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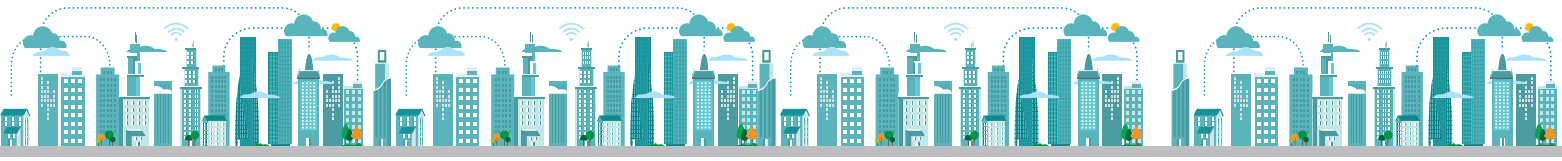

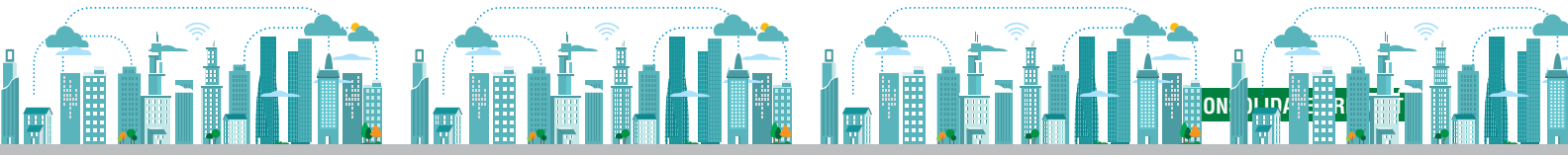

Executive Summary

The twentieth century changed the way we live. Human population went up from 1.5 billion in 1900 to 7 billion in 2010. The hope of a better life drove and continues to drive people to urban areas, leading to the growth of megacities around the world. Smart Cities emerged as a new concept to resolve several issues including population outburst, rapid urbanization, sustainable livelihood, job creations, and increased migrating population towards cities. In broad terms, smart cities encourage sustainable economic development and promote a high quality of life; several stories elaborate on the trend towards urbanization and the qualities needed for a city to be a smart city. Between 2015 and 2030, India's GDP is expected to multiply five times, with over 70% of new employment generated in cities. Close to 800 million square meters of commercial and residential space needs to be built to serve this population.

"The Prime Minister has a vision of developing '100 Smart Cities'[1], as satellite towns of larger cities and by modernizing the existing mid-sized cities." This report is built on basics of smart cities and throws light on current status of smart cities in India and relevant policies.

Chapter 1 of 'Smart Cities in India' report gives an idea of the concept of Smart City, why it is needed, and the major components or characteristics that are necessary for the mission. Chapter 2 discussed about the challenges faced by Smart Cities. By taking a clue from the worldwide scenario, India can also develop their implementation plan or strategy for meeting the goal which has been covered in Chapter 3. San Francisco, Seoul, and Amsterdam are the major examples at global level. Chapter 4 covered the funding pattern and selection criteria for cities. Kochi in Kerala, GIFT city in Gujarat, Haldia in West Bengal are some of the cities in India that met the characteristics of smart city, such as environmental sustainability, mobility, Information and Communication Technology, etc. Government of India has now started tendering for Smart Cities, nature and extent of central government support, benchmarks proposed for Smart City has been discussed in Chapter 5. Although the process of Smart City development has started, still a lot needs to be done.

1 Ministry of Urban Development (2014)

1 Overview

Urbanization accompanies economic development. As countries move from being primarily agrarian economies to industrial and service sectors, they also urbanize. This is because urban areas provide the agglomerations that the industrial and service sectors need. In fact, 90% of the world's urban population growth will take place in developing countries, with India taking a significant share of that. Urban areas also contribute a higher share of the GDP. The share of the GDP from urban areas in India has been growing. While the urban population is currently around 31% of the total population, it contributes over 60% of India's GDP. It is projected that urban India will contribute nearly 75% of the national GDP in the next 15 years.[2] It is for this reason that cities are referred to as the '**engines of economic growth**', and ensuring that they function as efficient engines is critical to our economic development. This trend of urbanization that is seen in India over the last few decades will continue for some more time. The global experience is that a country's urbanization up to a 30% level is relatively slow but the pace of urbanization speeds up thereafter, till it reaches about 60–65%. With an urban population of 31%, India is at a point of transition where the pace of urbanization will speed up.

It is in this context that the Government has decided on developing 100 'Smart Cities' in the country. Accordingly, in his budget speech of July 2014, the Finance Minister has stated the following: "As the fruits of development reach an increasingly large number of people, the pace of migration from the rural areas to the cities is increasing. A neo middle class is emerging which has the aspiration of better living standards. Unless, new cities are developed to accommodate the burgeoning number of people, the existing cities would soon become unlivable."[3]

> "The Prime Minister has a vision of developing '100 Smart Cities', as satellite towns of larger cities and by modernizing the existing mid-sized cities."

Current cities follow complex systems that are characterized by massive numbers of interconnected citizens, businesses, different modes of transport, communication networks, services, and utilities. Population growth and increased urbanization raise a variety of technical, social, economic, and organizational problems that tend to jeopardize the economic and environmental sustainability of cities. The rapid growth faced by several cities has generated traffic congestion, pollution, and increasing social inequality. In this context, a debate has emerged on the way new technology-based solutions, as well as new approaches to urban planning and living, can assure future viability and prosperity in metropolitan areas. In this discussion, the concept of Smart Cities has been the subject of increasing attention and it now appears as a new paradigm of intelligent urban development and sustainable socio-economic growth, whose origin can be traced back to the Smart Growth Movement of the late 1990s.

1.1 What is Smart City?

People migrate to cities primarily for employment. To support their happy and comfortable living, people also need good quality housing; cost-effective physical and social infrastructure, such as water, sanitation, electricity, clean air, education, healthcare, security, entertainment, etc. In this context, Smart Cities are those that are able

2 Ministry of Urban Development (2014)
3 Union Budget (2014)

to attract investments for development of infrastructure and other social facilities. Good infrastructure, simple and transparent online processes that make it easy to establish an enterprise and run it efficiently are important features of an investor-friendly city. Without this a city loses attraction as an investment destination. A Smart City investor is considered as someone who helps a city rather than someone who only profits from it.

1.2 Why Smart Cities?

Abraham Maslow a psychologist suggested that the first and most basic need people have is the need for survival: their physiological requirements for food, water, and shelter. People must have food to eat, water to drink, and a place to call home before they can think about anything else. If any of these physiological necessities is missing, people are not motivated enough to meet the growth needs. Maslow has identified seven categories of basic needs common to all people. Maslow represented these needs as a hierarchy in the shape of a pyramid (Figure 1.1). A **hierarchy** is an arrangement that ranks people or concepts from lowest to highest. According to Maslow, individuals must meet the needs at the lower levels of the pyramid before they can successfully be motivated to tackle the next levels. The lowest four levels represent **deficiency needs,** and the upper three levels represent **growth needs.**

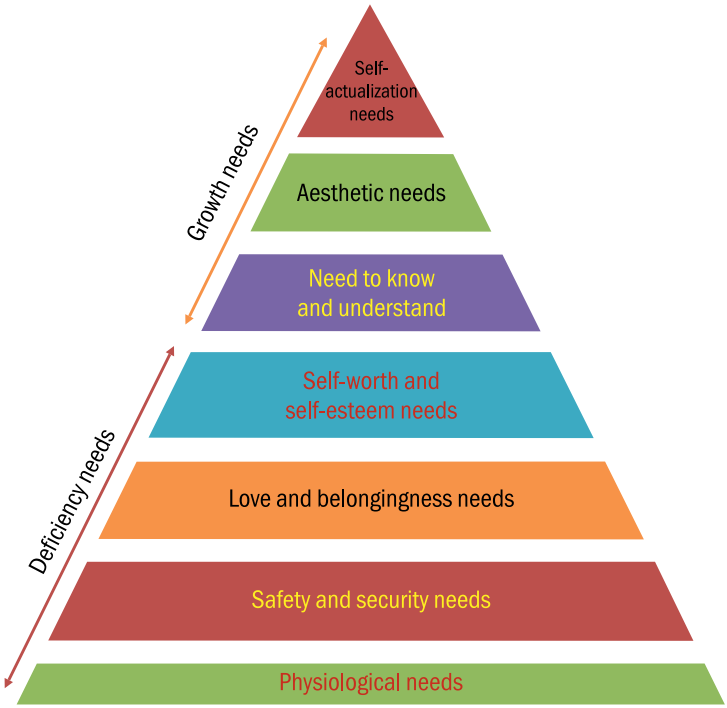

Figure 1.1: Maslow's hierarchy of needs

One will need to fulfil growth needs once their deficiency needs are fulfilled. In India, many cities have the infrastructure where deficiency needs are fulfilled and Smart City concept will fit in, while in other cities citizens are even struggling for their deficiency needs to be fulfilled. Due to dense population and lack of streamlined civic facilities and processes, such deficiencies remain unattended leading to complex problems in cities. To overcome this difference, the Government needs proper strategy that helps in successful implementation of Smart City concept. India is at a point of transition where the pace of urbanization will speed up. The relatively low base allows us to plan our urbanization strategy in the right direction by taking advantage of the latest developments in technology especially in Information and Communication Technology (ICT). Growth and Deficiency needs can be classified under Smart City characteristics (Table 1.1).

Table 1.1: Classification of Smart City components according to Maslow's hierarchy

	Domain	Objective
Growth Needs	Energy grids	Automated grids that employ ICT to deliver energy and enable information exchange about consumption between providers and users, with the aim of reducing costs and increasing reliability and transparency of energy supply systems.
	Public lighting, natural resources, and water management	Managing public lighting and natural resources. Exploiting renewable resources, such as heat, solar, cooling, water, and wind power.
	Waste management	Applying innovations in order to effectively manage the waste generated by people, businesses, and city services. It includes waste collection, disposal, recycling, and recovery.
	Environment	Using technology to protect and better manage environmental resources and related infrastructure, with the ultimate goal of increasing sustainability. It includes pollution control.
	Transport, mobility, and logistics	Optimizing logistics and transportation in urban areas by taking into account traffic conditions and energy consumption. Providing users with dynamic and multi-modal information for traffic and transport efficiency. Assuring sustainable public transportation by means of environmental friendly fuels and innovative propulsion systems.
	Office and residential buildings	Adopting sustainable building technologies to create living and working environments with reduced resources. Adapting or retrofitting existing structures to gain energy and water efficiency
	Healthcare	Using ICT and remote assistance to prevent and diagnose diseases and deliver the healthcare service. Providing all citizens with access to an efficient healthcare system characterized by adequate facilities and services
	Public security	Helping public organizations to protect citizens' integrity and their goods. It includes the use of ICTs to feed real-time information to fire and police departments
Deficiency Needs	Education and culture	Capitalizing system education policy, creating more opportunities for students and teachers using ICT tools. Promoting cultural events and motivating people participation. Managing entertainment, tourism, and hospitality
	Social inclusion and welfare	Making tools available to reduce barriers in social learning and participation, improving the quality of life, especially for the elder and disabled. Implementing social policies to attract and retain talented people
	Public administration and (e-) government	Promoting digitized public administration, e-ballots, and ICT-based transparency of government activities in order to enhance citizens empowerment and involvement in public management.
	Economy	Facilitating innovation, entrepreneurship, and integrating the city in national and global markets.

1.3 Smart City framework

Towards this objective, an integrated Smart City framework (Figure 1.2) comprising the key enablers like **Smart Governance, Smart Living, Smart People, Smart Mobility, Smart Environment**, and **Smart Economy** may be followed to facilitate implementation.

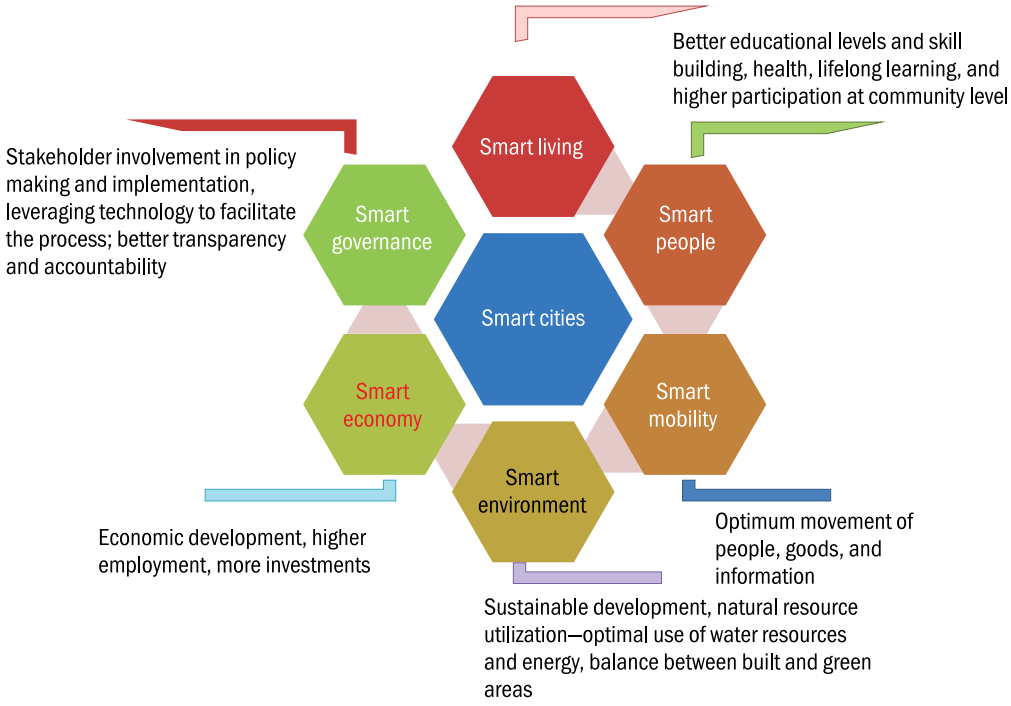

Figure 1.2: Smart City Components

1.4 Status of Indian cities considered under Smart City project

As per the Smart City concept, none of the cities are well prepared to be termed as Smart City. Existing cities are facing several challenges starting from urban governance to internet penetration. Here, we intend to carry out a comparative analysis of status of some of the existing cities (Delhi, Varanasi, Bengaluru, Kochi, and Ahmedabad) with respect to Smart City indicators (See Annexure 1).

In Smart City concept, ICT plays a key role in integrating different components (Figure 1.3). The data reveals that most of the cities are lacking infrastructure, social awareness, and skills to upgrade into the Smart Cities. Further to this, while some of the cities have ICT infrastructure, they are not utilized up to its optimum. There need to be an effective plan or layout by the city governance and government implementing agencies to build awareness, skills, and infrastructure to develop existing cities into future Smart Cities.

1.5 How existing cities become smart?

The idea of building 100 energy-efficient, ICT-enabled, and transit-oriented cities sounds promising. Experts at the recently concluded Smart Cities India Expo have called for focus on making these people oriented and socially inclusive because, even with excellent infrastructure, several global cities have failed to retain people and businesses. Technology is important but so are the economy and people. Research states 60% jobs can be generated within

these sub-cities. There can be many opportunities for decentralized production and related services. They should act like a sponge where money comes in and keeps circulating. There has to be a business model. It also requires citizen's participation in planning.

For Example, Melbourne is one of the most livable cities where footpaths have been widened to reduce space for cars and a vibrant economy created in the prime real estate of the city's central business district. Yokahama and Singapore are successful Smart Cities where people have automatically moved towards public transport.

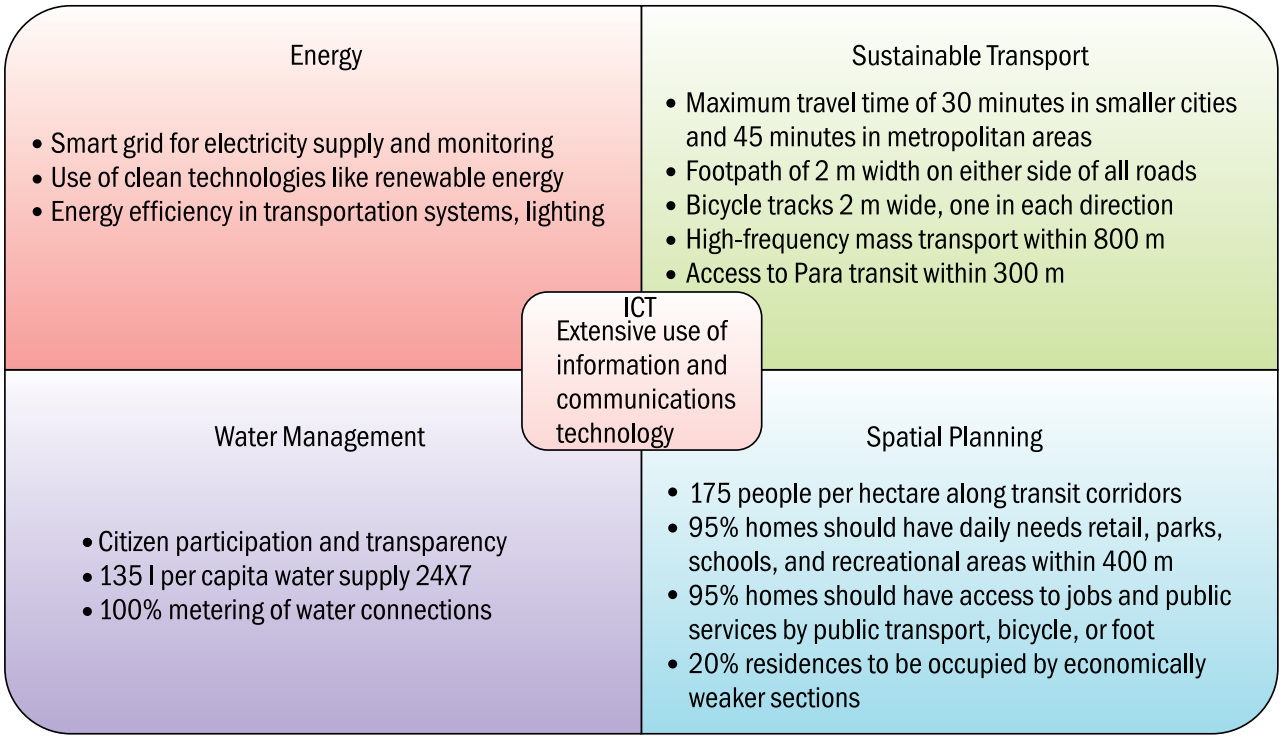

Figure 1.3: Features Required for Smart Cities

2 Challenges before Indian Smart Cities

The concept of smart cities has its challenges, especially in India. For instance, the success of such a city depends on residents, entrepreneurs, and visitors becoming actively involved in energy saving and implementation of new technologies. There are many ways to make residential, commercial, and public spaces sustainable by ways of technology, but a high percentage of the total energy use is still in the hands of end users and their behaviour. Few of the challenges are discussed below.

2.1 Mobility

2.1.1 Migration of population to urban locations for jobs

Migration from one area to another in search of improved livelihoods is a key feature of human history. While some regions and sectors fall behind in their capacity to support populations, others move ahead and people migrate to access these emerging opportunities. Industrialization widens the gap between rural and urban areas, inducing a shift of the workforce towards industrializing areas. Moreover, numerous studies show that the process of migration is influenced by social, cultural, and economic factors and outcomes can be vastly different for men and women, for different groups, and different locations.

2.1.2 Migration for work

The primary motive for migration, recorded by the census as well as the NSS, is an important indicator of how mobility is influenced by conditions of the labour market. Of the 27.4% who changed place of residence, as per 1991 census, 8.8% moved for employment reasons and 2.3% had business motives. The proportion moving due to economic motives was higher for males (27.8% moved for employment reasons and 7.1% for business reasons), compared with females (only 1.8% moved for employment reasons and 0.5% for business reasons).

2.1.3 Education

Rural areas, by and large, lack educational facilities, especially those of higher education and rural people have to migrate to the urban centres for this purpose. Many of them settle down in the cities for earning a livelihood after completing their education.

2.1.4 Lack of security

Political disturbances and interethnic conflicts drive people away from their homes. A large number of people have migrated out of Jammu and Kashmir and Assam during the last few years due to disturbed conditions there. People also migrate on a short-term basis in search of better opportunities for recreation, healthcare facilities, and legal advices or for availing service that the nearby towns provide.

2.2 Transport

City efficiency largely depends upon the effectiveness of its transport systems, that is, efficacy with which people and goods are moved throughout the city. Poor transport systems stifle economic growth and development, and the

net effect may be a loss of competitiveness in both domestic as well as international markets. Although Indian cities have lower vehicle ownership rate, number of vehicles per capita, than their counterparts in developed countries, they suffer from worse congestion, delay, pollution, and accidents than cities in the industrialized world. Few of the major challenges in India are listed below:

- Vehicular growth and availability of transport infrastructure in metropolitan cities
- Vehicular emission, congestion, and road safety issues
- Policy measures to improve urban transportation in India

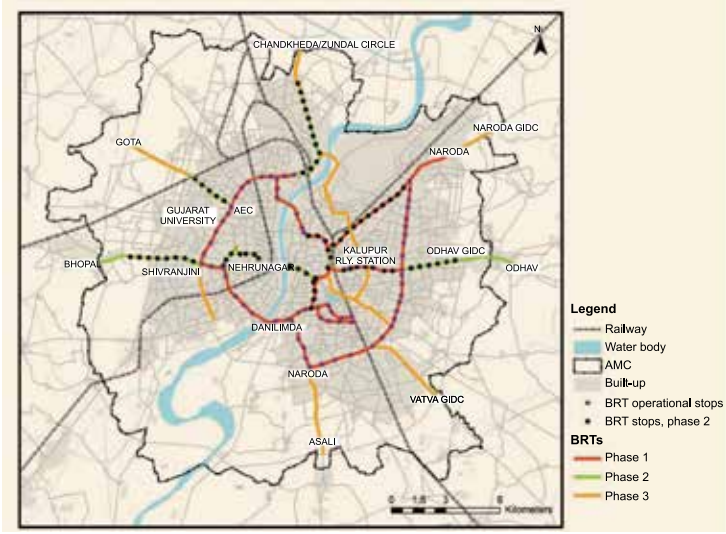

Figure 2.1: India's first BRT system in Ahmedabad
(Source: http://elibrary.worldbank.org)

2.3 Energy management

In the past few years, the level of energy waste in India has been on the rise, underscoring the need for the government and other stakeholders to address issues of sustainable development. India has the world's fourth largest electricity installed capacity, according to the Ministry of Urban Development's 2014 Concept Note[4] on Smart City. Yet, it continues to be a country with scarce electricity distribution. Here, smart grids can be a good way of bringing in transformative operations. There are many challenges:

- The old traditional system lacks good financial planning, resulting in losses due to poor revenue collection methods.
- The system is also ageing with poorly maintained infrastructure, such as transmission lines, among others.

Electricity theft

Smart energy technology entails laying a secure and ubiquitous communication link between power sources to the endpoint to ensure a good and efficient communication channel that will enhance good connectivity. Smart grids can be a good way of bringing in transformative operations. The smart grid technology is also able to predict and monitor possible failures and help technical teams to pre-empt possible solutions. This technology allows systems (the grid) to be fed by alternate energy sources such as solar, wind, and hydrocarbons, among others. The integration of this power generation into the smart grid enables further decentralization of distribution and boosts nationwide generation.

4 Smart cities council India (2014)

2.4 Information and communication technology

A common infrastructure pool allows the creation of a truly interconnected system with seamless communication between services. The sharing and unifying of the information infrastructure, or even the sharing of meaningful information/data such that it can improve efficiency and the quality of life of its citizens is an opportunity that will be recommended. However, there are many challenges:

- All resources and information generated by the city from different sources, systems, and services are distributed in different departments, regions, and their respective information systems.
- While the interconnection of different government departments and agencies is not the current focus, the sharing of meaningful data that can improve efficiency and the quality of life—a recurrent theme of a Smart City—of citizens is a challenge that can be explored
- Technology challenges; the existing status quo in how cities are run; and technology is not well understood across city sectors and by its administrators
- Among the main barriers to adopting such solutions is the complexity of how cities are operated, financed, regulated, and planned.
- Rapid urbanization adds pressure to the resource base and increases demand for energy, water, and sanitation, as well as for public services, education, and healthcare. Consequently, social, economic, and environmental issues have become closely interrelated.

2.5 Land acquisition

The issue of land acquisition in the region further complicates matters. The absence of a regulated land tenure system in most parts of the region means that acquiring tribal land for development will be a tedious task. While many factors of the scheme for selection of smart cities in India doesn't match the geographic, economic, and geographic profile in north-eastern states, the scheme will have minimal role in implementing smart cities in the region. However, newly announced Smart City Mission can achieve geographical spread in the North East Region (NER) by adopting measures, such as (i) Direct Central funding for a majority of the Smart City projects; (ii) Active participation from the State Governments; (iii) Mandatory special purpose vehicle (SPV) to manage and fund each Smart City; iv) Ensuring full implementation of the 74th Constitutional Amendment Act; and v) Special consideration during the city selection process on aspects of urban population and existing city infrastructure status.

2.6 Challenges for Smart City in North Eastern States

This scheme can play a crucial role in reshaping the troubled socio-economic conditions of many cities, including those in the NER states—Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura. However, north-eastern states have their own issues in implementing Smart City concept primarily due to geographic locations, economic issues, low city growth, and low migration of population to urbanization.

- **Urbanization Scenario**: As per the 2011 census, the decadal rate of urbanization of **NER (37%)** is higher than the national figure (32%) but the average urbanization level of NER is 18%, and only **Mizoram (52%)** is above the national urbanization level (31%). Also, the NER states comprise only 2.2% of India's urban population. Considering the motive of the Central government—to focus on Smart City development in states with bigger urban population—the NER states are likely to be side lined in this scheme.
- **Public–Private Partnership (PPP)**: The ministry is relying heavily on industry involvement through public–private partnership to achieve these targets. However, most infrastructure development projects in the NER are usually taken up by the State governments, through investment from the Central Plan Fund, and there is minimal private intervention.

3 Smart City Initiatives Worldwide

3.1 Worldwide scenario

As world urbanization continues to grow and with the total population expected to double by 2050, there exists an increased demand for intelligent, sustainable environments that reduce environmental impact and offer citizens a high quality life. A Smart City brings together technology, government, and society to enable the following characteristics:

There is a worldwide trend toward Smart City as shown by the following (Figure 3.1):

- Half of the world population is living in cities in 2013
- Half of the population of Asia will be living in cities by 2020
- Half of the population of Africa will be living in cities by 2035
- Population in cities is expected to grow from 3.6 billion to 6.3 billion by 2050.
- Over 50% of urbanization involves cities of less than 500,000 people

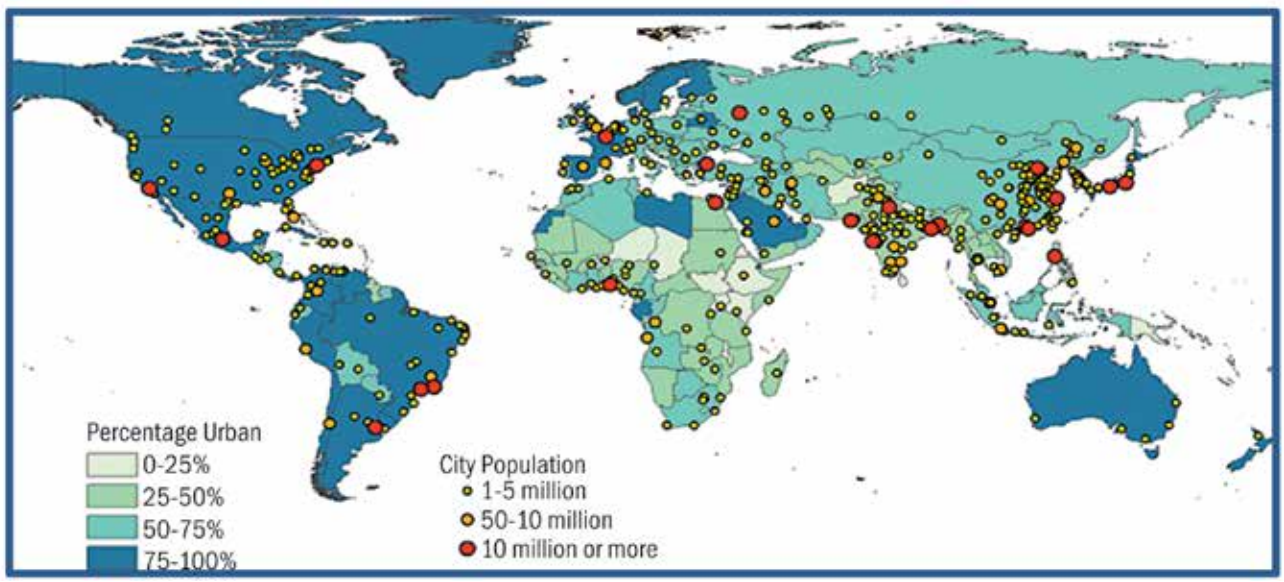

Figure 3.1: Percentage of urban population and agglomerations by class size, 2011
(Source: http://smartcities.ieee.org/about.html)

According to HIS Technology Report, annual investment on Smart City projects will rise from the current $1 billion to $12 billion in 2025. Other Smart City (Figure 3.2) forecasts tend to be broader in their definitions. Navigant Research forecasts global Smart City technology revenue will grow from $8.8 billion annually in 2014 to $27.5 billion in 2023, while Frost & Sullivan expects the global Smart City market to be valued at $1.565 trillion in 2020.

European Union (EU) classifies 240 of the 468 cities in the 28-nation bloc with 100,000+ inhabitants and at least one SC characteristic as smart cities. The European Commission identifies Amsterdam (the Netherlands), Barcelona (Spain), Copenhagen (Denmark), Helsinki (Finland), Manchester (UK), and Vienna (Austria) as 'the most successful' in the EU.

Europe, the Middle East and Africa region represents the largest number of smart cities at present; within a decade, Asia-Pacific will take the lead. By 2025, Asia-Pacific will account for 32 smart cities by 2025, Europe will have 31, and the Americas will contribute 25.

India's Prime Minister Narendra Modi announced plans to build 100 smart cities, including seven along the $90 billion Delhi–Mumbai Industrial Corridor, using a mixture of public–private partnerships (80%) and publicly funded infrastructure investment (20%). One city already under construction is the $10 billion Gujarat International Finance Tec-City.

China, too, is pursuing a smart cities strategy as part of its efforts to stimulate economic development and eradicate poverty. This strategy involves at least 54 SC projects, and includes cities like Beijing, Shanghai, Chengdu, Hangzhou, and Wuhan, who are aiming to build smart cities during the 12th Five-Year Plan (2011–2015).

In Japan, the national government has selected 13 locations for its Eco-Model Cities scheme. This includes four major cities—Kitakyushu, Kyoto, Sakai, Yokohama—plus 9 further small and medium cities.

Figure 3.2: Smart City initiatives in few countries

3.2 European scenario

Examining EU-28 cities with at least 100,000 residents, 240 (51%) have implemented or proposed Smart City initiatives. Although almost half of European Smart City have 100,000 to 200,000 inhabitants, this is only 43% of this size category, whilst almost 90% of cities over 500,000 inhabitants are Smart City (Figure 3.3). This is very clearly a large city phenomenon, with such cities each having a large number of Smart City initiatives compared to smaller cities. There are Smart City in all EU-28 countries, but these are not evenly distributed. Countries with the largest numbers are the UK, Spain, and Italy, although the highest percentages are in Italy, Austria, Denmark, Norway, Sweden, Estonia, and Slovenia.

Figure 3.3: Identified smart cities in Europe

In the global profile of urban development, the Smart City is emerging as an important basis for future city expansion. Europe's global competitors among the emerging economies are pursuing large Smart City programmes. More than half of the world's population lives in cities; this rises to over two-thirds in EU-28 and the proportion is growing. High-density city populations increase strains on energy, transportation, water, buildings, and public spaces, so solutions need to be found that are 'smart', that are, both highly efficient and sustainable on the one hand as well as generating economic prosperity and social wellbeing on the other. This is best achieved by mobilizing all of a city's resources and coordinating its actors using new technologies

and forward-looking joined-up policies. Smart City initiatives are spread across all six characteristics, but most frequently focus on Smart Environment and Smart Mobility. Geographically, there is also a fairly even spread, although Smart Governance projects are mainly seen in the older member states of France, Spain, Germany, the UK, Italy, and Sweden. Also noteworthy is that some characteristics typically occur in combination, such as Smart People and Smart Living. Cities in blue are the designated Smart City and those in red (Figure 3.3) are cities with a population of over 100,000 for which we did not find sufficient information online to categorize as a Smart City.

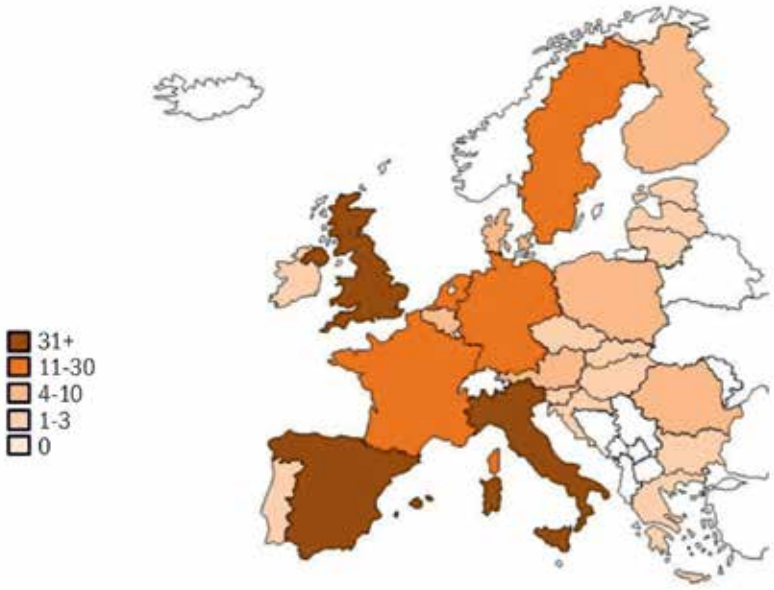

Figure 3.4: Total Number of Smart Cities in EU

It is clear that the larger countries, especially the UK, Spain, and Italy, have the largest number of Smart City—more than 30 each (Figure 3.4). However, this is not universally true; large countries such as Germany and France have fewer Smart City overall. As would be expected, the smaller countries have absolute lower numbers of Smart City. Overall, slightly over half (51%) of the 468 cities in the main sample meet our Smart City criteria, indicating how prevalent the Smart City movement has become in Europe in the last few years. First, all only six of the 52 cities in the EU-28 with more than 500,000 inhabitants are some form of Smart City, this is very clearly a large city phenomenon. All cities experience environmental problems to some degree, and these issues rank high on the agendas of civil society groups and businesses. The transnational nature of all environmental issues also suggests that it is a key area in which European institutions can add value. The emphasis on Smart Environment across the majority of cities may, therefore, reflect the significant role of large, multi-city initiatives focussing on this characteristic. While systems related to transportation, communication, water, and energy are underpinned by hard (and physically localized) infrastructure, issues affecting public services, business, and social networks may be less tangible and harder to link to an individual city. In this instance, Smart Governance and Smart Economy projects may be more likely to be pursued at a national level; the associated issues may be harder to frame as 'municipal problems'.

