A Systematic Overview of India's Smart City Mission

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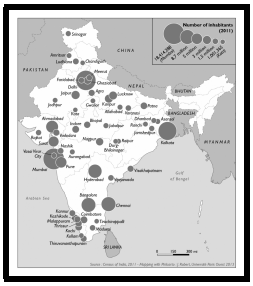
***Abstract*—India is experiencing huge urban agglomerations in recent times which pose a huge challenge to the city's infrastructure and growth. In order to keep pace with the development of the country, the cities must become smart to provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment with the application of smart solutions. This paper presents a systematic overview of the objectives, selection procedures, strategy for implementation, and financing of India's Smart City Mission recently launched by the Government of India. The later part of the article discuss the challenges encountered in the smooth implementation of the mission and what steps can be taken to overcome this challenges.**

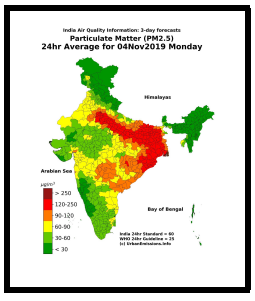
***Index Terms*—smart city, sustainable development, urban agglomerations**

I. Introduction

With more than 70 years since independence, India continues to provide its citizen a better quality of life. India has made progress in improving life expectancy, literacy, but has been slower in improving the level of income and reducing infant mortality rates when compared to other developing countries. Providing better infrastructure, transport facility and affordable living to all income groups is a challenge to the governing authorities as they will need to address the ever-increasing population of the country. Latest Census data shows that 475 cities or urban agglomerations (UA) situated in various parts of the country registered a population of over 100,000 each; together, these accounted for about 70% of India's total urban population of 377.11 million. [1]



(a) Potential smart cities due to urban agglomerations



(b) Air quality at different regions of the country

Fig. 1: Effect of urban agglomerations on the air quality index

It is evident from the above figures that the development of cities causes mismanagement of resources like improper road/rail network, poor sanitation, traffic jams, improper management of solid wastes etc. In order to lead a sustainable lifestyle, one must properly manage the available limited resources in order to achieve effective and affordable solutions to the basic requirements of the citizens. With the stable government in place, India can now set in motion a virtuous cycle of growth and development. India is a land of villages but now-a-days moving towards urbanisation for people aiming for a better income and living style. Urban areas are forecasted to house 40% of the total population of the country contributing to 75% of the GDP by 2030 [2]. In order to cope up with this transition there is a need to make our cities smart. Development of Smart Cities is a step in that direction.

A. Objectives of a Smart City

The prevailing infrastructure of a developing city create serious implications for the ecosystem of the city and its inhabitants. Indian cities are under utilizing the resources which can attract foreign investments in the projects. Various schemes were introduced to make the cities develop with the intervention of government but there was strong resistance in the success of these schemes which are summarized as follows. India's Smart Cities Mission (SCM) is a national

S. No.	Centrally Sponsored Scheme	Duration			Urban Centres Covered	Total Central Outlay	Funding Pattern (% share)		
		Start Year	End Year	Total Years	(Number)	(INR billion)	Centre	State	Local/ Other*
1	IDSMT	1979-80	2005	26	1854	n.a.	60	40	20-40
2	Mega City	1993-94	2005	12	05	23	25	25	50
3	JNNURM**	2005	2015	10	65	660	35	15	50
4	Smart Cities#	2015-16	2019-20	05	100	480	50	50	

Fig. 2: Major Urban Development Schemes Launched in India, 1979-2015

initiative by the Ministry of Urban Development (MoUD) to build a foundation for 100 smart cities in five years (FY 2015-16 to FY 2019-20) [3]. Table 2 summarizes the progress made by the mission to inseminate the guidelines, mechanism and implementation regarding smart cities to overcome all the

challenges faced during the development of upcoming cities. The MoUD defines a smart city as *"building and promoting cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment, and the application of "smart" solutions."* [3]

TABLE I: Smart Cities Mission Progress

Date	Activity
25 June 2015	Launch of Smart Cities Mission by Ministry of Urban Development; Announcement of criteria for selection of potential 100 smart cities only capable cities to be chosen through two-stage competition
27 August 2015	Declaration of names of 98 towns and cities; Jammu and Kashmir ask for more time; 12 out of 13 cities shortlisted from Uttar Pradesh
6 October 2015	Identification of consulting firms (Indian and foreign) by selected cities for preparation of Smart City Plans;plans to be prepared under supervision of municipal and State governments based on review of previous plans; plans to contain area development action plans and financing plans for the complete life cycle of the proposal
15 December 2015	Deadline for submission of Smart City Plans by municipalities and States;Based on evaluation of submitted plans, 20 out of 100 cities to be financed during the current financial year

The SCM' s purpose is to drive economic growth and improve the quality of life of people by enabling local area development that has three components:

- Area-based development (ABD) that will transform existing areas, including slums, into better planned ones, by retrofitting and redevelopment thereby improving liveability of the whole city;
- Green-field projects that will develop new areas in the city in order to accommodate the expanding population in urban areas; and
- Pan-city development (PAN) that envisages the application of selected smart solutions to existing city-wide infrastructure.

