towards Smart Cities

There is no unanimous definition on smart city or smart economy. The interrelationship of smart economy with smart city is also difficult to decipher. It is not clear whether a city is smart because of its smart economy or smart city is the reason

behind the workings of a smart economy. It is also unclear from literature surveys how spatial system of a smart city can be designed in such a way that a smart economy may start functioning.

The first view of city is that it is an *urban* area that presents itself as a homogeneous entity with a territorial boundary. This homogenous 'urban' character of a human settlement defines it as a *city*. For example, Census of India defines a city with certain minimal set of characteristics. On the one hand, all human settlements that satisfy the following criteria are considered census towns: (i) they have a minimum population of 5000; (ii) at least 75 % of the male main workers are engaged in non-agricultural pursuits; and (iii) a population density of at least 400 per km^2. On the other hand, an urban agglomeration is a continuous urban spread constituting a town and its adjoining outgrowths (OGs), or two or more physically contiguous towns together with or without outgrowths of such towns. An 'outgrowth' is a viable unit, such as a village or a hamlet or an enumeration block made up of such village or hamlet that is clearly identifiable in terms of its boundary and location.

A second view of city is an area with a definite administrative boundary, such as a Town Committee, Cantonment, Municipal Corporation, Municipality or Metropolitan Area defined by government on its discretion. Sometimes election statistics combine areas to a municipality so that it becomes a winning area for a (ruling) political party. This is to illustrate that such administrative areas are often subjective, and not based on rigorous spatial analysis.

The third view of city is that of a functional system or urban region that is based on and supported by connectivity and linkages among its constituent parts. For example, the daily interaction, movement of goods and people, telecommunication flows, and transportation connectivity combine to create a functionally connected region. When such a spatial system has urban characteristics, it may be termed as a metropolitan region. It may or may not be an urban agglomeration. This visualization of a city, if elaborated logically, can lead us to smart cities.

The above narrative leads us to visualize a smart city. Here a city is a digitally interconnected system where sensors of different kinds exist for different purposes and goals. They can be electronic devices with definite function to perform in an urban system or even human beings with biological, sociocultural, ecological, and economic goals. These sensors have unlimited capacity to establish functional linkages with outside world for social, cultural, environmental, and economic purposes that may create necessary conditions to enable the flow of communication, goods and services, and monies. ICTs enable sensors to be intelligent, which can be part of a control system—such as 'Supervisory Control and Data Acquisition' (SCADA), and that can be used for desired functions. Installing such sensors all over the city makes for an open big data of immense capacity and regulation by governance, which strives for common good of all people against petty, individual goals.

Compared to their rural counterparts, cities and towns boast better IT infrastructure and higher usage of ICTs and smart digital devices. Thus, cities generate vast amounts of data related to people, economy, infrastructure, culture,

environment, urban living, and decision-making. When such data are collected and recorded in an information system, such as geographical information system, it becomes available for decision-making in real time to resolve urban issues using city analytics; the primary user of the total smart city information is SCADA, a computer system for gathering and analysing real-time data [48]. SCADA is conventionally used for management of infrastructure, such as energy, oil and gas refining, nuclear reactors, telecommunications, transportation, and water and wastewater management. In terms of IT, when the use of SCADA is expanded to support the functioning of small or large urban systems, it gives rise to the notion of 'smart cities'.

In order to develop a better appreciation of and conduct research on smart economy in smart cities, we need to understand what a smart city is, to which we now turn.

1.5.2 Definition of Smart Cities

A literature survey shows there is no unanimous definition of smart cities. As the various scholars and practitioners view and understand them differently, there are several definitions of smart cities, which are listed below.

(1) The use of smart computing technologies to make the critical infrastructure components and service of a city—which include city administration, education, health care, public safety, real estate, transportation, and utilities—more intelligent, interconnected, and efficient [89].
(2) A city well performing in a forward-looking way in economy, people governance, mobility, environment, and living built on the smart combination of endowments and activities of self-decisive, independent, and aware citizens [90].
(3) A city striving to make itself smarter, more efficient, sustainable, equitable, and liveable [91].
(4) A city that monitors and integrates conditions of all of its critical infrastructure including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens [21].
(5) An instrumented, interconnected, and intelligent city instrumentation enables the capture and integration of live real-world data through the use of sensors, kiosks, meters, personal devices, the Web, appliances, camera, smartphones, implanted medical devices, and other similar data acquisition system including social networks as networks of human sensors interconnected means the integration of those data into an enterprise computing platform and the communication of such information among the various city services intelligent refers to inclusion of complex analytics, modelling, optimization,

and visualization in the operational business processes to make better operational decision [92].

(6) A city that gives inspiration, shares culture, knowledge, and life, a city that motivates, its inhabitant to create and flourish in their own lives [93].
(7) A city where ICTs strengthen the freedom of speech and the accessibility to public information and services [94].
(8) A city that monitors and integrates conditions of its entire critical infrastructure [92].
(9) A city connecting the physical infrastructure, the IT infrastructure and social infrastructure, and the business infrastructure to leverage the collective intelligence of the city [95].
(10) A city combining ICT and web 2.0 technologies with other organizational design and planning efforts to dematerialize and speed up bureaucratic process and help identify new innovative solutions to city management complexity, in order to improve sustainability and liveability [96].
(11) Smart cities are 'systems of people interacting with and using flows of energy, materials, services, and financing to catalyse sustainable economic development, resilience, and high quality of life; these flows and interactions become smart through making strategic use of information and communication infrastructure and services in a process of transparent urban planning and management that is responsive to the social and economic needs of society' [97].
(12) In the book "Geographic Information System for Smart Cities" [43], authors defined smart city as a 'knowledge based city that develops extra ordinary capabilities to be self-aware, how it functions 24 h and 7 days a week and communicate, selectively, in real time knowledge to citizen end users for satisfactory way of life with easy public delivery of services, comfortable mobility, conserve energy, environment and other natural resources, and create energetic face to face communities and a vibrant urban economy even at a time there is National economic downturns'.

This international collaborative research programme uses the definition of smart cities given by Vinod Kumar et al. [43].

1.5.3 Smart Economy—A Survey of Definitions

Smart economy, an essential building block a Smart City System (as noted above), has been defined in many ways. A review of literature reveals diverse definitions of smart economy.

(1) Smart economy involves the knowledge economy, where innovation and technologies are considered as the most important driving force [96].

(2) Smart economy involves the establishment of innovation clusters and mutual cooperation between enterprises, research institutions, and the citizens in order to develop, implement, and promote innovation through these networks [98].
(3) Smart economy combines the enterprise economy and innovation or the 'Ideas' economy. Smart economy is characterized through the use of human capital—knowledge, skills, and creativity, transforming ideas into valuable processes, products, and services. Smart economy also focuses on the creation of the 'green economy' by developing 'green companies' (promoting the employment of renewable energy sources, increasing the energy efficiency, based on its needs and reduction of costs) [34].
(4) Smart economy is an ability to employ the existing resources for the development and implementation of innovative solutions [99].
(5) Smart economy is a networking economy, developing new cooperation models in production, distribution, and consumption [100].
(6) Smart economy is the economy that is flexible and able to compete globally [openness], generating high added value, based on knowledge, innovations entrepreneurship [creativity] and social responsibility, and 'green' growth [responsibility] [101].
(7) Smart economy includes a favourable environment for economic growth and a high value-added-oriented integral economy [101].
(8) The economy of a smart city distinguishes the ability to overcome economic challenges, create new jobs, establish new businesses, and increase regional attractiveness and competitiveness [102].
(9) Urban efficiency is identified with the city's intelligence, as an effectively operating city attracts and maintains a skilled work force, new businesses, students, tourists, and residents [103].
(10) Smart economy is competitive in the spheres of innovation, entrepreneurship, intellectual property, efficiency, and the labour market flexibility and integrates in global markets [104].
(11) Smart economy is a green economy; it encourages reduction of the amount of carbon dioxide in industry and suggests investing in the 'clean economy' [105].
(12) Smart economy is related to economic competitiveness and involves innovation, entrepreneurship, economic image, efficiency and the labour market flexibility, integration in local and international markets as well as the ability to transform [106].
(13) Smart business (economy) includes the employment of information technologies and telecommunications in the companies' activities, new smart business processes, and a smart technology sector. Smart business is characterized by business growth, job creation, improvement of the staff's qualification, and efficiency gains [107].
(14) A city is smart when 'investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance' [108].

(15) Smart economy involves the economy, which is characterized by businesses-leaders, creating a favourable business environment in the city in order to attract new and retain the existing businesses. An important role in the long-term urban growth is played by high-technology and creative industries and a 'soft' infrastructure (knowledge networks, voluntary organizations, free of crime environment, after dark entertainment economy) [109].

1.5.4 Smart Cities and Internet of Things

As more and more devices are connected to the Internet, they expand IoT that is already bursting at the seams. According to a report released in April 2016 by DIGITALEUROPE, which represents the digital technology industry in Europe [110], the linking of physical and digital worlds is supporting a 'new digital revolution':

> The billions of connected things around us are helping drive a new digital revolution. Nearly 5 billion connected things today, reaching 25 billion by 2020, open the doors to entire new ways of living, thinking and operating. This revolution is transforming every part of society, every sector in industry and the entire government apparatus. Interactions in the value chain of a business, interactions amongst citizens, interactions between the government and citizens and interactions between businesses and citizens are changing forever. The IoT has arrived… [111].

The emergence of IoT and its continuing expansion is highly relevant for cities in general and smart cities in particular for four key reasons. First, the linking of physical and digital worlds starts in cities which, given their technological advancement and infrastructural development, are places where the digitalization of devices and gadgets precedes that in other, rural or remote areas, especially in the developing countries. Second, the expansion of IoT in urban settings enables the creation of smart cities that are able to communicate in real time with themselves and the rest of the world on a 24 h/day and 7 days/week basis. The creation of 'super IoT infrastructure', to use Rifkin's term, is taking place as the digitalized communication Internet converges with a digitalized, renewable 'Energy Internet' and a digitalized, automated 'Transportation and Logistics Internet' [21] is, therefore, highly relevant for smart economy in smart cities. Third, the emergence of IoT provides unprecedented opportunities to city governments to develop their infrastructure management systems in order to improve service delivery. Fourth, the continuing development of digital applications (apps) that are able to build and harness networks, which had not existed before, has opened up possibilities of new areas of urban economic expansion or smart economy in smart cities, for instance sharing economy.

1.5.5 Smart Cities and Sharing Economy

Within the digitally networked society of today, 'sharing economy' has emerged as a new economic or business model [112], which goes hand in hand with smart cities. 'Cities are already natural "sharing economies"—the space constraints and population density of urban living favors consumption that involves access to shared resources over asset ownership', noted Sundararajan [113]. This 'natural' feature of cities is important for the development of sharing economy in smart cities. As for smart cities, there is no firm definition of sharing economy. A couple of formulations, however, give insight into the nature of sharing economy:

> Sharing economies allow individuals and groups to make money from underused assets. In this way, physical assets are shared as services [114].

> The sharing economy can be defined as the (economic) model in which demand and supply are immediately in contact through an online platform, in order for the supply side to directly provide services and/or products with an underlying aim to improve the use of assets and to reduce transaction costs [25].

Two distinct sharing economy models are in operation: (i) *asset hubs* where 'a single company owns the goods or assets and sells access to users on a temporary basis' (by hour or day), and (ii) *peer-to-peer networks* where 'various would-be suppliers are connected with various would-be users' using an online platform [25]. While asset hubs evolve from traditional business models, peer-to-peer networks constitute new business models. These new and emerging business models provide useful perspectives and examples to promote and develop smart economy in smart cities.

1.5.6 Emerging Features of Smart Economy

The above survey of definitions and relevant developments reveals a set of key words that are essential to smart economy in smart cities. Accordingly, a smart economy can be said to have these emerging characteristics: competitiveness; knowledge-based economy; creativity and innovation; establishment of innovation clusters; innovation through networks; IoT; sharing economy; mutual cooperation between enterprises, research institutions, and citizens; entrepreneurship; job creation; social responsibility; green economy; Triple Helix Model in which governments, businesses, and academia have changing roles; and the use of ICTs.

1.6 Smart Economy in Smart Cities—Towards a Conceptual Framework

In developing the conceptual framework on smart economy in smart cities, our work builds on the review of the following: (i) building blocks of Smart City System (Sect. 1.2); (ii) economic role of cities (Sect. 1.3); (iii) conventional urban economy; (iv) 'supply-side' approaches to local economic development; (v) 'demand-side' approaches local economic development; (vi) theory of national competitive advantage; (vii) principles of competitiveness in new urban economies (Sect. 1.4); (viii) emerging definitions and features of smart cities and smart economy (Sect. 1.5); and (ix) our reflections on these, along with our past and ongoing work on smart cities and sustainable urban development. Before going into the conceptual framework, let us first look at the nature of smart economy.

1.6.1 Nature of Smart Economy

Smart economy is characterized by the use of ICTs in all economic activities. The ten goals as well as characteristics of smart economy in smart city are:

(1) Smart economy aims for and shows high ability to transform the Smart City with the efficient utilization of ICTs in every aspect of its economic activities. Therefore, smart city with smart economy has a clear long-term economic vision, which is agreeable to civil society, public and private sectors, and other relevant stakeholders.
(2) Smart economy builds on and cultivates a knowledge-based economy through the active sharing of tacit and explicit knowledge for economic benefit of all people.
(3) Innovative spirit that finds newer approach to economic activities. Innovation is stimulated through competition, collaboration, and clustering of economic units and activities.
(4) Entrepreneurship is generated out of individual effort (independent of family wealth and inheritance) and is nurtured through positive business climate, capacity building, institutional strengthening, and openness to unforeseen opportunities.
(5) Smart city economy acts as a force that creates international economic embeddedness in order to benefit from the process of economic globalization.
(6) Smart economy has the ability to create economic imaging, branding, and trademark.
(7) Smart economy features high productivity of land, labour, and capital.
(8) Flexibility of labour market that includes acceptance of labour from outside city, states, and nations that are devoid of conflicts.
(9) A good quality of life for all is essential for the growth of smart economy. This implies effective provision and management of urban infrastructure,

Table 1.7 User mode of access to Internet in India, (%) by year

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Work	34	38	40	29	32	14	10F	8F	6F
Home	30	26	23	37	32	24	19F	16F	14F
Cybercafe						19	13F	9F	7F
Mobiles	36	36	37	34	27	43	58F	67F	73F
Total	100	100	100	100	100	100	100	100	100

Source India Brand Equity Foundation [115]; also see Deutsche Bank Markets Research [116]
Note F—forecast

services, and amenities, and efficient management of urban environment, natural resources, and urban liveability.

(10) Appreciation, conservation, and promotion of local culture and heritage is central to smart economy, which celebrates it, manages it efficiently, facilitates the creative evolution in local art, culture, and heritage, and links it to the development and promotion of sustainable tourism.

A prerequisite for smart economy in smart cities is universal access to high-speed Internet. Smart city inhabitants tend to use Internet for all walks of life whether it is shopping, recreation, education, or participatory democratic governance. For instance, user mode access to Internet in India during 2007–2015 is given above (Table 1.7). The user mode in India has been changing over time from desktop Internet to mobile smartphone Internet, and also from work places to home. This will change the current window-shopping practice to Web browsing practice to select the particular brand of goods and services and purchase it strictly based on lower price at home delivery of high-quality products. Many of them may not be available in local market. The user mode data given in Table 1.7 are for entire India, but smart cities may show higher percentage of mobile users and home users than overall national average. This has great significance in E-Commerce (Sect. 1.6.2.2).

1.6.2 Conceptualization of Smart Economy in Smart Cities

We have made an attempt to conceptualize smart economy in smart cities in this international project at four urban spatio-economic levels: (i) smart economy of agglomeration and innovation, (ii) smart economy in commerce, (iii) smart economy in transportation and logistics, and (iv) smart economy in services.

1.6.2.1 Smart Economies of Agglomeration and Innovation

Due to economic factors, through historical reasons, or due to purposeful design and planning, economic units tend to agglomerate. This may take place in central

city areas—as in the case of specialized traders of Shahjahanabad in Delhi, on city's outskirts in industrial parks, or SEZs. Traditionally, agglomeration has often taken place of similar economic units, whether they are micro-, small, and medium enterprises, and agro-products industry (food processing of dairy or horticultural products). This has resulted in positive externalities of transportation, labour market access, and supply and distribution chains. Under the smart economy in smart cities, agglomeration is promoted to stimulate innovation in product design through competition, which may develop market for new products, expand supply chains for the latter, and in turn, develop (higher) local competitive advantage. The economies of agglomeration and innovation in cities have been well documented in case of ICTs, such as Silicon Valley [76] and Bangalore ICT clusters [117]. However, there is much to learn when it comes to smart economy sectors of micro-, small, and medium enterprises, agro-industry (dairy and horticulture), smart food sheds, and the like. smart economy sectors suitable for agglomeration and innovation may include:

(1) *Concept of Smart Food Sheds and Smart Economy in Urban Agriculture, Animal Husbandry and Horticulture*: Smart Food Shed is an old concept wherein urban open green spaces are utilized for garden food production for fresh food supply in smart cities. Such fresh food production uses ICT-enabled Smart Agriculture, such as GIS-enabled soil details and periodic testing of every square metre of land connected to fertilizer requirement and minimization of water use for highest productivity possible using computer models.
(2) *Smart Economy in Industries*: Smart economy in industries uses communication infrastructure in all aspects of industrial design and production. Industrial units focusing on and manufacturing specific products agglomerate to build and make use of collaborative advantage. They make use of networks and industry clusters, build strategic alliances and PPPs, and promote trust and empowerment. Open governance and smart systems support smart economy in industries. Further, smart transportation of raw materials for production and speedy transportation of finished products is achieved using smart and intelligent goods mobility.

1.6.2.2 Smart Economy in Commerce

Smart cities will likely feature a high penetration of e-commerce activities. E-commerce include three categories of economic activities: (i) online shopping or business to consumer e-commerce, where private consumers purchase products that they receive through postal mail or courier; (ii) transactions between companies or business to business e-commerce, such as that between manufacturers and wholesalers or between wholesalers and retailers; and (iii) transactions between individual sellers and individual consumers, for instance those supported by eBay [118].

In today's economy, an increasing number of commercial transactions take place through the use of Internet. E-commerce statistics for a few selected economies as

Table 1.8 E-commerce statistics in selected economies, 2013

	India	USA	China	Australia	Brazil	Sri Lanka	Pakistan
Internet users (millions)	137	245	538	20	79	3.2	29
Penetration (%)	11	78	40	89	40	15	15
Online buyers (million)	25	156	270	11	27	2	NA
Online buyers as % of internet users	18	64	50	55	34	63	NA
Consumer e-commerce	13	224	210	30	19	2	4

Source Internet World Statistics

Table 1.9 Internet users who made a purchase via mobile phone in Asia–Pacific region, Q4 2015

Country/region	Internet users who made a purchase via mobile phone (%)
Republic of Korea	43
China	34
Hong Kong, China	33
Thailand	31
Malaysia	31
Singapore	30
Vietnam	23
Indonesia	20
Australia	19
Philippines	18
India	17
Japan	13

Source Statista [120]

of 2013 are given in Table 1.8. In India, the retail e-commerce sales have grown over sixfold, from US $2.31 billion in 2012 to US $14 billion in 2015 [119]. In Asian–Pacific countries for which data are available, in the fourth quarter of 2015, the share of Internet users that made a purchase via mobile phone ranged between a high of 43 % in Republic of Korea and a low of 13 % in Japan [120]; see Table 1.9. There are various issues connected with e-commerce and its infrastructure development in India [121], including those related to constraints of Internet. McKinsey [122] found the following obstacles related to low levels of Internet user adoption and engagement in India: (i) limited availability of Internet infrastructure, (ii) high cost of access and usage, (iii) lack of awareness and low digital literacy, and (iv) narrow range of applications and services.

Despite many problems in e-commerce in India, in the year 2014, Flipkart attracted US $1 billion and Amazon India infused US $2 billion in their business with no new government policy in place to encourage such investment in e-commerce. This US

$3 billion is used to further develop the infrastructure, such as large warehouses, big data processing, innovative delivery system and efficient logistics. There can be even e-commerce sellers located internationally who provide goods and services to buyers in India and vice versa, if red tape is removed. The buyer can browse all brands which may not be locally available in secondary (tier-2) cities and order it. It has also been shown that there is considerable growth of women buyers in India ordering garments, cosmetics, and other branded accessories. Handholding by government in terms of favourable policy regime is not required for smart enterprises in a smart city, but what they do not require is red tape and corruption perpetuated by politicians, administrators, and their organized middlemen for rent-seeking.

1.6.2.3 Smart Economy and Energy

Smart economy of energy builds on smart energy grids, energy management, and automated systems, and the development of a digitalized, renewable 'Energy Internet'. *Geographical Information System for Smart Cities* [123] has discussed the following technological solutions that can be utilized for building smart economy of energy. *Smart energy grids* include sensors and instrumentation to improve distribution network efficiency and, in conjunction with smart metering, help match energy demand and supply. *Building energy management systems* where residents can automate the energy-consuming systems in buildings, and building sensors and controls allow for better use of buildings or prediction of faults. *Smart energy metering* where automated meter reading enables utility companies and occupants to access information digitally. *Outdoor lighting smart controls*, such as dimming and other controls, support greater energy efficiency. Other technologies that support smart economy of energy include power quality monitoring and energy quality monitoring.

The development of a digitalized, renewable 'Energy Internet' holds a key to the development of smart economy of energy. 'The great economic revolutions in history occur when new energy regimes emerge and new communication revolutions emerge to organize them', argues Rifkin [124]. This is already happening in Europe where the technology of communication Internet is being used to transform its electricity transmission grid into 'Energy Internet'. Further, the development of a digitalized, renewable 'Energy Internet' will be comprised of five foundational pillars, according to Rifkin [125]: (i) Refurbishing and retrofitting of buildings and other infrastructures to make them more energy efficient as well as the installation of renewable energy technologies to harness solar, wind, and other energy. (ii) Setting of ambitious targets to replace fossil fuels and nuclear power with renewable energy sources. (iii) Embedding of storage technologies, including hydrogen fuel cells, batteries, water pumping, 'at local generation sites and across the electricity grid to manage both the flow of intermittent green electricity and the stabilization of peak and base loads'. (iv) Installation of advanced meters and other digital technologies in every building 'to transform the electricity grid from servo-mechanical to digital connectivity in order to manage multiple sources of

energy flowing to the grid from local generators'. (v) Equipping of very parking space 'with a charging station to allow electric and fuel cell vehicles to secure power from the Energy Internet, as well as sell power back to the electricity grid'. Further, Rifkin contends that:

> The phase-in and the integration of the above five pillars transforms the electricity grid from a centralized to a distributed electricity system, and from fossil fuel and nuclear generation to renewable energy. In the new system, every business, neighborhood and homeowner becomes the producer of electricity, sharing his or her surplus with others on a smart Energy Internet that is beginning to stretch across national and continental landmasses [125].

Smart cities lend themselves as the ideal places where 'Energy Internet' can be developed along with the development of smart economy of energy.

1.6.2.4 Smart Economy in Transportation and Logistics

Smart economy in transportation and logistics arises out of designing smart city-specific Smart Mobility for the movement of people, and industrial and commercial goods. The development of digitalized, automated 'Transportation and Logistics Internet' [21] becomes important in the context of smart economy in smart cities. Such designed and managed Smart Mobility logistical network, within smart cities and beyond, has the ability to expand service areas of goods and services, which can give rise to more income and, therefore, more employment for smart entrepreneurs. For example, perishable cooked food items of high international demand—like Malabar food from south India, can be transported to dining rooms in Dubai or Singapore directly through smart mobility and smart logistics in a Smart City System using ICTs. Thus, the logistics industry for smart mobility has high potential to grow under smart economy in smart cities.