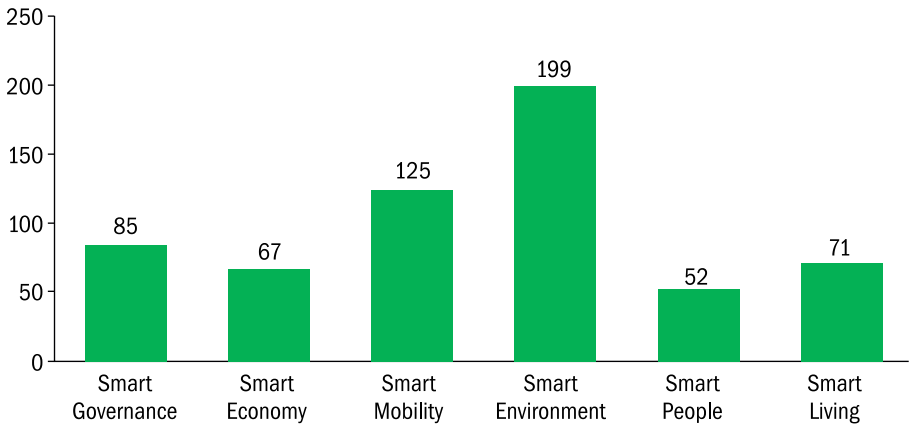

Figure 3.5: The number of Smart City in the EU presenting the six Smart City characteristics
(Source: http://www.smartcities.at)

3.3 Comparison between selected three cities

Smart cities have lately not been limited to ICTs, but and are focussed on enhancing urban life regarding six dimensions: people, government, economy, mobility, environment, and living. More than 150 Smart City cases can be observed around the world, which can be classified in: (i) existing cities in to Smart City; (ii) hard ICT infrastructure focussed cases; and (iii) soft ICT infrastructures in the urban space. Since there is no clear Smart City approach yet, there have been several attempts by international organizations to standardize Smart City solutions, such as for smart water, energy, transportation, buildings, etc.

Table 3.1: Comparison of selected Smart City

	Seoul	San Francisco	Amsterdam
History	Capital city of Korea since 1394	Founded 1776 and incorporated in 1850	Founded 1275, Capital city of the Netherlands
Total Area	605.4 km^2	600.6 km2	219.4 km^2
Population	10,528,774	City and County—808,977 (2008) Urban: 3,273,190 Metro: 4,335,391	City Area—790,654 in 2012 Urban: 1,209,419 Metro: 2,289,762
Households	4,192,752	780,971	400,000 (approx.)
Global Urban Competitiveness*	9th in the world	6th in the world	27th in the world
Global Cities Index**	8th in the world	17th in the world	26th in the world
Fixed Broadband Penetration***	36% (South Korea)	27.3% (United States)	38.5% (the Netherlands)
Households with Broadband Access***	97.5% (South Korea)	68.2% (United States)	79.5% (the Netherlands)
Prevent Crime/Disaster	9%	17%	2%
Medical/ Welfare /Healing	8%	_	4%
Environment	5%	15%	19%
Public Administration	13%	12%	22%
Transportation	20%	35%	15%
Education	2%	-	2%
Tour/Culture /Sports/Leisure	12%	15%	26%
Job Creation/Business	3%	3%	4%
Advanced Intelligent Technologies	37.5%	26.5%	13.2%
Unidirectional Service Using GPS	29.7%	55.9%	43.4%
Civic Engagement	1.6%	23.5%	18.9%

(Source: *The global urban competitiveness report 2011)

*** OECD Broadband Portal, 2011

**** 2012 Global Cities Index & Emerging Market Outlook Study, AT Kearney & The Chicago council on global affairs)

***Fixed broadband Penetration and Households with broadband access: Households and individuals in many OECD countries are now accustomed to using broadband (high speed) connections at home. At present, more than one household out of two has broadband Internet access in three-quarters of OECD countries. Korea has the largest share of households with a broadband connection via a computer or mobile phone (97%). The Netherlands and Denmark have the lowest regional differences in broadband access—but it is not the main explanation. The difference in broadband access between the top and the bottom region is the same in the United States and Germany (32 percentage points) but the territory of the United States is over 25 times that of Germany.

****Global Cities Index: It measures global engagement of cities across five dimensions: business activity, human capital, information exchange, cultural experience, and political engagement.

Table 3.2: Overview of the characteristics and impacts of generic Smart City solutions

Solution and Category	Smart City Solution	Where Implemented	Keywords	Impacts
Transport and Mobility	Smart cycling plans	Copenhagen, Paris, London	Cycle sharing, social sensors, electric bikes, smart cards	CO_2 emissions reduction, healthy living
	Integrated multi-modal transport	Copenhagen, London, Helsinki, Glasgow, Hamburg, Tallinn, Milan, Dublin, Ljubljana	Smart tickets, multi-modal travel, travel information and routing, sharing	CO_2 emissions reduction through congestion reduction, increased public transport, enhanced transport and competitiveness
	Smart traffic flow system	Barcelona, Eindhoven	Smart vehicle routing, smart mobility, sensors, tracking	CO_2 reduction by reducing travel and transit times, enhanced traffic flow due to decreased travel times
Building Technologies	Smart building technology and management	Amsterdam, Helsinki, Bremen	Smart and green building technology, demonstrators, Smart plugs, light-emitting diode, sensors, room climate	Reduced energy consumption, CO_2 reduction, awareness
	Smart City lighting	Barcelona, Milan	Street lighting, sensors, central monitoring, LED	Reduced energy consumption, CO_2, safety
Smart Governance	Smart open services platforms	Barcelona, Helsinki, Copenhagen, Malmo, Amsterdam, Dublin	Open services, open data, integrated transport solutions, Smart tickets, mobile apps	Reduced CO_2, private sector information reuse with knock-on effects on environment and energy, jobs and economic growth
	Single access points for government services	Barcelona, Manchester	eGov, single services window, online government portals	Reduced CO_2, reduced travel to municipal offices
	Local integrated sustainability initiatives	Amsterdam, Barcelona, Cologne	Local, smart energy management, monitoring, and user feedback, self-organization, local coordination	Reduced CO_2 through reduced energy consumption, democracy, inclusion

4 Smart Cities: Indian Scenario

Size of Indian cities expand mostly through the process of peripheral expansion, the trend being smaller municipalities and large villages surrounding the core city becoming part of the larger metropolitan area. Also, our cities have been growing population wise, as is evident from the figure of only five cities with million-plus population in 1951 going up to 53 in 2011. Whereas cities play an important role in the overall economic development of the country, accounting for 62–63% of overall GDP in 2009–10, projected to grow to 70% by 2030, generating 80–85% of the country's tax revenue and account for 70% of all new jobs created in India in the next 20 years, our annual capital spending in urban infrastructure works out to US$17 per capita. Our investment in urban infrastructure is just 0.7% of GDP as of 2011–12, whereas Brazil spends 4.5% and South Africa invests 6% of their GDP in urban areas.

4.1 Identifying the Smart City

In order to modernize our cities and make them internationally competitive, the Government has decided to support the development of 100 Smart City in the country. In view of this, cities with a 1–4 million population would seem to be the most appropriate. Besides, satellites to larger cities would also make very good candidates. Accordingly, the current thinking is that 100 cities to be developed as Smart City may be chosen from amongst the following:

- One satellite city of each of the cities with a population of 4 million people or more (9 cities)
- All the cities in the population range of 1–4 million people (44 cities)
- All state/union territory (UT) capitals, even if they have a population of less than 1 million (17 cities)
- Cities of tourist and religious importance (10 cities)
- Cities in the 0.5–1.0 million population range (20 cities)

Box: 1

	Persons (in million)		Decadal Growth (%)	
	2001	2011	1991–2001	2001–11
Total	1029	1210	21.5	17.6
Rural	743	833	18.1	12.2
Urban	286	377	31.5	31.8
Percentage of total population	*27.81	*31.16		

Source: http://moud.gov.in/

Total Number of Cities- 100
₹ 48,000 crore over five-year's outlay
₹ 100 crore per year for five years per city

4.2 Process of selection of Smart City

Union Cabinet approved building of 100 smart cities and upgradation of basic infrastructure—Atal Mission for Rejuvenation and Urban Transformation (AMRUT)—across 500 cities with outlays of ₹48,000 crore and ₹50,000 crore, respectively. With the country aspiring for a manufacturing-led rebound in GDP growth rate, it is imperative that cities prepare themselves for more people moving into the cities. Experts feel that making them 'smart', with adequate core infrastructure—clean water supply, efficient public transportation, affordable housing, power supply, robust IT connectivity, better health and education, and sustainable urban environment—could make a big difference and, if implemented well, the sector could attract private sector investments. Along with this, a push from State governments and Urban Local Bodies (ULBs) could ensure that the sector has the potential to ensure an economic revival across the country and generate incremental employment.

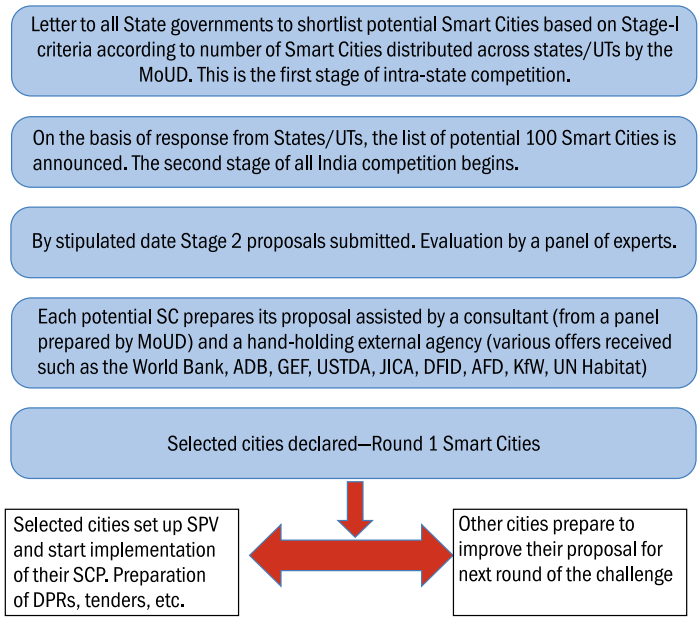

Figure 4.1: *Steps in the selection of Smart cities*

Table 4.1: Identified Smart City in Indian states

State/ UT	No. of cities	State/ UT	No. of cities	State/ UT	No. of cities
A&N Islands Port Blair	1	**Haryana** Karnal, Faridabad	2	**Nagaland** Kohima	1
Andhra Pradesh Vishakhapatnam, Tirupati, Kakinada	3	**Himachal Pradesh** Dharamshala	1	**Odisha** Bhubaneswar, Raurkela	2
Arunachal Pradesh Pasighat	1	**Jharkhand** Ranchi	1	**Puducherry** Oulgaret	1
Assam Guwahati	1	**Karnataka** Mangalore, Belagavi, Shivamogga, Hubballi-Dharwad,Tumakuru, Devanegere	6	**Punjab** Ludhiana, Jalandhar, Amritsar	3

Bihar Muzaffarpur, Bhagalpur, Biharsharif	3	**Kerala** Kochi	1	**Rajasthan** Jaipur, Udaipur, Kota, Ajmer	4
Chandigarh	1	**Lakshadweep** Kavarrati	1	**Sikkim** Namchi	1
Chhattisgarh Raipur, Bilaspur	2	**Madhya Pradesh** Bhopal, Indore, Jabalpur, Gwalior, Sagar, Satna, Ujjain	7	Tamil Nadu Tiruchirapalli, Chennai, Tiruppur, Coimbatore, Vellore, Salem, Erode, Thanjavur, Tirunaveli, Dindigul, Madurai, Thoothkudi	12
Daman & Diu Diu	1	**Maharashtra** Navi Mumbai, Nashik, Thane, Greater Mumbai, Amravati, Solapur, Nagpur, Kalyan-Dombivali, Aurangabad, Pune	10	**Telangana** Greater Hyderabad Greater Warangal	2
Dadra & Nagar Haveli Silvassa	1	**Manipur** Imphal	1	**Tripura** Agartala	1
Delhi New Delhi Municipal Council	1	**Meghalaya** Shillong	1	**Uttar Pradesh** Moradabad, Aligarh, Saharanpur, Bareilly, Jhansi, Kanpur, Allahabad, Lucknow, Varanasi, Ghaziabad, Agra, Rampur	13
Goa Panaji	1	**Mizoram** Aizawl	1	**Uttarakhand** Dehradun	1
Gujarat Gandhinagar, Ahmedabad, Surat, Vadodara, Rajkot, Dahod	6			West Bengal New Town Kolkata, Bidhannagar, Durgapur, Haldia	4

(*Source:* http://moud.gov.in)

Of the 100 proposed smart cities (Table 4.1) across states and union territories, 20 would be selected this financial year. The rest would join the club in two batches of 40 each in the next two years, said a source in the government.

