

SMART CITIES IN INDIA: CREATING A SMARTER NATION



Author:

Rahul Bajaj, Quality & Business Excellence, Sterlite Technologies Ltd.

Date Released: February 2018

ABSTRACT

India is gearing up for implementation of 100 Smart Cities and the country will have its first ever Smart City by 2020, which is all set to turn the

world's attention to us. To live up to the credibility we earned after the launch of "Mangalyaan" and in our efforts to scale new heights, it is important to carefully consider every



step in the implementation of smart cities.

Smart city implementation demands excellent coherence and coordination among various large departments like IT, Civil, Utilities, Telecom, Security, Municipal Corporations, Surveillance, Logistics & the Smart City implementation team. Hence, until diligent measures are put in place to ensure a seamless co-ordination between all these different units, a successful implementation will not be possible.

This whitepaper discusses how Sterlite Tech's expertise and depth of knowledge has enabled the successful implementation of smart city projects across major cities in India. We also discuss in detail about what constitutes a Smart City, its core infrastructure elements, mission, risks involved, key challenges, project approach, scheduling and control. To conclude, we also recommend an approach for risk identification, quantification criteria, mitigation strategies and aversion mechanisms.

Defining smart cities

There is no universally-accepted definition of a smart city. It means different things to different people. The conceptualisation of a Smart City, therefore, varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents. A smart city would have a different connotation in India than, say, in Europe.

Some definitional boundaries are required to guide cities in the Smart City Mission. Every city dweller in India will imagine a smart city to

have a list of services, indicating their level of aspiration. To meet these aspirations and needs of the citizens, urban planners should ideally aim at developing the entire urban eco-system, which is represented by the four pillars of comprehensive development- institutional, physical, social and economic. This can be a long-term goal and cities can work towards developing infrastructure required for the development incrementally.

The core infrastructure elements in a Smart City would include:

- Adequate water supply
- Assured electricity supply
- Sanitation, including solid waste management
- Efficient urban mobility and public transport
- Affordable housing, especially for the poor
- Robust IT connectivity and digitalization
- Good governance, especially e-Governance and citizen participation
- Sustainable environment
- Safety and security of citizens,

particularly women, children and the elderly

- Health and education

Accordingly, the purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to smart outcomes. Area-based development will transform existing areas (retrofit and redevelop), including slums, into better planned ones, thereby improving the liveability of the city. New areas (greenfield) will be developed around cities in order to accommodate the expanding population in urban areas. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services. Such comprehensive development will improve quality of life, create employment and enhance incomes for all, especially the poor and the disadvantaged, leading to more inclusive cities.

Smart city: A multi-dimensional approach



Overview: The Smart Cities Mission

The objective of the Smart Cities Mission is to promote cities that provide core infrastructure and offer a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions. The Smart Cities Mission of the Government of India is based on a sustainable and inclusive development approach. The aim of the mission is to create a model that can be replicated, catalysing the creation of similar Smart Cities in various other parts of the country.

Why do we need Smart Cities?

India is known for its planned urbanization which can be traced back to many centuries. Cities existed as religious centres, trading and manufacturing hubs. However, with exploding population and lack of a grand systemic vision, along with colonization spanning several years, development occurred in bits and pieces and not in alignment with local requirements and environmental concerns. Consequently, urbanization also happened in silos with disconnect between economic and educational needs on one hand and social and environmental impact considerations on the other. The Smart City Mission is a timely, focused, pan-Indian initiative to tap the local resources effectively and then integrate them with the needs of local citizens. The state can play a role, more as a facilitator, in the identification of short term and long term projects to be undertaken. The next step would be to select appropriate technologies, with people's participation, to achieve and sustain planned growth, measured by certain pre-defined indicators of "smartness", as this concept evolves overtime.