Geographical Information System for Smart Cities has discussed in detail how smart people movement and smart goods movement can be executed [123] in the following ways: (i) *Smart transport cards* link multiple forms of transport and make it more convenient for travellers to use, and for transport authorities to understand mobility patterns; (ii) *Car clubs* help users to hire or share vehicles easily and will prevent purchase of new cars; (iii) *Cycle hire/share programmes* help users to hire bicycles for mobility and can thus prevent avoidable car trips and related CO2 emissions; (iv) *Electric buses and trains* that are more efficient and ideally run on renewable power; (v) *Electric vehicles* that can become mobile energy storage units and help to balance peak demand; (vi) *Real-time transport information* that supports and facilitates mobile applications for journey planning; (vii) *Real-time transport displays* provide visibility to users and encourage uptake of public transportation; and (viii) *Real-time information for logistics* supports telematics and communications with drivers to optimize transportation routes.

1.6.2.5 From Sharing Economy in Smart Cities to 'Sharing Cities'

Sharing economy opens up a new dimension for local economic development in cities and city regions. As for smart cities, the generation and evolution of sharing economy is contingent upon digital connectivity. On the one hand, the pace of expansion of digital connectivity in a city will determine how fast it can create conditions for the generation and evolution of sharing economies. On the other hand, 'by creating a favourable environment for the rise and spread of sharing economy businesses, a city may better and faster achieve the objectives and features that characterize it as being smart' [25]. In the Information Age, this underlines that for cities to become smart cities, and in turn to support sharing economies, they ought to invest in Internet and other digital infrastructure, expand connectivity (which may require lowering the cost of access and usage), improve awareness of and expand digital literacy (especially in developing countries and for low-income groups), and provide support to expand the range of applications and services.

Based on the developments in recent years, four models of sharing economy can be understood as the following:

1. '*Individuals offering services through their own assets*: individuals increase the use of their assets by providing short-term services to other individuals, as is the case when offering a room on AirBnB, or a ride on BlaBlaCar.
2. *Private companies offering "micro" services*: in this case, private firms offer the possibility to use (rent) for short periods some of the assets that are owned by the company. Examples are the different car-sharing services, such as Car2Go.
3. *Peer-to-peer marketplaces*: platforms that give companies or individuals the opportunity to sell goods to other companies or individuals. This model can have different variations, for example, in the case of Ebay, we mainly find items produced by a fourth party, while, in the case of Etsy, the supply side is also the producer.
4. *Peer-to-peer labour services*: through these platforms, potential workers can offer their workforce for a specific task, as is the case for Taskrabbit, but the same could probably be said even for Uber drivers' [25, emphasis original].

The above survey of the various models of sharing economy indicates two areas that need attention. First, the sharing economy models are primarily based in developed countries, although some—for instance, Uber taxi—are expanding their business in emerging economies, such as China, India, and South Africa. This underlines the vast scope for the generation and expansion of sharing economy in smart cities of developing world. Second, cities in developing countries, especially those that aspire—and are on the way—to become smart cities, provide ample opportunities for the generation of localized sharing economy.

Having elaborated these ideas, it must be acknowledged that not all is well with sharing economies. Certain models of sharing economy lend themselves to 'run-away capitalism' at the cost of impoverishing (low-income) workers [126]. Instead of supporting 'a global race to the bottom to attract footloose capital', leaders of

smart cities 'need to support and emphasize communal models of sharing that build solidarity and spread trust. Sharing systems designed around equity and justice will naturally shift cultural values and norms towards trust and collaboration' [127; also see 128].

1.6.2.6 Smart Economy in Services

There are number of examples of Smart Economy in Services. The broadband Internet services and video conferencing facility available in smart cities can generate smart economy in services, such as medical service. A smart city, with a state-of-the-art medical facility having superior capacity, can diagnose remotely a disease through telemedicine and save lives. It can decentralize diagnosis and initial treatment in distant cities and human settlements through ICTs and telemedicine. With regard to education services, smart cities can provide tele-education within city regions and beyond; in turn, this can also lead to reduction of transportation trips made within and from outside the city as well as to prevention of CO2 emissions from such trips. Other services that can involve smart economy include solid waste recycling and management, smart parking, business incubation and trade facilitation centres, and skill development centres.

1.6.3 Smart Economy and Smart City Structure

The most important question that is generated by smart city economy is how to plan and design at multilevel, urban structure and land use composition appropriate for smart city economy. Is there a need for change in existing approach? Unfortunately, there is not much of thinking generated so far on this topic internationally. The urban structure has many levels, the metropolitan urban agglomeration, the city, the zonal plan, and the urban design level. It is obvious that existing structure is not desirable since the ways in which economic activities are conducted have changed, as indicated in the previous para. The best way is to study this phenomenon in an existing smart city and find out how these changes can be accommodated.

1.6.3.1 Smart City Economy and ICT

To start with, let us investigate this relationship. Smart economy is characterized by the use of ICT in all economic activities. A smart city can be distinguished from other cities on one dominant and unique factor, namely presence and growth of ICTs in six systems of smart cities that we discussed earlier. They are measurable in terms of smart city ICT indicators, which are listed below.

(1) The number of ICT specialists used in theses six systems.
(2) The number of all electronic devices such as sensors connected to Internet in these six smart city-building blocks.
(3) The number of personal computers connected to the Internet.
(4) The number of Internet users.
(5) The share of number of enterprises with Internet connection in all enterprises active.
(6) Investment in hardware.
(7) Investment and expenses for information technology products and services.
(8) Investments and expenditures of communication for products and services.
(9) Share of enterprises that have their own website in total company assets.
(10) Share of enterprises that buy–sell business online in total assets.
(11) Share of teleworking/telecommuting employees in total employees.

All six building blocks that constitute a Smart City System shall be using ICTs in a significant manner or showing higher percentage growth. All sectors of smart city economy contribute, and the presence of ICTs therein is an indication that the city is getting transformed to smart city economy. It is therefore important to understand the use of ICTs in the various sectors of smart city economy. For an initial list of ICT indicators for various sectors, see Appendix 1.

1.6.3.2 Hypothetical Examples of Smart Economy

In the absence of empirical studies on changing urban structure and land use of smart cities, we may look at some hypothetical examples to suggest what changes can be expected in the city structure and land use where there is smart economy operating.

To appreciate such changes, the existing urban structure needs to be understood first. Planners divide cities into several districts. Based on specialized endowment of activities in the district, there may be differing characteristics. He/she then restructures individual zones to districts and sub-districts. Higher-level facilities and services with occasional use pattern are provided in the district centres. In the sub-district or neighbourhood level, planners provide essential services and facilities for local daily needs. There can also be highest-level centres, sometime more than one in a city higher than district centres. Then required land uses are provided and zoned. The provision of these related land uses is made on the basis of income and expenditure pattern of the population in the district and sub-district, and the amount of money that can flow into these activities in these centres. This analysis gives sufficient basis for computing land use distribution based on sustainable floor area turnover per month. Spatial standards prepared by government helps in land use computation. Some governments accept mixed land use, but some others do not but marginally agree to mixed land use of certain kind. These centres sustain, lag, or perish depending upon availability of access and essential provision of required services. However, these urban structures get destroyed or replaced as soon as

major infrastructure investment such as a metro rail system comes into being. Then the area surrounding metro-stations becomes appropriate district or neighbourhood centres. Smart mobility in these centres increases the land value and generates high urban pressure to locate all mix of appropriate land use and generate needs for higher density appropriate to higher land value. If metro-station passes through a district centre, it augments its development, but if it is not, then it adversely affects its future development, so also with neighbourhood centres.

This also changes when smart economy starts operating in the city. We consider all activities, which generate wealth and employment as smart economy, and it can be based on as many land use types as possible. For the hypothetical example, we take two examples. First is that of retail trade in a neighbourhood centre, and second relates to e-commerce. There are three preconditions for smart city economy. They are integrated six building blocks of Smart City System (discussed in Sect. 1.2), ten smart economy goals (Sect. 1.6.1), and high usage of ICTs in any economic activity (Sect. 1.6.3.1).

Example 1: Neighbourhood Retail Store

The retail store in this example supplies grocery to households in the neighbourhood. The owner feels that she wants to expand her economic operation beyond this neighbourhood. Now she has a website where anyone in this town can order groceries using a special template in Excel sheet she has made in the website, and deposit money using secure payment gateway. Once money is received in her bank, she delivers what is ordered by using her bicycle. She still wants to increase her business and joins as seller in E-Commerce portals such as Amazon India, E-Bay, and Flipkart. She also tries to market some traditionally cooked items, heritage value goods, and local handicrafts through this portfolio. She often receives orders from abroad or foreign tourists for such items, and she is able to sell it abroad through eBay. Here the retail trader has shown her innovative spirit, entrepreneurship, and is creating a local image with heritage goods. She achieves high productivity by having her portal open 24 h and 7 days a week and also received international attention from foreign customers.

In this case, what has happened is that our neighbourhood retailer has transformed a local economic activity with limited service area to an international commercial activity. Smart mobility helps her to move her activity within and outside city with little loss of time. Smart governance does not regulate (i.e. harass with red tape just for rent-seeking since all her transactions are made through the website) her much to sell her merchandize abroad. The service area designated by planners for her activities has changed, and the space requirement for her activities has also changed. She reduces her work by allowing her products to be stored in Amazon warehouses that are very large and well managed, located in strategic cities in India based on logistical network that reduces delivery time, and Amazon supplies all logistics to supply her goods within and outside India for an additional reasonable fee. She also makes use of similar infrastructure of local warehouse by sharing with someone else that has his/her own storage space in the city. She longs to move to a shop near to metro-station so that her mobility increases and her

delivery time of retail goods minimizes. Neighbourhood concept in local retail seems to have vanished long ago at the advent of smart cities and smart economy, which will increasingly be the case also for the structuring of cities by planners. Face-to-face use of neighbourhood social space is replaced by virtual goal-oriented communities in ICT space. Her requirement for shop area is reducing as she innovates using other warehouses controlled by computers, and so also her rent and capital requirement for retail trade establishing the value of smart people. Her profit margin increases as she attempts to be more innovative and realizes her strength lies in local branding and heritage value addition to her business.

Example 2: E-Commerce in India

Nowadays, the main goal for e-commerce in India is to reduce the time of delivery after electronic payment is made, which ranges from one day (or few hours) to seven working days. Sellers send their stock to E-Commerce providers, such as Amazon warehouses, which provide support for packing and delivery using couriers, which is monitored by sellers and buyers. With more capital infusion in their business, Amazon India is now in the process of acquiring land and developing a system of large capacity automated warehouses in more accessible locations across India to stock seller's products and that is delivered to buyers eventually within 24 h or even less, say 4–8 h. They are also increasing the list of cities where same-day (within few hours) delivery order is possible, thereby replicating the role of neighbourhood shopkeepers by providing home delivery neighbourhood service nationally. They are attempting to shrink nation to neighbourhood. Amazon and Google are collaborating with drone manufacturers to use it as another way of delivering sellers' items in E-Commerce directly to households. Amazon is also using local *Kirana*-shop (grocery store) with excess capacity to use it for e-commerce delivery points to pick up goods sold. While such services are easy to execute in mega-cities, it is difficult in secondary (tier-2) cities. It is the secondary cities that show rapid rise in buyers' population for Amazon and eBay. Amazon and others are now using various approaches for speedy delivery of goods. They include high-technology solution of airdrop using unmanned drones in USA to using local *Kirana*-shops in India to stock and deliver goods home locally. The main goal of e-commerce in India is to deliver goods in few hours after ordering in the same day across India. It is important to find out how much percentage of household expenditure is used for E-Commerce in a smart city, and what are the requirements of E-Commerce infrastructure, for example large warehouses and their likely location as changes affect the land use computations of planners.

Locational decision and logistics of smart city population may change the land use requirement of a smart city. There may be need for less retail space in the neighbourhood, but more nearmost accessible areas, such as around metro-stations. Local *Kirana*-shops can be part of e-commerce without even attached to Amazon, eBay, or Flipkart. They can have a website, and advertise and sell their products. Smart mobility in smart city helps them to send their products to anyone wherever they are located. This phenomenon changes the traditional concept of retail trade service area and turnover per square metres computation of commercial area. All

commercial uses when zoned are mixed-uses with varying proportion of recreational component for all age groups. More research is required on such mixes and urban design appropriate to such mixes in smart cities.