4.3 Lavasa: India's first fully planned hill city

Key Features

- India's first planned hill city since independence.
- It is a convenient three hours' drive from Mumbai, an hour's drive from Pune.
- Has 3 BHK homes and will also offer homes that fit budgets across socio-economic classes.

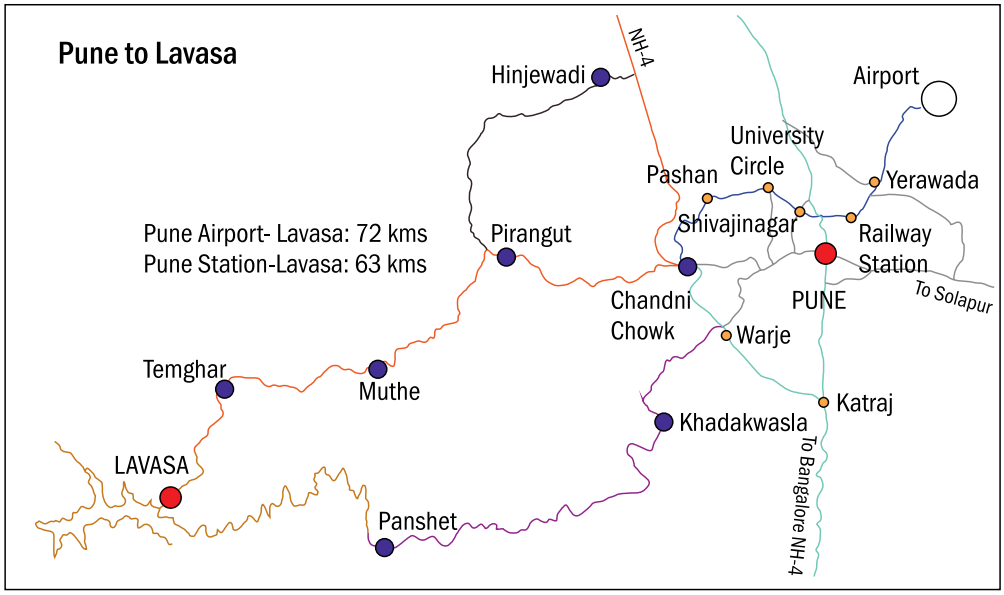

Figure 4.2: City map

- It is expected to provide abundant opportunities as global leaders in hospitality, health, and wellness, education.
- Diverse work possibilities appealing to the IT and biotech industry, KPOs, and R&D companies, and the world of art, fashion, and animation.
- Permanent population of 0.2 million residents and a Lavasa Tourism inflow envisaged at 2 million per annum.

4.4 Kochi: Kerala

Key Features

- Smart City Kochi (SCK), a joint venture between Smart City Dubai and the Kerala government.
- Project includes environmental and sustainability study, urban design landscape guidelines, traffic impact study and plot development guidelines.
- The project, sprawling over 246 acres at Edachira, Kakkanad is expected to generate 90,000 direct jobs.
- It will adhere to international sustainability standards that protect the environment and provide its inhabitants with comfortable, healthy and productive spaces for work and leisure.
- Already home to over 4,500 different knowledge-based companies making them the largest networked business spaces in the world

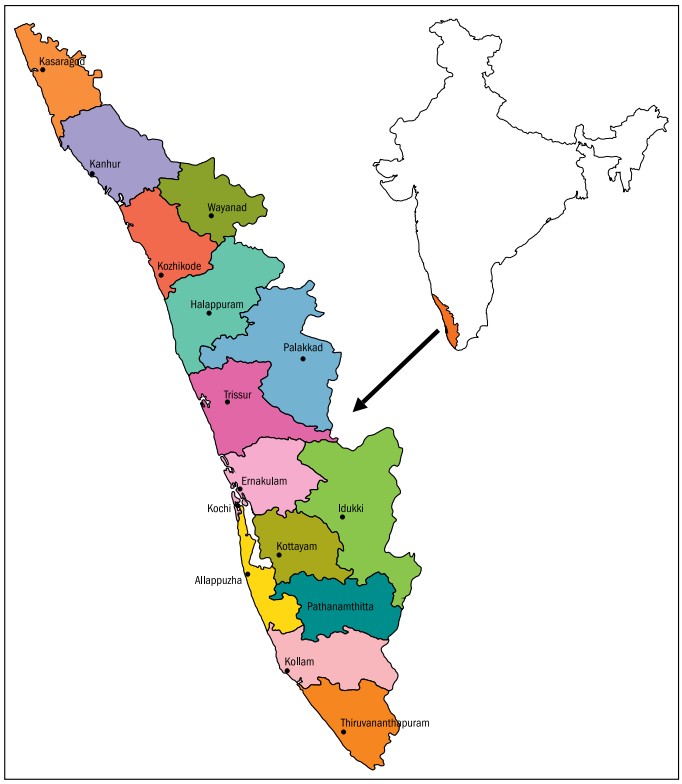

Figure 4.3: City map

- Companies operating in Smart City Kochi can plug into this global network and leverage a host of benefits; such as, networking events and forums where companies share best practices, forge partnerships, access new talent and enter new markets.
- Smart City Kochi will claim the most advanced and reliable ICT infrastructure available in Kochi today.

4.5 Haldia: West Bengal

Key Features

- The European Business and Technology Centre (EBTC) plans to initiate a pilot project to demonstrate 'smart city concept' at the industrial town of Haldia in West Bengal.
- Project would focus on lowering carbon footprint
- EBTC is a European Union initiative to assist business units in India and Europe on clean technology transfer.
- Estimated investment in the pilot project would be close to €10 million
- Copanhagen Cleantech Cluster and EBTC will together work to identify projects, undertake their execution, and facilitate research and innovation related to green technology initiatives in the energy and environment sectors.

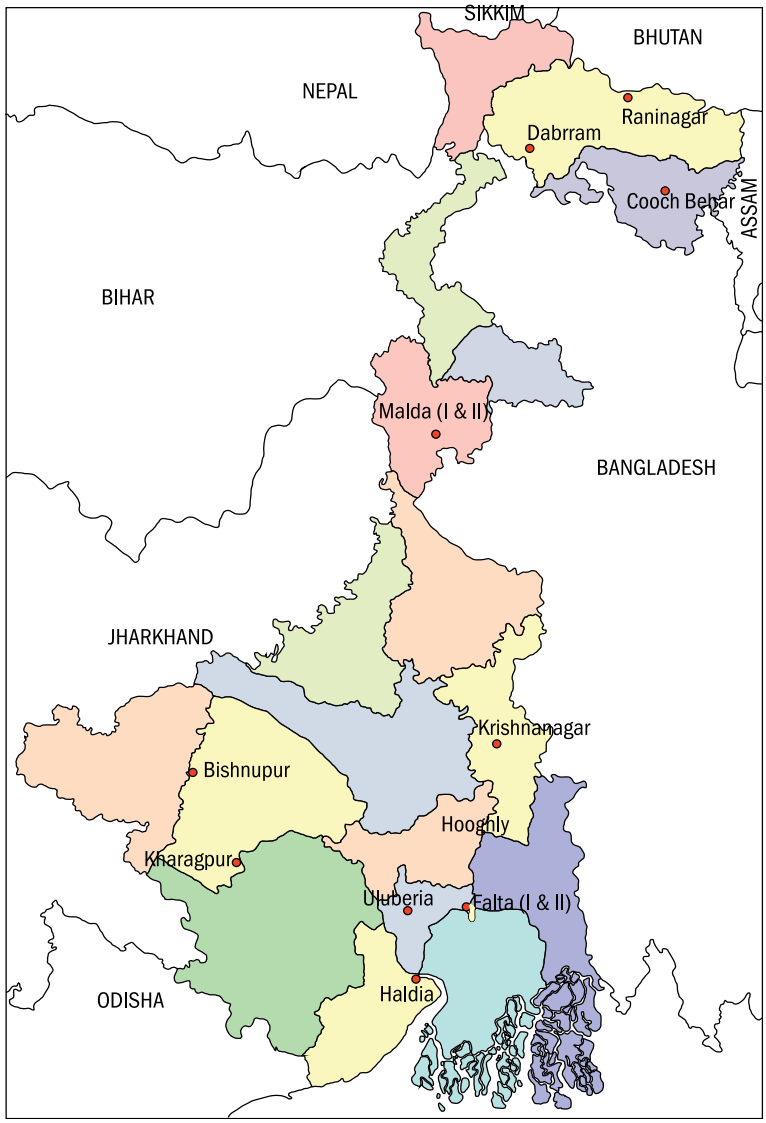

Figure 4.4: City map

4.6 Gujarat International Finance Tech City (GIFT)

GIFT is an under-construction city in the Indian state of Gujarat which is about 12 km from Ahmedabad International Airport. It will have a special economic zone, international education zone, integrated townships, an entertainment zone, hotels, a convention centre, an international techno park, Software Technology Parks of India units, shopping malls, stock exchanges, and service units. GIFT aims at providing transportation network that ensures accessibility, easy and fast mobility, and zero road accidental deaths. GIFT is conceptualized as a global financial and IT services hub, a first-of-its-kind in India, designed to be at or above par with globally benchmarked financial centres, such as Shinjuku, Tokyo, Lujiazui, Shanghai, La Defense, Paris, London Dockyards, etc.

4.7 Smart City activities in other locations

Chennai's- Metropolitan Water Supply and Sewerage Board migrated to an ERP platform to integrate discrete modules and enable MIS and citizen service complaints, billing and collection, and procurement leading to efficiency and transparency of operations.

Bengaluru -Bengaluru definitely scores well on the basic SC characteristics like smart economy and smart people, but the city has to rapidly make amendments to fulfil the criteria of other factors, such as traffic management, parking management, waste management, water management, and energy management.

Mumbai- Municipal Corporation of Greater Mumbai has put in place comprehensive ICT-enabled strategy for delivering citizen services through a web-enabled system operated through the corporation's portal and linked to SAP, which allows for real-time data and operations.

Meesewa in Andhra Pradesh, which is a single entry portal for all services, renders 45 types of services through over 5,500 counters in the state and the number of transactions has crossed six million.

Ahemdabad- Bus Rapid Transport System (BRTS) in Ahmedabad – BRTS in Ahmedabad, operated by Ahmedabad Janmarg Limited, initiated its operations in 2009. Investments in Phase 1, intending to cover a third of Ahmedabad's population of around 3 million people, was around ₹ 500 crore. Currently, BRTS with 12 operating bus routes covering 126 bus stops, has an Integrated Transportation Management System, including a number of smart solutions like Advanced Vehicle Tracking System, Fleet Management System, Automatic Fare Collection System, Passenger Information System, and Vehicle Scheduling & Dispatching mechanism.

Figure 4.5: Smart City initiatives taken in India

5 Policies & Regulations

It is in the background of all these inadequacies in urban India that the Government of India (GoI) decided to make a major intervention to bring about improvements in the urban scenario by launching in 2005 the reforms driven, fast, planned development of cities through JnNURM with a huge grant provision of a little over ₹660 billion. The main thrust of the strategy of urban renewal was to ensure improvement in urban governance. State governments, ULBs, and parastatal agencies together were required to agree to time-bound implementation of an agenda of 23 key reforms and also chip in their share of finances equal to the central grant for projects taken up. One such reform was introduction of system of e-governance using IT applications like *Geographic Information System* (GIS) and *Management Information System* (MIS) for various services provided by urban bodies/parastatals like development authorities and water boards.

