

The Smart City Mission of India: Transforming Urban Landscapes for a Sustainable Future

DIPESH H. DALAL

*Lecturer in Civil Engineering Department, Government Polytechnic for Girls, Ahmedabad, Gujarat, India .and
Research scholar from GTU University, Gujarat, India.*

Abstract—Smart City Mission of India, launched in 2015, aims to drive sustainable urban development through technology integration, infrastructure upgrades, and citizen-centric governance. Envisioned to transform 100 cities into efficient and sustainable urban centers, the mission focuses on core infrastructure, smart mobility, robust IT connectivity, and improved quality of life. By leveraging public-private partnerships and participatory planning, it fosters innovation and inclusivity. However, challenges such as funding constraints, uneven implementation, and digital divide issues persist. This review evaluates the mission's progress, highlighting achievements in urban rejuvenation and persistent gaps, offering insights into enhancing the long-term efficacy of smart urban initiatives.

Index Terms- Urban Development, Urban Governance, Digital Infrastructure, Smart Mobility, Citizen-Centric Development, India Urbanization.

I. INTRODUCTION

The rapid urbanization of India presents unprecedented challenges, including inadequate infrastructure, environmental degradation, and increasing pressure on basic services. The Smart City Mission (SCM), launched in 2015 by the Government of India, aims to address these challenges by fostering sustainable and technologically advanced urban centers. This paper explores the mission's vision, components, and relevance in the context of India's broader developmental goals.

Smart city ensures the traditional network and symbol of more efficient services with the use of the latest technologies for the benefit of its inhabitant. The smart city word is use to define smart living with combination of information and communication technology. A smart city has an infrastructure to provide life quality, a safe and clean environment to its citizens by smart technology. Looking into so much criteria there is no unique definition of smart city

worldwide. Here are some definitions of “Smart City” from different sources like different international organizations, Governments of different countries, various research agencies and corporations. According to World Bank Economic Forum, the main objective of the smart city is to develop, share and disseminate actionable frameworks and best practices to catalyze action at the global and regional level to resolve the infrastructure gap[1]. As per World Bank, A smart city thoughtfully and sustainably pursues development with all of these components in mind with the additional foresight of the future needs of the city. This approach allows cities to provide for its citizens through services and infrastructures that address both the current needs of the population as well as for projected growth. The European Council state that smart city is a place where the traditional networks and services are made more efficient with the use of digital and telecommunication technologies, for the benefit of its inhabitants and businesses. UK Government define smart city should enable every citizen to engage with all the services on offer, public as well as private, in a way best suited to his or her needs[2]. A smart city brings together technology, government and society to enable the following characteristics: a smart economy, smart mobility, a smart environment, smart people, smart living and smart governance.

II. SMART CITY MISSION OF INDIA

Government of India (GOI) launched Smart City Mission in 2015 across hundreds of cities in India [3]. As per GOI Smart city define as “it focuses on their most pressing needs and on the greatest opportunities to improve lives. They tap a range of approaches - digital and information technologies, urban planning best practices, public-private partnerships, and policy change - to make a difference and they always put people first [4]. Conversation of city into smart city depend on many parameters. The urban area growth

is increasing from the past few decades due to desire of people to stay in a smart city. India is rapidly increasing towards the urbanization, 30% of increment was shown from the year 2001-2011 from 1951 to 2001[5.](Bhagat, 2018). The smart city concept in India boosted by the prime minister of India, with the announcement to developed 100 smart cities in 2015. So, India becomes the market for the smart city projects. The smart city projects for developing the smart city after the declaration of “Make in India”, “Smart Cities Mission”, “Atal Mission for Rejuvenation and Urban Transformation (AMRUT)” and many more to transformed cities into smart cities. Also, the Swachh Bharat Mission (SBM) is initiative for environment to make clean and green smart city. The significant objective of the smart city condition is meant to improve the nature of administrations open to the general public individuals by creating the use of resources productively. Some of core infrastructure elements decided by GOI for smart city was shown in Fig. 1.1.



FIGURE 1. 1 Core infrastructure elements for Smart City.