It is important to identify at smart city level what changes of land use are required thereby to change the land use plan. It is also important to increase population density in areas around high-mobility nodes and hubs in a city, such as mono- or metro rail stations through urban design for urban compaction, and evolve high-density and high-quality urban living. The benchmark population density suggested in Smart City Mission of India is 175 persons per hectare. This will be in contrast to older-generation planners who recreated low-density village life in urban settings, which was against the principle of land economics and land use succession. Some Indian cities have low urban population density, which needs to be increased further for economic use of infrastructure and providing high mobility to all. Public realm assumes greater importance in smart cities with more disposable household income for recreation of all age groups. It is important to reinvent into public realm and use high-quality urban design to be of use to smart city population. Mixed land use is accepted in India now, as in many other countries. It is important to play with various levels of mix land uses in high-mobility hubs and nodes of smart cities. There is scope for urban redevelopment and renewal in these nodes keeping the characteristics of heritage.

1.6.4 Smart City and Institutional Processes

Smart City Economic Development has taken place in different countries under differing institutional frameworks. It is important to have comparative study of such institutional set-up and enrich and reform the existing institutional frameworks (for example, MPC in India) that plan, develop, and manage smart cities. Triple Helix Model is evolving in many smart cities. Is it possible to transform existing institutional set-up with Triple Helix Model?

The collective and symbiotic leadership of three actors in Triple Helix Model is of prime importance for metropolitan regional development. The 74th constitutional amendment legislation of India had given constitutional status for Metropolitan Planning Committee (MPC) for metropolitan cities or agglomerations of one million plus population. Without Triple Helix Model built into it, many state governments have difficulty in understanding its true worth (for the composition and functions of MPC, see Appendix 2).

After many years of enacting the 74th Constitutional Amendment, only West Bengal and Maharashtra States have constituted the MPCs in Kolkata and Mumbai, respectively. Two other states—Andhra Pradesh and Gujarat—have enacted enabling legislation to constitute MPCs. Bengaluru in Karnataka State could enact MPC only in 2013. Other states having other metropolitan cities are yet to take any action in this regard. Kerala introduced MPC in its Planning Ordinance in 2013, but no cities have MPC as of today.

Generally as in Kolkata, the Chief Minister of West Bengal State is the Chairperson of the MPC. Prime Minister and/or Chief Minister are also involved in appointing Vice Chancellors of University, Directors of higher educational establishment and Public Research Institution and laboratories. Generally in metropolitan cities (population over 1 million), there should be higher education institutional cluster and industrial cluster. The first task is to institute the MPC, which should give leadership in implementing Triple Helix Model for accelerated economic development of the smart city or Smart Urban agglomeration. The MPC should have members drawn from the highest level of academia, industries and government, not necessarily from local institutions. In addition to Mayors and President of 'Panchayats' (rural local governments) and Municipalities, Academia and Industrialist shall be members of the MPC. There should be an implementing Agency for MPC. It should manage the data of the Metropolitan GIS Centre. Implementing Agencies should have Planning Wing with well-trained and experienced professionals, Engineering Wing capable of large-scale construction, and Finance wing capable of mobilizing large-scale funding for metropolitan development from India or abroad. Director or Vice Chancellor of University or Public Research Institution in an urban agglomeration can be a proven Industrialist to bridge the relationship between industry and university and make the triple helix evolve. Government can implement regional development policies and give special incentives to accelerate triple helix functioning for fast economic development. Industries shall be encouraged to undertake undergraduate technical education with the collaboration of universities. There is a recent attempt of Mercedes Benz Industries (Germany) to start School of Mechatronics in Trivandrum. Oracle Corporation is also setting up a training centre in a Village software start-up in Kerala to train college students around.

These are evidence of emerging Triple Helix Model working in Kerala. Government should also start training institutes similar to Kerala Institute of Local Administration or Institute in Management in Government. They can be enablers of Triple Helix Model at the state level in Kerala. The first step of smart city planning is to make city self-aware by encouraging students and research workers to collect ecological, economic, and cultural data to be fed into smart city GIS for making city self-aware continuously. Incentives and funds may be provided to universities, polytechnic, or schools to collect and update information and by the use of models if it is required by the MPC. The information generated by smart city GIS shall be used by all constituents of Triple Helix Model to frame their policies, plans, and strategies. Finally, it is the MPC that should prepare Policy and Strategy for smart city.

1.7 Smart Cities, Smart Economy, and Social Inclusion

Can smart cities and smart economy be socially inclusive? How to strategize social inclusion in smart city development, or how to make smart cities socially inclusive? What economic activities can be promoted for social inclusion in smart economy? These are some of the key questions that arise with regard to the role of people and

their (civil society) organizations in smart economy in smart cities. We will discuss these three important questions in the following subsections.

1.7.1 Smart People Are Central to Smart Cities

Can smart cities and smart economy be socially inclusive? Smart People are central to smart cities, as noted earlier (Sect. 1.2). They are the most prominent building block in the Smart City System. Without the active participation and involvement of smart people, a smart city will not be able to function. However, there are two factors that will determine if smart cities and smart economy will be socially inclusive: (i) Internet access, and (ii) affordability of (smart) digital devices.

Internet Access. The global access to Internet has been rising gradually (Fig. 1.13). In 2013, 2.69 billion people, or 38 % of world's population, had Internet access. According to an estimate, the global figure of Internet users will surpass three billion in 2015 and reach 42.4 % coverage [129; also see 130]. India already (2014) has 215.6 million Internet users, and this number is expected to grow to 346.3 million in 2018. It is important to note that Internet access is generally higher in cities than in rural areas though this is changing fast in developing

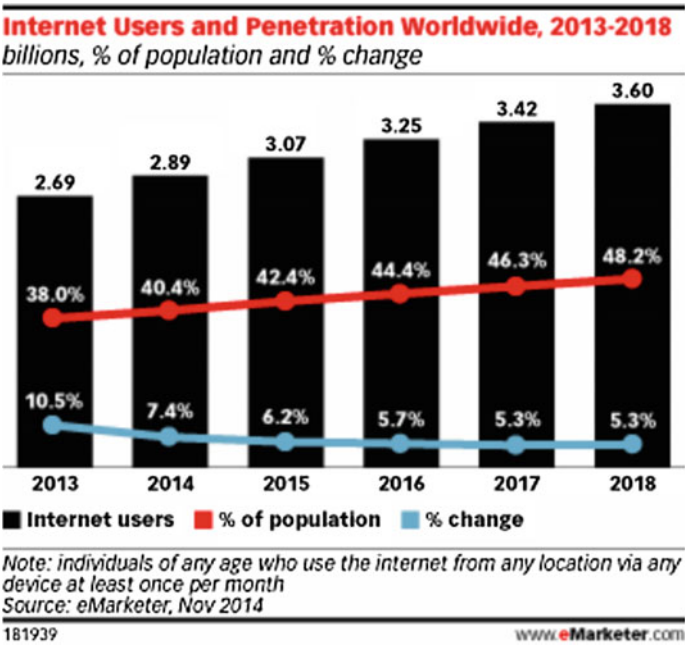

Fig. 1.13 Internet users and penetration worldwide, 2013–2018. *Source* [129]

countries. For instance, China plans to expand full broadband access to its rural and urban areas by 2020 [131].

Affordability of (Smart) Digital Devices. If user mode of access data is taken into account as proxy indicator, it shows that the proportion of people accessing Internet with mobile phones has been increasing in India (Table 1.7). The affordability of smart digital devices has also been increasing. However, one cannot deny the fact that a large number of people may not have access to (smart) digital devices and Internet for many years to come. In such cases, governments have to move forward and provide Internet access through the public availability of Internet hubs. This has been/is being successfully done in Kerala State of India, which is the only state in India (or perhaps the world) where 100 % e-literacy is achieved through training by an institution called Akshaya. Run mainly by private entrepreneurs, Akshaya provides Internet access to people at a walking distance. The spread of Akshaya is a testimony of its economic viability, and all e-governance functions of the Government of Kerala can be executed at a nominal fee [44, 132]. Therefore, Internet access and affordability of (smart) digital devices are critical for facilitating and promoting two-way interaction between the local government and people.

1.7.2 Strategies for Social Inclusion in Smart City Development

How to strategize social inclusion in smart city development, or how to make smart cities socially inclusive? There are three strategies that can facilitate social inclusion in smart city development, which are discussed as follows.

1.7.2.1 Strategic Vision for Smart City Development

For the collective preparation of a *Strategic Vision for Smart City Development*, governments can directly involve citizens through 'strategic planning' exercise and request their inputs through a dedicated two-way interactive website. To people who have personalized Internet access, they can directly provide their inputs. To people who do not have personalized Internet access, governments can provide open access through public sector Internet cafes/hubs that can be installed in local governments offices or other public buildings. Moreover, governments can complement Internet-based consultation with seminars and open meetings in public spaces in the city, especially for those with limited Internet access. Governments can also organize webinars, particularly to involve those who are not locally based and/or may be travelling at the time of such strategic consultations.

1.7.2.2 People's Participation in Smart City Planning

People's participation in urban planning is a well-researched subject. However, people's participation in Smart City Planning has gone beyond the statutory consultation required for preparing urban master plans. We feel that this will require paying attention to three specific aspects.

People-Driven Physical Development of Smart City. First, as cities become increasingly smart, governments will have to invite and receive people's concrete feedback on the ways in which the conventional city is changing. A case in point is the changes in land use that may occur with the growth of e-commerce, as discussed earlier (Sect. 1.6.3.2). This may hold true about changing travel patterns, evolving modal split in transportation, location of economic activities next to mono- or metro rail stations, reductions in household water usage in view of resource constraints, or improved recycling through efficient solid waste management.

ICT-facilitated Planning Consultations. Second, people's involvement in smart city Planning will increasingly become easier and simpler with the ever-expanding Internet access and affordability of (smart) digital devices. In addition to open consultative meetings and seminars, webinars and online consultations will become commonplace. This will add to transparency in Smart City Planning and better record keeping of consultations.

Increased Frequency in Planning Consultations and Decision-Making. Third, as one would expect, the increasing usage of ICTs and enhancing interface between governments and citizens will lead to an increasing frequency of people's participation in Smart City Planning and related decision-making. For instance, if interactive websites are properly designed, it would become possible to apply for and obtain planning permission online, as designed in the urban design studio exercise conducted at the National Institute of Technology, Calicut (cross-reference this with the Chapter on Calicut study once all chapters are numbered).

1.7.3 People-Driven Economic Development of Smart City

What economic activities can be promoted for social inclusion in smart economy? Given the central role Smart People will play in a Smart City System, perhaps this question should be rephrased as: What sort of people-driven economic development activities would contribute to smart economy? Although the idea of smart city holds the promise of an expanding role of people in smart economy, we would like to discuss two areas of people's proactive involvement and inputs can significantly expand economic activities. First is the development of economic clusters where micro-, small-, and medium-sized enterprises can come together, develop business blueprints and knowledge-based economy plans, and seek government support. Such initiatives can be based on conventional professional guilds and/or economic enterprises located in one or more contiguous neighbourhoods. The people-led design and implementation of such initiatives will build and/or strengthen *local*

collaborative advantage, and thus will add to competitiveness of smart economy. Second, people can take lead or work together with local governments to design and develop urban economic activities linked to culture and heritage conservation, preservation, and celebration (latter in the form of art and cultural festivals). Such economic activities would contribute to expansion of smart economy, develop city branding, provide employment, and preserve local culture and heritage. The design and development of such economic activities people can integrate the use of ICTs and smart digital devices and build on the purposefully designed websites.

1.8 Supporting Transition to Smart Economy in Smart Cities

Supporting the transition from conventional urban economy to smart economy in smart cities will require extraordinary changes in the urban management, governance, and decision-making. Such changes will become critical because they will be required as a result of the expanding interaction between governments, private sector, civil society organizations, and citizens. Therefore, it is important to discuss the various approaches to and stages of urban governance with regard to the transition of conventional urban economy to smart economy in smart cities.