How Smart Cities will benefit citizens

- a) Better city planning and development
- b) E-government services delivered to citizens, faster, and at a lower operating expense
- c) Local economic development
- d) Improved productivity and service

Waste Management

- a) Waste converted to be used as fuel
- b) Waste water can be treated for reuse
- c) Recycling & reduction of waste

Water

- a) Smart meters
- b) Leakage identification and prevention
- c) Water quality monitoring

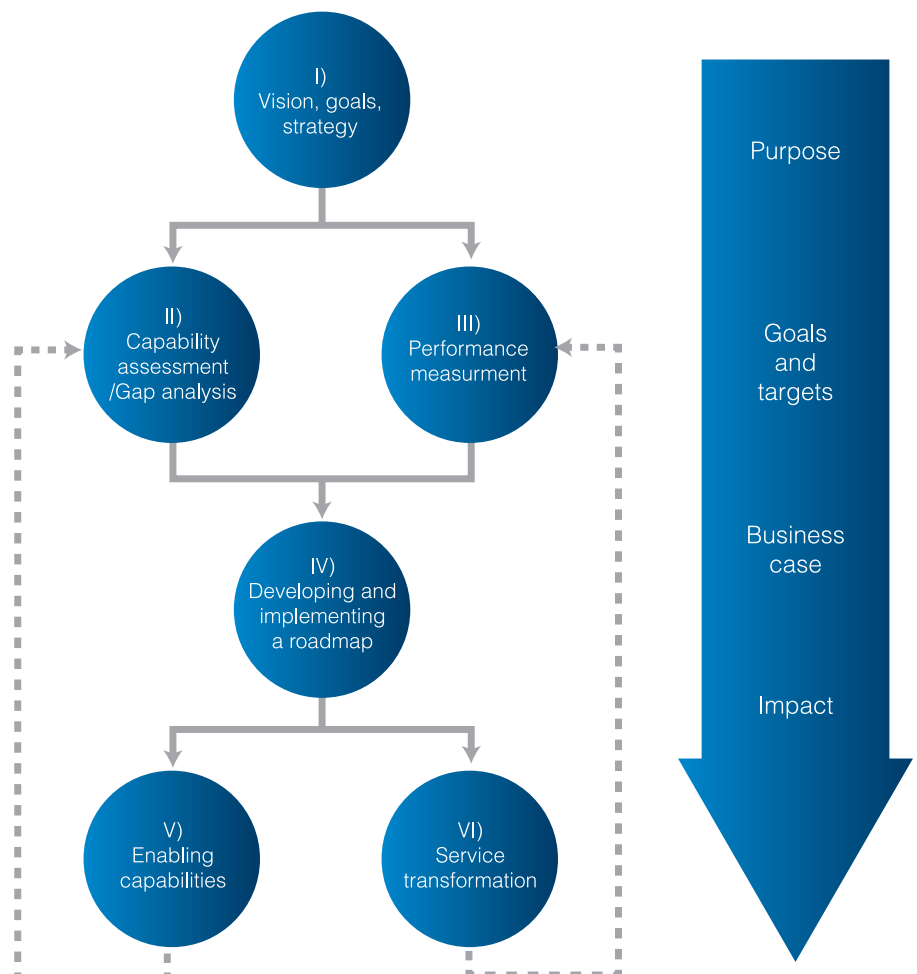
Energy

- a) Smart meters
- b) Green buildings
- c) Renewable sources of energy

Mobility

- a) Smart parking
- b) intelligent traffic management
- c) Integrated multi-modal transport

The Conceptual Idea of Smart City



The Guiding Principles for a Smart City

- 1. Well-being** – Refers to the overall liveability conditions in a city, which includes hard and soft infrastructure, aesthetics, functionality and safety aspects, which build an image of a modern, well-connected city which is IOT-enabled.
- 2. Equity** – Refers to the availability of conditions for the mental, physical and social well-being of citizens.
- 3. Efficiency** – Refers to how well the city is equipped to meet the demands for resources, finances and manpower to produce the desired outcomes (i.e., city goals).
- 4. Foresight** – Signifies a commitment to address long-term challenges and aspirations of a city.

The Eight Critical Pillars of India's Smart City Program

- 1. Smart Governance:** Investments of about US\$1.2 trillion will be required over the next 20 years to spruce up various departments such as transportation, energy and public security to build smart cities in India.