III. OBJECTIVES OF SMART CITY MISSION

The SCM seeks to:

- Improve the quality of life by ensuring access to core infrastructure and services.
- Promote sustainable and inclusive urban development.
- Integrate smart technology to enhance efficiency and governance.
- Foster innovation and economic growth.

IV. KEY FEATURES AND IMPLEMENTATION FRAMEWORK

The SCM employs an area-based development approach, focusing on three core models:

1. Retrofitting: Upgrading existing urban areas.
2. Redevelopment: Replacing and redesigning existing infrastructure.
3. Greenfield Development: Building new urban spaces on vacant land.

The mission emphasizes public-private partnerships (PPPs), citizen participation, and the use of integrated command and control centers (ICCCs) for urban management.

Smart cities integrate technology and data to enhance the quality of life for citizens, sustainability, and economic development. Here are different factors that contribute to a smart city:

Technology:

1. IoT (Internet of Things) Sensors
2. Data Analytics and Visualization
3. Artificial Intelligence (AI) and Machine Learning (ML)
4. Cloud Computing and Storage
5. Cyber security Measures

Transportation:

1. Electric or Self-Driving Vehicles
2. Smart Traffic Management
3. Public Transit Systems (e.g., smart bus routes)
4. Bike-Sharing and Pedestrian Infrastructure
5. Integrated Mobility Platforms

Energy and Environment:

1. Renewable Energy Sources (solar, wind, hydro)
2. Energy Efficiency Initiatives
3. Green Spaces and Urban Forestry
4. Water Management Systems
5. Waste-to-Energy Conversion

Public Services:

1. Smart Healthcare Systems
2. Digital Education Platforms
3. Public Safety and Emergency Response
4. Smart Waste Collection and Recycling
5. Citizen Engagement and Participation Platforms

Economy and Governance:

1. E-Governance and Digital Services
2. Innovation Hubs and Startups
3. Smart Tourism Initiatives
4. Digital Payment Systems
5. Transparency and Open Data Policies

Citizen- Centric:

1. Inclusive and Accessible Design
2. Community Engagement and Participation
3. Digital Literacy Programs
4. Public Wi-Fi and Digital Infrastructure
5. Quality of Life Metrics and Monitoring

Safety and Security:

1. Surveillance Systems
2. Emergency Response Systems
3. Cyber security Measures
4. Disaster Preparedness and Response
5. Intelligent Crime Prevention Systems

These factors work together to create a comprehensive smart city ecosystem that prioritizes sustainability, efficiency, and citizen well-being.

V. LITERATURE REVIEW

The examples of various smart cities across the world who show the development of cities according to different factors discussed is last section.

1. Singapore

Singapore consistently tops the list of the world’s smartest cities no matter how they are rated. It was the only city in the top ten of the IMD’s rankings not to move position from 2020 to 2021 – an indication of the city’s commitment to smart technology. Singapore is widely regarded as being ahead of the curve when it comes to smart technology. The country has an ageing population, and the government is focused on digital technologies and initiatives to raise productivity in the country’s advanced economy. This has included a move to a digital healthcare system – normalizing video consultations as well as introducing wearable IoT devices to monitor patients remotely. Singapore is the second-most densely populated city in the world and their Smart Nation vision aims to digitally collect information throughout the city using sensors. The sensors collect a massive amount of information about what citizens do on a daily basis and they can measure

everything from how clean a certain area is to how crowded an event is. Singapore is also aiming to be the first country to develop a new eco- smart city that is entirely vehicle-free. To be located in Tengah in the western region of Singapore, the planned forest city will be home to five residential districts with 42,000 houses, as well as safe zones for both pedestrians and cyclists.