1.8.1 Government-Led Conventional Urban Economy

The development of conventional urban economy relied on public sector-led planning, design, investment, implementation, and monitoring of development process. Primarily national governments, and in some cases their local-level offices, played a key role in economic and spatial (including master) planning; development of growth poles, new satellite towns, economic enterprise zones, industrial parks, business parks and technopoles; and infrastructure planning and development. Such an approach was considered important in the immediate aftermath of many African and Asian countries becoming independent from colonial powers. In many cases, the new and independent governments of the developing countries had inherited state-of-the-art know-how and technologies for managing cities and towns. The development models that were proposed during 1950s and 1960s emphasized significant roles of national governments. This began to change during 1970s and 1980s when it was realized that central governments were unable to deliver development outcomes and poverty was rising. Consequently, the demand for decentralization and local-level accountability became increasingly evident. Many countries enacted legislation during 1980s and 1990s to decentralize authority to sub-national and local governments [3]. Decentralization of authority and devolution of financial powers to local governments was to revolutionize the ways in

which towns, cities, and metropolitan areas were to be governed, with increased role to be provided for locally elected representatives as well as local communities. Decentralization did lead to democratization of local polity as elections were instituted at local level. However, the newly elected political leaders at the local level did not view community leaders in good light. As a result, in many cases a confrontational relationship developed between the representatives elected to local governments and the local leaders who were elected to and represented community-based organizations, for example Civic Exnoras in Chennai [133], and resident welfare associations in many cities of India. To address such issues, an effort was made in Delhi through a government and resident welfare association partnership programme called *Bhagidari* (literally, 'partnership') [134]. Despite decentralization drives in many countries, local development activities have remained under the overarching influence of national and sub-national governments, for instance in India where limited financial and taxation powers were given to local governments under the 74th Constitutional Amendment Act of 1992.

1.8.2 Public and Private Sector Cooperation

In early 1990s, international development organizations started to argue about improving efficiency in 'governance'. As governments were often found lacking in technical and financial capacity, cooperation between the public and private sectors was seen as a key to improving (urban) infrastructure and services. 'PPPs are a mechanism for government to procure and implement public infrastructure and/or services using the resources and expertise of the private sector. Where governments are facing ageing or lack of infrastructure and require more efficient services, a partnership with the private sector can help foster new solutions and bring finance" [135]. Advocates of PPPs argue that these partnerships utilize the skills and resources of both the public and private sectors and share risks and responsibilities. While the public sector focuses on policy, planning, and regulation by delegating day-to-day functions, the city benefits from the technical expertise of the private sector. Arguments against PPPs include increase in utility tariffs—for instance for water supply and wastewater management, displacement of public sector employees [82], and corruption [3].

Where the public and private sector cooperation seems to work better is in the development of SEZs, industrial estates, and science parks. Governments provide developed land with infrastructure and services, and the private sector makes investment in form of economic enterprises. SEZs have worked to trigger (and sustain) export-oriented growth when they properly equipped with infrastructure and have geographical connectivity. However, many SEZs and science parks have not aimed to focus on innovation and development local economic competitiveness. Instead, they have become an agglomeration of manufacturing units focused mainly on exports (Sect. 1.4). Apart from SEZs, industrial estates, and science parks, governments' main strategy to support local economic development relies on

building of infrastructure, and the individual economic enterprises are expected to take advantage of it.

1.8.3 Participatory Governance for Smart Economy in Smart Cities

Due to the ongoing development of ICTs and their ever-increasing use, human settlements of all sizes—whether they are towns, cities, metropolitan areas, or mega-cities, will evolve into smart cities. With the power of ICTs and smart digital devices in their hands as well as growing online financial transactions, people have already begun to expect much more from their governments, infrastructure and service providers, and commercial vendors. Contributors to 'E-governance for Smart Cities' [44] have discussed, supported by empirical case studies, how e-governance is contributing to the development of smart cities. The spread of electronic banking has facilitated online bill payments, including those to utility and service providers.

One of the next big stages, if not the very next big stage, will be the expansion of people's role in the development of smart economy in smart cities. This has already begun in the case of expanding e-commerce, for example in India, which is changing the way in which people shop on a daily basis (Sect. 1.6). Next, in terms of generators of demand for developed land, people are already contributing, though indirectly, to governance and decision-making, for example with regard to land use planning and development decisions around metro-stations. In the coming years, if not decades, this may evolve further where groups of economic enterprises may seek redevelopment of brown fields as land use succession takes place. Inner city old industrial areas may become clusters of clean ICT industries, thereby promoting local economic competitiveness for the development of smart economy in smart cities. An approach to revitalize inner city areas was supported by Porter [136] who argued that:

> A sustainable economic base can be created in the inner city, but only as it has been created elsewhere: through private, for-profit initiatives and investment based on economic self-interest and genuine competitive advantage—not through artificial inducements, charity, or government mandates.

Meeting the challenge of providing greater role to people in the development of smart economy will require: (i) putting together of people's ideas into workable proposals for local economic development (Sects. 1.7.2 and 1.7.3), (ii) openness of different levels of government and planning authorities to such proposals made by citizens and citizen groups (which may be registered as associations or companies), and (iii) ICT-facilitated interaction between governments and citizens to ensure ART in urban governance decision-making.

1.9 Sustainable Models of Smart Cities and Towards Smart Cities Standards

1.9.1 Sustainable Development of Communities—Indicators for City Services and Quality of Life (ISO 37120)

1.9.1.1 ISO 37120 and Its Benefits

In May 2014, the International Organization for Standardization (ISO) launched ISO 37120 on "*Sustainable development in communities—Indicators for city services and quality of life*" as part of an integrated suite of standards currently being formulated for sustainable community development. ISO 37120 'defines and establishes methodologies for a set of indicators to steer and measure the performance of city services and quality of life' [137]. This International Standard does not provide a value judgement, or numeric thresholds on what a particular city should choose as appropriate targets for the indicators. Rather it gives internationally standardized indicators, which are consistent, standardized, and comparable over time or cities. Indicators are qualitative, quantitative, or descriptive measures.

In this age of rapid urbanization, city indicators can be used as critical tools for city managers, politicians, researchers, business leaders, planners, designers, and other professionals to help ensure policies are put into practice that promote liveable, tolerant, inclusive, sustainable, resilient, economically attractive, and prosperous cities globally. Cities need indicators to measure their performance for improving quality of life and sustainability globally. Moreover, planning for future needs of the city must take into account current use and efficiency of resources in order to plan for tomorrow. Existing indicators are often not standardized, consistent, or comparable over time or across cities, thereby establishing importance of ISO 37120. Performance measurement of city services and quality of life over time can, in turn, help to strengthen smart governance and smart living. These indicators can also be utilized to measure city services and quality of life for sustainable development of smart cities with respect to impact of ICT deployment.

The launch of ISO 37120 is important because it is the first ISO standard that can be utilized to measure the performance of, plan for, and support decision-making for smart cities. The ISO 37120 standardized indictors are provided for 18 themes related to city services and quality of life: (i) economy, (ii) education, (iii) energy, (iv) environment, (v) finance, (vi) fire and emergency response, (vii) governance, (viii) health, (ix) recreation, (x) safety, (xi) shelter, (xii) solid waste, (xiii) telecommunication and innovation, (xiv) transportation, (xv) urban planning, (xvi) wastewater, (xvii) water and sanitation, and (xviii) reporting and record maintenance [138].

Benefits of Standardized Indicators. The International Standard ISO 37120 lists out 10 benefits of standardized city indicators for service delivery and quality of life [139].

(1) More effective governance and delivery of services
(2) International benchmarks and targets
(3) Local benchmarking and planning
(4) Informed decision-making for policy makers and city managers
(5) Learning across cities
(6) Leverage for funding and recognition in international entities
(7) Leverage for funding by cities with senior levels of government
(8) Framework for sustainability planning
(9) Transparency and open data for investment attractiveness
(10) Data are moving fast [through Internet leading to] big data and the information explosion. ISO can help to give cities a reliable foundation of globally standardized data that will assist cities in building core knowledge for city decision-making, and enable comparative insight and global benchmarking.

1.9.1.2 ISO 37120 and Smart Economy in Smart Cities

The International Standard ISO 37120 with regard to urban 'Economy' is given in its Sect. 1.5 that is directly related to smart economy in smart cities. There are two types of standardized indicators: (i) core indicators are those 'that are required to demonstrate performance in the delivery of city services and quality of life'. (ii) Supporting indicators are those 'that are recommended to demonstrate performance in the delivery of city services and quality of life' [138].

Core Indicators:

(1) *City's unemployment rate (core indicator)*: Unemployment rate always has been a key performance indicator as it is the single most important measure of a city's economic health and vitality. ISO 37120 calculates unemployment rate in a traditional manner and defines the unemployed as those seeking work in the past month, and excludes the discouraged, hidden, and long-term unemployed from the calculation. Employment exchange data may help here.
(2) *Assessed value of commercial and industrial properties as a percentage of total assessed value of all properties (core indicator)*: This indicator can help cities detect and quantify an eroding economic base. It is a very good indicator of dynamics of industrial and commercial development of a city. ISO 37120 focuses on commercial and industrial property values only.
(3) *Percentage of city population living in poverty (core indicator):* ISO 37120 defines persons in poverty as 'those unable to adequately provide water, food, shelter and basic needs for themselves over a 12-month period'. Children are particularly affected by poverty, which can lead to poor health, impaired educational attainment, homelessness, and chronic unemployment.

Supporting Indicators:

(4) *Percentage of persons in full-time employment (supporting indicator)*: This indicator is similar to the unemployment rate and reflects the economic health of a city as well as the impact of local economic policy. ISO 37120 focuses this indicator on city residents of legal working age who work 35 h or more per week.
(5) *Youth unemployment rate (supporting indicator)*: As important as the overall unemployment rate is, the youth unemployment rate can be an even better indicator of a city's economic and social stability. Young men and women in many countries around the world face increasing uncertainty about their economic future, which can translate into significant social unrest and upheaval. ISO 37120 defines unemployed youth as those persons above the legal age and under 24 years of age who are actively seeking employment.
(6) *Number of business per 100,000 populations (supporting indicator)*: This indicator measures the level of a city's economic activity and performance and can reflect a city's overall business climate and attitudes towards growth and entrepreneurship.
(7) *Number of new patents per 100,000 population per year (supporting indicator)*: Innovation is an essential element of a city's or region's continued economic prosperity. However, there are issues of using these indicators primarily because patents for multinational corporations are generally filed in that corporation's home city, and universities file it in the capital city, and so on. Maybe the number of patents used in the city *for* 100,000 populations per year is a good surrogate and not that is registered *in* a city.

These indicators can be used to track and monitor progress on city performance, in this case with regard to smart economy in smart cities.

1.9.2 Towards Measuring Progress of Smart Cities

India's Smart Cities Programme [60, 64] has generated copious discussion on what is the current state of cities in the country, and what will be the benchmarks and indicators to measure progress towards the development of 100 smart cities. One strand of this discussion relates to the potential pathways to reach a state of 'smart city' or to develop 'smart cities'. A related theme is how progress towards reaching the state of or developing a smart city can be measured. In this regard, it is pertinent to look at the 'Smart Cities Maturity Model' developed by the Sustainable Business Leadership Forum (SBLF) [140].

1.9.2.1 Maturity Model for Smart Cities

SBLF argues that the current paradigm of 'successful cities' targets on providing 'access' to infrastructure and services. This leaves 'a very limited focus and scope to drive resource optimization over the "whole system" of a city, particularly through the integrated use of physical infrastructure and ICT' [140, p. 7] in the following four areas:

- 'Changing behaviour of citizens when interacting with the physical environment
- Closing the loop on resource and energy flows within different parts of a city, as also its exchanges with other cities, peri-urban areas, and rural supply bases
- Creating negligible response times to variability events (biohazards, climate change, security, disasters, crime)
- Measuring, tracking, and embedding efficiencies in resource and energy consumption'.

What is then needed is a 'common lens on success' on the above four areas for which SBLF has developed a 'Smart Cities Maturity Model', as shown in Fig. 1.14. Through a 4-stage maturity model, the SCMM aims to establish the metrics that can be applied to a 'future city' to gauge preparedness on the above-mentioned four areas, viz. access, efficiency, behaviour, and systems focus. In the first stage of Smart Cities Maturity Model, 'urban resilience' takes form of access to basic urban services. The second stage involves efficient resource and energy use, which is actively measured and embedded in a future smart city. Third stage is reached when people interact with physical assets in various ways that unlock new pathway for achieving sustainability. The fourth stage of 'high urban resilience' is attained with 'systems focus' wherein close-loop and sustainable resource and energy exchanges are strengthened in a future smart city.

Maturity Model	**1**	**2**	**3**	**4**
	Basic Urban Services			**High Urban Resilience**
KPIs relate to…	**Access**	**Efficiency**	**Behaviour**	**Systems Focus**
What success looks like…	Urban infrastructure and technologies are available and urban services are being delivered	Efficient resource & energy use is actively measured and embedded in a future city	People interact with physical assets in ways which unlocks new pathways for sustainability	Close-loop & sustainable resource & energy exchanges are being strengthened within a city

Fig. 1.14 Smart Cities Maturity Model. *Source* [140, p. 7]. *Note KPI* key performance indicators

Table 1.10 Measuring smart city resilience in India

Maturity Model	1		2		3		4	
	LOW URBAN RESILIENCE						HIGH URBAN RESILIENCE	
	Access		Efficiency		Behaviour		Systems Focus	
	ISO	India	ISO	India	ISO	India	ISO	India
Transport	✓✓	✓✓	●	●	✓	●	●	●
Spatial Planning	✓✓	✓✓	●	●	●	●	●	●
Water Supply	✓✓	✓✓	✓	✓	●	●	●	●
Sewerage & Sanitation	✓✓	✓✓	●	●	NA	NA	●	●
Solid Waste	✓✓	✓✓	●	●	●	●	●	●
Storm Water Drainage	NA	NA	●	✓	NA	NA	NA	NA
Energy & Electricity	✓✓	✓✓	✓✓	✓	●	●	●	●
Telecom & WiFi	✓✓	✓✓	●	●	●	●	●	●
Economy, Finance, Education & Health (Grouped)	✓✓	✓	●	●	✓	✓	NA	NA
Environment	✓	●	●	●	●	●	●	●

Source [140, p. 9]

1.9.2.2 Measuring Smart City Resilience in India

In order to measure the current state of smart city resilience in India, SBLF applied the Smart Cities Maturity Model to the metrics under ISO 37120 on *Sustainable development in communities—Indicators for city services and quality of life* [137] and Government of India's *Smart City Concept Note Benchmarks* [55]. The result of this exercise is presented in Table 1.10.

The findings presented in Table 1.10 portray a realistic picture of the state of 'urban resilience' in India based on the application of the Smart City Maturity Model. SBLF notes four key findings as follows:

(1) 'Indian and International norms are on-par and in agreement on: (a) baseline performance expected for urban services in smart cities; and (b) the need to build and embed a focus on resource efficiency as we start to use smart city infrastructure.
(2) There is absence of KPIs [key performance indicators] to promote resource sustainability and urban resilience by creating a change in resource flows within the city or through the way citizens interact with the physical environments.
(3) The conversation on Efficiency is limited to energy and water only—there is a huge missed opportunity to recover materials and energy from sewerage, solid waste, and wastewater from urban ecosystems.
(4) There is a lack of a "systems" approach both within the National and the International standards framework to fostering urban resilience' [140, p. 9].

This exercise conducted by SBLF on Smart City Maturity Model with regard to measuring the current state of 'urban resilience' underlines that a lot of work needs to be done with regard to developing smart economy in smart cities of India.

Appendix 1

ICT Indicators for Economic Sectors

ICT use in government: Generally, Governance System is resistant to change unless great visionary politician rules the democratic institutions with absolute majority. This is very much exhibited by the fact there are many Administrative Reform Commissions, but only a fraction of recommendations are implemented in many countries. Progress of ICT use in government can be studied by the following indicators.

(1) Number of ICT specialists employed in government works.
(2) The number of electronic devices used in government.
(3) The number of personal computers connected to the Internet in government offices.
(4) The number of Internet users in government.
(5) The percentage of institutions with Internet connectivity in all institutions.
(6) The share of investments and expenditures for ICT products and services in total investment and expenditure.
(7) Investments and expenditures for ICT products.

Observation of the economic and financial indicators illustrates the increases/decreases in quantitative and qualitative indicators of the smart city economic development. It is important to watch how ICTs are used for the sale and purchase products online products and changing turnover due to online sales. Growth is indicated in India by Flipkart infusing US $1 billion and Amazon India infusing US $2 billion in e-commerce business in India in later half of 2014.

Educational Sector also contributes to smart city economy. Education sector includes both educational institutions in the public and private. The calculation of indicators of urban economy in educational sector will take into account of all three levels, namely primary, secondary, and tertiary. Further, there shall be provision for continuing education for smart city citizen. The indicators that measure the progress of smart city economy in education sector are the following.

(1) The number of PCs per 100 students.
(2) The number of PCs connected to the Internet per 100 pupils and students.
(3) The education institutions connected to the Internet in total number of educational institutions.
(4) The number of students using Internet.

ICT in Public Health Sector: The use of ICT in public health sector can result in growth of smart city economy. The number of persons employed per hospital bed is generally on a higher side than large and medium industries and certain capital-intensive small industries, and therefore, health sector contributes to smart city economy in a great deal. By implementing the health sector of new electronic communications services will achieve an increase in efficiency, with lower costs. Health sector growth of smart city economy can be measured in the following indicators.

(1) The number of ICT equipment used.
(2) The number of personal computers connected to the Internet.
(3) The number of medical institutions sharing Internet connection in all institutions.
(4) The share of investments and medical expenses for ICT products and services in total investment and expenditure.
(5) Investments and expenditures for ICT products used in health sector.

ICT in Household Sector: Analysis is also needed for the household sector and influences the degree of development of settlements. The indicators are:

(1) Share of households with fixed telephone and mobile.
(2) Share of households owning personal computers connected to the Internet in total households.
(3) Share of total household expenditure on communications.

ICT in SME Sector: Another important employment generator in smart city economy is SME sector. It is important to watch how ICT products are used there.

(1) Share of enterprises that have personal computers.
(2) Share of employees using personal computers.
(3) Share of enterprises with Internet access.
(4) Share of the number of employees using the Internet.
(5) Share of enterprises with website.
(6) Share of enterprises that sell via the Internet.
(7) Share of enterprises purchasing on the Internet.

Tourism and heritage (both cultural and natural resources) are another component of smart city economy which contributes to income growth. The related indicators are as follows:

(1) Share of cultural institutions holding personal computers.
(2) Share of employees using personal computers.
(3) Share of cultural institutions with Internet access.
(4) Share of employees using the Internet.
(5) Percentage of institutions of cultures with website.
(6) Share of cultural institutions that sell over the Internet.

Tourism sector generates large revenues, which make this sector a pillar of economic development in smart cities, and hence the implementation of new ICTs.

(1) The percentage of tourism that have personal computers.
(2) Share of employees using personal computers.
(3) Share of employees using the Internet.
(4) The percentage of tourism industrial units with website.
(5) The percentage of tourism that provides services via the Internet.

Similar ICT indicators can be developed for key economic sectors of smart cities.

Source: Authors

Appendix 2

Composition and Functions of Metropolitan Planning Committee (MPC) in India

Article 243ZE. Committee for Metropolitan Planning.

(1) There shall be constituted in every metropolitan area a MPC to prepare a draft development plan for the Metropolitan area as a whole.
(2) The Legislature of a State may, by law, make with respect to

   (a) The composition of the MPCs;
   (b) The manner in which the seats in such Committees shall be filled:

Provided that not less than two-thirds of the members of such Committee shall be elected by, and from among, the elected members of the Municipalities and Chairpersons of the Panchayats in the, Metropolitan area in proportion to the ratio between the population of the Municipalities and of the Panchayats in that area;

(a) The representation, in such Committees of the Government of India and the Government of the State and of such organization and institutions as may be deemed necessary for carrying out the functions assigned to such Committees;
(b) The functions relating to planning and coordination for the Metropolitan area, which may be assigned to such Committees;
(c) The manner in which the Chairpersons of such Committees shall be chosen.

(3) Every MPC shall, in preparing the draft development plan,

   (a) Have regarded to:

      (i) The plans prepared by the Municipalities and the Panchayats in the Metropolitan area;

(ii) Matters of common interest between the Municipalities and the Panchayats, including coordinated spatial planning of the area, sharing of water and other physical and natural resources, the integrated development of infrastructure, and environmental conservation;
(iii) The overall objectives and priorities set by the Government of India and the Government of the State;
(iv) The extent and nature of investments likely to be made in the Metropolitan area by agencies of the Government of India and of the Government of the State and other available resources whether financial or otherwise;

(b) Consult such institutions and organization as the Governor may, by order, specify.

(4) The Chairperson of every MPC shall forward the development plan, as recommended by such Committee, to the Government of the State.

Functions of MPCs are as follows:

As per 74th Constitution Amendment Act legislature of the State may, by Law, make provisions regarding functions relating to planning and coordination for the metropolitan area that may be assigned to MPC. Accordingly, it is suggested that the following functions may be assigned to MPCs:

(i) Preparation of Draft Development Plan for Metropolitan Area.
(ii) Coordination of plans prepared by the Municipalities and Panchayats in the metro area including coordinated spatial planning of the area.
(iii) Coordination and sorting out of common issues involving Panchayats and Municipalities in the metro area including sharing of water and other physical and natural resources.
(iv) Allocation of resources made available by the state and central government to local-level institutions.
(v) Phasing and prioritization of development works or works involving number of Panchayats or urban area.
(vi) Advice and assistance to local bodies in preparation of development plans.
(vii) Serving as a link to disseminate development objectives, policies, and priorities of Central and State Governments among various local bodies by formulating operational guidelines so that the same may be considered while preparing plans of the respective local bodies.
(viii) Resolution of conflicts and to avoid areas of overlap between different agencies operating in the metropolitan area.

References

1. Dahiya, B (2015) 'World Urban Realities', *Magazine for Architecture and Urban Planning – DaNS*, 19 February. Available at: http://www.dans.org.rs/index.php?option=com_content&task=view&id=660&Itemid=52 (accessed 21 May 2015)
2. Dahiya, B (2014) Southeast Asia and Sustainable Urbanization, *Global Asia*, Vol. 9, No. 3, pp. 84-91
3. UN-HABITAT (2010) *The State of Asian Cities 2010/11*, UN-HABITAT, Fukuoka
4. Dahiya, B (2012) Cities in Asia, 2012: Demographics, economics, poverty, environment and governance, *Cities*, Vol. 29, Supplement No. 2, pp. S44–S61
5. UN-HABITAT (2013) *State of the World's Cities 2012/2013: Prosperity of Cities*, Routledge, New York, and UN-HABITAT, Nairobi
6. Dahiya, B (2012) Asian cities in the 21st century, *East Asia Forum*, available at http://www.eastasiaforum.org/2012/06/26/asian-cities-in-the-21st-century/ (accessed 21 May 2015)
7. Dahiya, B (2012) 21st Century Asian Cities: Unique Transformation, Unprecedented Challenges, *Global Asia*, Vol. 7, No. 1, pp. 96-104
8. United Nations Population Fund (UNFPA) (2007) *State of the World Population 2007: Unleashing the Potential of Urban Growth*, New York
9. The World Watch Institute (2007) *The State of the World 2007: Our Urban Future*, W.W. Norton & Company, New York
10. The Economist (2007) 'The world goes to town'. Available at: http://www.economist.com/node/9070726 (accessed 21 May 2015)
11. United Nations, Department of Economic and Social Affairs, Population Division (2014). *World Urbanization Prospects: The 2014 Revision*, CD-ROM Edition
12. United Nations, Department of Economic and Social Affairs, Population Division (2014) *World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352).*
13. Brundtland GH, and World Commission on Environment and Development (1987) *Our Common Future: Report of the World Commission On Environment and Development*, Oxford University Press, Oxford
14. See: https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals
15. See: http://www.un.org/sustainabledevelopment/cities/
16. See: https://en.wikipedia.org/wiki/Web_search_engine
17. See: http://www.pcmag.com/encyclopedia/term/51537/smartphone
18. Castells, Manuel (1996) *The Information Age: Economy, Society, and Culture, Volume I: The Rise of the Network Society*, Blackwell, Oxford.
19. Castells, Manuel (1997) *The Information Age: Economy, Society, and Culture, Volume II: The Power of Identity*, Blackwell, Oxford.
20. Castells, Manuel (1998) *The Information Age: Economy, Society, and Culture, Volume III: End of Millennium*, Blackwell, Oxford.
21. Rifkin, J (2015) How the Third Industrial Revolution will create a Green Economy, *The World Post*, available at http://www.huffingtonpost.com/jeremy-rifkin/third-industrial-revolution-green-economy_b_8286142.html (accessed December 2015)
22. European Commission (2014) *Internet of Things the next revolution: A strategic reflection about a European approach to the Internet of Things*, CONNECT Advisory Forum, European Commission, Brussels.
23. Rifkin, J (2015) *The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism*, Palgrave Macmillan, New York.
24. The Economist (2013) All eyes on the sharing economy, *The Economist*, available at http://www.economist.com/node/21572914/ (accessed December 2015)
25. Gori, P, Parcu, PL and Stasi, ML (2015) *Smart Cities and Sharing Economy*, EUI Working Paper RSCAS 2015/96, Robert Schuman Centre for Advance Studies, Florence School of Regulation, European University Institute, San Domenico di Fiesole.