Key Highlights:

- US\$1.2 billion allocated for smart cities and FDI norms relaxed
- US\$83 million allocated for Digital India Initiative
- PPP Model to be used to upgrade infrastructure in 500 urban areas
- Smart City projects to create 10 15% rise in employment
- Ministry of Urban Development has plans to develop 2 smart cities in each of India's 29 states

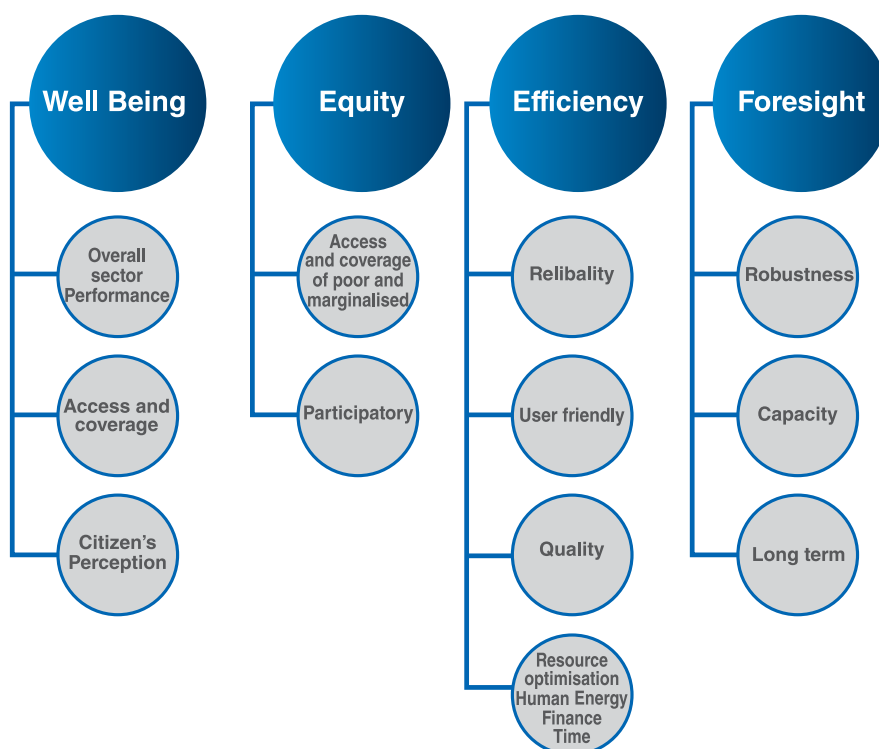
- Delhi Mumbai Industrial Corridor Development Corporation Ltd (DMICDC) plans seven "smart cities" along the 1,500 km industrial corridor across six states with a total investment of US\$100 billion

2. Smart Grid: Three crucial dimensions of smart energy systems are:

- Electrification of all households with power available for at least 8 hours per day by 2017
- Establish smart grid test bed by 2014 and smart grid knowledge centre by 2015
- Implementation of 8 smart grid pilot projects in India with an investment of US\$10 million Energy Storage
- Addition of 88,000 MW of power generation capacity in the 12th Five Year Plan (2012-17)
- India needs to add at least 250 400 GW of new power generation capacity by 2030
- The Power Grid Corporation of India has planned to invest US\$26 billion in the next five years
- Smart meters
- India to install 130 million smart meters by 2021

3. Smart Environment: The crucial dimensions of ensuring sustainable development are:

- Ministry of New and Renewable Energy has plans to add capacity of 30,000 MW in the 12th Five Year Plan (2012-17)
- Water and waste water management
- The Indian Ministry of Water Resources plans to invest US\$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 US\$276 million Sanitation
- About 67% of the rural population



Guiding Principles for the Smart City Reference Framework



continues to defecate in the open, and India accounts for about 50% of the world's open defecation.

- The Government of India and the World Bank have signed a US\$500 million credit for the Rural Water Supply and Sanitation (RWSS) project in the Indian states of Assam, Bihar, Jharkhand and Uttar Pradesh.

4. Smart Transportation: The Government of India has set ambitious targets for developing public transportation system to support the ever-growing urban populace.

- The Government of India has approved a US\$4.13 billion plan to accelerate electric and hybrid vehicle production by setting an ambitious target of 6 million vehicles by 2020
- Electric vehicle charging stations in all urban areas and along all state and national highways by 2027

Railways

- Metro: The Ministry of Urban Development plans to invest more than US\$20 billion on metro rail projects in the coming years.
- High-speed rail: The proposed 534 km Mumbai-Ahmedabad high speed rail project will incur an investment of around US\$10.5 billion.
- Monorail: India's first monorail project at Mumbai will cost around US\$500 million, of which US\$183 million has been spent on phase I.

5. Smart IT & Communications:

- Cloud computing will evolve into a US\$4.5 billion market in India by 2016
- Broadband connections to 175 million users by 2017

Security and Surveillance

- Under the flagship "Safe City" project, the Union Ministry proposes US\$333 million to make seven big cities (Delhi, Mumbai, Kolkata, Chennai, Ahmedabad, Bangalore and Hyderabad) to focus on technological advancement rather than manpower Disaster Management.
- The Government of India and World Bank have signed a US\$236 million agreement for reducing disaster risks in coastal villages of Tamil Nadu and Puducherry.

6. 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 US\$621 million and is expected to reach US\$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%.

7. Smart Health

- Health budget up by 27% in FY 2014-15 to US\$5.26 billion, with special focus on improving affordable healthcare for all.
- To establish six new AIIMS-like institutes and 12 government medical colleges in the country.
- Accessible, affordable and effective healthcare system for 1.2+ billion citizens.

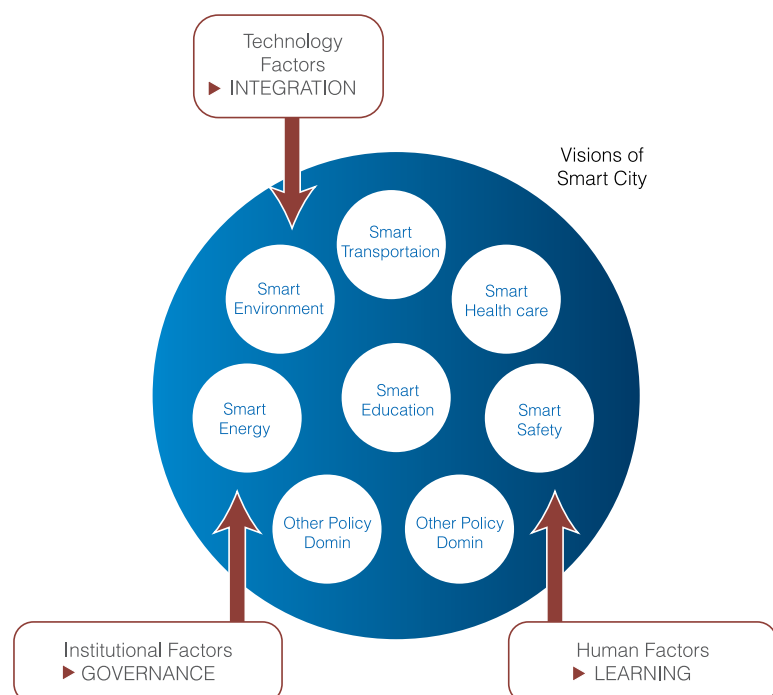
Insurance

- FDI limit in the insurance sector was increased to 49% from 26%.
- Insurance industry has potential to reach US\$1 trillion by 2020.

Medical Devices

- Indian medical devices market to reach US\$11 billion by 2023.
- 100% FDI allowed in the medical devices sector under the automatic route.

The Nam and Pardo Smart City Model



Wellness

- Indian wellness industry is expected to reach around US\$16.65 billion by 2015

8. Smart Education: The Government of India has allocated US\$13.95 billion in the Union Budget

and industry requirements

- 100% FDI allowed in the education sector
- India's online education market size expected to be US\$40 billion by 2017

75% (GBP£334billion), real estate 21%(GBP£94 billion) and remaining has been allocated for ICT.

On the other hand, real estate constitutes 40% total cost for greenfield projects, it will be only 19% for brownfield cities. Infrastructure costs constitute more than ¾th of the total cost for

Feasibility Study of Economic investment in Smart Cities Projects

Foreign Countries/ Organizations collaborating with India on Smart City Program:

Entity	Selected Major investment plans in India
France	Plans to invest GBP£1.5 billion in development of three smart cities, including Puducherry & Nagaland.
US	Anticipated GBP£25 billion private investment into India, partnership on clean water and solid waste management for 500 cities.
Japan	GBP£22 billion-mix of private and public investment
China	GBP£12bn-mix of private and public investment
Germany (kW Bankengruppe)	GBP£0.7bn on solar capacity for next 10 years
Asian Development Bank (ADB)	GBP£1.6bn to establish five industrial zones for Andhra Pradesh: GBP£39mn for North Karnataka Urban Sector investment program.

2014-15 for the education sector, up by 12.3% from the previous year.