FIGURE 1. 2 Schematic picture of AI used in Singapore

2. Oslo

Oslo is a smart city that is focused on creating a sustainable, eco-friendly environment. Whilst sustainable cities and smart cities often share a lot of common goals, there is a difference between the two. A city can be sustainable without necessarily being smart. In this case, however, Oslo ticks both boxes. The city has over 650,000 LED lights that are all connected to processing stations and these lights can intelligently adjust the amount of lighting based on current needs. Oslo has also gone all-in on electric vehicles, committing for all vehicles in the city to be electric by 2025. Oslo is not a small city. With 670,000 citizens, that is a huge commitment to both smart technology and sustainability and they are currently on track to achieve that goal. They already have incentives in place for zero-emission cars including free parking, the use of bus lanes and lower taxes and toll prices. Traffic is an area the city is working hard to improve. As well as introducing all-electric vehicles by 2025, they also currently monitor cars using small license plate detectors to understand traffic flow around the city and develop a data-driven way to improve traffic congestion.



FIGURE 1. 3 Schematic picture night light facility of osio

3. New York

Whilst New York does not feature as high as you might expect on the IMD list of smart cities, it is widely regarded as one of the smartest cities in the world. Hundreds of smart sensors have been placed throughout the different districts of New York City as part of its smart city pilot project in 2020. The Programme collects huge amounts of data to help manage essential services around the city including waste management and collection more efficiently. The city is also improving connectivity for citizens, replacing phone booths with charging stations that are also Wi-Fi-enabled. Car sharing has been popular in the city for a number of years, and this continues to grow and evolve. Car sharing helps to reduce emissions in and around the city as well as helping to manage traffic congestion. The police department has tested web-based software from Hunch Lab that uses historical crime data, terrain modelling, and other information to predict and respond to crime. The test produced a marked decrease in violent crime, and now other city agencies are interested.



FIGURE 1. 4 New York city view at night

4. London

London is another city that surprises people when it comes to the adoption of smart city technology. The city has set up a number of smart city initiatives over the past decade and this is driven by the Office of Technology which is committed to making sure London is a smart city. Their Civic Innovation Challenge is one example. The challenge is aimed at helping entrepreneurs and start-ups to develop solutions to the growing number of urban issues experience throughout the city. Connect London is another smart city project that aims to provide 5G connectivity and fiber-optic coverage throughout the whole city. The iconic lampposts that dominate the skyline will also be fitted with sensors and electric vehicle charging points as London also aims to reduce emissions and cut traffic congestion. To achieve their goals, London has a Smart City Plan that includes strategies for how to implement technology in a city that's expected to grow to 10 million people in the next decade or so. The plan includes key areas including healthcare, transportation, and energy management, all of which could benefit from smart city solutions.



FIGURE 1. 5 AI used in London

5. Copenhagen

The Danish capital, Copenhagen, came seventh in the IMD's list of smart cities in 2021, down one place from sixth in 2020. Like Oslo, Copenhagen is taking a sustainable approach to its smart city developments.

In 2017, the Copenhagen Solutions Lab received an award for its system which monitors air quality, energy consumption, traffic, and waste management. The system also connects parking systems, traffic lights, buildings, smart metering, and charging systems for electric vehicles to direct traffic in real-time. The city is working towards bringing all these smart technologies into a single platform to deliver a more efficient automotive experience in the city as well as being able to collect all that data in one place. In addition, the city is working with the Massachusetts Institute of Technology (MIT) to develop an intelligent bike system in the city.

Zurich Zurich's first steps to becoming a smart city started with streetlight sensors, which would increase brightness or dim according to traffic levels. Thanks to this, Zurich was able to save up to 70% of energy. After this success, the city installed more smart streetlights with additional features such as collecting environmental data and public Wi-Fi transmitters. Smart buildings are in and Zurich is no exception. Heating, electricity and cooling are all optimized to save energy. Zurich also boasts of a world-class public transportation system, which is highlighted by the mobile app Zürimobil, which provides real-time traffic information, as well as alternative transportation methods. When it comes to open data, the city of Zurich really invests in it.

They also believe in smart participation. In some urban projects, they leverage collaboration from different stake holders. The city has an on-demand service integrated into the public transportation system, called Pikmin. Vehicles from Pikmin are booked through a smartphone and when user destinations and similar, they're automatically bundled together into the same vehicle.