26. National Geographic special issue on Climate Change, available a: http://www.nationalgeographic.com/climate-change/special-issue/
27. Weldon, D (2015) Has the global economy slowed down? BBC, available at: http://www.bbc.com/news/explainers-31661078 (accessed December 2015)
28. Harrison C, Eckman B, Hamilton R, Hartswick P, Kalagnanam J, Paraszczak J, and Williams P (2010) Foundations for Smart Cities, *IBM Journal of Research and Development*, Vol. 54, No. 4.
29. See: http://unhabitat.org/habitat-iii/
30. See Habitat III Vision: http://unhabitat.org/wp-content/uploads/2014/07/UN-Habitat-Urban-Visions-No.3-Vision-for-Habitat-III-2013.pdf
31. Kanter, RM and Stanley SL (2009) Informed and Interconnected: A Manifesto for Smarter Cities, Harvard Business School Working Paper No. 09-141, Boston, MA
32. IBM Corporation (2009) A vision of smarter cities: How cities can lead the way into prosperous and sustainable future, IBM Corporation, Somers, NY (New York State)
33. The Climate Group, Arup, Accenture, and University of Nottingham (2011) Information Marketplaces: The New Economics of Cities, London
34. Schaffers H, Komninos N, Pallot M, Trousse B, Nilsson M, and Oliveira A (2011) Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation. In: Domingue J et al (Eds) Future Internet Assembly, LNCS 6556, pp. 431-446. http://dx.doi.org/10.1007/978-3-642-20898-0_31
35. Batty M, Axhausen KW, Giannotti F, Pozdnoukhov A, Bazzani A, Wachowicz M, Ouzounis G, and Portugali, Y (2012) Smart cities of the future, *The European Physical Journal Special Topics 214*, pp. 481–518.
36. Campbell, Tim (2012) *Beyond Smart Cities: How Cities Network, Learn, and Innovate*, Earthscan, London
37. Deakin, M and Al Waer, H (eds) (2012) *From Intelligent to Smart Cities*, Routledge, London
38. Balch, O (2013) Getting smart with cities to build a sustainable future, The Guardian, 6 March. Available at http://www.theguardian.com/sustainable-business/smart-cities-sustainable-future
39. Balch, O (2013) Smart cities: how to build sustainable urban environments, *The Guardian*, 20 March. Available at http://www.theguardian.com/sustainable-business/smart-cities-sustainable-urban-environments
40. Smedley, T (2013) Now is the time for cities to get smart, *The Guardian*, 11 April. Available at http://www.theguardian.com/sustainable-business/time-for-cities-to-get-smart
41. Department for Business Innovation & Skills (2013) Smart Cities: Background Paper, No. BIS/13/1209, Department for Business Innovation & Skills, London
42. Department for Business Innovation & Skills (2013) Global Innovators: International Case Studies on Smart Cities, No. BIS/13/1216, Department for Business Innovation & Skills, London
43. Vinod Kumar, TM and Associates (ed) (2014) Geographic Information System for Smart Cities, Copal Publishing Group, New Delhi
44. Vinod Kumar, TM (ed) (2015) E-Governance for Smart Cities, Springer, Singapore
45. Copenhagen Cleantech Cluster (undated) Danish Smart Cities: Sustainable Living in an Urban World, An Overview of Danish Smart City Competencies, Copenhagen Cleantech Cluster, Copenhagen
46. Brookings and ESADE (2014) *Getting Smarter about Smart Cities, Summary and Key Takeaways*, Brookings, Washington DC
47. Habitat III (2015) *Habitat III Issue Papers: 21 – Smart Cities*, United Nations, New York
48. Vinod Kumar, TM (2015) E-Governance for Smart Cities. In: Vinod Kumar, TM (ed) E-Governance for Smart Cities, Springer, Singapore
49. Dahiya, B (2015) Shifting focus to the mobility of people, China Daily – Asia Weekly, 6-12 February. Available at https://www.academia.edu/10556084/Shifting_focus_to_mobility_of_people_China_Daily_-_Asia_Weekly

50. UN-HABITAT (2013) Planning and Design for Sustainable Urban Mobility: Global Report on Human Settlements 2013, Routledge, Abingdon, Oxon
51. *World Bank Data: World Development Indicators & Global Development Finance*, Online database last updated July 9 2012, http://data.worldbank.org
52. Fay, M and Opal, C (1999) *Urbanization without Growth: A not so uncommon Phenomenon*, Policy Research Working Paper, World Bank, Washington DC. Available at: http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-2412
53. The Economist (2012) Concrete gains. America's big cities are larger than Europe's. That has important economic consequences. *The Economist*. Available at: http://www.economist.com/node/21564536 (accessed July 2015)
54. Cillizza, C (2014) The case for big cities, in 1 map. *Washington Post*. Available at: http://www.washingtonpost.com/blogs/the-fix/wp/2014/02/19/you-might-not-like-big-cities-but-you-need-them/ (accessed July 2015)
55. Dougherty, C (2012) U.S. cities with bigger economies than entire countries. *Wall Street Journal*. Available at: http://blogs.wsj.com/economics/2012/07/20/u-s-cities-with-bigger-economies-than-entirecountries/ (accessed December 2013)
56. Etzkowitz, H (2006) *MIT and the Rise of Entrepreneurial Science*, Routledge, London and New York
57. Indian Institute of Human Settlements (2012) *Urban India 2011: Evidence*, Indian Institute of Human Settlements, Bangalore
58. Government of India (2011) *Census of India 2011, Provisional Population Total, Urban Agglomeration and Cities*, New Delhi.
59. PwC [PricewaterhouseCoopers Private Limited] (2014) *Future of India: The Winning Leap*. Available at: http://www.pwc.in/en_in/in/assets/pdfs/future-of-india/future-of-india-the-winning-leap.pdf (accessed January 2015)
60. Government of India (2014) *Smart Cities Concept Note*, New Delhi. Available at: http://indiansmartcities.in/downloads/CONCEPT_NOTE_-3.12.2014__REVISED_AND_LATEST_.pdf (accessed January 2015)
61. Bhagat, RB (2011) Emerging Pattern of Urbanisation in India, *Economic and Political Weekly*, Vol. XLVI, No.34 (August 20), pp. 10-12.
62. Bank of Boston (1997) *MIT: Impact of Innovation*, Economics Department, Bank of Boston, Boston MA.
63. Eesley, C. and Miller, W (2012) *Impact: Stanford University's Economic Impact via Innovation and Entrepreneurship*, Stanford University, Stanford, CA.
64. Government of India (2015) *Smart Cities – Transform-Nation: Mission Statements & Guidelines*, Government of India, Ministry of Urban Development, New Delhi.
65. The Economic Times (2016) Budget 2016: Over Rs 7,290 crore allocated for AMRUT, 'Smart Cities' in budget, *The Economic Times*, 29 February, available at: http://economictimes.indiatimes.com/articleshow/51196019.cms (accessed March 2016).
66. Howard, E (1902) *Garden Cities of To-morrow,* S. Sonnenschein & Co., Ltd., London.
67. Choe, K and Roberts, B (2011) *Competitive Cities in the 21st Century: Cluster-Based Local Economic Development*, Asian Development Bank, Mandulayong City, Philippines.
68. Perroux, F (1955) Note sur la notion de poles croissance. *Economic Appliquee*, 1 & 2:307-320 (Translated by Mette Monsted, 1974).
69. Misra, RP (1971) *Growth Poles and Growth Centres in Urban and Regional Planning in India, and Training Programme for Regional Development in Developing Countries: An Experiment in India*, Institute of Development Studies, University of Mysore, Mysore.
70. Misra, RP, Rao, VLSP and Sundaram, KV (1970) *Growth Poles and Growth Centers in Regional Planning and Development in India, Part 1 and 2*, United Nations Research Institute of Social Development (UNRISD), Geneva.
71. Khemero, BHS (2006) Urbanization and Sustainability in Cambodia. In *Urbanization and Sustainability in Asia: Case Studies of Good Practice,* edited by BH Roberts and TH Kanaley. Manila: Asian Development Bank and Cities Alliance.

72. Mabbitt, R (2006) Urbanization and Sustainability in Lao Peoples Democratic Republic. In *Urbanization and* Sustainability *in Asia: Case Studies of Good Practice,* edited by BH Roberts and TH Kanaley. Manila: Asian Development Bank and Cities Alliance.
73. Ramos, JM (ed) (1993) *Planning and Design of Industrial Estates for Regional Development in Asia.* United Nations Centre for Regional Development, Industrial Estate Authority of Thailand, Nagoya.
74. Dennis, AR (1987) Export Processing Zones and Economic Development in Asia: A Review and Reassessment of a Means of Promoting Growth and Jobs. *American Journal of Economics and Sociology* 46 (1): 89–106.
75. Cooke, P (2001) From Technopoles to Regional Innovation Systems: The Evolution of Localised Technology Development Policy, *Canadian Journal of Regional Science*, XXIV:1, pp. 21-40.
76. Castells, M, and Hall, P (1994) *The Making of 21st Century Industrial Complexes: Technopoles of the World.* London: Routledge.
77. See: http://www.sage-ereference.com/view/urbanstudies/n282.xml (accessed June 2015)
78. See for Brazil: http://techinbrazil.com/technopoles-in-brazil
79. Biswas, RR (2004) Making a Technopolis in Hyderabad, India: The Role of Government IT Policy. *Technological Forecasting and Social Change* 71 (8): 823–835
80. Wang, S (1998) Investigating Policy Barriers to Immigrant Business Development: A Case Study of Chinese in GTA. Toronto: CERIS.
81. Ramasamy, B, Chakrabartya, A, and Cheahb, M (2004) Malaysia's Leap into the Future: An Evaluation of the Multimedia Super Corridor. *Technovation* 24 (11): 871–883.
82. Gentry, B S and Dahiya, B (forthcoming) Public-Private Partnerships to Improve Urban Environments. In: Bai, X, Graedel, T and Morishima, A (eds) *Cities in Evolution: Urbanization, Environmental Change and Sustainability*, Cambridge University Press, Cambridge
83. Maré, DC (2004) What Do Endogenous Growth Models Contribute? Motu Working Paper 04-04, Motu Economic and Public Policy Research, Wellington (New Zealand). Available at: http://motu-www.motu.org.nz/wpapers/04_04.pdf
84. See: http://www.investopedia.com/terms/e/endogenousgrowththeory.asp
85. Aghion, P and Howitt, P (1998) *Endogenous growth theory,* Cambridge, MA: MIT Press.
86. Anderson, D (1995) The Need for a New Learning Infrastructure, *Training Tomorrow*, 9(2), pp 21-32.
87. Porter, M (1990) *The Competitive Advantage of Nations*, Macmillan, New York.
88. Asian Development Bank (2013) *Urban Operational Plan: 2012-2020*, Asian Development Bank, Mandulayong City, Philippines.
89. Washburn, D, Sindhu, U, Balaouras, S, Dines, RA, Hayes, NM, and Nelson, L E (2010) Helping CIOs Understand "Smart City" Initiatives: Defining the Smart City, Its Drivers, and the Role of the CIO. Cambridge, MA: Forrester Research, Inc. Available at http://public.dhe.ibm.com/partnerworld/pub/smb/smarterplanet/forr_help_cios_und_smart_city_initiatives.pdf
90. Giffinger, R, Fertner, C, Kramar, H, Kalasek, R, Pichler-Milanovi, N, and Meijers, E (2007) Smart Cities: Ranking of European Medium-Sized Cities. Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology. Available at http://www.smart-cities.eu/download/smart_cities_final_report.pdf
91. Glaeser, EL and Berry, CR (2006). Why are smart places getting smarter? Taubman Center Policy Briefs, PB-2006-2. Available at http://www.hks.harvard.edu/rappaport/downloads/policybrief s/brief_divergence.pdf
92. Hall, RE (2000) The vision of a smart city. In Proceedings of the 2nd International Life Extension Technology Workshop (Paris, France, Sep 28). Available at http://www.osti.gov/bridge/servlets/purl/773961- oyxp82/webviewable/773961.pdf
93. Rios, P (2008) Creating "the smart city". Available at https://archive.udmercy.edu/bitstream/handle/10429/393/2008_rios_smart.pdf
94. Partridge, H (2004) Developing a human perspective to the digital divide in the smart city. In Proceedings of the Biennial Conference of Australian Library and information Association

