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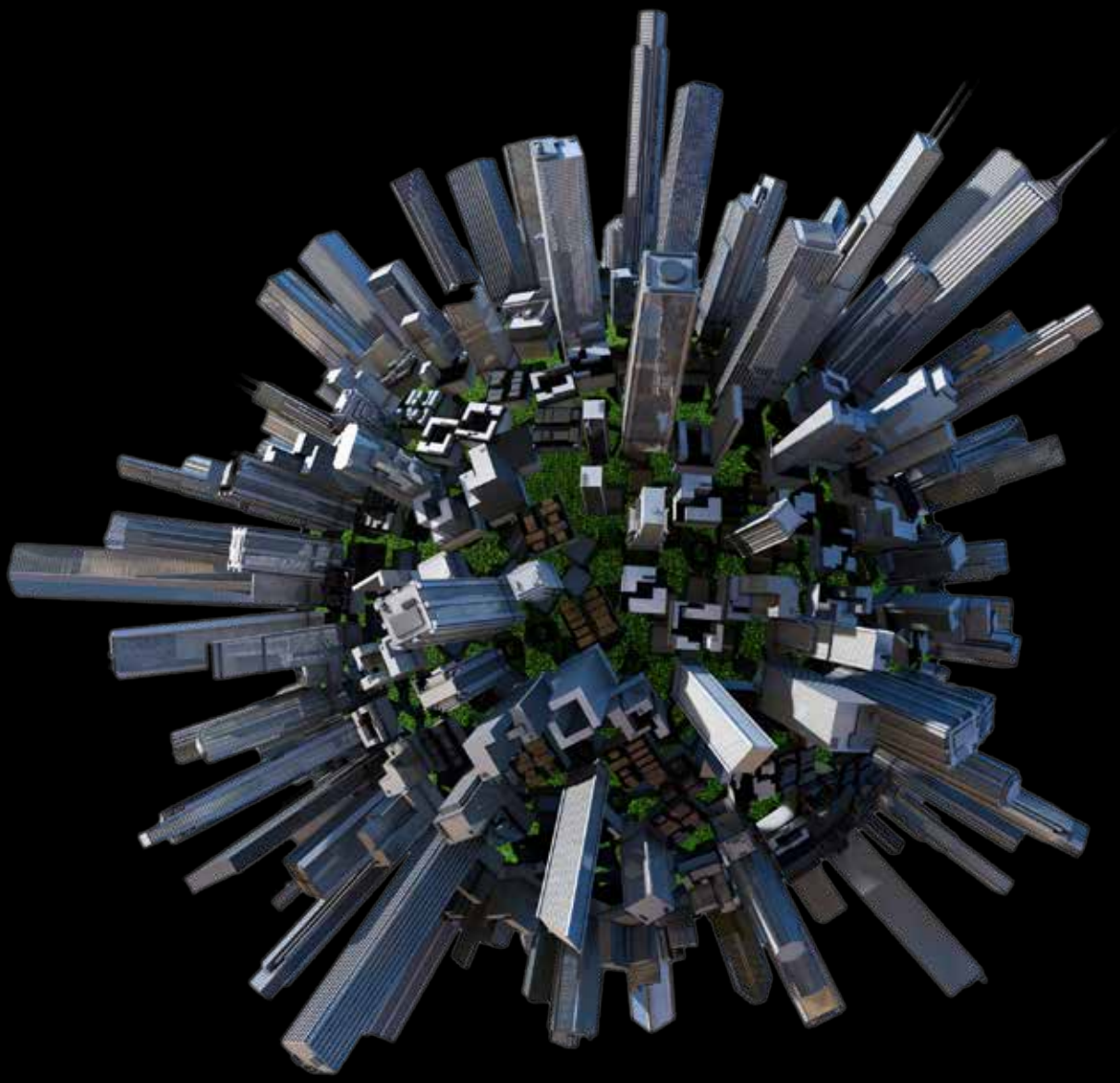

Smart and Sustainable Cities of the Future

Key Initiatives under Smart Cities Mission, Government of India

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Contents

Overview of smart cities

Introduction

Although there are multiple definitions of "smart city", the term means aspirational levels of infrastructure and services in the entire urban ecosystem for citizens.

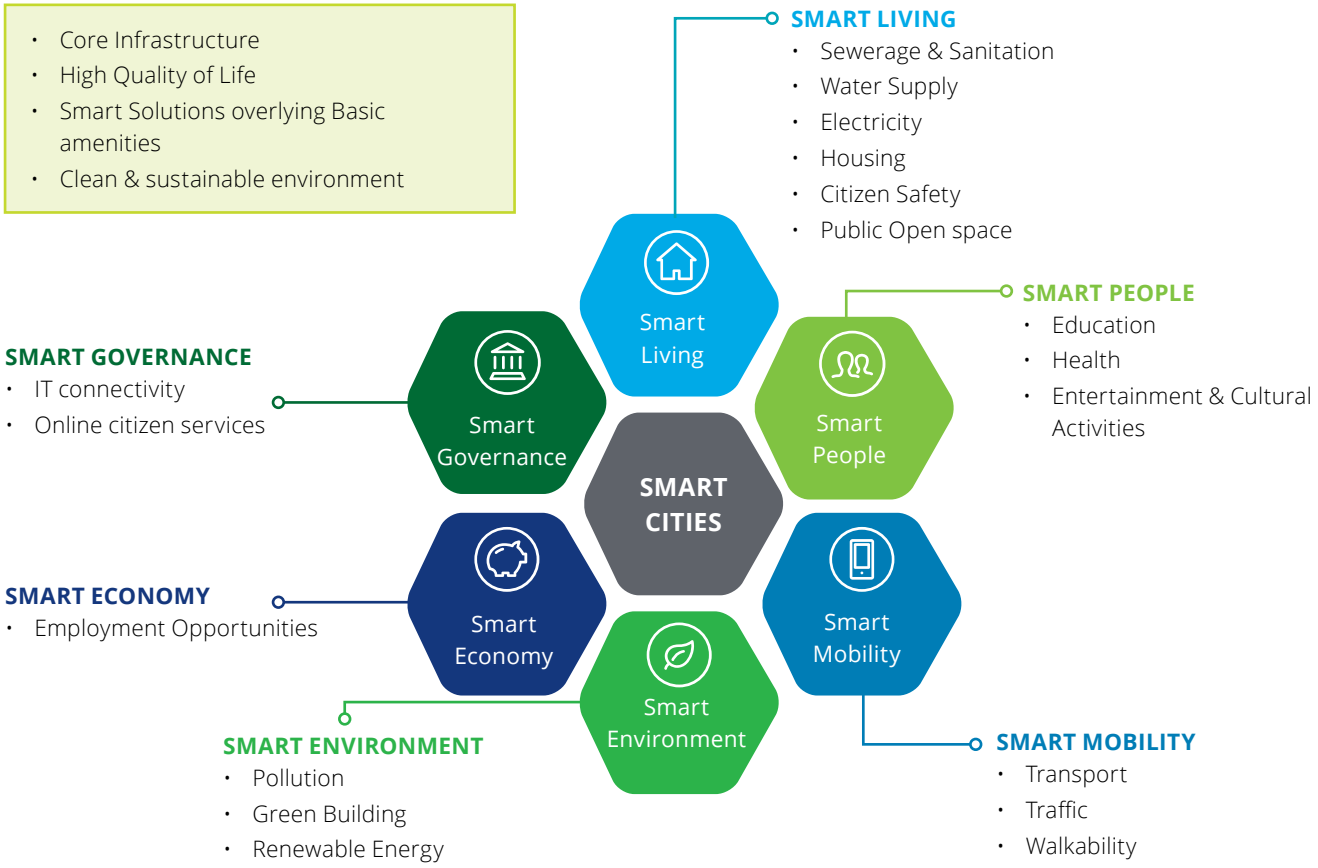
A smart city is an economically vibrant city that provides its citizens a good quality of life using Information Communication and Technology (ICT) solutions. The Smart Cities Council[1] defines a smart city as one that uses digital technology for all city functions. Similarly, World Bank[2] defines a smart city as a technology-intensive city that has sensors installed everywhere and offers highly efficient public services using information gathered in real time by thousands of interconnected devices. Further, a smart city cultivates a better relationship between citizens and governments using the available technology. It relies on feedback from citizens to help improve service delivery. It puts in place mechanisms to gather this information.

The following figure shows the key components of a smart city:

Key Components of a Smart City

What all contribute towards making a city smart?

- Core Infrastructure
- High Quality of Life
- Smart Solutions overlying Basic amenities
- Clean & sustainable environment



Source: Deloitte Analysis

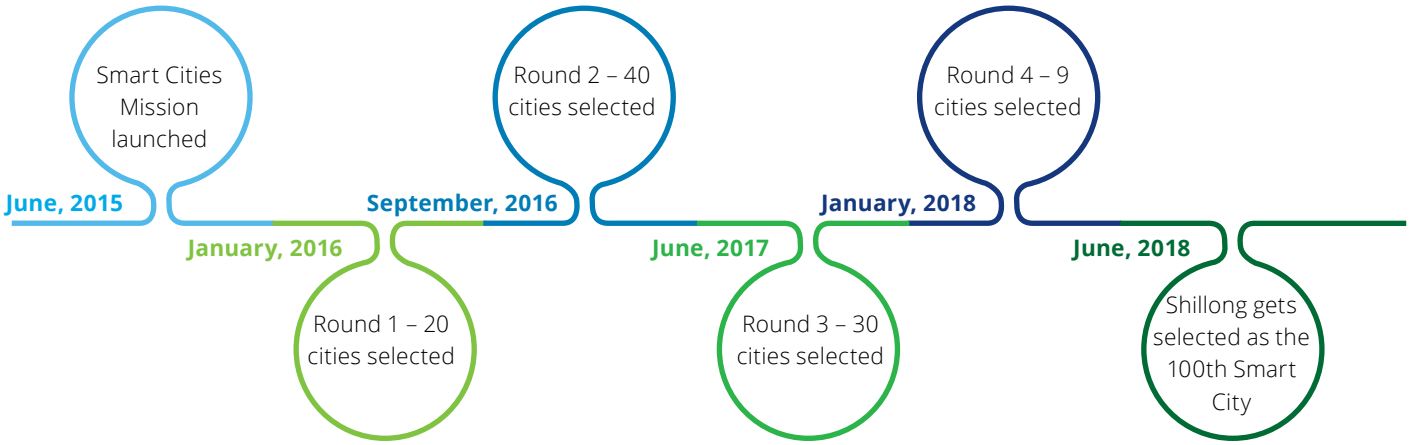
1. https://smartcitiescouncil.com/smart-cities-information-center/definitions-and-overviews
2. http://www.worldbank.org/en/topic/digitaldevelopment/brief/smart-cities

The desired urban ecosystem for a smart city can be represented by the four pillars of comprehensive development—institutional, physical, social and economic infrastructure[3]. To cater to this holistic development, the Ministry of Housing and Urban Affairs (MoHUA) launched the Smart Cities Mission on 25 June 2015[4].

The selection process[5] for the participating cities includes a "challenge method" that comprised two stages. In stage 1, the number of eligible cities that respective states can nominate were informed and the states selected potential smart cities through an intra-state competition. About 110 cities participated in the selection process, and prepared and submitted smart city proposals for evaluation.

Cities prepared smart city proposals after extensive interactions with citizens. These interactions focused on identifying the key challenges citizens faced and areas in which they wanted improvements. This made the process interactive and inclusive. In stage 2, the selection of smart cities across India is completed. It took four different rounds to select 100 smart cities. The following graph shows a brief timeline of the mission progress, as of June 2018:

Overview of Smart Cities Mission Progress



Source:[6] Smart Cities Mission, An overview of implementation

3. http://smartcities.gov.in/content/innerpage/what-is-smart-city.php
4. http://mohua.gov.in/cms/smart-cities.php
5. http://smartcities.gov.in/upload/presentation/5ae32ac896104Cities%20Presentation.pdf
6. http://smartcities.gov.in/upload/presentation/5c4834d78cdb30_SCM%20Prez_for%20CLAF_v3.pdf

Overall strategy[7]

The Smart Cities Mission has an integrated pan-city and area-based development strategy.

Pan-city development follows a whole of the city concept and envisages the application of selected smart solutions to the existing city infrastructure. The application of these solutions involves the use of technology, information, and data to improve infrastructure and services. These solutions would cover all citizens.

Area-based development includes redevelopment, retrofitting, and greenfield projects in a contiguous pilot area within the city, as shown below:

Key Components of Area-based Development Strategy

Redevelopment Project

- Replacement of the existing built-up environment and enable co-creation of a new layout
- Minimum area of 50 acres required
- Potential areas: Old slum areas, Core City areas

Retrofitting Project

- Planning in an existing built-up area to achieve smart city objectives, along with other objectives
- Minimum area of 500 acres required will be identified by the city in consultation with citizens
- Existing structures largely to remain intact

Greenfield Project

- Introduction of Smart Solutions in previously vacant area using innovative planning, plan financing and plan implementation tools
- Minimum area of 250 acres required
- Could be located either within the limits of the Urban Local Body or Urban Development Authority (UDA)

7. http://smartcities.gov.in/content/innerpage/strategy.php
8. http://smartcities.gov.in/upload/presentation/5c4834d78cdb30_SCM%20Prez_for%20CLAF_v3.pdf
9. http://smartcities.gov.in/content/innerpage/strategy.php

The smart city proposal of each shortlisted city includes either one or a combination of the area-based development and pan-city initiatives featuring smart solution(s). A key feature in the smart city plan is to try to ensure that there is a sense of inclusiveness among citizens, irrespective of age, gender, and economic status. The Smart Cities Mission mandated that the proposal has at least one citywide smart solution benefiting all citizens.

Governance and institutional mechanism

As multiple government departments and agencies provide various city services, it is a challenge to coordinate the activities of these departments or agencies (which tend to work in silos). Given the smart city programme following a whole of the city concept for urban transformation and the experience of previous urban development initiatives, there is need for an institutional mechanism to ensure coordination among all players involved in city infrastructure and services. These players need to coordinate to design, plan, and implement smart city initiatives.

Another key concern was the capacity of human resources, particularly in non-metropolitan cities, to plan and implement smart city initiatives. With a large outlay on infrastructure and ICT solutions, many cities did not have experience or expertise in managing procurement or monitoring projects of such a scale. There was a need for involving professional expertise at the city level.

The Smart Cities mission proposed the following institutional and governance mechanisms:

Special purpose vehicle (SPV) for implementing the smart city plan

- An SPV implements the mission at the city level. It is required to plan, appraise, approve, release funds, implement, manage, operate, monitor, and evaluate smart city development projects.
- The SPV has to be a limited company incorporated under the Companies Act, 2013, at the city-level. A full-time chief executive officer (CEO) heads the SPV. The SPV needs to have nominees of central government, state government, and urban local body (ULB) on its board. As of May 2018, 91 SPVs had been formed under the Smart Cities Mission[10].

Structure of SPV

According to the guidelines of MoHUA[11], an SPV has to be structured in such a way that the state or Union Territory (UT) and ULB are the promoters with 50:50 equity shareholding. The private sector or financial institutions could be considered for taking an equity stake in the SPV, provided the shareholding pattern of 50:50 of the state or UT and ULB is maintained and the state or UT and ULB together have a majority shareholding and control of the SPV.

According to the guidelines, a full-time CEO heads the SPV and reports to the board of directors. The CEO is appointed for a fixed-term of three years. The board of directors is required to have representatives of central government, state government, ULB, and independent directors, in addition to CEO and functional directors. Chief operations officer, chief financial officer, company secretary, and other technical resources (appointed in line with the human resource policy approved by the SPV board) will support the CEO.

10. Press Release by Ministry of Housing and Urban Poverty Alleviation on 17th May, 2018: http://pib.nic.in/newsite/PrintRelease.aspx?relid=179368
11. http://smartcities.gov.in/upload/uploadfiles/files/SPVs.pdf
12. http://smartcities.gov.in/upload/uploadfiles/files/SPVs.pdf

Functions and Responsibilities of SPV

The following are some key functions and responsibilities of SPV[12]:

i. Conduct technical appraisal and sanction projects
ii. Execute projects
iii. Take measures to comply with the requirements of MoHUA with respect to the Smart Cities Mission
iv. Mobilise resources within timelines for project execution
v. Approve and take action on review, and monitor reports of third-party agency
vi. Oversee capacity building activities
vii. Monitor project completion activities
viii. Review activities related to the Mission, including budgeting, implementing projects, preparing Smart city plan (SCP), and coordinating for the Mission or schemes
ix. Incorporate joint ventures and enter into public-private partnerships for the implementation of the smart cities programme
x. Determine .0and collect user charges, collect taxes, surcharges, etc., as authorised by the ULB

Financing of smart cities

According to the Smart Cities Mission, the central and state government funds would mainly finance smart cities. Resources are also likely to come through public-private partnerships and convergence with other government schemes, such as Atal Mission for Rejuvenation and Urban Transformation, Swachh Bharat Mission, and Digital India.

Funds are also expected to be raised through borrowings from bilateral and multilateral sources, such as World Bank and Asian Development Bank. Municipal bonds will also be used to raise funds. The city's own revenue, largely obtained through property, profession, entertainment, advertisement taxes, and other taxes, would also be used. The SPV can also raise funds from other sources, such as user charges for parking, water, and sewerage services.

Significant investment in terms of capital cost is expected in cities to set up infrastructure and facilities for smart interventions, the challenge of funding operations and maintenance, and asset replacement is a key concern for cities beyond the mission period.

The Smart Cities mission provides states or cities an opportunity to examine innovative funding mechanisms. These include mechanisms that many cities have adopted across the world: (i) value capture finance in terms of monetising developed land, (ii) rentals from sharing urban assets such as utility ducts and city optical fibre networks, (iii) betterment levy, tax incremental financing from city areas benefiting from smart interventions, (iv) transferable or additional floor space index, and many more.

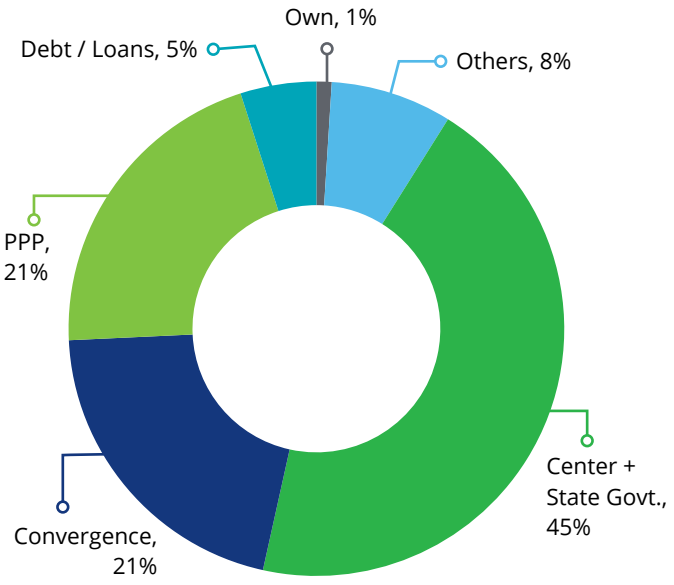
11. http://smartcities.gov.in/upload/uploadfiles/files/SPVs.pdf
12. http://smartcities.gov.in/upload/uploadfiles/files/SPVs.pdf

Financial landscape and key sectors of smart cities

As part of the Smart Cities Mission, an investment of INR 2.04 lakh crore is planned for various projects[13].

Planned sources of funds include central and state governments (45%), convergence of various government schemes (21%), public-private partnerships (21%), debts or loans (5%), cities' own funds (1%) and funds from other sources (8%), as depicted in the chart below.

Planned Source of Funds for Smart Cities



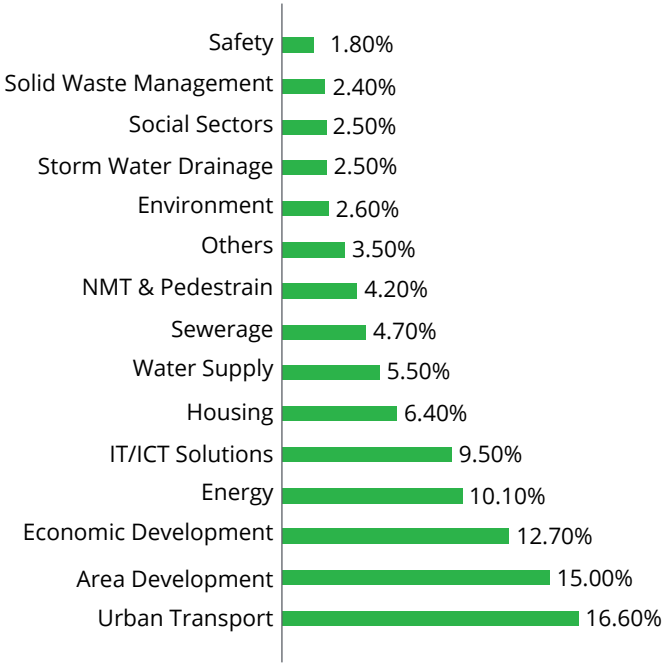
Source: Ministry of Housing and Urban Affairs, 2018, Presentation on Smart Cities Mission to Consultative Committee (Urban Development)

Until March 2018, the government of India had released funds worth INR 10,459.2 crore under the Smart Cities Mission[14]. These funds have been released over a period of three years: FY 2015-16 (INR 1,467.2 crore), FY 2016-17 (INR 4,492 crore), and FY 2017-18 (INR 4,499.5 crore).

Focus and investments by sector

As observed from the chart below, the urban transport, area development, economic, and energy sectors have emerged as focus sectors in smart cities. These sectors account for more than 50% of the total planned investments. Initiatives across the water supply and sewerage sectors, IT or ICT solutions (including automation or e-governance facilities), and the housing sector account for 10.2%, 9.5% and 6.4% of the total planned investments, respectively.

Investments in 99 cities by Sector



Source: Ministry of Housing and Urban Affairs, 2018, Presentation on Smart Cities Mission to Consultative Committee (Urban Development)

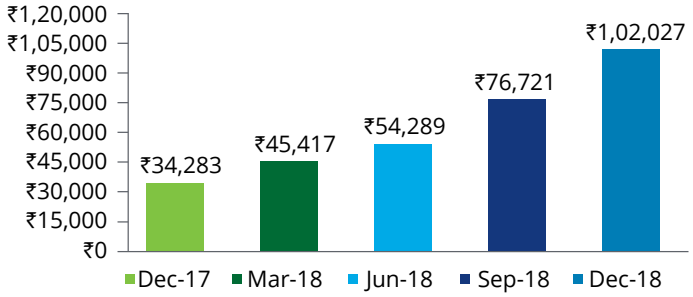
13. Ministry of Housing and Urban Affairs, 2018, Presentation on Smart Cities Mission to Consultative Committee (Urban Development)
14. http://smartcities.gov.in/content/innerpage/fund-release.php

Status of smart cities mission

To date, the Smart Cities Mission picked up momentum and shown significant progress in the past two years. According to MoHUA, the government of India, as on 31 December 2018, projects worth over INR 1 lakh crore has been tendered out by cities with work started or completed being nearly 60% in value terms, as presented in the charts below.

Cumulative value of work tendered out by quarter

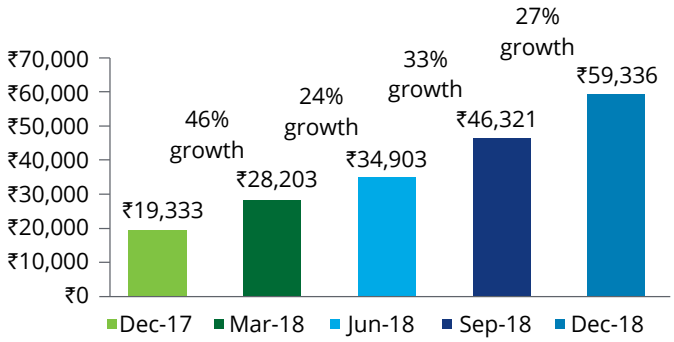
In INR Crores



Source: Ministry of Housing and Urban Affairs, Government of India

Cumulative value of work started/ completed by quarter

In INR Crores



Source: Ministry of Housing and Urban Affairs, Government of India

Representative sector-specific projects and learnings

Overall progress of smart city projects[15]

The following sections describe key initiatives under the Smart Cities Mission under three broad themes: ease of living, digital technology, and sustainability.

Ease of living

Ease of living projects involve the introduction of technology-enabled roads and transportation systems for the improved mobility for citizens. The table below summarises the implementation progress of ease of living projects*:

Status of Ease of Living Projects

Details		Smart Roads	Smart Mobility
Work Started/Completed	Number of Cities	35	26
	Investments (in INR Crore)	3,529	1,778
Under Tendering	Number of Cities	9	21
	Investments (in INR Crore)	1,907	1,935

Source: Ministry of Housing and Urban Affairs, 2018, Presentation on Smart Cities Mission to Consultative Committee (Urban Development). *As on June 2018

Smart road projects worth INR 3,529 crore have been completed or are in progress in 35 cities. Smart mobility projects related to non-motorised transport and public bike sharing projects worth INR 865 crore have been completed or are in progress in 18 smart cities.

Smart mobility projects also include projects related to the creation of transport infrastructure viz. provision of buses, development of bus stops, construction of foot-over and rail-over bridges or subways, and development of multi-modal transit hubs. Projects worth INR 913 crore have been completed or are in progress in 12 cities, while projects worth INR 1,615 crore are in the tendering phase in 14 cities. A case study on public bicycle sharing initiative is presented below.