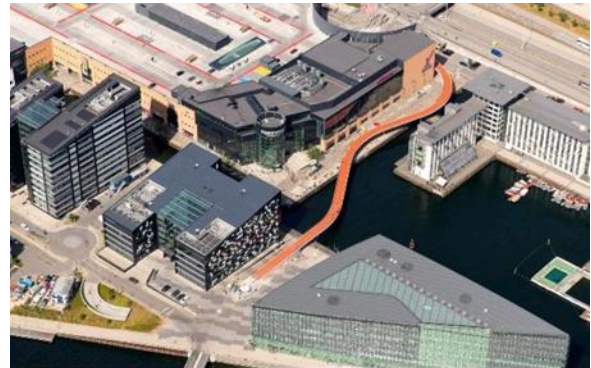


FIGURE 1. 6 Wave shape bridge in Copenhagen

6. Seoul

For Seoul, data is king. The city analyses traffic flow, speed and air quality using sensors and CCTV. When sensors detect unusual temperature, humidity, or lighting, workers or emergency services are contacted right after. 5G is actually a thing in South Korea and its capital is one of the first cities to use 5G in mobility and transportation. Seoul also combined LTE signal data of mobile carriers and the public data of the city government to create something called the "Daily Population Data". This data is useful for commercial and marketing activities, for example. Seoul is trying to improve citizen engagement. Some examples of these initiatives are "Democracy Seoul", a policy proposal platform, "M-Voting", a mobile voting system and "Seoul Online Civil Complaints", to register and process citizen complaints. One of their most incredible ideas is roads that recharge vehicles during the drive. It's a technology called OLEV which charges vehicles wirelessly. When a vehicle drives through one of the recharging surfaces, the device installed on the vehicle body converts it into energy thanks to magnetic fields. The Seoul Metropolitan Government (SMG) announced Seoul will be the first major city to enter the metaverse, around 2023. The city's plan is to create a metaverse which allows

citizens to meet with avatars to deal with civil complaints and other governance matters.



FIGURE 1. 7. South Korean Smart city Seoul

7. Dubai

Dubai is on the fast track to becoming one of the smartest cities in the world. The city went through a seven-year plan to digitalize governance services, health, education, urban planning, transportation and more.

Most of these services are now available in the Dubai Now app. They also opened their data to the private and public sectors to incentivize third-party applications for citizens. Automation has been leveraged in the transportation sector to reduce fatigue-related traffic accidents. Another interesting fact is Dubai's police has three autonomous police stations where you can pay fines, report accidents and other matters. Dubai is ambitious and aims to make its city a paperless city, with all government transactions becoming 100% digitized.



FIGURE 1. 8 Different Shapes buildings in Dubai

The examples of various smart cities across the country who show the development of cities according to different factors as per smart city mission 2015.

1. Bhubaneshwar, Odisha:

Bhubaneshwar continues its ranking in one Top 10 smart cities in India that is socially focused, giving importance to the improvement of the social environment and development based on areas. The management of traffic is smooth, and functional parks create an easy-going and family-orientated feel. Being home to educational establishments as well as Special Economic Zones (SEZs), Bhubaneshwar contributes to fast urbanization which adds attractiveness for investment purposes. The IT Incubation Centre and Golden Quadrangle NH-5 are what make the city more appealing. Places like Kalinga Nagar and Chandrasekhar see an increase in demand for residential properties.



FIGURE 1. 9. Skyscrapers in Bhuvneshwar

2. Pune, Maharashtra:

The fast growth of Pune is supported by educational institutions and SEZs, becoming one of the Top 10 smart cities in India. Travel from one place to another is made easier with smart buses, a planned metro rail system, and better roads for transportation. Improvement can also be seen in both residential and commercial spaces. A smart city proposal encompasses the twin city of Pimpri- Chinchwad, which is recognized for its organized structures. Places such as Hadapsar and Baner are also involved in this smart city plan.