(Queensland, Australia, Sep 21-24). Available at http://eprints.qut.edu.au/1299/1/partridge.h.2.paper.pdf
95. Hartley, J (2005) Innovation in governance and public services: Past and present. Public Money & Management, 25(1), pp. 27-34
96. Torres, L, Pina, V, and Royo, S (2005) E-government and the transformation of public administrations in EU countries: Beyond NPM or just a second wave of reforms? Online Information Review, 29(5), pp. 531-553 http://dx.doi.org/10.1108/14684520510628918
97. European Commission (2013) *European Innovation Partnership on Smart Cities and Communities: Strategic Implementation Plan*, European Commission, Brussels, 14 October. Available at: http://ec.europa.eu/eip/smartcities/files/sip_final_en.pdf (accessed April 2015)
98. Bakici, T, Almirall, E and Wareham, J (2013) A Smart City Initiative: the Case of Barcelona, Journal of Knowledge Economy 4(2): 135–148. http://dx.doi.org/10.1007/s13132-012-0084-9
99. Zygiaris, S (2013) Smart City Reference Model: Assisting Planners to Conceptualize the Building of Smart City Innovation Ecosystems, Journal of the Knowledge Economy 4(2): 217–231. http://dx.doi.org/10.1007/s13132-012-0089-4
100. Anttiroiko, AV, Valkama, P and Bailey, SJ (2013) Smart Cities in the New Service Economy: Building Platforms for Smart Services, AI and Society, Special Issue: Competition and Innovation for Smart and Creative Society, June. http://dx.doi.org/10.1007/s00146-013-0464-0
101. Dėl 2014–2020 Metų Nacionalinės Pažangos Programos Patvirtinimo (2012) Available online (accessed 17 June 2015): http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=439028&p_query=&p_tr2=2
102. Alawadhi, S, Aldama-Nalda, A, Chourabi, H, Gil-Garcia, JR, Leung, S, Mellouli, S, Nam, T, Pardo, TA, Scholl, HJ, and Walker, S (2012) Building Understanding of Smart City Initiatives, Electronic Government 7443: 40–53. http://dx.doi.org/10.1007/978-3-642-33489-4_4
103. Auci, S and Mundula, L (2012) Smart Cities and a Stochastic Frontier Analysis: A comparison among European cities. http://dx.doi.org/10.2139/ssrn.2150839
104. Ariffin, A (2012) Iskandar Malaysia's Definition of Smart City. [online] [accessed 17 June 2015] Available from Internet: http://sustainableiskandar.com.my/iskandar-malaysias-definition-of-smart-city/
105. Davies, AR, and Mullin, SJ (2011) Greening the economy: interrogating sustainability innovations beyond the mainstream, Journal of Economic Geography 11: 793–816. http://dx.doi.org/10.1093/jeg/lbq050
106. Giffinger, R (2011) European Smart Cities: the need for a plane related understanding. [online] [accessed 17 June 2015]. Available from Internet: http://www.smartcities.info/files/04%20-%20Rudolf%20Giffinger%20-%20SC_Edinburgh_VUT_RGiffinger.pdf
107. Dirks, S.; Keeling, M. 2009. A Vision of Smarter Cities: How Cities Can Lead the Way into a Prosperous and Sustainable Future. Somers, NY: IBM Global Business Services. [online] [accessed 8 December 2013]. Available from Internet: http://public.dhe.ibm.com/common/ssi/ecm/en/gbe 03227usen/GBE03227USEN.PDF
108. Caragliu, A, DelBo, Ch, and Nijkamp, P (2011) Smart Cities in Europe, Journal of Urban Technology 18(2): 65–82. http://dx.doi.org/10.1080/10630732.2011.601117
109. Hollands, RG (2008) Will the real smart city please stand up?, City 12(3): 303–320. http://dx.doi.org/10.1080/13604810802479126
110. See: http://www.digitaleurope.org
111. DIGITALEUROPE (2016) *DIGITALEUROPE's Views on the Internet of Things*, DIGITALEUROPE, Brussels, 15 April, available at: http://www.digitaleurope.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=2156&PortalId=0&TabId=353 (accessed April 2016)
112. Sundararajan, A (2016) *The Sharing Economy: The End of Employment and the Rise of Crowd-based Capitalism*, MIT Press, Cambridge, MA.
113. Sundararajan, A (2014) *Peer-to-Peer Businesses and the Sharing (Collaborative) Economy: Overview, Economic Effects and Regulatory Issues,* Written testimony of the hearing entitled, The Power of Connection: Peer-to-Peer Businesses, held by the Committee on Small

Business of the United States House of Representatives, January 15. Available at: http://smallbusiness.house.gov/uploadedfiles/1-15-2014_revised_sundararajan_testimony.pdf (accessed February 2016).
114. PwC [PricewaterhouseCoopers Private Limited] (2015) *The Sharing Economy*, Consumer Intelligence Series. Available at: https://www.pwc.com/us/en/technology/publications/assets/pwc-consumer-intelligence-series-the-sharing-economy.pdf (accessed March 2016)
115. IBEF [India Brand Equity Foundation] and Aranca (2013) *The Rise and Rise of E-Commerce in India*. Available at: http://www.ibef.org/download/The-Rise-and-Rise-of-E-commerce-in-India.pdf (accessed May 2014)
116. Deutsche Bank Markets Research (2015) *Industry: Indian e-Commerce*. Available at: http://www.indiavca.org/pdf/bnncddhexgpnt6i.pdf (accessed April 2015)
117. Saxenian, A (2000) *Bangalore: The Silicon Valley of Asia?* Working Paper No. 91, Stanford University, Sanford, California.
118. Statista (2016) Statistics and facts about e-commerce in India, available at: http://www.statista.com/topics/2454/e-commerce-in-india/ (accessed April 2016).
119. Statista (2016) Retail e-commerce sales in India from 2012 to 2018 (in billion U.S. dollars), available at: http://www.statista.com/statistics/289770/india-retail-e-commerce-sales/ (accessed April 2016).
120. Statista (2016) Internet users in Asian countries who have made a purchase via mobile phone in 4th quarter 2015, available at: http://www.statista.com/statistics/255214/mobile-commerce-penetration-in-asia-pacific-countries/ (accessed April 2016).
121. Vinod Kumar, TM (2015) 'Smart City E-Governance: Issues and Future'. In: Vinod Kumar, TM (ed) *E-Governance for Smart Cities*, Springer, Singapore.
122. McKinsey & Company (2012) *Online and upcoming: the Internet's impact on India*, December.
123. Vinod Kumar, TM (2014) 'Towards smart cities in India'. In: Vinod Kumar, TM (ed) Geographic Information System for Smart Cities, Copal Publishing Group, New Delhi, pp. 325-392.
124. Big Think Editors (2014) Jeremy Rifkin on the Energy Internet, available at: http://bigthink.com/think-tank/jeremy-rifkin-on-the-energy-internet (accessed March 2016)
125. Rifkin, J (2015) The Rise of the Internet of Things and the Race to a Zero Marginal Cost Society, *The World Post*, available at: http://www.huffingtonpost.com/jeremy-rifkin/internet-of-things_b_8306112.html (accessed April 2016).
126. Hill, S (2015) *Raw Deal: How the "Uber Economy" and Runaway Capitalism are screwing American Workers*, St. Martin's Press, New York.
127. Agyeman, J and McLaren, D (2014) 'Smart Cities' Should Mean 'Sharing Cities', *TIME*, September 29. Available at: http://time.com/3446050/smart-cities-should-mean-sharing-cities/ (accessed February 2016).
128. McLaren, D and Agyeman, J (2015) *Sharing Cities: A Case for Truly Smart and Sustainable Cities*, MIT Press, Cambridge, MA.
129. Marketer (2014) Internet to Hit 3 Billion Users in 2015, available at: http://www.emarketer.com/Article/Internet-Hit-3-Billion-Users-2015/1011602 (accessed May 2015).
130. Internet Society (2014) *Global Internet Report 2014: Open and Sustainable Access for All*, Internet Society, Geneva
131. Quigley, JT (2013) China: Full Broadband Coverage by 2020, Gigabit Internet for Major Cities, *The Diplomat*, available at: http://thediplomat.com/2013/08/china-full-broadband-coverage-by-2020-gigabit-internet-for-major-cities/ (accessed May 2015)
132. Gurumurthy, A, Singh PJ, and Kasinathan, G (n.d.) *The Akshaya Experience: Community Driven Local Entrepreneurs in ICT Services, Case Study 5*. Available at: http://www.akshaya.kerala.gov.in/pdf/04_UNDP_Report_5-India.pdf (accessed May 2015)
133. Dahiya, B (2001) *Whither Urban Governance: Self-Help Civil Society, Political Conflicts and Environmental Services in Chennai, India*. Unpublished PhD Thesis, University of Cambridge, Cambridge

134. Resident Welfare Associations Bhagidari Web Portal, available at: http://www.rwabhagidari.com (accessed April 2015)
135. Public-Private Partnership in Infrastructure Resource Center (PPPIRC), available at: http://ppp.worldbank.org/public-private-partnership/overview (accessed April 2015)
136. Porter, Michael E. (1995) The Competitive Advantage of the Inner City, *Harvard Business Review*, May-June Issue. Available at: https://hbr.org/1995/05/the-competitive-advantage-of-the-inner-city
137. ISO (2014) *Sustainable development in communities: City indicators for service delivery and quality of life.* Available at: http://www.iso.org/iso/catalogue_detail?csnumber=62436 (accessed 20 August 2014)
138. ISO (2014) *Sustainable development in communities: City indicators for service delivery and quality of life – Online Browsing Platform.* Available at: https://www.iso.org/obp/ui/#iso:std:62436:en (accessed 20 August 2014)
139. ISO (2014) *Sustainable development in communities: City indicators for service delivery and quality of life. ISO 37120 briefing note: the first ISO International Standard on city indicators.* Available at: http://www.iso.org/iso/37120_briefing_note.pdf (accessed 20 August 2014)
140. Sustainable Business Leadership Forum (2014) *Sustainability Outlook: Shaping New Age Urban Systems: Energy, Connectivity & Resilience – Briefing Paper*.