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100 Smart cities in India

Facilitating implementation

For Private circulation amongst delegates of "100 Smart Cities: Need for Innovation and Integrated Approach" workshop on 10th February, 2015

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Introduction to smart cities



With half the world's population living in cities, increasing the strain on energy, transportation, water, building and public spaces, there is an increasing need for "smart" city solutions which are both efficient and sustainable on one hand and can generate economic prosperity and social wellbeing on the other. Various definitions have been put forth for smart cities. Some of them have been highlighted below.

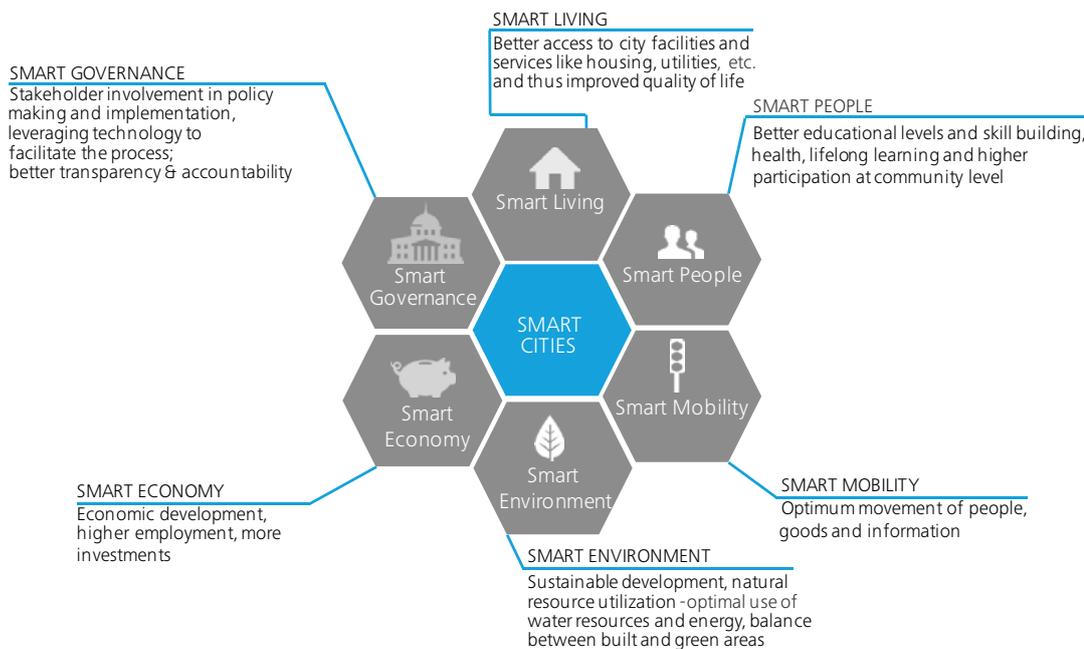
"Smart Cities have been characterized and defined by a number of factors including sustainability, economic development and a high quality of life. These factors can be achieved through infrastructure (physical capital), human capital, social capital and/or Information and Communication Technologies (ICT) infrastructure" – European Commission

"The Smart City is a process, or series of steps, by which cities become more "livable" and resilient and, hence, is able to respond quicker to new challenges. Thus, a Smart City should enable every citizen to engage with all the services on offer, public as well as private, in a way best suited to his or her needs" – Department of Business Innovation & Skills, UK

"A city that monitors and integrates conditions of all of its critical infrastructures – including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings – can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens." - The U.S. Office of Scientific and Technical Information

"Smart City is a high-tech intensive and advanced city that connects people, information and city elements using new technologies in order to create sustainable greener city, competitive and innovative commerce and an increase in quality of life with a straightforward administration and maintenance system of city" – Barcelona City(2011)

From an implementer's perspective, a smart city is one which leverages traditional (for example: water supply) and modern (ICT for example) enablers to fuel sustainable economic development, ensuring high quality of life and better management of natural resources.

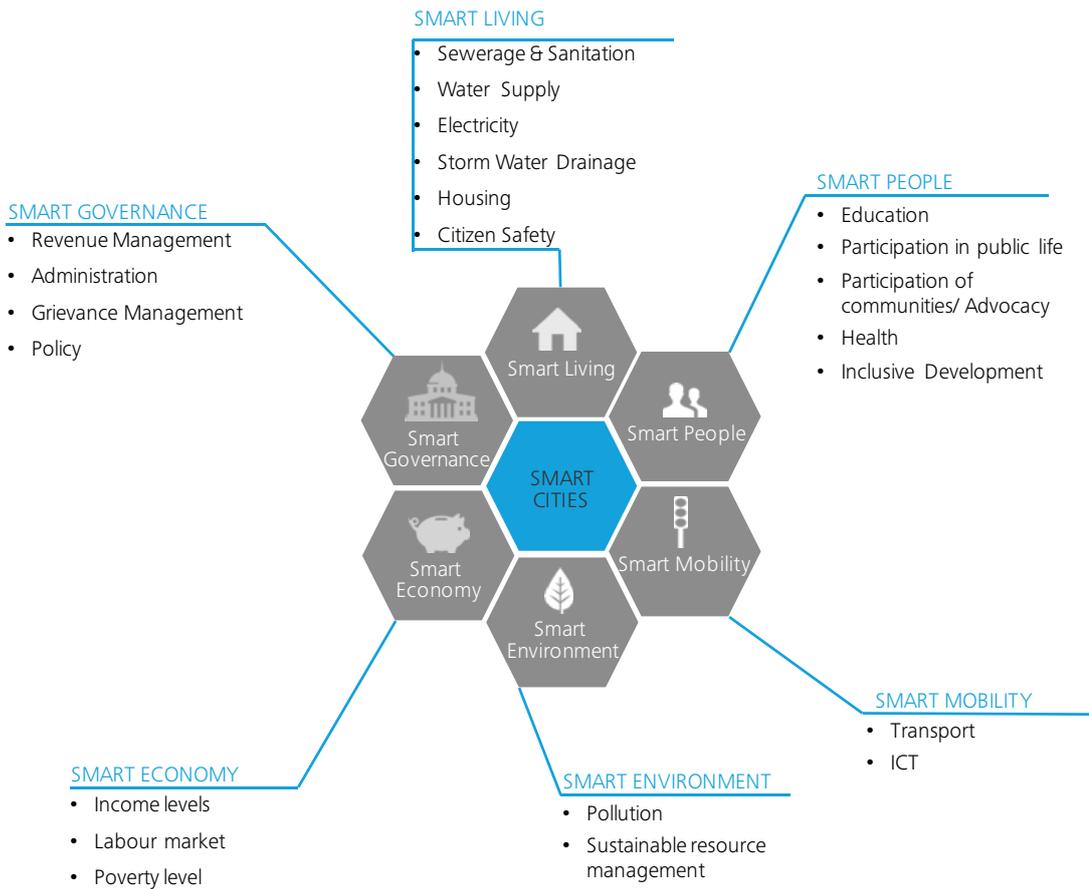


Towards this objective, an integrated smart city framework comprising of the following key enablers- SMART GOVERNANCE, SMART LIVING, SMART PEOPLE, SMART MOBILITY, SMART ENVIRONMENT and SMART ECONOMY (Refer figure above) may be followed to facilitate implementation.

The framework essentially serves a dual purpose – (i) for existing cities aspiring to incorporate smart features, the dimensions of the framework can be further expanded through metrics which will enable assessment of the level of preparedness and priority areas of intervention for these cities; and (ii) for new cities, the same framework with its associated dimensions and derived metrics can be used to plan, develop and operate infrastructure and other services. Excerpts from a representative preparedness assessment toolkit based on the framework above have been presented in the next page.

In India, for example, the preparedness toolkit can be applied to various cities leveraging existing data from various secondary sources like, Census of India publications, Service Level Benchmarks published by MoUD, NSSO data, City Development Plans, etc.

Globally various cities have developed to achieve various stages of “smartness” while many cities are still in the process of implementing smart functionalities within their operations. Accordingly cities like New York, London, Berlin, Hamburg, Amsterdam, Copenhagen, Barcelona, and Vienna have incorporated smart functionalities in their administrative operation and service delivery mechanism. There have also been a number of instances wherein entirely new cities have been planned and implemented as smart cities. For example, Songdo in South Korea, built on 1500 acres of reclaimed land and 65 kms from Seoul along with Tianjin Eco City in China (built on around 7400 acres and located 40 km from Tianjin city centre and 150 km from Beijing city centre) which is a collaboration between China and Singapore, are being developed as Smart Cities from inception.



India's aspirations on smart cities



Currently while 30% of the Indian population reside in urban centers, these centers contribute around 65% to the national GDP¹. It is projected that urban India will contribute about 75%² of national GDP in the next 15 to 20 years while another 300³ million people get added to the existing 300 million dwelling in Indian urban centers. The speed of urbanization will exert immense pressure on the urban infrastructure, urban finance, natural resources, quality of urban life etc. In order to manage this high level of urbanization, it is imperative for the Government to resort to smart concepts and smart solutions. Government of India has thus decided to develop 100 smart cities in India, as highlighted by the Finance Minister during his budget speech of July 2014. Towards this end, Ministry of Urban Development (MoUD), has developed a Draft Concept Note highlighting the criteria for developing potential smart cities and the mechanism for its implementation. Key highlights include:

- Operational procedures including development of Citizen Reference Framework, Smart City Development plan and Environmental Sustainability Plan
- Selection of smart cities from among
 - Satellite cities of four million+ population
 - Cities in the population range of one to four million
 - All state/ Union Territory capitals
 - Cities of tourism/ religious/ economic importance not included above and
- Cities having population between 0.2 – 1 million.
- Leveraging instruments enabling smart cities like Energy Efficiency, Demand Management, Improved Access to Information, Environmental Sustainability, use of Clean Technology, use of ICT, participation of Private Sector, Citizen Participation and Smart Governance
- Conditions preceding smart city development including, commitment to tripartite agreement between ULB, State and MoUD; commitment to e-Governance & presence of Citizen's Charter; presence of notified Master Plan; clarity on financing mechanism – own source, grants, PPP and financial sustainability; commitment to environmental sustainability and Disaster Management Strategies.
- Central government support in the form of financial support through viability gap funding, policy support and capacity building support. Financing mechanism including, leveraging schemes by other Ministries; PPP projects; creation of a fund blending grants from central government, borrowings from multilateral / bilateral agencies and bonds subscribed by national and state level development agencies etc.

Though the government has committed to the development of smart cities in India, the state/ ULB level strategies for quick implementation needs to be formulated and the operating model needs to be finalized.

1 Planning Commission and Census of India
2 Planning Commission and MoUD
3 Planning Commission, 2014

Indian cities

Existing elements of smart solutions

Given the financial outlay and technical capacity needed for implementing smart cities, there have been multiple instances of leveraging existing infrastructure and solutions to upgrade to smart solutions. In India too there are a number of examples of elements of smart solutions being adopted for urban service delivery. Select examples include⁴:

- Bus Rapid Transport System (BRTS) in Ahmedabad – BRTS in Ahmedabad, operated by Ahmedabad Janmarg Limited, initiated its operations in 2009. Investments in Phase 1, intending to cover a third of Ahmedabad's population of around 3 million people, was around INR 500 crores. Currently, BRTS with 12 operating bus routes covering 126 bus stops, has an Integrated Transportation Management System, including a number of smart solutions like Advanced Vehicle Tracking System, Fleet Management System, Automatic Fare Collection System, Passenger Information System and Vehicle Scheduling & Dispatching mechanism.
- SCADA for Water Management in Pimpri, Chinchwad – The SCADA system for water management implemented in 2011 with an investment of around INR 13 crores, enabled real time water auditing, monitoring and control for the entire city spread over 171 sq. kms with a water supply of around 450 ML per day. The system provides city engineers data pertaining to the electrical efficiency, flow, pressure, level, valve operation, filter operations on a real time

basis at various points of the water supply value chain (raw water pumping station, water treatment plant, pure water pumping station and Elevated Service Reservoirs) and enable controlling/ managing the same. The SCADA based reporting system allows the ULB insight into the flow, level, pressure & efficiency along with insights into possible issues on a day to day basis. Use of historical data, set benchmarks for various supply parameters with the suggested corrective measures allows formulation of corrective strategies to achieve water quality across primary and secondary distribution targets.

- Solid Waste Management System in Greater Hyderabad Municipal Corporation – Greater Hyderabad Municipal Corporation has implemented multiple smart solutions with regards to solid waste management including (i) monitoring of more than 1000 dustbins utilizing mobile technology; (ii) monitoring of more than 2000 solid waste management workers utilizing mobile technology; and (iii) development of integrated waste management facilities on PPP basis with private sector partners.

Though select cities in India exhibit smart solutions as highlighted above, the challenge is to replicate these solutions on a larger scale and to augment specific functionalities to bring in additional smart / intelligent features.

⁴ JnNURM Reform Documents, MoUD and websites of individual ULBs

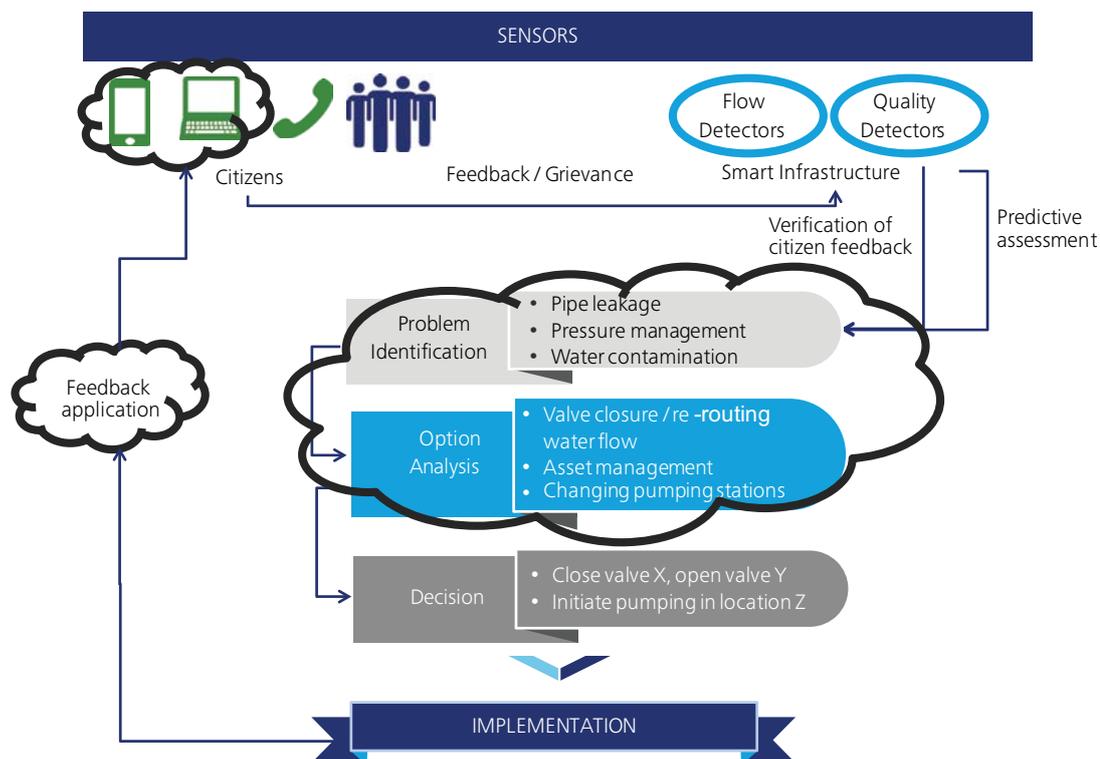
Breaking down smart city solutions

An example of water distribution

At this stage, it becomes important to segregate the different functionalities of an integrated smart solution. We have tried to do this using the SCADA based water management solution which has already been implemented in many Indian cities like PimpriChinchwad, Surat, Bangalore, etc.

A normal SCADA based solution enables collection of water flow / pressure related data at different points of the transmission and distribution network, which can be

used to regulate the water flow in the network through valves and pumps. However if the data collected through a SCADA system can be integrated through a back end ICT solution with customer / stakeholder feedback collected through other sources like social media, service delivery call centres, websites, etc. and a set of automated responses can be generated, we achieve a complete smart water solution. Graphical depiction of such a solution is given below.





It is therefore possible to leverage a cloud based ICT solution capable of integrating data from various sources and generating smart responses to build upon the existing SCADA based water distribution system at a fraction of the time and cost which would have been taken to build such a system from scratch. Any cloud based solution would also offer the following advantages:

- 1 Significant savings in hardware and application costs
- 2 Overcoming technical capacity constraints at ULBs
- 3 Standardization of business processes and operating practices
- 4 Open data standards and central repository for all data across states
- 5 Opportunity to host ICT application developed by private developers with associated revenue models

Key implementation issues and probable solutions

As initiatives to develop smart solutions to address the challenges associated with rapid urbanization are being undertaken and the high focus is given by Government of India on creating 100 smart cities, multiple challenges / issues are likely to affect the implementation phase. Select issues and potential solutions have been elaborated in the table below.

Key issues	Potential Solutions
Financial Challenges	
<ul style="list-style-type: none"> Developing a new or green field Smart City with target population of 5 to 10 lakhs is likely to require financial investment ranging between INR 75,000 and 150,000 crores and may require 8 – 10 years for implementation Most ULBs are not financially self-sustainable and tariff levels fixed by the ULBs for providing services often do not mirror the cost of supplying the same. Even if additional investments are recovered in a phased manner, inadequate cost recovery will lead to continued financial losses 	<ul style="list-style-type: none"> For new cities, a large part of the initial investments may be recovered through sale of land and/or commercial and residential real estate. Suitable land pooling options and other related mechanisms (like higher Floor Area Ratio/ Floor Space Index etc.) need to be considered for this purpose Suitable financing options like BoT (Build-Operate-Transfer) may be considered to stagger the initial requirement Tariff structure needs to be redesigned to enable cost recovery through some level of cross subsidization Initial investment cost for ICT related applications, which are anyway significantly lower than associated network-level infrastructure (pipeline extensions, for example), can be reduced and recovered in a phased manner by adopting a cloud based scalable model, with cost recovery being transaction-based
Technical Capacity Constraints	
<ul style="list-style-type: none"> Most ULBs have limited technical capacity to ensure timely and cost effective implementation and subsequent operations & maintenance due to limited recruitment over a number of years along with inability of the ULBs to attract best of talent at market competitive compensation rate 	<ul style="list-style-type: none"> Leverage private partnership and outsourcing arrangements both for implementation as well as operations & maintenance with output based contracts Opt for a cloud based model or architecture for implementation of ICT as it results in the operations and maintenance responsibility being taken over by private vendors
Institutional Capacity	
<ul style="list-style-type: none"> Successful implementation of smart city solutions need effective horizontal and vertical coordination between various institutions involving institutions providing various municipal amenities as well as effective coordination between central government (MoUD), state government as well as local government agencies on various issues related to financing, sharing of best practices and sharing of service delivery processes 	<ul style="list-style-type: none"> Develop a tripartite framework as part of which local governmentsis provided access to defined financial and technical support in lieu of undertaking specific governance reforms and setting up requisite institutional mechanisms like a Central Control Room with representation from all agencies, having a common database for sharing of data etc.

Stitching together the implementation framework

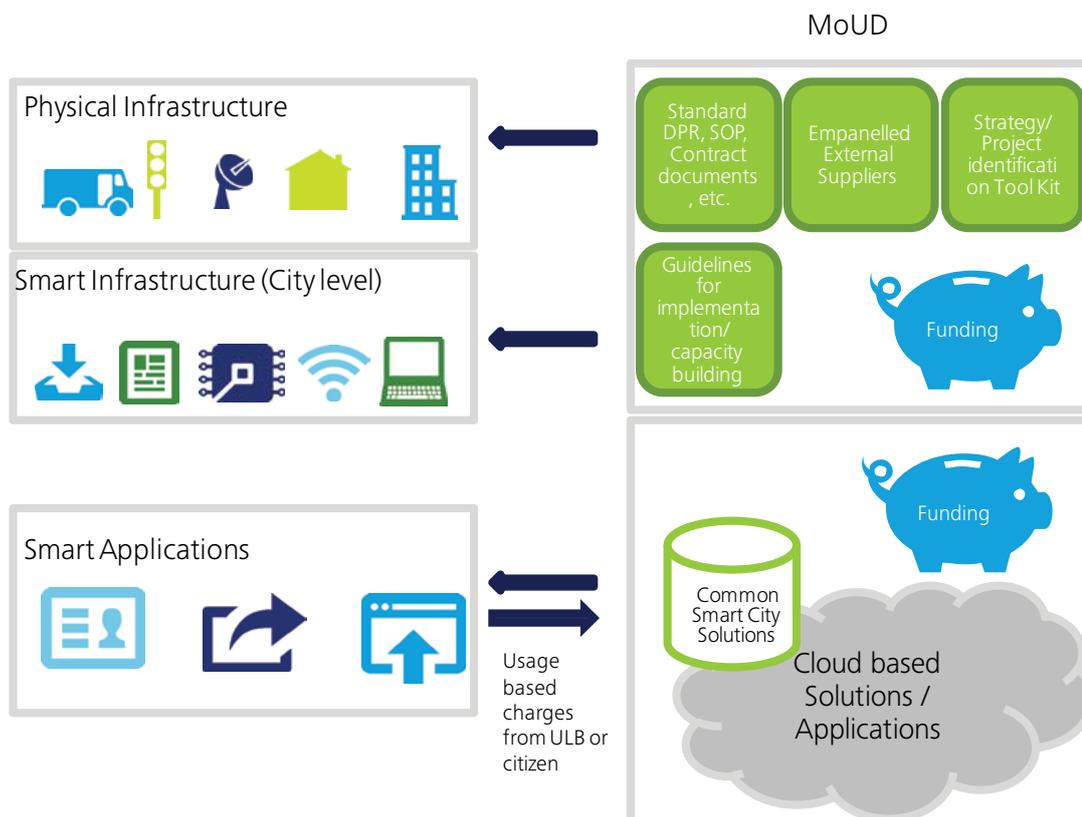
Based on the above, a potential implementation framework is likely to comprise the following:

- City level infrastructure and associated services in the form of water and sewerage network, electricity lines, transportation systems, policing etc. operated by agencies like the municipal corporations, urban development department, transport department, home department, electricity boards etc., supplemented by network level sensors / instrumentation like SCADA (for water pipelines, for example), Global Positioning systems and IP enabled

closed circuit televisions (for transport as well as policing applications)

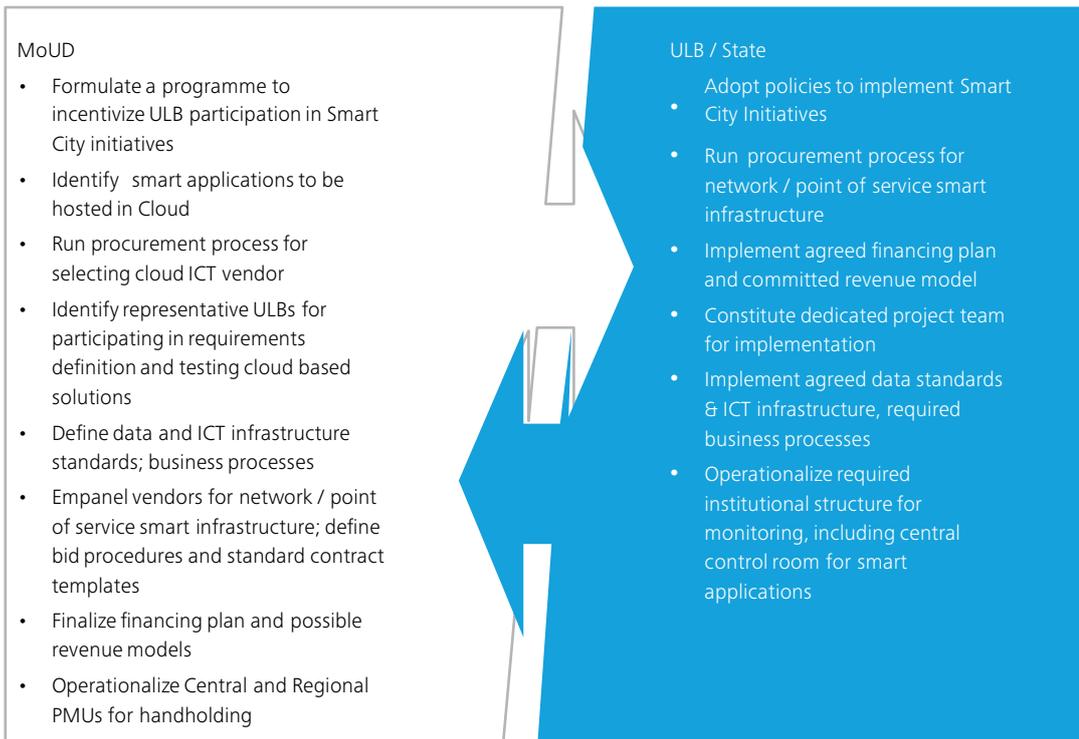
- Cloud based back end ICT platform which is capable of collecting data from the city level, processing it and generating potential and possible responses in an intelligent manner which can then be actioned upon by city level central control rooms.

An illustrative architecture for such an implementation framework has been presented below.



Each individual agency in the three tiers of Government, namely, the Government of India (MoUD), State Governments and Municipal Corporation / ULBs

would need to play its own distinct role for any such implementation framework to achieve its desired outcomes. Indicative roles have been illustrated below.



The proposed implementation framework will also enable private service providers to host their applications on the cloud based infrastructure and provide their services to citizens as well as public agencies for a fee. Adoption of such an architecture is expected to significantly reduce the time and cost of implementing smart city functionalities by leveraging solutions that are already existing, both in the public and private sector enabling rapid scaling up of facilities.

A similar implementation framework has been deployed as part of the EU Platform for Intelligent Cities (EPIC) initiative, which essentially comprises a set of specific applications / solutions hosted on cloud, which can be subscribed by public agencies or by individual citizens (refer figure alongside).

Smart City services using the EPIC platform has been provided across multiple cities in Europe (Source: EPIC Roadmap for Smart Cities; www.epic-cities.eu). Select examples include:

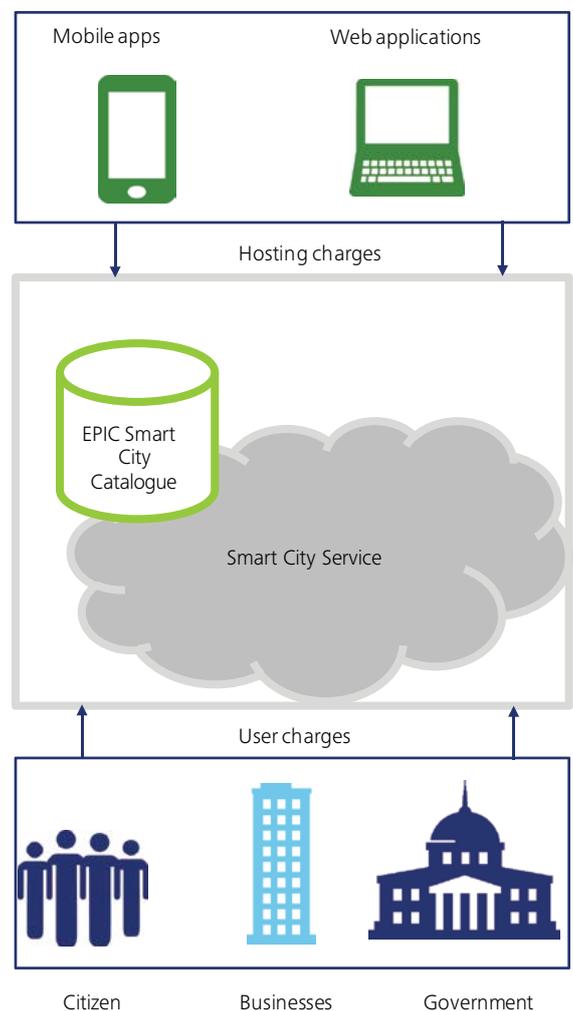
- Relocation Service in Brussels: For exploring the city and finding a place to live in, the government has partnered with service providers like IMMOWEB, iMINDS etc. who use the EPIC platform to provide service to users through web and mobile interface
- Smart Environment Service in Manchester/ Birmingham: The Manchester City Council, using the EPIC platform monitors domestic energy consumption and benchmarks energy consumption in social house through a monitoring interface used by the government
- Urban Climate Forecasting and Prediction Service in Antwerp, Paris and Tilburg: Governments use the urban climate prediction service composed of different elements like forecasting, scenario analysis, climate change impact etc. for better decision making

- Urban Planning in Issy-les-Moulineaux: Partnering with Navidis and ISSY who provide the service, a web interface has been created for urban planning by citizens and backend processing and decision making for administrators

External service providers

EPIC Platform

Users



About ICC

Founded in 1925, Indian Chamber of Commerce (ICC) is the leading and only National Chamber of Commerce operating from Kolkata, and one of the most pro-active and forward-looking Chambers in the country today. Its membership spans some of the most prominent and major industrial groups in India. ICC is the founder member of FICCI, the apex body of business and industry in India. ICC's forte is its ability to anticipate the needs of the future, respond to challenges, and prepare the stakeholders in the economy to benefit from these changes and opportunities. Set up by a group of pioneering industrialists led by Mr G D Birla, the Indian Chamber of Commerce was closely associated with the Indian Freedom Movement, as the first organised voice of indigenous Indian Industry. Several of the distinguished industry leaders in India, such as Mr B M Birla, Sir Ardeshir Dalal, Sir Badridas Goenka, Mr S P Jain, Lala Karam Chand Thapar, Mr Russi Mody, Mr Ashok Jain, Mr. Sanjiv Goenka, have led the ICC as its President. Currently, Mr. Roopen Roy is leading the Chamber as its President.

ICC is the only Chamber from India to win the first prize in World Chambers Competition in Quebec, Canada.

ICC's North-East Initiative has gained a new momentum and dynamism over the last few years, and the Chamber has been hugely successful in spreading awareness about the great economic potential of the North-East at national and international levels. Trade & Investment shows on North-East in countries like Singapore, Thailand and Vietnam have created new vistas of economic co-operation between the North-East of India and South-East Asia. ICC has a special focus upon India's trade & commerce relations with South & South-East Asian nations, in sync with India's 'Look East' Policy, and has played a key role in building synergies

between India and her Asian neighbours like Singapore, Indonesia, Bangladesh, and Bhutan through Trade & Business Delegation Exchanges, and large Investment Summits.

ICC also has a very strong focus upon Economic Research & Policy issues - it regularly undertakes Macro-economic Surveys/Studies, prepares State Investment Climate Reports and Sector Reports, provides necessary Policy Inputs & Budget Recommendations to Governments at State & Central levels.

The Indian Chamber of Commerce headquartered in Kolkata, over the last few years has truly emerged as a national Chamber of repute, with full-fledged State Offices in New Delhi, Guwahati, