

Science and Technology Trends

The Advent of Smart Cities

The Advent of Smart Cities in India

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1. The Context for Smart Cities in India: Urban Governance Reforms and Technology Interventions¹

India has emerged as one of the fastest growing economies of the world, with urban areas becoming the predominant contributors to the national economy. Cities play a critical role in national growth. An estimated 65 percent of India's GDP comes from urban areas. Rapid urbanisation in Indian cities has led to a dual challenge: increasing densities that have resulted in over-burdening of existing infrastructure like water supply, sanitation, housing, transportation and energy and hence, deteriorating quality of urban life, on one hand; and, expanding city limits resulting in fragmented development and degenerated peripheral growth, on the other, thereby again compromising the quality of life.

The advent of smart cities in India marks the culmination of an extended process of reforms in the urban sector, which refers to the broader national approach to the system of urban settlements in the country as well as the interventions that have been undertaken to develop urban infrastructure, services and urban governance. The reform of urban development and governance was radically affected

by the economic liberalization initiated in 1991, marking a dramatic shift away from statist planning towards competitive and free-market driven processes. Two events, one immediately before and one after 1991, give a glimpse of this dramatic shift.

The National Commission on Urbanization, set up in 1986, submitted its final report to the government in 1988. The Commission had conducted an unprecedented and in-depth study of the network of cities in the country and the economic processes that were causing urbanization. It recommended investments in growth corridors and hotspots of economic activity; however, its perspective was national, whereas the urban sector was determined by one single truth: that the Constitution of India gave the responsibility of management of land and municipal governance to the state governments that formed the federal Union of India. Thus, the Commission's brief was rooted in the assumption that the central government could determine the course of urbanization in the country, whereas the imperatives of a liberalised economy required that cities were treated as corporate bodies that could operate as economic entities in the market. This new thinking was initiated by the enactment in 1993—two years after liberalisation of the economy—of the

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1 PEARL programme, Reforms and ICT in Urban Services, New Delhi, NIUA, June 2015

74th Constitutional Amendment that devolved the powers of local self-government to democratically elected ‘urban local bodies’ (essentially, municipalities of various demographic sizes). This landmark initiative began the modern evolution of the urban sector in India, of which the smart city mission is the latest manifestation.

The Government of India envisaged a broad-based reform of the urban sector. With the support of the United States government, it embarked on an ambitious programme of assessing the reform requirements and capacity-building needs of Indian cities, especially with regard to their financial health and sustainability. The ‘Financial Institutions Reform and Expansion Program—Debt and Infrastructure’ (FIRE-D) Program commenced in 1994 with funding and technical assistance from US-AID. The program identified deficiencies in financial management, resource mobilization and project development and promoted a comprehensive approach for impactful and sustainable urban reforms and increasing investment in urban infrastructure, with specific focus on the urban poor.²

In addition to official initiatives for urban reform, the 1990’s also witnessed a number of city-specific and localised initiatives that generated good practices for urban reform through the efforts of capable and enlightened city administrators. These include the transformation of Surat in the aftermath of the plague, the issuance of the first municipal bond in Ahmedabad and PPP projects for sewerage and water supply in Allandur and Tirupur in Tamil Nadu. Pioneering state governments also became champions for reform, resulting in increased transparency and accountability in Hyderabad and Bangalore and streamlining of building plan approvals in Pune and Mysore. Most such reforms were initiated with the support of bilateral agencies like USAID and DFID and multilateral agencies

like the World Bank and ADB.

In 1994, the Ministry of Finance set up an Expert Group on Commercialization of Infrastructure Projects.³ The expert group submitted its report in 1996 and contributed to the 9th Five Year Plan (FYP 1997-2002), which stressed the need to explore market-based forms of financing such as municipal bonds and to achieve the necessary municipal reforms. The 10th FYP (2002-2007) announced comprehensive urban reforms and public private partnerships in urban infrastructure projects, including the introduction of 100 percent Foreign Direct Investment (FDI) in integrated townships and infrastructure projects. The Urban Reforms Incentive Fund (URIF) was announced in the 2002-03 budget, to incentivize reforms in seven key areas, including the repeal of the Urban Land Ceiling and Regulation Act (ULCRA), rent control, computerized registration of property, rationalization of stamp duty and property tax, levy of user charges and introduction of double entry system of accounting in the ULBs.

In 2005, the Government of India (GoI) launched the Jawaharlal Nehru National Urban Renewal Mission (JnNURM) as a logical next step in the urban reforms trajectory. The seven year mission (2005-2012) focused on 65 mission cities and provided stimulus funding for infrastructure projects in water supply and sanitation, transportation, etc. as an incentive for reforms at state and city levels, develop appropriate enabling and regulatory frameworks, enhance the credit worthiness of municipalities and integrate the poor with the service delivery system.

“E-governance” was one of the mandatory reforms to be achieved at the ULB level. Several Indian cities had already begun deploying a few smart technologies to efficiently provide civic services. Cities such as Hyderabad, Surat, Coimbatore, Bengaluru, Mangalore, Jamshedpur, Kanpur, Delhi,

² See ‘India: Pioneer Of Municipal Finance’, <https://usaid-credit.exposure.co/india-pioneer-of-municipal-finance>, referenced 15 June 2018.

³ India Infrastructure Report, IDFC Limited, 1996

Mumbai and Chennai have launched initiatives related to the deployment of advanced communications systems, metro rail systems, traffic management systems, smart meters, GPRS for solid waste management, GIS to manage property tax, online water quality monitoring, and online building plan approval systems.

2. Smart Cities in India: the Formative Years

The enabling policy framework⁴ for the technology aspect of smart cities gained momentum with the launch of The National e-Governance Plan (NeGP) by the GoI to institute and enable mechanisms to improve the system of governance and thus provide better services to the citizens by effective use of Information & Communication Technology (ICT). NeGP comprised 27 Mission Mode Projects that included e-Governance in municipalities. A total of 35 JnNURM cities with 1 million population were made pilot cities for NeGP and guidelines were drafted for a new Centrally Sponsored Scheme (CSS) for other cities and towns. The following services were to be covered under this reform at the ULB level:

- Basic citizen services: birth and death registration and health programs
- Revenue earning services: property tax and licenses
- Development services: water supply and other utilities, building plan approval
- Efficiency improvement services: procurement and monitoring of projects
- Back office improvements: accounting and personnel management system
- Monitoring: citizen grievance redressal

In 2011, Government of India approved a scheme for creation of a National Optical Fiber Network (NOFN) for providing Broadband connectivity to rural local bodies or panchayats (village councils).⁵ Another significant policy was the National Industrial & Manufacturing Zone policy of 2013, which stipulated the creation of industrial townships to house the workers and other professionals who would be required to operate the new manufacturing industries that are to be established along the Delhi-Mumbai Industrial Corridor, with the Dedicated Freight Corridor as its backbone. Promoted by the Department of Industrial Policy & Promotion of the Ministry of Commerce, seven “smart cities” have been envisaged on the DMIC.

The Delhi Mumbai Industrial Corridor Development Corporation has also committed to developing smart eco-cities with investment from Japanese companies based on their experience of developing Yokohama and Kitakyushu.⁶ State governments like Kerala and Gujarat have also independently devised their own plans for developing the Kochi Smart City and the Gujarat International Finance Tec-City (GIFT) respectively.

Reforming the government system through good governance was one of the key agenda points in the Bharatiya Janata Party’s (BJP’s) election manifesto for India’s General Elections in 2014. Open government and accountable administration with administrative reforms as the priority was expected to bring in transparency in the Government’s decision-making process. Highlighting the importance and power of the middle class and “neo middle class” (people who have risen from the category of poor and are yet to stabilize in the middle class), the manifesto touched upon the need for proactive handholding to meet the increasing aspirations.

4 PEARL programme, op. cit

5 PIB press release announcing cabinet approval of scheme for creation of a National Optical Fiber Network (NOFN) for providing Broadband connectivity to Panchayats, October 2011

6 ECO CITIES FOR INDIA Jun 20, 2011 by Dhanapal. G. See more at:
<http://www.sustainabilityoutlook.in/content/eco-cities-india#sthash.oECw4R2W.dpuf>

2.1 Smartness as an Electoral Promise

Under the charismatic leadership of Narendra Modi, the Bharatiya Janata Party (BJP) led the National Democratic Alliance to a historic victory in the elections to India's national parliament in 2014. In its election manifesto, the BJP had stated categorically that part of its approach for delivering its commitments to the electorate was to see urbanisation in India as an opportunity and to plan for urban areas which can reflect efficiency, speed and scale.⁷ Cleanliness and sanitation were given high priority along with programmes for integrated waste management, housing & urban poverty alleviation, urban transport, technologically-enabled scientific, strategic and long-term planning. The manifesto also promised integrated habitat management and the development of 100 smart cities. In his first Union Budget Speech, the Finance Minister Arun Jaitley announced a fiscal allocation of INR 7,060 crores (USD 118 million) for creating the blueprint for smart cities.⁸

The Digital India programme was envisaged by the Department (now Ministry) of Electronics and Information Technology, with a vision to transform the country into a digitally empowered society and knowledge economy.⁹ With Prime Minister Modi's commitment to digitalisation as a means to achieve transparency and efficiency in governance—inspired by his promise of “more governance, less government”—the Digital India program became the key ingredient for the urban transformation that he would solidify through the smart city mission. Most of the terms of Digital India were deeply connected to cities and urban life and formed a blueprint for the delivery of these features in substantive form. The components of Digital India include

“Infrastructure as Utility to Every Citizen”, with high speed and cyber-secure internet connectivity and mobile telephony to bridge the digital divide and enable “cradle to grave” digital identity (later to become ADHAAR), financial inclusion through banking services and digital access to government services. The development of ‘single windows’, improvement of ‘Ease of Doing Business’ rankings and leveraging of GIS for decision support systems would eventually enable collaborative and participatory governance.

3. Mission Transform-Nation¹⁰: the Smart Cities Mission as a ‘Theory of Change’

India's Smart Cities Mission was launched on 25th June 2015. The Mission treated the lack of a universal definition of “smart cities” as a premise, with the argument that India's needs are very different from the other countries where the global trend toward smart cities was being propelled from locations such as Songdo in South Korea, Masdar in Abu Dhabi and specific projects in Barcelona, Helsinki, Dublin, Berlin and London. Thus, India's Mission guidelines stated quite emphatically that there is no universally accepted definition of a smart city, thus dedicating itself to the holistic development of the urban ecosystem, with cities incrementally adding “layers of ‘smartness’” and creating replicable projects, thereby acting like “lighthouses” for other aspiring cities. Significantly, the mission stated its objective in terms of achieving urban ‘smartness’ in the context of overall urban sector ambitions: “To drive economic growth and improve the quality of life of people by enabling local development and harnessing technology as a means to create smart

7 BJP Election Manifesto, 2014 available at bjp.org

8 Budget 2014-15, Speech of Hon'ble Minister of Finance: Point no 24

9 PIB press release announcing cabinet approval of Digital India – A programme to transform India into digital empowered society and knowledge economy, August 2014

10 Exploratory research on Smart Cities, June 2015

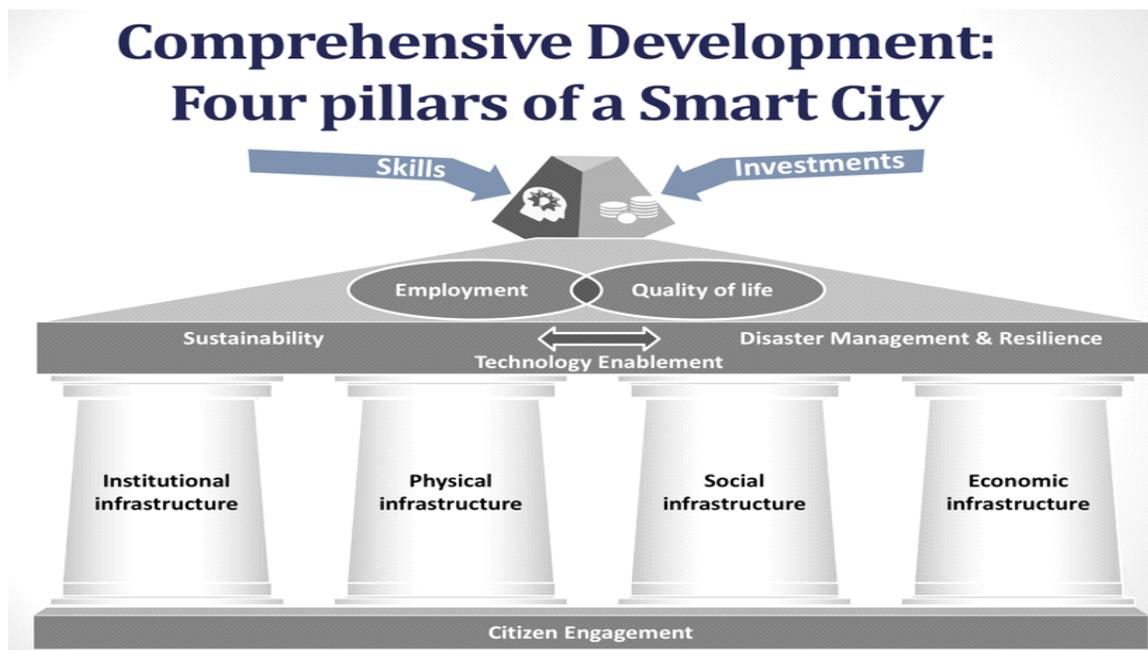
outcomes for citizens.” (Smart City Mission Guidelines, 2015) The enabling of local development was seen strategically as a two-pronged approach: to spatially locate the key economic drivers in each city and to pursue retrofitting, redevelopment or greenfield development in such locations in order to fully realize the economic potential. In addition, to identify city-wide priorities with respect to urban management and service delivery needs and to service those needs by introducing at least one or two smart solutions that impact the lives of all citizens.

The smart development strategy for the lighthouse city was evolved through a consultative process wherein large numbers of stakeholders and citizens were engaged in creating baselines and long-term visions as well as identifying the areas for intervention and the specific needs for which ‘pan-city’ solutions were devised. Thus, a significant thrust was given to result-oriented projects that benefit the local residents in terms of economy, health and well-being and other social and cultural

outcomes. Measurable improvements in service delivery and efficiency were given as much importance as qualitative outcomes related to public health and wellbeing, inclusion and access and improved governance. The ambitions of the Mission are pithily captured in the following statement:

“The specific priorities are to have clean air according to norms, move towards zero discharge of solid and liquid waste, make streets litter free, involve citizens in policy-making and execution, generate jobs, expand the identified core economic activity(ies) of the city, make the city prepare for floods and extreme weather, reduce and eliminate poverty, make basic services available to all—especially the poor and disadvantaged, create recreation spaces and parks, realign processes so that citizens get timely municipal services through complete disintermediation, and promote good governance in general and mobile governance in particular.”

Figure 1. Four ‘pillars’ of a smart city, identified in the first draft of the Smart City Guidelines, 2014



Given that the Prime Minister had personally articulated the ambitious byline—“Mission Transform-Nation”—it is not surprising that the Mission became a vehicle for introducing into the urban sector in the country, the good practices and innovations that had been identified through experience and research in the urban sector, especially but not solely during the JnNURM. The dissemination and adoption of good practices was given a fillip through exposure to the global urban sector, which was promoted by the interventions of multilateral and bilateral agencies and bilateral cooperation agreements between India and the developed countries of Europe, North America and the Asia-Pacific region.

It could be argued that the theory of change described by the smart city mission—which guides a mission for urban transformation—has a greater significance than its specific targets: to develop 100 smart cities with at least one in each state and union territory¹¹ of India from a larger pool of over 4000 cities in an incremental manner over five years. While the numerical targets and their achievement form the tangible promise given by the ruling National Democratic Alliance in its election manifesto, the impact of the Mission must be understood in terms of its longer term goals and its explicit ambition to be a “game-changing” urban initiative. The salient aspects of this larger sectoral goal can be subjected to more detailed examination; however, the broad contours of the theory of change are described in the following sections.

3.1 The Smart City Challenge

The “India Smart City Challenge” is widely recognised to be the first of its kind in India as well as the urban sector globally. It exemplifies the competitive spirit that Prime Minister Narendra Modi has stipulated for all public programs in the country,

wanting to thereby push for greater innovation in urban development whereby a development program can address the specificity of local context while following a standardised template and competing for funding on the basis of merit that can be objectively established.

The ‘challenge’ was conducted in two stages. In stage 1, the state governments were asked to identify ‘candidate cities’ which would participate in stage 2, the main challenge. The candidate cities were also shortlisted on a competitive basis, taking into account their performance in achieving reforms during JnNURM and their current administrative and financial performance.

A standard template was devised for submission of the proposals, such that all proposals, regardless of the size and type of city, could be judged on a common basis and on their own merit. A unique innovation was introduced through the design of the blank standard template in which the proposals were to be prepared, consisting of a set of 43 questions and providing limited word counts for each response as well as a stipulation of page limits for enclosures.

The competition brief required that each city should propose to develop one area-based development—either a retrofitting of minimum 500 acres, a redevelopment of minimum 50 acres or a Greenfield development of minimum 250 acres—on the principles of place-making and integrated urban planning, and one or two pan-city smart solution which would improve the delivery of municipal services throughout the city. Cities were asked to conceive transformative projects that could result in the highest possible impact in the following aspects: economic growth (measured by the number of new jobs created, new firms attracted, increased productivity and business climate in the formal as well as informal sectors, recognition of and incorporating urban vendors), and improved quality of life, especially for the poor (measured by

¹¹ Union territories in India are under the direct administrative rule of the central Government of India

reduction in commuting time, support of non-motorized transport, improvement in air and water quality, increased coverage of water supply, solid waste management, street lighting, green public spaces, and public safety and security).

3.2 Demand-Driven and Consultative Process

The Challenge process mandated that the projects being identified by the city to achieve the 24 essential features would be identified through the sharing of baseline assessments with the citizens and stakeholders and the conducting of public consultations, focus group discussions and opinion polls. The competing cities employed an array of engagement tools and forums to ensure coverage and deepen the engagement process. More than 1.7 million participants engaged with the mission on the 'My Gov' platform of the Government of India. Overall, "an unprecedented 1.5 crore citizens were consulted while envisioning and preparing smart city proposals (Smart City Mission, Weekly Bulletin)." The local governments used innovative mediums for presenting facts and soliciting inputs from the public, including infographics, creative competitions for essay-writing, poster-making, painting, logo and tagline creation, as well as street plays, sports events, music concerts and discussion groups on social media, television and radio. Specific efforts were taken to engage the poor and vulnerable sections of society.

3.3 Institutional Capacity-Building

A structural weakness in the urban sector in India has been the lack of capacity within the urban local bodies. In order to attain success in the Smart City Mission, it was anticipated that each city would need the capacity to plan, implement, operate and manage the entire life-cycle of the projects funded by the Mission. The need to preserve the orientation toward results and protect the projects from the vagaries

of frequent changes in the political economy—an average term for a Mayor in Indian cities is 18 months—forced a strategic decision that continues to be debated.

The Mission requires that in order to avail of funding, each city must establish a 'special purpose vehicle (SPV)', a Limited company incorporated under the Companies Act, 2013, in which the State/UT and the ULB will be the promoters having 50:50 equity shareholding, that would ensure stringent accounting and managerial practices. As per Mission guidelines, the SPV "will plan, appraise, approve, release funds, implement, manage, operate, monitor and evaluate the Smart City development projects (Smart City Mission Guidelines)." This is particularly significant in the context of Indian municipalities, which have historically been weak in such aspects. The Boards of the SPVs would include key stakeholders from government departments and agencies as well as others; however, the Chief Executive was expected to be sourced from the private sector. A key responsibility is to ensure financial sustainability of projects over their entire lifecycle. The SPV is expected to lead the innovation agenda in the city and become an integral part of the reform process, ensuring coordination amongst stakeholders and monitoring results. In addition to the key management personnel, each SPV is also required to hire a team of domain experts in the form of a Project Management Cell.

3.4 Strategic Planning

The Smart City Mission has made a distinct departure from the normal approach to urban planning, which had been dominated by the perpetuation of "master planning." A strategic approach to planning has been adopted rather than the usual physical planning of infrastructure and the determining and regulation of land use. The smart cities were required to adopt such a strategic approach also because the Mission targeted existing cities and

‘brownfield’ sites¹². It insists on cities to identify their strengths, weakness, opportunities and threats (SWOT); prepare suitable vision statements, make proposals, and implementation and financial plans for the same. The application framework required a logical framework that related the goals of the project with the outcomes being targeted: the ‘means’ deployed with the ‘ends’ being sought by the city. While drawing up the log-frame, the cities also identified the main risks and assumptions as well as the framework for monitoring progress.

Table 1. The logical framework used in the template for submitting proposals in the Smart City Challenge, 2015

Mission Results Hierarchy	Performance Indicators	Assumptions and Risks
Goal at national level:		
Sub-goal of city:	Impact indicators:	
Purpose of area based developments:		
1		
2		
Purpose of each area based activity:	Area based outcome indicators:	Assumptions and risks
1.1		
1.2		
2.1		
2.2		
Purpose of smart solutions:		
1		
2		
Purpose of each smart solution activity:	Smart solution outcome indicators:	Assumptions and risks
1.1		
1.2		
2.1		

3.5 Convergence

The mission encourages cities to leverage their smart city proposals as natural convergence points for other national initiatives, thus enabling an integrated approach to urban planning and a broader engagement with issues ranging from economic development (‘Make in India’ Mission), adoption of digital technologies (‘Digital India’) and housing (‘Pradhan Mantri Awas Yojana’) to urban infrastructure (‘Atal Mission for Rejuvenation & Urban Transformation’), heritage conservation (‘Heritage Rejuvenation & Infrastructure Development and Augmentation Yojana’), sanitation and waste management (‘Swachh Bharat’ Mission) and livelihoods (‘National Urban Livelihoods Mission’). As a result, a number of cities could converge the funding available from schemes for installation of piped natural gas, solar panels and promotion of e-vehicles. The thrust on convergence between schemes and programs that are being, or can be, executed in the same city was a recognition of a trivial fact: that cities are sites for integrated development and not just incidental locations where different schemes get implemented. Most significantly, convergence rescues the development process from the waste and redundancy caused by overlapping investments and duplicated expenditure.

3.6 Integration

Fundamentally related to the issue of convergence is that of integration. In a dramatic departure from business-as-usual, where each government department or agency would pursue their plans and implement projects in relative isolation from the other, the smart cities are required to integrate their projects across sectors, such that all aspects are

¹² A departure from this approach of focusing on existing cities was when the Andhra Pradesh government sought approval for the greenfield city of Amaravati, its new capital, in the third round of the Smart City Challenge. However, this selection has been kept in abeyance till such time that Amaravati is formed as an ‘urban local body’.

Table 2. Milestones and progress of the Smart City Mission

Round of Selection	Month & Year	Number of Cities Selected	SPV Formed	PMC Setup
Round 1	January 2016	20	20	20
Fast Track	May 2016	13	13	13
Round 2	October 2016	27	27	27
Round 3	June 2017	30		
Round 4	January 2018	9		
Total		99	92	69

addressed in a holistic manner and contribute to the overall quality of life. Thus, each city was required to plan for the provision of 24 “essential features”, which included traditionally non-urban services such as power supply, healthcare, education, employment generation and environment. The ‘smart city plan/proposal’ thus contained a variety of projects that were provided approval and sanctioned funds at the same time.

4. Mission Update: Transformation in Progress

The results of Round 1 of the Smart City Challenge were declared in January 2016, six months after the launch of the Mission. This period included the preparation and submission of proposals in December 2015 and the subsequent evaluation of proposals by a jury of experts. The pace of execution can be described as unprecedented, especially given the unusual scale and nature of ambitions in the Mission. By January 2018, 99 cities have been selected, with the last one awaiting the resolution of an unexpected legal hurdle. The 99 selected cities have proposed a total investment of INR 201979 crores (USD 33.7 billion), with approximately 80.76% of the funds proposed to be invested in the Area-Based Developments and about 19.24% in the Pan City Solutions.

The progress of the Mission and its institutional setup is shown in Table 2.

An appraisal of the Smart City Mission would tend to consider the achievements of the Mission in comparison with the past. However, it is more constructive to consider the ways in which the Mission has become a barometer of the evolution of the urban sector in India. It is worthwhile to recall that the projects being executed in 99 cities are conceived in response to each city’s baseline as well as the opinion of local stakeholders about their needs and the articulation of their demands. As such, the Mission indicates changing priorities, needs and wants of the cities.

The projects currently being implemented under the Mission are broadly distributed across 14 categories. These projects include provision of basic infrastructure as well as improved governance and IT-enabled services using cloud-based technology. The new kinds of projects being executed include integrated command-and-control centers, common payment cards across platforms, CCTV surveillance platforms, parking management, signage and Information Management Systems, solar installations, real time monitoring of pollution, waste and transport, and app-based systems for promoting cycling, car-sharing, traffic management, wastewater treatment and reuse, intelligent meters and water ATMs. Innovations like GPS-enabled vehicle tracking and automatic fare collection, SCADA for water management and street lighting, public Wifi, skill development and enterprise incubation, circular economy, and promotion of local Identity and awareness, tele-medicine and digital learning platforms are also proposed by some cities.

Table 3. Sector-wise distribution of the projects in 99 smart cities, with shares of overall costs

	Sector	Number of Projects (% total)	Cost (% total)
1	Area Development	22.0%	11.05%
2	Economic Development	4.2%	1.70%
3	Energy	8.5%	11.02%
4	Environment and Pollution	5.1%	2.48%
5	Housing	2.8%	11.77%
6	IT Connectivity and Digitization	11.2%	11.17%
7	NMT	4.7%	2.30%
8	Safety and Security	1.3%	1.45%
9	Sewerage and Septage	5.2%	6.55%
10	Social Sector-Education and Health	6.6%	3.52%
11	SWM	8.3%	4.67%
12	Storm Water Drainage	1.6%	1.54%
13	Urban Transport	10.4%	8.27%
14	Water Supply	4.7%	14.44%

Since the Mission was launched three years ago, 940 projects are being executed by the 70 cities that have established SPVs and hired the required human resources. The remaining 29 cities are in different stages of institutional development. 313 projects with a total cost of INR 5221.92 crores (approximately USD 870 million) have already been completed. These constitute 16.25% of the total projects. Another 627 projects with a total cost of INR 26910.55 crores (USD 4.5 billion), constituting the remaining 83.75% of projects, are at various stages of implementation. The category-wise distribution of the 940 projects that have been envisaged by 70 cities are described in Table 3.

Within three years of launch, the Smart City Mission has revealed the capacity of the sector for absorbing innovation and reform. While the structural challenges remain in the larger pool of cities in the country that have not been covered by the Smart City Mission, the ‘theory of change’ and the ‘lighthouse’ effect has begun to show results, as increasing numbers of cities learn from each other and experiment with ‘smart’ solutions for their needs and challenges.

Specific aspects of the Mission that need extensive research and further evolution—based on the evidence

that will emerge during 2018-19—include the innovative financial arrangements that cities will need as they progress further along the path to becoming “sustainable, resilient, safe and inclusive”, as is envisaged by the Sustainable Development Goal 11, a key part of the New Urban Agenda adopted by India and the international community. Urban transformation cannot be achieved through government funds alone. Smart cities have leveraged government grants to the order of 2.5 times. Popular sources of finance encouraged in the Mission projects are public private partnerships (PPP), municipal bonds, and land value capture. Pune and Hyderabad have issued municipal bonds that provide a 13% return on investment. A policy framework for Value Capture Finance has been prepared by the Ministry of Housing & Urban Affairs and promoted with all state governments (Smart City Mission, Weekly Bulletin). The PPP mode of funding is being used for 98 projects with a total worth of about INR 6000 crores (USD 1 billion). The projects are structured around the leasing of centrally located land parcels or the easing of right-of-way provided by the city. These projects are case-studies in innovative municipal financing, with large PPP components:

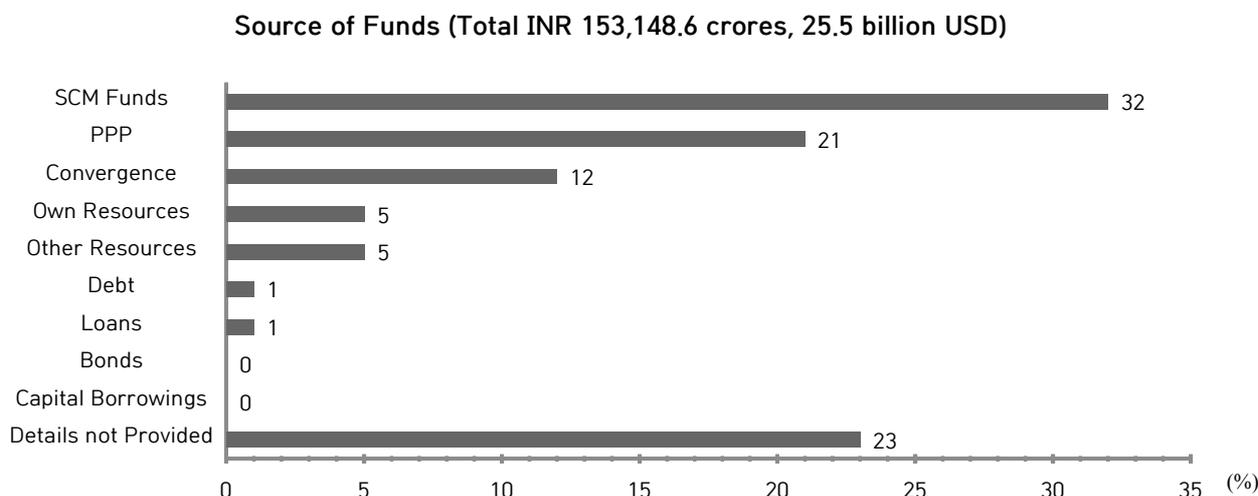
- Railway Station Multimodal Hub, Bhubaneswar (INR 600 crores, USD 100 million)
- Janpath Government Housing Redevelopment, Bhubaneswar (INR 1260 crores, USD 210 million)
- Slum Rehabilitation in Junavadaj area, Ahmedabad (INR 462 crores, USD 77 million)
- Sector 43, Chandigarh (INR 2568 crores, USD 428 million)
- Intelligent street poles, Bhopal (INR 690 crores, USD 115 million)
- Mixed Use Development, Faridabad (INR 965 crores, USD 161 million)
- Intermodal Transport Hub, Ahmedabad (INR 609 crores, USD 102 million)
- Market Redevelopment, Raipur (INR 1026 crores, USD 171 million)

It is significant that the PPP mode, which accounts for approximately 20% of the overall financial outlay of the Mission, is predominantly based on the emerging paradigm of land value capture, which promises to become a significant source of self-generated funding for Indian cities in the future.

It has been mentioned earlier that the convergence between departments and agencies and the

integration of different domains in the urban sector have been two of the significant aspects introduced by the Smart City Mission. Two examples would clarify further the significance of these aspects. The case of the Command-and-Control Centres provides a clear illustration of the principle, whereby the centers are integrating otherwise standalone services such as E-governance, SCADA, traffic management, solid waste management and GIS-based property tax collection systems. This has required efficient coordination and enterprise resource planning within a large number of departments and agencies such as the Traffic Police, administration, local bus systems, transport licensing and others. Similarly, the common ‘smart card’ payment system in Bhubaneswar, that provides benefits to users across transportation and other municipal services, involves the transportation as well as IT, finance and other departments. The successful implementation of such a solution will enhance user experience, increase revenues for the service providers and capture valuable data on the use of transit and other services for planning in the future. ICT also enables the city to deliver government subsidies more transparently and efficiently.

Figure 2. Sources of funds for the smart cities



5. Smart Cities and the Future of Urbanization in India

Globally, India is at the forefront of generating massive concentrations of urban population. A widely cited rule of thumb is that as the population of a city doubles, it requires three times the previous built-up area. This results in increased demand for urban services—water, transportation, sewage treatment and affordable housing. A landmark study by the McKinsey Global Institute in 2010 estimated that such demand would increase 5 to 7 times across India’s urban centers. At the same time, the Indian government has also made far reaching commitments towards the larger welfare of the planet at the COP 21 Summit, by assuring the world community that it will reduce the emission intensity of its GDP by 33% by 2030. It has also committed to achieving the New Urban Agenda by 2030, which further complicates its ambitions, because the achievement of its environmental commitments must be done while maintaining the equitable, sustainable and resilient growth paradigm.

With the advent of smart cities in India, the country can be more confident of achieving a veritable decoupling of urban development from resource intensity. A description of the desired decoupling resonates with the model of smart city development in India:

[Decoupling] will require structural changes in business models, lifestyles and modes of governance and will primarily rely on a combination of changes gained through new alliances of fast-movers working together to demonstrate desirable alternatives to business-as-usual. (ibid)

The decoupling of a resource-intensive paradigm of urban development will require the wide-scale adoption of smart city principles and the scaling and replication of efforts that have been initiated

in 99 cities. While it is predictable that 80% of the costs projected by the cities is devoted to ‘area-based development’, it is significant that in more than 80 of the 99 cities, 60% of the ABD expenditure will be on retrofitting the existing urban spaces.

The retrofitting of existing urban areas may not be as fast and as convenient as the development of greenfield areas, however, the fact that most cities have chosen to invest further in existing areas is a reflection of their confidence that the contemporary city must build further on the economic value created by numerous generations of local residents over the city’s history. This is inherently a reflection of faith that older areas of the city can be made more sustainable through adaptation and improvement. Smart cities can benefit from the replication of some key aspects across the entire city.

In pursuit of compactness and the disavowal of urban sprawl, the smart cities can adopt mixed land use by planning for a range of compatible activities and land uses in juxtaposition in order to make land use more efficient. The creation of safe and walkable localities will reduce congestion and air pollution and boost the local economy by promoting localised interaction between diverse economic agents. The area-based development is also a manageable scale at which smart cities can pursue the integrated planning of infrastructure, services and public open spaces. It can easily be mapped onto the spatial structure of municipal wards or development zones. It also perpetuates the consultative spirit of the smart city, whereby local stakeholders and citizens become the generators of consensus about local needs and demands. The scaling and replication of the area-based development model can embed the ‘bottom-up’ approach to urban development in all cities of the country—which perhaps explains why the Vice-President of India, in a speech on 25th April 2018, chose to highlight this particular aspect of the smart cities mission.

The area-based developments in the smart cities have a concomitant in the ‘pan city solutions’ that are an equally significant component of the smart city plans. As solutions that leverage ICT and digitalisation, and given their ‘pan-city’ footprints, these solutions can proliferate across each city, deepening the impact and relevance of the smart city mission. While most cities have currently focused their attention on monitoring of municipal services, traffic management and security through surveillance, there are numerous solutions that can be introduced into each city. The proliferation of pan city solutions will allow the smart cities to intersect their development trajectories with other smart cities across the globe, thereby accessing ready-to-use technologies. However, it is more significant that as the cities replicate and scale their ‘smartness’, they will also attract the talent and human resource that can produce the innovative solutions required for the solution of local and peculiar problems. Thus, the Mission’s ambition of promoting frugal innovation through development of locally customised solutions can become a reality as each city evolves further.

A significant role in identifying innovative solutions will be played by the evidence and data that is gathered during the Mission and made available to researchers, entrepreneurs and civil society organisations who can subject the evidence to the cold light of scientific inquiry. This purpose will be greatly served by the City Liveability Standards that have been developed by the Ministry of Housing & Urban Affairs in 2017, which shall form the basis for the preparation of the Liveability Index for smart cities in India. Although the ISO 37120 and the SDGs do offer criteria for measuring progress, there is a felt need for an Indian adaptation of these standards, which could either be too elaborate

or simply indeterminable in the Indian context. While the smart cities are adopting different pathways for achieving their goals, a ‘common minimum framework’ was needed. The first annual assessment across 116 Indian cities on 79 indicators in 15 categories will soon be completed, with results scheduled to be announced on 25 June 2018, the third anniversary of the Mission.

The existence of objective criteria for measurement of impact will also allow for the larger partnerships that the country is eager to establish with countries and organisations that can bring innovations and sustainability to the Mission.¹³

Besides the access to good practices and global recognition, India will benefit from partnerships, investments and technical assistance from around the globe. These already include the Indo-French cooperation in the field of Sustainable Urban Development, through which the French development bank, AFD will extend a Loan of EUR 100 million to fund innovative projects in the smart cities, as well as the European Commission’s funding of a Euro 6 million ‘Technical Assistance’ grant to handhold the cities to create world-class projects. The German, British, Dutch and other countries are offering their support to the Mission. The World Bank and Asian Development Bank are also devising programs to support, with the ADB already identifying 10 cities to support through Technical Assistance.¹⁴

Even internally, new programs of the Government of India are seeking collaboration with the Mission, such as the sanctioning of INR 2,920 crore by the Ministry of Home Affairs under the Nirbhaya Fund, to make the smart cities safer for women.¹⁵ Further innovation is being sparked by the Mission in other countries: in 2015, Infrastructure Canada launched the Canadian Smart Cities Challenge on a similar

¹³ Extracted from 17 issues of the mission’s ‘Weekly Bulletin’, SmartNet

¹⁴ Jalandhar, Raipur, Bhagalpur, Aurangabad, Rajkot, Lucknow, Kakinada, Allahabad, Guwahati, and Coimbatore

¹⁵ The program has commenced with support to Delhi, Mumbai, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad and Lucknow.

pattern as India's mission. The Global Smart City Performance Index devised by the British market research agency Juniper Research, ranks the top 20 global smart cities in terms of the integration of Internet of Things (IoT) technologies and connected services across four key areas: mobility, healthcare, public safety and productivity. It has listed Bhubaneswar among the top 20 best performing smart cities in the world, along with London, San Francisco, Barcelona, Melbourne, Seoul, Rio de Janeiro, Tokyo and Singapore, which tops the list.

The evolutionary vision of the Smart Cities Mission makes it the most likely pathway for achieving the Sustainable Development Goals, especially Goal 11 that calls for the development of safe, inclusive, sustainable and resilient cities.

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