II. Selection Procedure of States for Smart City Mission

Out of the total 28 states in India and some of the Union Territories, each state has its own geographical, physical and political boundaries shared between other states. The purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to Smart outcomes.

The Smart City Mission (SCM) addresses the issue of urbanisation by Local Area Development in order to accommodate the over increasing population as discussed in previous question related to the background of mission. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services.

The mission has further defined smartness in terms of both physical and non-physical assets such as water supply, waste management, energy sources and supply, safety, citizen participation, economy and employment, and education. The MoUD initiated the SCM through the India Smart Cities Challenge. To take part in this challenge, Indian cities competed for central government funding by submitting a smart city proposal (SCP). On an average, each city selected will receive USD 15.03 million per year from the central government to spend on smart city development. An equal amount of matching funds will be contributed by the State/Urban Local Body (ULB); therefore, nearly USD 15,031 million of Government and ULB funds will be available for smart city development.

The Smart Cities Challenge was to submit proposal about how the city can be retrofitted or modified in order to utilize minimal resources without hampering the system. The proposal submitted by the cities is to be based on a framework not limited to feasibility, cost effectiveness, citizen participation, energy, economy, mobility and so on. To have a comparable parameter the weightage based ranking system is followed. Out of the 90 cities that participated in the challenge the cities who made it to the top of the list implemented framework which included feasibility and cost-effectiveness which has a weightage of 30%, followed by result orientation (20%), citizen participation (16%), smartness of proposals (10%), strategic plans (10%), vision and goals (5%), evidence-based city profiling and key performance indicators (5%) and processes followed (4%). FIGURE shows the rank list of the first 20 cities selected for the smart city mission for the period of five years.

The cities in order of ranking are: Bhubaneswar, Pune, Jaipur, Surat, Kochi, Ahmedabad, Jabalpur (Madhya Pradesh), Visakhapatnam, Solapur (Maharashtra), Davanagere (Karnataka), Indore, New Delhi Municipal Council (Delhi), Coimbatore, Kakinada (Andhra Pradesh), Belagavi (Karnataka), Udaipur, Guwahati, Chennai, Ludhiana and Bhopal. The different steps followed by the government for the selection of the smart city proposal is shown in figure 4.

In its proposal, Bhubaneswar has chosen 985 acres close to the railway station and proposed complete retrofitting of the area. Pune's idea is to invest 2,200 Cr. in 5 years in selected local area (Aundh-Baner-Balewadi (ABB)) to fully transform liveability across all dimensions so that it matches best-in-class global cities. Pune has identified 19 ICT solutions in mobility and water, the top issues across all interactions and research. Ahmedabad city is committed to improve their transport system, implemented water harvesting systems and started the management of solid municipal waste as per standards. On the other hand, Bhopal city submitted the proposal of Shivaji Nagar redevelopment project is designed to unlock the value of underutilized government land in the heart of the city. It will radically transform the area into an eco-friendly and financially sustainable model. It will incorporate all smart city features within a new urban landscape, ensuring relationship of people to place and buildings to space. It is strategically located between two primary transport axes (BRTS & proposed Metro) and embodies ToD principles to provide a compact, walkable and sustainable spatial morphology. This will lead

Fig. 3: Rank list of the first 20 cities selected as smart cities under Smart City Mission

to a ripple effect in catalysing the future economic and social development of Bhopal. [4]

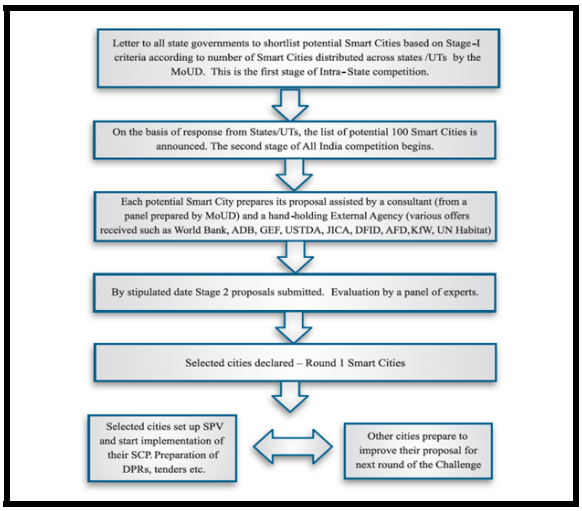


Fig. 4: Procedure for selection of smart city

III. Strategy for Implementation, Financing and Administrative Structure of the Mission

The Smart City Mission started by Hon. Prime Minister Mr. Narendra Modi on 25th June 2015, to develop 100 cities strategically to cope with the rapid urbanisation of Indian Cities. The program is implemented based on the strategic components of Area-based development like City Improvement (retrofitting), city renewal (redevelopment) and city extension (Greenfield development) plus a Pan-City initiative in which Smart Solutions are applied covering large parts of the city. A brief summary of the various strategies as discussed in TABLE II will put light upon the challenges associated with each of the strategies so that the bottle neck in implementation can be reduced.

TABLE II: Summary of the various strategies for implementation of Smart City Mission

Strategy	Deliverables	Activity
Retrofitting	To make the existing area more efficient and liveable.Easier to replicate to other states as time required for retrofitting will be low	As previous facilities are going to be in place, the model should be able to provide more intensive infrastructure service levels.
Redevelopment	Replacement of the existing built-up environment with a new enhanced infrastructure using mixed land use and increased density (higher FSI and high ground coverage)	Land clearance and competitive bidding can cause a sense of rivalry. Funding requirement for setting up of entirely new structure may lead to poor quality of development of the region.
Greenfield development	Using innovative planning, planned financing and plan implementation tools in previously vacant areas for affordable housing specially for the poor	Expanding population made to live in highly congested area can result into non-sustainable lifestyle, leading to various ill-effects associated with a heavily crowded locality
Pan-city initiative	Use of technology, information and data to make infrastructure and services better	Positive effect on productivity and quality of life of citizen can be improved by smart solutions provided people get used to the technology easily because changing the behaviour of the citizens can be a great challenge for implementation

A. *Implementation of Smart Cities- execution process*

The implementation of the Mission at the City level will be done by a Special Purpose Vehicle (SPV) created for the purpose. The SPV will plan, appraise, approve, release funds, implement, manage, operate, monitor and evaluate the Smart City development projects. The SPV would be a limited company incorporated under the Companies Act, 2013, at the city level and would be formulated through equity contributions from the state and Central governments. The private sector or financial institutions can be considered for an equity stake in the SPV; however, the shareholding pattern of 50:50 of the state/union territory and the ULB must be maintained and they together should have a majority shareholding and control of the SPV. The SPV would be headed by a full-time CEO and would be appointed with the approval of the MoUD. The board of directors shall be constituted by representatives of the Central Government, state government, ULB, independent directors as well as the CEO and functional directors. The Divisional Commissioner/ Collector/Municipal Commissioner/Chief Executive of the Urban Development Authority shall be the Chairperson of the SPV. The SPV may appoint Project Management Consultants

(PMC) for designing, developing, managing and implementing area-based projects. SPVs may take assistance from any of the empanelled consulting firms in the list prepared by MoUD and the handholding agencies. For procurement of goods and services, transparent and fair procedures as prescribed under the State/ULB financial rules may be followed. Model frameworks as developed by MoUD may also be used for Smart City projects.

B. Financing of Smart Cities

The Smart Cities Mission (SCM) is a centrally sponsored scheme, where state governments and urban local bodies (ULBs) will have to contribute funds for implementation of projects specified in the Smart City Proposal, on a matching basis with the funds provided by the central government. The entire budget for the Mission over five years is estimated to be Rs 480 billion (6 billion euro). The Government of India allocated around Rs 2 lakh crore (25 billion euro) to develop 100 cities under the Smart Cities Mission. According to the SCM Guidelines, in the first year, each 'smart city' will receive an initial corpus amount of Rs 200 crore (25 euro million). In every subsequent year, for the next three years, the government will provide Rs 100 crore (12.5 million euro) to each city. The central government will provide each potential 'smart city' with an advance amount of Rs 2 crore (0.25 million euro) for the preparation of the Smart City Proposal. This amount, along with Administrative and Office Expenses (A & OE) of the Ministry of Urban Development, will be deducted from the initial corpus amount. Each 'smart city' will thus receive Rs 194 crore (24.25 million euro) in the first year of its development. Subsequently after A&OE deductions, cities will receive Rs 98 crore (12.5 million euro) annually for next three years. By matching the government's contribution with an equal amount, states can ensure that each city has access to Rs 976 crore (122 million euro) to complete 'smart city' projects within four years. States are expected to seek funds for projects outlined in the Smart City Proposal from multiple sources, including:

- States'/ULBs' own resources from collection of user fees, beneficiary charges and impact fees, land monetization, debt, loans etc.
- Additional resources transferred as a result of acceptance of the recommendations of the Fourteenth Finance Commission (FFC).
- Innovative finance mechanisms, such as municipal bonds with credit rating of ULBs, Pooled Finance Development Fund Scheme, and Tax Increment Financing (TIF).
- Leverage borrowing from financial institutions, including bilateral and multilateral institutions, both domestic and external sources.
- The National Investment and Infrastructure Fund (NIIF).
- Other Central Government schemes like Swachh Bharat Mission, AMRUT, National Heritage City Development and Augmentation Yojana (HRIDAY).
- Public-private partnerships (PPP) etc.

Each Smart City Proposal is required to include a 'Financial Plan' that provides extensive details of itemized costs, resource plans, revenue and payback mechanisms, plans for recovery of Operation and Maintenance costs, financial timelines, and plans for mitigating financial risk. The competence of this Financial Plan is an important criterion in judging the prospective of a potential 'smart city. According to the SCM Guidelines, each 'smart city' is expected to receive an annual instalment of funds subject to:

- Quarterly submission of a 'City Score Card' to MoUD;
- Satisfactory physical and financial progress shown in implementation of the Proposal, in the form of a Utilization Certificate and annual 'City Score Card';
- Achievement of milestones, as indicated in the timelines contained in the Smart City Proposal; and,
- Robustness of the functioning of the city's Special Purpose Vehicle (SPV), the entity constituted at the city level to implement the Mission's objectives. Leading economies around the world have shown interest in India's smart city mission and are looking forward to participating in the development of smart cities. Major funding partners include Spain, the United States of America, Germany, Japan, France, Singapore and Sweden.

C. Administrative structure of the Smart City Mission

The administrative structure of Smart City Mission is monitored by the National level monitoring team divided into two broad committee as the Apex Committee and National Mission Directorate. The working of these committee is discussed here.

1) Apex Committee: An Apex Committee (AC), headed by the Secretary, MoUD and comprising representatives of other related Ministries and organisations will approve the Proposals for Smart Cities Mission, monitor their progress and release funds. This Committee will meet periodically, as considered necessary. The AC will consist of the following indicative members:

- Secretary, Housing and Poverty Alleviation - Member
- Secretary (Expenditure) – Member
- Joint Secretary, Finance, MoUD - Member
- Director, National Institute of Urban Affairs (NIUA) - Member
- Chief Planner, Town and Country Planning - Member
- Select Principal Secretaries of States - Member
- Select CEOs of SPVs - Member
- Mission Director - Member Secretary

2) National Mission Directorate: The key responsibilities of the directorate are as follows:

- Develop strategic blueprint and detailed implementation roadmap of the Smart Cities Mission, including the detailed design of the City Challenge.
- Coordinate across Centre, States, ULBs and external stakeholders in order to ensure that external agencies are efficiently used for preparation of Smart City Proposal (SCP), Detailed Project Reports (DPRs), sharing of best practices, developing Smart Solution, etc.

- Oversee Capacity building and assisting in handholding of SPVs, State and Urban Local Bodies (ULBs). This includes developing and retaining a best practice repository (Model RFP documents, Draft DPRs, Financial models, land monetization ideas, best practices in SPV formation, use of financial instruments and risk mitigation techniques) and mechanism for knowledge sharing across States and ULBs (through publications, workshops, seminars).

The state level monitoring is done by State Level High Powered Steering Committee (HPSC), chaired by Chief Secretary. The key responsibilities of the HPSC are given below:
• Provide guidance to the Mission and provide State level platform for exchange of ideas pertaining to development of Smart Cities.
• Oversee the process of first stage intra-State competition based on Stage 1 criteria.
• Review the SCPs and send to the MoUD for participation in the Challenge.

3) City level Monitoring: A Smart City Advisory Forum will be established at the city level for all 100 Smart Cities to advise and enable collaboration among various stakeholders and will include the District Collector, MP, MLA, Mayor, CEO of SPV, local youths, technical experts, and at least one member from the area who is a:
• President / secretary representing registered Residents Welfare Association,
• Member of registered Tax Payers Association / Rate Payers Association,
• President / Secretary of slum level federation, and
• Members of a Non-Governmental Organization (NGO) or Mahila Mandali / Chamber of Commerce / Youth Associations.
The CEO of the SPV will be the convener of the Smart City Advisory Forum.

IV. Challenges encountered in the implementation of the Smart City Mission

The total number of 100 smart cities have been distributed among the States and UTs based on an equitable criterion. The formula gives equal weightage (50:50) to urban population of the State/UT and the number of statutory towns in the State/UT. Based on this formula, each State/UT will, therefore, have a certain number of potential smart cities, with each State/UT having at least one. This distribution is given below. The number of potential Smart Cities from each State/UT will be capped at the indicated number. (This distribution formula has also been used for allocation of funds under Atal Mission for Rejuvenation and Urban Transformation - AMRUT). [5]

The distribution of smart cities will be reviewed after two years of the implementation of the Mission. Based on an assessment of the performance of States/ULBs in the Challenge, some re-allocation of the remaining potential smart cities among States may be required to be done by MoUD. The table below shows the number of cities potentially identified as smart cities in the corresponding states.

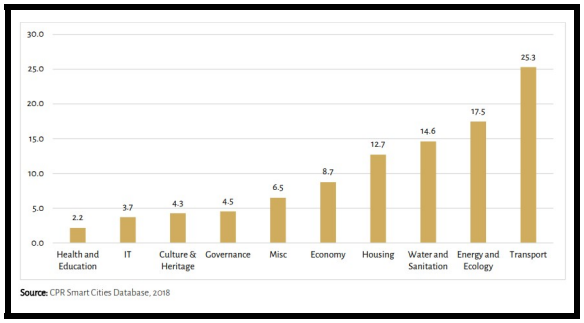


Fig. 5: Investment in Smart City Projects sectorwise

The top 5 development categories - Transportation, Energy and Ecology, Water and Sanitation, Housing and Economy – constitute almost 80% of the SCM budget like project headings undertaken under JNNURM. The major focus of all the states is to invest in transportation to minimize the pollution. [6]

Most of the states are changing from conventional Internal Combustions Engines (ICE) to Electric Vehicles (EV's). One such retrofitting is implemented by Pune City as shown in Fig. 6 below.

Fig. 6: Pune Mahanagar Pravahan Mahamandal Limited (PMPML) Electric Bus in the dedicated garage

Just after the inauguration of the Electric bus there was a problem with the charging transformers which led the buses rest at their places in the garage due to non-operation of service as shown in Fig. 7

V. Conclusion

The name urban local bodies were formally recognized in the 74th Constitutional Amendment Act (CCA) passed by the Government of India in the year 1992 which triggered the need for the development of cities being agglomerated by urban migrations. With this local-level empowerment came the opportunity to transform not only the way that citizens engaged with their government, but also the way that public services were delivered. So, after a decade in 2015, to implement these reforms in the urban sector Smart City Mission was deployed.

According to data presented by the Ministry of Housing and Urban Affairs to the Lok Sabha, 2,342 projects worth Rs 90,929 crore have been tendered as of end November,2019 of which 1,675 projects worth Rs 51,866 crore are under

Fig. 7: Engineers and concerned officials testing the condition of the transformer

implementation or have been completed. In other words, a whopping 67% of the projects have either just been tendered or are yet to go through the process.

The following conclusions can be made with respect to the current India's Smart City Mission in order to improve the dissemination of key resources of the Smart City Mission and improve the livelihood of humankind.

1) The reason for the slow pace of the projects being completed is because there is not much awareness among the citizens about the concept of smart cities.
2) The Smart City Mission is flexible in tendering the projects of all sorts right from Transportation to energy and smart process to good governance.
3) The procedure of tendering must be made smooth and transparent and must be given wide publicity by means of advertisements and campaigning so that small players can too bid and be part of the tendering system.
4) The current SCM lacks a finance model which can guide the authorities at the local and national level to demand and arrange for funds for several projects.
5) A success model implemented by one of the cities must be made available as a white paper so that smaller cities in terms of budget can get to understand the basics of the project and go for it.
6) One needs to see how these projects will be financed as most projects need would move through complete private investment or through PPPs (public-private partnership).
7) Successful implementation of smart city solutions needs effective horizontal and vertical coordination between various institutions providing various municipal amenities as well as effective coordination between central government (MoUD), state government and local government agencies on various issues related to financing and sharing of best practices and service delivery processes. (Three-Tier Governance)
8) For any smart city in the world, the focus is on reliability of utility services, whether it is electricity, water, telephone or broadband services. Smart cities should have universal access to electricity 24×7; this is not possible with the existing supply and distribution system. Cities need to shift towards renewable sources and focus on green buildings and green transport to reduce the need for electricity

The need of any developing country is to sensitise the citizen to understand the policy framework of governing body towards making a city smart by numerous ways. The citizens play a major role in utilising these resources and move the country towards sustainability.

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