5.1 Funding pattern

The Smart City Mission will be operated as a Centrally Sponsored Scheme and the Central government proposes to give financial support to the Mission to the extent of ₹48,000 crores over five years, that is, on an average ₹100 crore per city per year. An equal amount, on a matching basis, will have to be contributed by the State/ULB; therefore, nearly Rupees1 lakh crore of Government/ULB funds will be available for Smart City development.

The project cost of each Smart City proposal will vary depending upon the level of ambition, model, capacity to execute, and repay. It is anticipated that substantial funds will be required to implement the Smart City proposal and towards this end, government grants of both the Centre and State, will be leveraged to attract funding from internal and external sources. The success of this endeavour will depend upon the robustness of SPVs revenue model and comfort provided to lenders and investors. It is expected that a number of schemes in the Smart City will be taken up on PPP basis; the SPVs have to accomplish this.

The GoI funds and the matching contribution by the States/ULB will meet only a part of the project cost. Balance funds are expected to be mobilized from:

- States/ ULBs own resources from collection of user fees, beneficiary charges and impact fees, land monetization, debt, loans, etc.
- Additional resources transferred due to acceptance of the recommendations of the Fourteenth Finance Commission.
- Innovative finance mechanisms, such as municipal bonds with credit rating of ULBs, pooled finance mechanism, tax increment financing.
- Other Central government schemes like Swachh Bharat Mission, AMRUT, National Heritage City Development and Augmentation Yojana.
- Leverage borrowings from financial institutions, including bilateral and multilateral institutions, both domestic and external sources.
- States/UTs may also access the National Investment and Infrastructure Fund, which was announced by the Finance Minister in his 2015 Budget Speech and is likely to be set up this year.
- Private sector through PPPs.

The distribution of funds under the Scheme will be as follows:

- 93% project funds.
- 5% administrative and office expenses (A&OE) funds for state/ULB (towards preparation of Smart City plan and for Project Management Consultants, pilot studies connected to area-based developments and deployment and generation of Smart Solutions, capacity building as approved in the Challenge, and online services).
- 2% A&OE funds for MoUD (Mission Directorate and connected activities/structures, research, pilot studies, capacity building, and concurrent evaluation)

A large part of the financing for smart cities will have to come from the private sector with the States/Cities and Central government only supplementing that effort.

5.2 Nature and extent of Central government support

The Central government's support will be in three forms:

- **Financial support**: Huge investments will be needed. Therefore, innovative methods of raising revenues will have to be developed by the States and Cities, taking into account some of the possibilities outlined earlier. These efforts will be supplemented by the Central government through the Ministry of Urban Development and other Ministries responsible for different sectors, such as health, education, power, transport, IT, communications, etc., by way of allocations specifically for the development of Smart City.
- **Policy support and legal backing**s: It is recognized that urban development is a State Subject under the Constitution of India. Yet, the Central government can play an important supporting role in facilitating appropriate policies that provide a framework for urbanization. While we have a National Urban Transport Policy, we do not have a national urban policy. It would be appropriate for the Urban Transport Policy to also fall within the framework on a National Urbanization Policy.
- **Capacity building**: Developing 100 Smart City across the country will need a large number of professionally-trained manpower and several decision support systems to be in place. Thus, there is a need for a large capacity building programme that encompasses training, education, contextual research, knowledge exchange, and a rich database.
- **Approval process:** The States would be required to submit proposals for approval of the respective satellite cities, cities of tourist and religious importance, as well as cities in the 0.2–1.0 million population range. These proposals would be reviewed by a committee that will be serviced by a regional multidisciplinary Programme Management Unit (PMU) and then approved by the Central Government, supported by the national PMU11.

5.3 Government initiatives

Some of the key highlights (Figure 5.1) under various parameters are listed below.

Smart Transport	▪ Ministry of Urban Development plans to invest more than USD 20 billion on the metro rail projects in the coming years. ▪ India's first monorail project at Mumbai will cost around USD 500 million, of which USD 183 million has been spent on phase I.
Smart Information and Communication	▪ Broadband connections to 175 million users by 2017. ▪ Under the flagship 'Safe City' project, the Union Ministry proposes USD 333 million to make seven big cities (Delhi, Mumbai, Kolkata, Chennai, Ahmedabad, Bengaluru, and Hyderabad) to focus on technological advancement rather than manpower.

Smart Buildings	▪ India is expected to emerge as the world's 3rd largest construction market by 2020, by adding 11.5 million homes every year. ▪ The Intelligent Building Management Systems market is around USD 621 million and is expected to reach USD 1,891 million by 2016. ▪ Smart buildings will save up to 30% of water usage, 40% of energy usage and reduction of building maintenance costs by 10 to 30%.
Smart Governance	▪ USD 83 million allocated for Digital India Initiative. ▪ PPP model to be used to upgrade infrastructure in 500 urban areas. ▪ Plans to develop at least two smart cities in each of India's 29 states. ▪ Delhi–Mumbai Industrial Corridor Development Corporation Limited (DMICDC) plans seven smart cities along the 1,500 km industrial corridor across six states with total investment of USD 100 billion.
Smart Energy	▪ Establish smart grid test bed and smart grid knowledge center. ▪ Implementation of eight smart grid pilot projects in India with investment of USD 10 million. ▪ Addition of 88,000 MW of power generation capacity in the 12th Five-Year Plan (2012–17). ▪ The Power Grid Corporation of India Limited has planned to invest USD 26 billion in the next five years. ▪ Installation of 130 million smart meters by 2021.
Smart Environment	▪ Ministry of New and Renewable Energy has plans to add capacity of 30,000 MW in the 12th Five-Year Plan. ▪ The Indian Ministry of Water Resources plans to invest USD 50 billion in the water sector in the coming years. ▪ The Yamuna Action Plan Phase III project for Delhi is approved at an estimated cost of USD 276 million.

Figure 5.1: Government Initiatives under Smart City Components

5.4 Tendering for Smart City

Government draws out the blueprint of 100 smart cities across the country; India's first smart city project at Dholera is expected to get a boost at the seventh edition of the Vibrant Gujarat Summit. The Dholera Special Investment Region (SIR) is expected to be one of the main investment draws at Vibrant Gujarat Summit 2015 that is also seeking investments for another smart city in the state –the Gujarat International Finance Tec (GIFT) City as well as other infrastructure and manufacturing projects in the state along with the Delhi-Mumbai Industrial Corridor. The Dholera smart city, being developed along the Delhi-Mumbai Industrial Corridor has already initiated the tendering process.

The Ministry of Urban Development has received proposals from 85 of the 98 cities included in the smart city mission within the stipulated time. The High powered steering committee (HPSC) constituted in each state and Union Territories and headed by the Chief Secretary is required to approve the smart city proposals including that of Visakhapatnam, Chandigarh, Guwahati, Panaji, Dharamshala, Faridabad, Amritsar, Hyderabad and New Town Kolkata.

There are three ways for States/UTs to select entities to prepare Smart City Proposals for Stage-2 of the challenge, (1) select a consulting firm from the panel prepared by Ministry of Urban Development (MoUD), (2) appoint a consulting firm outside the panel by following a fair and transparent process, or (3) use a Handholding Agency. The MoUD will technically qualify a panel of consulting firms and the States/UTs are at liberty to draw upon the Panel. Accordingly, MoUD has shortlisted a panel of consulting firms to assist the cities in preparing the Smart City Proposals and the region-wise list of short listed consulting firms is enclosed in Annexure-2.

5.5 Proposed benchmarks for Smart City

Table 5.1: Benchmarks under each component

GoI proposed benchmarks for smart cities under each component	
Parameter	**Benchmark**
Transport	▪ Maximum travel time of 30 minutes in small and medium size cities and 45 minutes in metropolitan areas. ▪ Continuous unobstructed footpath of minimum 2 m wide on either side of all street with **right-of-way** (RoW) 12 m or more. ▪ Dedicated and physically segregated bicycle tracks with a width of 2 m or more, one in each direction, should be provided on all streets with carriage way larger than 10 m (not RoW). ▪ High-quality and high-frequency mass transport within 800 m (10–15 minutes walking distance) of all residences in areas over 175 persons/hectare of built area. ▪ Access to para-transit within 300 m walking distance.
Spatial Planning	▪ 175 persons/hectare along transit corridors. ▪ 95% of residences should have daily needs retail, parks, primary schools, and recreational areas accessible within 400 m walking distance. ▪ 95% residences should have access to employment and public and institutional services by public transport or bicycle or walk. ▪ At least 20% of all residential units to be occupied by economically weaker sections in each Transit Oriented Development (TOD) Zone 800 m from transit stations ▪ At least 30% residential and 30% commercial/institutional in every TOD Zone within 800 m of transit stations.
Water Supply	▪ 24 × 7 supply of water ▪ 100% household with direct water supply connections ▪ 135 litres of per capita supply of water ▪ 100% metering of water connections ▪ 100% efficiency in collection of water-related charges
Sewerage & Sanitation	▪ 100% households should have access to toilets ▪ 100% schools should have separate toilets for girls ▪ 100% households should be connected to the waste water network ▪ 100% efficiency in the collection and treatment of waste water ▪ 100% efficiency in the collection of sewerage network
Solid Waste Management	▪ 100% households are covered by daily door-step collection system. ▪ 100% collection of municipal solid waste ▪ 100% segregation of waste at source, i.e., biodegradable and non-degradable waste ▪ 100% recycling of solid waste

Storm Water Drainage	▪ 100% coverage of road network with storm water drainage network ▪ Aggregate number of incidents of water logging reported in a year = 0 ▪ 100% rainwater harvesting
Electricity	▪ 100% households have electricity connection ▪ 24 × 7 supply of electricity ▪ 100% metering of electricity supply ▪ 100% recovery of cost ▪ Tariff slabs that work towards minimizing waste
Telephone connections	▪ 100% households have a telephone connection including mobile.
Wi-Fi Connectivity	▪ 100% of the city has Wi-Fi connectivity ▪ 100 Mbps internet speed
Health Care Facilities	▪ Availability of telemedicine facilities to 100% residents ▪ 30 minutes emergency response time ▪ 1 dispensary for every 15,000 residents ▪ Nursing home, child welfare and maternity centre—25 to 30 beds per lakh population ▪ Intermediate hospital (Category B)—80 beds per lakh population ▪ Intermediate hospital (Category A)—200 beds per lakh population ▪ Multi-speciality hospital—200 beds per lakh population ▪ Speciality hospital—200 beds per lakh population ▪ General hospital—500 beds per lakh population ▪ 10,020 Family welfare centre for every 50,000 residents ▪ 1 Diagnostic centre for every 50,000 residents ▪ 1 Veterinary hospital for every 5 lakh residents ▪ 1 Dispensary for pet for every 1 lakh residents
Pre Primary to Secondary Education	▪ Area equivalent to 15% of residential area for building hospitals ▪ 1 pre-primary/nursery school for every 2,500 residents ▪ 1 Primary school (class I to V) for every 5,000 residents ▪ 1 Senior secondary school (Cass VI to XII) for every 7,500 residents ▪ 1 Integrated school (Class I to XII) per lakh of population ▪ 1 School for physically challenged for every 45,000 residents ▪ 1 School for mentally challenged for per 10 lakh population
Higher Education	▪ 1 College per 1.25 lakh population ▪ 1 University ▪ 1 Technical education centre per 10 lakh population ▪ 1 Engineering college per 10 lakh population ▪ 1 Medical college per 10 lakh population ▪ 1 Other professional college per 10 lakh population ▪ 1 Paramedical institute per 10 lakh population ▪ 1 Veterinary institute
Fire Fighting	▪ 1 Fire station per 2 lakh population /5–7km ▪ radium ▪ 1 Sub-fire station with 3–4 km radius

Others	▪ Use of renewable energy in all sectors ▪ Rooftop solar panels on all public, institutional, and commercial buildings as well as multi-storied residential housings ▪ Adherence to green building norms ▪ Common ducting for all services ▪ Double entry accounting on real-time basis ▪ 3D maps on GIS of property and all services—power, water supply, sewerage, etc. ▪ Cities to formulate building and parking standards

Source: http://smartcities.gov.in/

Conclusion

The concept of Smart City envisioned by the current Government is a much needed and timely one. The current urban population is 1.5 billion and over a period of time, this can reach up to 60% of total population contributing 75% of GDP. In this context, making the city smart is both necessary and challenging. The framework of such cities has been discussed in some details in the preceding pages. The international comparison clearly shows that in Europe and elsewhere, a great deal of emphasis is being put for preserving and developing Smart City. Multidimensionality of smart cities concept crosscutting ICT applications on transport, energy management, water management, healthcare, etc., is an important aspect.