- US\$78.5 million has been allocated to set-up five new IITs and five new IIMs
- The Ministry of Human Resource Development plans to have 1,000 private universities for producing trained manpower to meet services

Making way for greenfield and brownfield projects

The associated capex per sq. km of built 'Smart City' environment varies widely due to specific urban locations as well as some Smart City-specific aspects. The total investment opportunity in '100 Smart Cities' is GBP £445billion. Of this, the total infrastructure constitutes

brownfield projects and more than half in case of greenfield projects. For greenfield and brownfield projects, the top three components are: transport system (45%) overall infrastructure costs, followed by surveillance solutions (10%) and power (8%).

	(A) Greenfield & Satellite Cities	(B) Breakup of total cost	(C) Brownfield	(D) Break up of total cost	(B) + (C)
Infrastructure Development Cost	56%	44	77%	282	326
Transport System (roads rail transit)	26%	20	35%	128	149
Traffic support	2%	2	3%	11	13
Street Lightning	1%	1	2%	5	6
Land Procurement	2%	2	3%	11	13
Water sourcing and transmission	3%	2	4%	13	15
Power	5%	4	6%	22	26
Land improvement & earth works	3%	2	4%	15	17
Water Distribution					
Sewerage, Solid waste and storm water projects	3%	2	4%	15	17



Landscaping, Signage's and building works	1%	1	3%	15	17
Surveillance solutions	6%	4	8%	27	32
Real estate	40%	31	10%	70	101
Other infrastructure	2%	2	3%	9	11
Renewal and Development			10%	37	37
Housing	33%	26			
Commercial	3%	2			
Retail	2%	2	3%	11	13
Hospitality, Recreation, education etc.	2%	2	6%	22	24
ICT (including internet connectivity)	4%	3	4%	15	18
Total		78		367	445

Assessing the Risks Involved in Building Smart Cities

- According to the World Urbanization Report of the UN, over 50% of the global population reside in urban areas. The rapid increase in global urban population has called for optimization of efficient, sustainable, and secure systems that will affect the quality of our daily lives.
- Notwithstanding the benefits of emerging technologies, we also need to be aware of the risks involved such as personal data breaches, harm to critical infrastructure or damage to public trust.
- Failure of interconnected devices presents risks of a larger magnitude. Disruption of infrastructure can lead to major risks wherein connected devices transfer adverse risks rapidly across the entire network.
- It is challenging to invest in information security while also creating a sustainable environment. The major challenge facing smart cities is ensuring environmental protection while providing digital connectivity and data-driven services. Security systems may be sufficient in isolation, however, they are not capable of securing interconnected devices. Hence, it is hard to measure or mitigate risks such as financial data breaches.

- Commercial enterprises face the challenge of adapting to ever-changing technology trends and a lack of clarity in terms of information security standards, governance etc., which does not allow them to proceed with their development programs.

Mitigation Plans

- Prepare in advance to ensure that we can prevent the potential risks associated with a smart city. Review the suppliers' products, services, and also observe any changes made to the organization's network profile.
- Continuous monitoring of suspicious devices, sensors, and other communication points is a must.
- Ensure the integrity of data collected through big data analytics for performing commercial activities and municipal activities.
- Public trust is a major challenge due to the emerging technologies of collecting, analysing, aggregating, and exchanging data, which raises privacy concerns.
- Enterprises owning or depending on cyber-physical systems should maintain safety, stability, as well as availability of collected data.

The Way Forward: Digital Enterprise & Smart Cities

With more than half of the global population residing in cities equipped with innovative solutions such as connected waste management, smart parking, and smart traffic control, Smart Cities will combat many of the challenges posed by rapid urbanization.

Gradually, IoT solutions will be implemented to save money and transform cities so that they become easier to live in.

IoT offers unique opportunities for revenue generation, cost reduction, operational efficiency and improvement in the overall customer value and experiences. However, the digital transformation journey cannot happen overnight. We need to focus on solving the current issues facing the cities and also have a long term plan to achieve the end result. It can vary from saving power in one city using smart lighting alternatives to improving citizens' security through public Wi-Fi connectivity.

Technology plays an integral role in the overall strategy of developing a smarter, connected city. We need to pursue each technology solution as a separate entity and align it with the budget as well as political constraints.

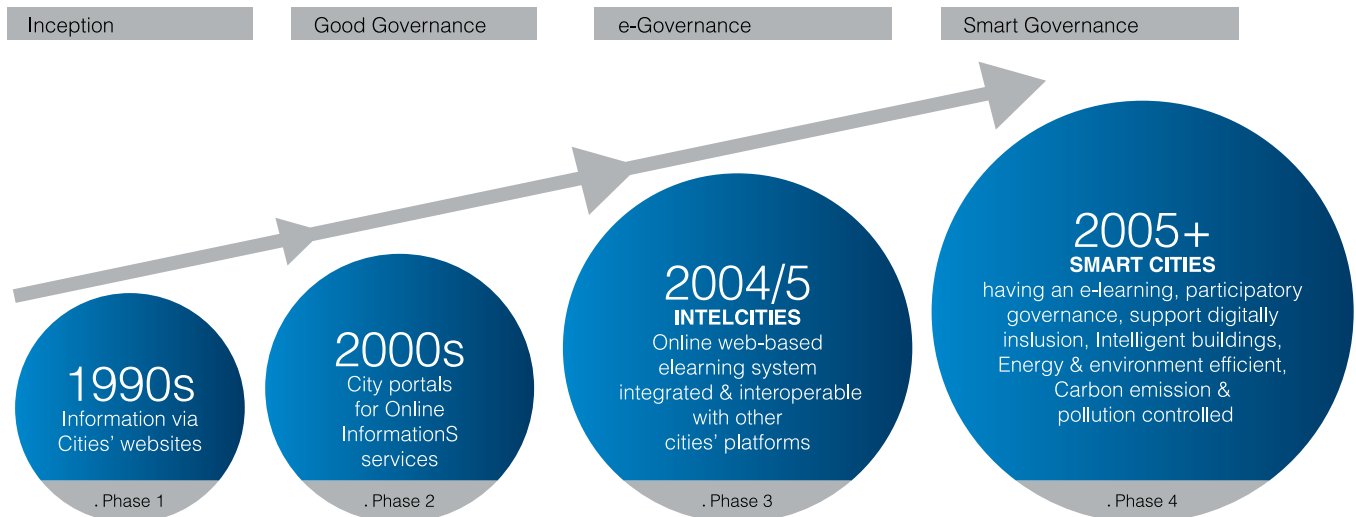
The integration of big data with other emerging technologies will



essentially lead to the creation of smart cities. Modern cities must

incorporate these technologies and techniques to become smarter.

Human Role evolution in Smart City governance



Number of cities allocated to states based on urban population and number of statutory towns

Round-1 Winners					
S.no.	Cities	Name of State/UT	S.no.	Cities	Name of State/UT
1	Bhubaneswar	Odisha	11	Indore	Madhya Pradesh
2	Pune	Maharashtra	12	New Delhi	New Delhi
3	Jaipur	Rajasthan	13	Coimbatore	Tamil Nadu
4	Surat	Gujarat	14	Kakinada	Andhra Pradesh
5	Kochi	Kerala	15	Belgaum	Karnataka
6	Ahmedabad	Gujarat	16	Udaipur	Rajasthan
7	Jabalpur	Madhya Pradesh	17	Guwahati	Assam
8	Visakhapatnam	Andhra Pradesh	18	Chennai	Tamil Nadu
9	Solapur	Maharashtra	19	Ludhiana	Punjab
10	Davangere	Karnataka	20	Bhopal	Madhya Pradesh
Round-2 Winners					
S.no.	Cities	Name of State/UT	S.no.	Cities	Name of State/UT
1	Lucknow	Uttar Pradesh	7	Dharamasala	Himachal Pradesh
2	Bhagalpur	Bihar	8	Warangal	Telangana
3	Faridabad	Haryana	9	Panaji	Goa
4	Chandigarh	Chandigarh	10	Agartala	Tripura
5	Raipur	Chhattisgarh	11	Imphal	Manipur
6	Ranchi	Jharkhand	12	Port Blair	Andaman & Nicobar



Round-3 Winners

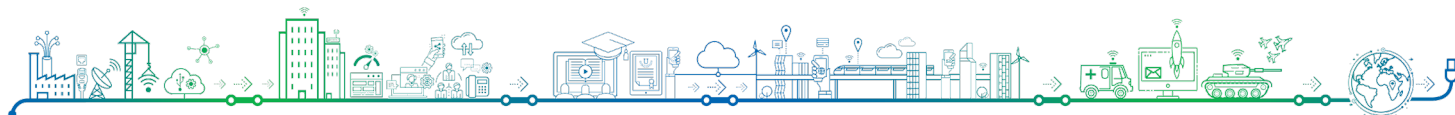
S.no.	Cities	Name of State/UT	S.no.	Cities	Name of State/UT
1	Amritsar	Punjab	15	Tumakuru	Karnataka
2	Kalyan	Maharashtra	16	Kota	Rajasthan
3	Ujjain	Madhya Pradesh	17	Thanjavur	Tamil Nadu
4	Tirupati	Andhra Pradesh	18	Namchi	Sikkim
5	Nagpur	Maharashtra	19	Jalandhar	Punjab
6	Mangalore	Karnataka	20	Shimoga	Karnataka
7	Vellore	Tamil Nadu	21	Salem	Tamil Nadu
8	Thane	Maharashtra	22	Ajmer	Rajasthan
9	Gwalior	Madhya Pradesh	23	Varanasi	Uttar Pradesh
10	Agra	Uttar Pradesh	24	Kohima	Nagaland
11	Nashik	Maharashtra	25	Hubli-Dharwad	Karnataka
12	Rourkela	Odisha	26	Aurangabad	Maharashtra
13	Kanpur	Uttar Pradesh	27	Vadodara	Gujarat
14	Madurai	Tamil Nadu			

Round-4 Winners

S.no.	Cities	Name of State/UT	S.no.	Cities	Name of State/UT
1	Thiruvananthapuram	Kerala	16	Dehradun	Uttarakhand
2	Naya Raipur	Chhattisgarh	17	Tiruppur	Tamil Nadu
3	Rajkot	Gujarat	18	Pimpri Chinchwad	Maharashtra
4	Amravati	Andhra Pradesh	19	Bilaspur	Chhattisgarh
5	Patna	Bihar	20	Pasighat	Arunachal Pradesh
6	Karimnagar	Telangana	21	Jammu	Jammu and Kashmir
7	Muzaffarpur	Bihar	22	Dahod	Gujarat
8	Puducherry	Pondicherry	23	Tirunelveli	Tamil Nadu
9	Gandhinagar	Gujarat	24	Thoothukudi	Tamil Nadu
10	Srinagar	Jammu and Kashmir	25	Tiruchirappalli	Tamil Nadu
11	Sagar	Madhya Pradesh	26	Jhansi	Uttar Pradesh
12	Karnal	Haryana	27	Aizawl	Mizoram
13	Satna	Madhya Pradesh	28	Allahabad	Uttar Pradesh
14	Bangalore	Karnataka	29	Aligarh	Uttar Pradesh
15	Shimla	Himachal Pradesh	30	Gangtok	Sikkim

Round-5 Final Chance

S.no.	Cities	Name of State/UT	S.no.	Cities	Name of State/UT
1	Erode, Dindigul	Tamil Nadu	6	Dadra and Nagar Haveli	Silvassa
2	Navi Mumbai, Amravati	Maharashtra	7	Daman and Diu	Diu
3	Uttar Pradesh	Saharanpur, Rai-Bareilly, Meerut, Ghaziabad, Rampur	8	Lakshadweep	Kavaratti
4	Bihar	Biharsharif	9	Meghalaya	Shillong
5	Arunachal Pradesh	Itanagar	10	Manipur	Imphal



Indian & International Smart Cities: A comparative analysis

1. Cities such as Barcelona, Helsinki, Toronto, Singapore and San Francisco are often at the top of most lists of “Smart Cities” because they have the resources and expertise to be good business partners and ambassadors of public interest.
2. The challenges and opportunities for Smart Cities in developing countries like India—that are urbanizing at a dizzying pace—are many. The need of the hour is to focus more on basics such as clean and reliable energy, safe and secure streets, transparency and citizen engagement.
3. Nairobi is a good example to follow due to the focus on broadband, mobile apps and government efficiency.
4. Governance of cities is critical for ensuring prosperity of citizens and also for a better economic future. In this regard, it is important for the Indian government to benchmark to international standards, when it comes to administration.
5. Globally, most smart cities are governed at the city level, whereas in India, even though the Smart Cities Mission is a Central Government initiative, the states wield great authority (nearly 70% of government decisions are made at the state level).
6. State governments are free to engage directly with other countries to attract foreign investment and are largely responsible for all infrastructure development.
7. Further devolution of authority to the cities and local municipalities, however difficult, is critical for the success of the Smart Cities initiative. Significant and urgent political reforms are required for this to happen in the country.