Public Bicycle Sharing Project in Bhopal

To promote non-motorised transport in the city, Bhopal Smart City Development Corporation Ltd. (BSCDL) launched the country's first completely automated 24x7 bicycle sharing project under the Smart Cities Mission. With 50 fully automated docking stations linked to the central control system, citizens can access bicycles via their smart phone or smart card. Users can also locate their bicycles through installed GPS devices and open the electronic lock by swiping the "My Bus BRT" smart card. The project costed about INR 7 crore and was implemented on a public-private partnership mode. The initiative helped improve traffic flow, and contributed to the environment significantly. It has offset more than 7400 kilogram of CO2 emissions since its launch after logging more than 34,000 clean kilometres.

Source: https://smartnet.niua.org/weekly-update?m=wu3

15. Ministry of Housing and Urban Affairs, 2018, Presentation on Smart Cities Mission to Consultative Committee (Urban Development)

Key Learnings

The success of a public bicycle-sharing project significantly depends on an efficient marketing and communication strategy and the right selection of a site.

Efficient marketing and communication strategy: To ensure the success of this project in Bhopal, BSCDL adopted a marketing and communication strategy wherein advertisements, public relations and events, and identity media and website were the chosen channels of communication. These channels ensured the maximum number of targeted consumers are covered.

Right selection of site: Choosing the right site location is important as the selection of a wrong site may lead to safety issues for users, lesser patronage, poor revenue generation, etc. To ensure the right selection of the site, BSCDL focused on key parameters, such as area suitability and terrain, land use, existing public transport corridors, existing spots of high public transport usage, areas of public interest, such as parks, and student population spots.

Digital technology

Digital technology projects relate to improving governance and easing the lives of citizens using information technology. Under this theme, smart cities have developed command and control centres to control the overall functioning and monitor activities in the city. These cities have also developed mobile applications to ease the lives of the citizens so that they can access essential services through their mobiles. The following table gives us an overview of the implementation status of the projects related to digital technology*:

Status of Ease of Living Projects

Details		Command & Control Centres	Mobile Applications
Work Started/Completed	Number of Cities	23	11
	Investments (in INR Crore)	3,084	39
Under Tendering	Number of Cities	33	1
	Investments (in INR Crore)	2,719	2

Source: Ministry of Housing and Urban Affairs, 2018, Presentation on Smart Cities Mission to Consultative Committee (Urban Development). *As on June 2018

Command and control centres related projects worth INR 3,084 crore have been completed or are in progress across 23 smart cities. Mobile application-based projects worth INR 39 crore have been completed or are in progress in 11 smart cities.

Digital technology intervention largely refers to ICT-enabled pan-city solutions, including setting up internal command and Control Centres through which incidents across the city is tracked, reported and responded to leveraging multiple field level sensors across the city. These addressed interventions like safety & security, intelligent traffic management, etc. However these solutions also has enabled accessibility and inclusiveness in keys areas of healthcare and education. A case study of use of ICT in government schools has been presented below.

Transforming Government Schools in New Delhi

To make the teaching and learning process effective by addressing the learning needs of students using varying learning styles, New Delhi Municipal Council (NDMC) is introducing ICT interventions in NDMC and Navyug schools. NDMC has set up 444 smart classrooms with audio and visual smart boards, digital libraries with library automation systems, and tablet-based smart classes for assessment. Due to these initiatives, there is marked improvement in academic scenario in these schools with better class X and XII results, increased enrolment, and improved performance of both teachers and students.

Source: https://smartnet.niua.org/weekly-update?m=wu32

Key Learnings

To make these ICT interventions successful, it is important to train teachers on the effective handling and integration of ICT within classrooms. Since the launch of the project, there has been significant emphasis on regular training of teachers on their subject and different digital platforms introduced in NDMC schools. Smart classes, digital lab, and tablet-based classes have been successful because teachers received regular and comprehensive training. Teachers also received special in-house weekly training to become accustomed to teaching through smart boards.

Sustainability

Sustainability focused projects relate to creating sustainable solutions for essential needs of citizens. Under the Smart Cities Mission, projects such as smart water, smart wastewater, smart solar, and waterfront development have been undertaken. The following table summarises the implementation progress of sustainability projects*:

Status of Sustainability Focused Projects

Details		Smart Water	Smart Wastewater	Smart Solar	Waterfront Development
Work Started/ Completed	Number of Cities	40	29	49	15
	Investments (in INR Crore)	4,079	2,623	886	452
Under Tendering	Number of Cities	10	17	7	12
	Investments (in INR Crore)	980	4,707	176	660

Source: Ministry of Housing and Urban Affairs, 2018, Presentation on Smart Cities Mission to Consultative Committee (Urban Development). *As on June 2018

Smart water projects worth INR 4,079 crore have been completed or are in progress across 40 cities and smart wastewater projects worth INR 2,623 crore have been completed or are in progress across 29 smart cities.

In the area of renewable energy, solar electrification (smart solar) projects worth INR 886 crore have been completed or are in progress across 49 cities.

Place making projects such as riverfront development projects worth INR 452 crore have been completed or are in progress across 15 cities.

A case study on water supply management using SCADA has been presented below:

Water Supply SCADA in Ahmedabad

Water treatment and water distribution services are key factors for the development of any city and all urban local bodies. In the first phase, Ahmedabad Municipal Corporation (AMC) has commissioned a network of the Supervisory Control and Data Acquisition (SCADA) system across its distribution network to generate real-time data, and develop standard operating procedure for auto analysis and alerts for flow and energy. The SCADA system allows for local and remote control function and is equipped with safety shutdown features. It is integrated by AMC with the Integrated Command and Control Centre, to help in effective decision-making and save cost.

Source: https://smartnet.niua.org/weekly-update?m=wu33

Key Learnings

While most cities have adopted the SCADA system for water supply, the key feature that makes the project a breakthrough is that it is well integrated with the Integrated Command and Control Centre (ICCC)in Ahmedabad. The integration of SCADA with ICCC makes it possible to combine data from various sources, such as SCADA, complaint redressal system, surveillance cameras, and Geographical Information System . It helps perform pattern analysis, which in turn leads to effective decision-making. This integration also helps improve the accountability of various agencies involved in water supply.

Concluding remarks

The 100 Smart Cities Mission programme was launched in 2015 and is expected to be completed by 2023[16]. As observed above, some key projects, including smart roads or place making projects, aimed at improving the ease of living for citizens have already been completed in some cities. This gives citizens the visibility of the programme. As digital technology is one of the major focus areas of the mission, command and control centres have been completed in cities such as Vishakhapatnam, Kakinada, and Bhopal. These centres are expected to address issues of incidence reporting using field-level sensors, planning or monitoring response, and introducing data evidenced urban planning. Sustainability focused projects such as smart water and waste management, solar electrification, and riverfront development, are also being pursued with a focus on the conservation of natural resources and the protection of environment.

The Smart Cities Mission is a significant transformation programme that has highlighted the significance of comprehensive integrated development of cities. It has helped in bringing various agencies involved in urban planning and management together through an SPV and ensuring a better standard of living for urban population (through better coordination and management). The mission has not only allowed for coordination among agencies but also showed merit of comprehensive provision of urban services. The integration of urban services allows for better decision-making and thus better services. The mission has also helped in highlighting the capacity and institutional challenges to all the urban stakeholders. It has provided a platform for the cities to attempt to resolve these challenges through smart cost-effective solutions.

Overall, the Smart Cities Mission is one of the flagship missions of MoHUA, which has received global attention given its scale and opportunity to bring in transformational changes in the urban landscape. This can serve as a case study for other nations. The mission has the potential of taking India closer to the aim of being one of the smart nations in the world.

In the future, the key challenge is expected to be (i) ensuring the sustainability of interventions at the city level and (ii) extending benefits to other cities in the country not covered under the current programme.

Funding will be the key requirement for ensuring sustainability as well as replicating the success stories in other cities. MoHUA has already undertaken initiatives to explore additional sources of revenues for cities. These sources include the monetisation of data and analytics generated through the integrated command and control centres in a city. The experience of cities that have successfully adopted such business models (including Copenhagen, Manchester, and Bristol) may be studied. These practices may be suitably adopted for other Indian cities by enacting policies at the centre or state level and building capacity among city officials.

The replicability of smart solutions to other cities may be considered through the proposed India Urban Data Exchange initiative planned by MoHUA. The urban data exchange platform may enable cities to share their applications with other cities. This will reduce investment requirements for developing similar applications for the recipient city and provide a source for revenue generation to the city providing the application. Some states such as Madhya Pradesh and Tamil Nadu are setting up cloud-based platforms, which may allow other non-participating cities in those states to benefit from the applications and solutions implemented, in the future.

16. Source: Ministry of Housing and Urban Affairs, 2018, Presentation on Smart Cities Mission to Consultative Committee (Urban Development)

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