In India, converting the existing congested cities into smart ones is a formidable task. While Greenfield cities as planned along the Delhi–Mumbai corridor are a little easier to set up, but conceptualization and implementation of the same have to be done with a forward vision and continuous monitoring in existing cities.

GoI has already identified possible Smart City and has asked for responses from the State governments within the financial framework laid down for this purpose. The concept of Smart Cities in India is an evolving one and therefore, a great deal, as stated above, will depend upon proper formulation and careful implementation.

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Annexure-1

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Smart Governance
Delhi	Local body administrative responsibilities are shared by MCD, NDMC and Delhi Cantonment Board
Kochi	Statutory bodies that oversees its development are Great Cochin Development Authority (GCDA) and Goshree Islands Development Authority (GIDA)
Ahmedabad	Administrative responsibility in the city are with Ahmedabad Municipal Corporation (AMC) and Ahmedabad Urban Development Authority (AUDA)
Varanasi	Administrative responsibility in the city are with Varanasi Nagar Nigam (Municipal Corporation) , Varanasi Development Authority (VDA), Power of state is managed by Uttar Pradesh Power Corporation Limited (UPPCL) and Law and Order is managed by Uttar Pradesh Police of Varanasi Zone
Bengaluru	Administrative responsibilities are with the departments. Efficient governance is present in the city. Departments for poverty, transport, law and order, and education is present.

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Smart Citizen
Delhi	Incentives provided for sports facilities and swimming pools in schools, clubs and group housing. (Proposed) Provisions for sports infrastructure for local, national, and international events. (Proposed)
Kochi	Self-sustaining, balancing business spaces, job creation, encourage job retention and employee satisfaction
Ahmedabad	58 City Civic Centers: 8 in Central Zone, 10 in East Zone, 11 in New West Zone, 9 in North Zone, 9 in South Zone and 11 in West Zone Municipal Sports Complexes and Skating Rinks run by AMC
Varanasi	▪ Varanasi is one of the city, involved in Clean Ganga Campaign under Swachh Bharat Abhiyan (Proposed) ▪ Citizens are using Wi-fi in major Ghats. ▪ Special partnership agreement with Japanese city to rejuvenate it into smart city. ▪ PM has launched Integrated Power Development Scheme (IPDS). It will get ₹572 crore for the project that aims at underground cabling of power lines (Proposed)
Bengaluru	▪ Creating awareness on improving the quality of life in all aspects. ▪ Sensitizing all section of people from the general public to the administrators to the executers. ▪ Design of self-contained townships' led to lesser stress on resources. ▪ A participatory 'city sustainability plan' was developed and rigorously implemented. ▪ Behavioural changes in communities due to increased environmental awareness.

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Smart Energy
Delhi	▪ Approx. 2,500 MW solar power generation potential through solar rooftop ▪ Solar rooftop installations are encouraged in government office and high rise buildings
Kochi	Solar powered lighting, LEED Platinum building
Ahmedabad	City is about to have India's first smart grid system, where consumers will be able to pick a suitable plan for electricity consumption. (Proposed)
Varanasi	Institute of Environment and Sustainable Development, Banaras Hindu University (BHU) will get a 'Green Building' (Proposed)
Bengaluru	There are four solar powered buildings in the city

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Smart Technology
Delhi	Wi-fi connectivity in the social hubs of the capital
Kochi	Access to the Metro Ethernet network, Cloud computing, Telecommunications and Network
Ahmedabad	▪ Free wifi availability in Kankaria Lake, Gandhi ashram, Iskon mall, Karnavati club, Science city, Civil hospital, Drive-in, Madhupura market ▪ Places where free wi-fi will be soon available Sabarmati Ashram, BJ Medical College and lots of more places (Proposed)
Varanasi	▪ Wi-fi connectivity along the major Ghats of the city
Bengaluru	Free wi-fi availability in MG Road, Brigade Road, Shanthi Nagar bus station, Yeshwantpur bus station, Koramangala bus station and CMH Road, Indiranagar

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Smart Infrastructure
Delhi	▪ Collection and Transportation in (Karol Bagh, West Zone, Central Zone, South Zone, City Zone, SP Zone) ▪ MCD is making Improvement in Practices ▪ Segregation and collection of road side collection of sweeping waste (NDMC) ▪ Teatment plant Capacity (512.4MGD) Existing Sanitary Landfills site: ▪ Ghazipur (70 Acres) ▪ Okhla (56 Acres) ▪ Bhlasa (40 Acres)

	Disaster Management centre provided in each administrative zone. (Proposed) Building regulations for safety of structures as per seismic zone. (Proposed) Land Use zoning as per micro zonation. (Proposed) 43 Fire Stations in NCT Three Disaster Management Control Centers: ▪ Nehru Place ▪ Laxmi Nagar ▪ Rohini
Kochi	▪ A Seepage treatment plant would be set up in Brahmapuram (Proposed) ▪ More sewage plant would be made operational in the city (Proposed)
Ahmedabad	▪ Metro availability – In the approved route for 1st phase includes two corridors named as North-South corridor and East-West corridor. Total length of this phase is 37.776 km consisting 33 stations (including 4 underground stations)
Varanasi	▪ Three sub cities — Sarnath, Banaras Hindu University and Airport City will be carved out as smart sub-cities, interconnected by a network of flyovers. (Proposed) ▪ The ministry plans to restore the Sarnath Temple, the Jain temples of Varanasi with help from the Archaeological Survey of India (Proposed)
Bengaluru	▪ Elsys Intelligent Devices Pvt. Ltd, an Indian startup, has launched Raksha Safe Drive, a smart road safety platform enabled by electronics, Internet of Things (IoT), telecommunications and cloud technology. (Proposed) ▪ Alternative city like Mysore developed. ▪ Alternative city Kolan developed. ▪ Alternative city Trunkum developed.

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Smart Mobility
Delhi	▪ Air, rail and sea travel lines converge. ▪ Metro facility is available connecting Delhi and NCR ▪ Solar rooftops installed in the Badarpur—Faridabad metro line by Sun-edison
Kochi	▪ Air, rail, and sea travel lines converge.
Ahmedabad	▪ Ahmedabad has an international airport named as Sardar Vallabh Bhai Patel International Airport ▪ First phase of ₹10,700-crore Ahmedabad Metro rail project will be starting soon. (Proposed) ▪ There are two Transport services under AMC one is Ahmedabad Municipal Transport Services (AMTS) and second is Bus Rapid Transit System (BRTS)
Varanasi	▪ Construction of a metro rail, an IT park, a skill development centre and an IT research and development centre (Proposed) ▪ Varanasi has an international Airport named as Lal Bahadur Shastri International Airport, Babatpur

Bengaluru	▪ Congesting transport. ▪ De-centralization of the city. ▪ Multi-modal public transport. ▪ Eco-friendly automobiles. Running on non-conventional fuels. ▪ Two airports.

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Smart Buildings
Delhi	▪ 8 GRIHA rated buildings , 2 LEED rated buildings
Kochi	▪ 9 LEED Rated Buildings
Ahmedabad	LEED rated Building ▪ Torrent Research Institute in Ahmedabad uses the 'hamarewala green' approach to save energy costs. ▪ The Sangath building, an architect's studio in Ahmedabad adopts a careful landscape planning. (Energy-efficient building) ▪ Shapath V, being developed by Savvy Infrastructires Ltd on Ahmedabad's SG Highway, is tallest building in Ahmedabad and is constructed on Green building norms.
Varanasi	▪ Institute of Environment and Sustainable Development, Banaras Hindu University (BHU) will get a 'Green Building' (Proposed)
Bengaluru	▪ ITC Royal Gardenia, Bengaluru has reduced heat gain to large extent by their design and have experienced serious energy savings

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Smart Healthcare
Delhi	▪ Health facilities proposed to achieve norms of five beds / 1,000 population ▪ Enhancement of FAR for hospitals and other health facilities. ▪ Nursing Homes, clinics, etc., also allowed under relaxed Mixed Use norms.
Kochi	▪ There are more than 20 medical centers in Kochi ▪ Ernakulam Medical Centre ▪ Amrita Institute of Medical Sciences and Research Centre ▪ Gyno Specialty Hospital and many more

Ahmedabad	▪ Medical Institutes in Ahmedabad ▪ Ahmedabad Municipal Corporation Medical Education Trust Medical College ▪ B J Medical College ▪ CU Shah Medical College ▪ Government Medical College and many more
Varanasi	▪ Partnership for Safe Medicines (PSM) India has signed a MoU with IIT, BHU for establishing a centre of excellence on 'Patient Safety and Accessibility to Quality Healthcare' to achieve a goal of universal healthcare. (Proposed)
Bengaluru	▪ Bengaluru is considered as the medical hub. Some medical institutes are as follows: ▪ Bengaluru Medical College and Research Institute ▪ The medical facilities in Bengaluru are well within reach of a citizen

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Education
Delhi	▪ Delhi's literacy rate was recorded at 86.34% - up by 4.67% in comparison to the 2001 census. ▪ Good primary and secondary Schools , Good Universities are present , Medical Colleges, Engineering Colleges, Management Institutes
Kochi	▪ Educational institute are well within reach ▪ Good Primary and secondary schools, Universities, Engineering and Medical Colleges, Fisheries and Ocean Studies are available.
Ahmedabad	▪ Schools in Ahmedabad are run either by the AMC or privately by individuals and trusts. ▪ Majority of the schools are affiliated to the Gujarat Secondary and Higher Secondary Education Board (GSEB). Some schools like the Delhi Public School and the Kendriya Vidyalayas are associated with the Central Board for Secondary Education (CBSE). ▪ IIM, Ahmedabad ▪ Gujarat University ▪ Gujarat Vidyapeeth (Educational Institutions within reach)
Varanasi	▪ The Educational Institutes are within reach: ▪ Up Board , CBSE, ICSE schools, Universities, Medical Colleges, Pharmacy Colleges are available
Bengaluru	▪ Average literacy rate of Bengaluru (Bengaluru) district is 87.67%. ▪ Educational institutions within reach CBSE, ICSE schools, Universities, Medical Colleges, Management Colleges

Cities	Criteria [By using Information and Communication Technologies (ICTs)]
	Environment & Air Quality
Delhi	▪ According to PM Narendra Modi, government will publish air quality data for 10 cities, under which Delhi is one of them. (Proposed) ▪ Nitrogen Dioxide levels in Delhi exceeded National Ambient Air Quality Standards
Kochi	▪ Fluctuating trend and Chennai is well within the NAAQS. ▪ Rainwater harvesting through Storm water Management system ▪ Outdoor circulations and seamless integration with the nature ▪ Landscape treated as an extension of the vegetation on site ▪ Environmental responsive building (efficient and sun responsive envelope, natural ventilation, passive cooling)
Ahmedabad	▪ Abundance of green, natural open spaces, Solar powered lighting, Rainwater harvesting, Storm water Management system
Varanasi	▪ With respect to Respirable Suspended Particulate Matter (RSPM/PM10), Varanasi exceeded the NAAQS almost in all the years. ▪ According to PM Narendra Modi, government will publish air quality data for 10 cities, under which Varanasi is one of them. (Proposed)
Bengaluru	▪ With respect to Respirable Suspended Particulate Matter (RSPM/PM10), Bengaluru exceeded the NAAQS almost in all the years. ▪ According to PM Narendra Modi, government will publish air quality data for 10 cities, under which Bengaluru is one of them. (Proposed)

Annexure- 2

Region 1. Bihar, Odisha, West Bengal and Andaman & Nicobar Islands

Rank	Name of Consulting firms
1.	Deloitte Touche Tohmatsu India Private Limited (Deloitte) in association with Urban Management Consultant (UMC) and Hijli Inspiration (Inspiration)
2.	Srei Infrastructure Finance Limited In association with . Navayuga Spatial Technologies Private Limited RSP Design (India) Consultants Pvt Ltd
3.	Alia Consulting Solutions Pvt. Ltd. in association with Akanya Development Solutions and Genesis Fin tech
4.	ArkiTechno Consultants (India) Pvt Ltd in association with IRS Systems South Asia Pvt Ltd
5.	The Energy and Resource Institute in association with Tractebel Engineering SA, Belgium and Avalon Information Systems Pvt Ltd
6.	Mahindra Consulting Engineers Limited in association with SUEZ Environment Consulting and Akara Research and Technologies Pvt Limited
7.	DDF Concultants Pvt Ltd in association with MSN Infrastructure and Financial Consultant Ltd and SGI Studio Galli Ingegneria Pvt Ltd
8.	NCPE Infrastructure India Pvt Ltd
9.	Ecorys Nederland BV in association with Ecorys India Pvt Ltd
10.	N K Buildcon Pvt Ltd
11.	SoftTech Engineers Pvt Ltd an association with Design Point Consult Pvt Ltd

Region 2: Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Chandigarh and Delhi

Rank	Name of Consulting firms
1.	AECO India Pvt Ltd in association with AECOM ASIA COMPANY LIMITED
2.	Tandon Urban Solutions Pvt. Ltd. (TUSPL) in association with Spatial Decisions and Maha Infotech Pvt. Ltd. (MIPL)
3.	Arup India Pvt Ltd
4.	WAPCOS LTD in association with Yashi Consulting Services Pvt Ltd and Cambridge Systematics Consulting & Technology Private Limited,
5.	McKinsey & Company Inc
6.	The Energy and Resource Institute in association with Tractebel Engineering SA, Belgium and Avalon Information Systems Pvt Ltd
7.	All India Institute of Local Self Government
8.	Mukesh and Associates in association with VisionRI Connexion Services Private Limited
9.	KPMG Advisory Services Pvt Ltd
10.	Ecorys Nederland BV in association with Ecorys India Pvt Ltd
11.	DRA Consultants Pvt. Ltd. In JV with Unity Consultants Pvt. Ltd. and Vansh Infotech Pvt. Ltd

Region 3: Uttar Pradesh and Uttrakhand

Rank	Name of Consulting firms
1.	PricewaterhouseCoopers Private Limited in association with Rudhrabhishek Enterprise Private Ltd.(RPEL) and CPG Consultants Pte Limited,
2.	ICF Consulting India Pvt Ltd in association with ICF Consulting Sevices India Pvt Ltd and Total Synergy Consulting Pvt Ltd
3.	Mars Planning and Engineering Services Pvt Ltd in association with Walls Roberts and Todds and UPICO
4.	Aarvee Associates Architects Engineers and Consultants Pvt Ltd in association with MARS Telecom Systems Pvt Ltd
5.	Engineers India Ltd in association with JPS Associates P Ltd
6.	N K Buildcon Pvt Ltd
7.	SoftTech Engineers Pvt Ltd an association with Design Point Consult Pvt Ltd
8.	Data World Pty Ltd in association with Innovest Advisory Services Pvt Ltd and Caritas Eco Systems Pvt Ltd
9.	International City/County Management Association (ICMA) in association with Urban Management Centre (UMC) and Edgesoft India Pvt. Ltd.
10.	Dorsh Holding GmbH in association with Dorsh Consult India Pvt Ltd and L R Kadiyali and associates

Region 4: Madhya Pradesh and Chhattisgarh

Rank	Name of Consulting firms
1.	Haskoning DHV Consulting Pvt Ltd in in JV with HaskoningDHV Nederland B.V. and Grant Thornton Green Boulevard
2.	Delhi Integrated multi model transit system Ltd (DIMTS) in association wirh Uttarakhand Infrastructure Development Company Limited (U-DEC) and Insttitue for Spatial Planning and Environmental Research Company (ISPER)
3.	Mehta and Associates in JV with Oswal Computers and Consultants Pvt Ltd
4.	PricewaterhouseCoopers Private Limited in association with Rudhrabhishek Enterprise Private Ltd.(RPEL) and CPG Consultants Pte Limited,
5.	Voyants Solutions Pvt Ltd in association with MINRAJ Consultants
6.	Infosys Limited In association with ICLEI - Local Governments for Sustainability South Asia and Administrative Staff College of India,
7.	WAPCOS LTD in association with Yashi Consulting Services Pvt Ltd and Cambridge Systematics Consulting & Technology Private Limited,
8.	All India Institute of Local Self Government

9.	Pell Frischmann Consultants Ltd in association with Frischmann Prabhu
10.	Shah Technical Consultants Pvt. Ltd. (STC)
11.	DRA Consultants Pvt. Ltd. In JV with Unity Consultants Pvt. Ltd. and Vansh Infotech Pvt. Ltd.

Region 5: Maharashtra and Jharkhand

Rank	Name of Consulting firms
1.	CRISIL Risk and Infrastructure Solutions Limited In association with PriMove Infrastructure Development Consultants Pvt. Ltd. And Probity Soft Pvt. Ltd
2.	Delhi Integrated multi model transit system Ltd (DIMTS) in association wirh Uttarakhand Infrastructure Development Company Limited (U-DEC) and Insttitue for Spatial Planning and Environmental Research Company (ISPER)
3.	EPTISA Servicios de Ingenieria, S.L. in association with LKS India Pvt Ltd
4.	Knight Frank (India) Pvt Ltd in association with Fortress Infrstructure Services and PSP Financial Consultants Pvt Ltd
5.	Mars Planning and Engineering Services Pvt Ltd in associarion with Walls Roberts and Todds and UPICO
6.	Alia Consulting Solutions Pvt. Ltd. in association with Akanya Development Solutions and Genesis Fin tech
7.	Tandon Urban Solutions Pvt. Ltd. (TUSPL) in association with Spatial Decisions and Maha Infotech Pvt. Ltd. (MIPL)
8.	Arup India Pvt Ltd
9.	Aarvee Associates Architects Engineers and Consultants Pvt Ltd in association with MARS Telecom Systems Pvt Ltd
10.	Infrastructure Development Corporation (Karnataka) Limited (iDeCK) in association with IDFC Foundation
11.	McKinsey & Company Inc.

Region 6: Rajasthan, Gujarat, Daman & Diu, Dadar & Nagar Haveli

Rank	Name of Consulting firms
1.	Darashaw & Co. Pvt. Ltd in consortium with IDOM Ingenieria y Consultoria S.A.U. & FUNDACION CARTIF
2.	Lea Associates South Asia Pvt Ltd in association with Crux Consultants Pvt Ltd and VBSOFT Pvt Ltd
3.	IIDC Limited in association with Urban Mass Transit Company Limited and Building Design Partnership Limited
4.	Egis India Consulting Engineers Pvt. Ltd. In association with IAU idF France and Egis EAU
5.	Haskoning DHV Consulting Pvt Ltd in in JV with HaskoningDHV Nederland B.V. and Grant Thornton Green Boulevard,
6.	Deloitte Touche Tohmatsu India Private Limited (Deloitte) in association with Urban Management Consultant (UMC) and Hijli Inspiration (Inspiration)
7.	Mott MacDonald Private Limited in association with Mott MacDonald Limited and Ernst and Young LLP
8.	Feedback Infra Private Limited in Association With Buro Happold Engineers India Pvt. Ltd.and Cisco Systems Services B.V
9.	Mehta and Associates in JV with Oswal Computers and Consultants Pvt Ltd
10.	ICRA Management Consulting Services in association with Limited NJS Engineers India Private Limited
11.	Jones Lang LaSalle Propoerty Consultants India P Ltd in association with Townland Consultants Pvt Ltd and Tata Consulting Engineers Ltd

Region 7: Tamil Nadu, Kerala, Puducherry, Lakshadweep

Rank	Name of Consulting firms
1.	EPTISA Servicios de Ingenieria, S.L. in association with LKS India Pvt Ltd
2.	ICRA Management Consulting Services in association with Limited NJS Engineers India Private Limited
3.	Jones Lang LaSalle Propoerty Consultants India P Ltd in association with Townland Consultants Pvt Ltd and Tata Consulting Engineers Ltd
4.	CRP Risk Management Limited in association with Infrastructure Management and Advisory Services Private Limited

5.	Infrastructure Development Corporation (Karnataka) Limited (iDeCK) in association with IDFC Foundation
6.	Mahindra Consulting Engineers Limited in association with SUEZ Environment Consulting and Akara Research and Technologies Pvt Limited
7.	NCPE Infrastructure India Pvt Ltd
8.	Mukesh and Associates in association with VisionRI Connexion Services Private Limited,
9.	KPMG Advisory Services Pvt Ltd
10.	Pell Frischmann Consultants Ltd in association with Frischmann Prabhu
11.	Shah Technical Consultants Pvt. Ltd. (STC)

Region 8: Andhra Pradesh, Telangana, Karnataka and Goa

Rank	Name of Consulting firms
1.	Darashaw & Co. Pvt. Ltd in consortium with IDOM Ingenieria y Consultoria S.A.U. & FUNDACION CARTIF
2.	Lea Associates South Asia Pvt Ltd in association with Crux Consultants Pvt Ltd and VBSOFT Pvt Ltd
3.	IIDC Limited in association with Urban Mass Transit Company Limited and Building Design Partnership Limited
4.	Egis India Consulting Engineers Pvt. Ltd. In association with IAU idF France and Egis EAU
5.	CRISIL Risk and Infrastructure Solutions Limited In association with PriMove Infrastructure Development Consultants Pvt. Ltd. And Probity Soft Pvt. Ltd
6.	Mott MacDonald Private Limited in association with Mott MacDonald Limited and Ernst and Young LLP
7.	Srei Infrastructure Finance Limited In association with . NaVayuga Spatial Technologies Private Limited RSP Design (India) Consultants Pvt Ltd
8.	AECOM India Pvt Ltd in association with AECOM ASIA COMPANY LIMITED
9.	Knight Frank (India) Pvt Ltd in association with Fortress Infrstructure Services and PSP Financial Consultants Pvt Ltd
10.	Infosys Limited In association with ICLEI - Local Governments for Sustainability South Asia and Administrative Staff College of India
11.	CRP Risk Management Limited in association with Infrastructure Management and Advisory Services Private Limited

Region 9: Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim

Rank	Name of Consulting firms
1.	Feedback Infra Private Limited in Association With Buro Happold Engineers India Pvt. Ltd.and Cisco Systems Services B.V
2.	ICF Consulting India Pvt Ltd in association with ICF Consulting Sevices India Pvt Ltd and Total Synergy Consulting Pvt Ltd
3.	Voyants Solutions Pvt Ltd in association with MINRAJ Consultants
4.	ArkiTechno Consultants (India) Pvt Ltd in association with IRS Systems South Asia Pvt Ltd
5.	DDF Concultants Pvt Ltd in association with MSN Infrastructure and Financial Consultant Ltd and SGI Studio Galli Ingegneria Pvt Ltd
6.	Engineers India Ltd in association with JPS Associates P Ltd
7.	Data World Pty Ltd in association with Innovest Advisory Services Pvt Ltd and Caritas Eco Systems Pvt Ltd
8.	International City/County Management Association (ICMA) in association with Urban Management Centre (UMC) and Edgesoft India Pvt. Ltd.
9.	Dorsh Holding GmbH in association with Dorsh Consult India Pvt Ltd and L R Kadiyali and associates

ENVIS Centre on Renewable Energy and Environment

The Energy and Resources Institute