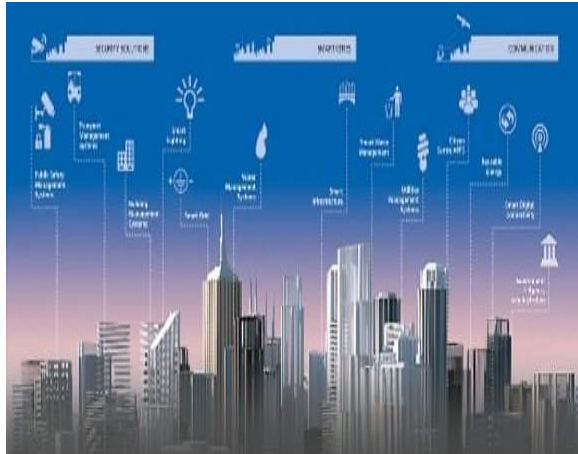


FIGURE 1. 10. Networking in Pune city

3. Indore, Madhya Pradesh:

Indore is still on top when it comes to waste handling process and famous heritage, having ideas for sustainable retrofitting. Ideas like smart classrooms and better healthcare make Indore a place where people want to live. Places of education and learning like IIT and IIM bring students here as well as create jobs, helping in the growth of property. The city has been given awards for its good handling of waste and efforts in preserving heritage.



FIGURE 1. 11. Traffic circle at Indore

4. Ahmedabad, Gujarat:

Ahmedabad, it is a place where history and development come together. Being recognized by UNESCO for its historical importance adds to the special quality of this city that combines old with new in an interesting way. Ahmedabad's inclusion on the list of top smart cities in India is not surprising because it has very good tourism facilities, focuses strongly on safety matters and manages urban areas efficiently. In the city, there are many places for staying that can

meet the needs of people from different parts of life. Also, Ahmedabad has good waste management and sanitation systems which make sure it is clean and healthy for both locals living there and those visiting as tourists. In Ahmedabad, smart projects like e-governance, city surveillance and unified command centres show the embrace of technological progress. These actions have made administration smoother while also improving safety for everyone and how services are given out. Moreover, the Gujarat International Finance Tec-City and also the Ahmedabad- Dolega Expressway have been very important for economic growth and connecting this city. These efforts have made Ahmedabad a central place of new ideas and chances in business. Ahmedabad's successful combination of history, tourism, safety and urban management with smart initiatives has placed it in the Top 10 smart cities of India. This makes Ahmedabad an appealing place for both people who live there and those who visit them.



FIGURE 1. 12. Development of Riverfront in Ahmedabad

5. Coimbatore, Tamil Nadu:

Coimbatore harmoniously mixes its industrial history with current urban growth, making it one among the top 10 smart cities in India. Recognized for sustainable energy and water preservation, this city displays a balance of green practices along with progress. The functioning traffic system, open parks and CCTV surveillance add to its smart city attribute. The city provides a wide range of places to stay and has put in place effective methods for managing waste and hygiene. Coimbatore is accepting technology by using e-governance, observation systems, and combined

control centers which make things work better while also improving public protection. The rising IT industry is also helping in the development of real estate, especially in places like Vandavall and along Trichy Road. The Coimbatore metro and ring road projects are adding to its smart city reputation by enhancing connectivity.



FIGURE 1. 13. View of Coimbatore circle

6. Kochi, Kerala:

Kochi, the Special Economic Zone (SEZ) of Kerala, is a fascinating mix of past and present. It has plans for balanced development that focus on creating sustainable living around its industrial growth. Canal restoration, better housing, health centres, waste management, and water supply are important parts of its smart city plan. Traffic management and control centres: These play a crucial role in maintaining safety and security. They help to monitor the movement of vehicles, manage traffic flow efficiently, and respond promptly to any emergencies or accidents on the roadways. Real estate development: The Kochi metro along with special economic zones (SEZs) as well as information technology (IT) parks are key factors that boost real estate growth. These ventures create high demand for commercial spaces, residential units, and other property types around their locations. My friend, these two points are what I think is the answer you're looking for to your question.



FIGURE 1. 14. Smart Building of Kochi

7. Hyderabad, Telangana:

Hyderabad blends historical charm with modern advancements, earning its place as one of the top 10 smart cities in India. The city offers comfortable living with affordable land options and well-planned infrastructure. Its thriving IT clusters contribute to its smart city status. Hyderabad prioritizes smooth transportation through 135 link roads and the Strategic Road Development Plan. Intelligent development corridors like Pancheri Industrial and Hyderabad Airport attract real estate investments. The city's seamless integration of historical richness and technological progress makes it an attractive destination for residents and businesses alike.



FIGURE 1. 15. Networking in Hyderabad

8. Jaipur, Rajasthan:

Pink City, Jaipur, is writing a splendid section in its history as it becomes part of smart cities. Smart schemes in Jaipur are linked with land rejuvenation

and advancements at heritage spots. You can find intelligent auto stands, info kiosks, UG metro stations as well as automated water quality management among other things here. Regarding real estate investments, places such as Sikar Road Corridor and Ajmer Road are promising, effectively putting it in the position of Top 10 smart cities in India.



FIGURE 1. 16. City entry gate of Jaipur

9. Surat, Gujarat:

Surat, known as the ‘Diamond City of India.’ It stands high among the top 10 smart cities in India with its many smart city efforts. The Surat Municipal Corporation is responsible for solar power generation here, along with waste-to-energy plants and clever water management systems. Big projects such as the city-wide Surat IT-MAC and Common City Payment System add to its recognition of being a smart city. Surat, with its mix of cultural variety and technological progress, is a city that provides an interesting blend of heritage and modernity.



FIGURE 1. 17. Flyover Bridges in Surat

10. Lucknow, Uttar Pradesh:

Lucknow, the capital of Uttar Pradesh and a place known for its cultural and historical importance, is now among India’s top 10 smart cities. The city gives attention to managing traffic effectively with an

organized traffic control system. It also has places for charging electric buses. Lucknow makes the smart city experience even better by providing wi-fi spots in parks and public areas. Emphasizing this blending of cultural wealth with modern facilities, Lucknow presents a distinct mix of heritage and technological advancements. This makes it appealing to both people who live here and those coming to visit.



FIGURE 1. 18. Circular buildings in Lucknow

VI. ACHIEVEMENTS BY INDIA UNDER MISSION SCM 2015

Since its inception, the SCM has made significant strides:

- Infrastructure Upgrades: Improved public transportation systems, water supply, and waste management in selected cities.
- Digital Initiatives: Implementation of e-governance platforms and smart metering systems.
- Renewable Energy Projects: Adoption of solar and other renewable energy sources.
- Economic Growth: Creation of innovation hubs and smart industrial zones.

VII. CHALLENGES FACES FOR SUCESSFUL IMPLEMENTATIONS OF SCM BY INDIA

Despite notable progress, the SCM faces several hurdles:

- Funding Constraints: Limited financial resources and reliance on PPPs.
- Governance Issues: Fragmented responsibilities among stakeholders.

- Digital Divide: Unequal access to technology and connectivity.
- Socioeconomic Concerns: Risk of exclusion for marginalized populations.

VIII. COMPARATIVE ANALYSIS WITH GLOBAL SMART CITY INITIATIVES

Comparing India's SCM with global initiatives in cities like Singapore and Barcelona reveals best practices and lessons that can inform Indian urban strategies. While Indian cities focus heavily on basic infrastructure and citizen engagement, global counterparts emphasize advanced automation and climate resilience.

IX. POLICY IMPLICATIONS

The SCM offers valuable insights for policymakers in India and other emerging economies. Strategies for improvement include:

- Enhanced funding mechanisms, including municipal bonds and international partnerships.
- Streamlined governance structures to ensure accountability and efficiency.
- Targeted digital literacy programs to bridge the digital divide.
- Greater emphasis on climate-resilient infrastructure.

CONCLUSION

The Smart City Mission of India represents a paradigm shift in urban development, striving to balance technological advancements with sustainability and inclusivity. While the journey is fraught with challenges, the mission's successes provide a foundation for future growth. With strategic interventions, India's SCM can serve as a model for sustainable urbanization in the Global South.

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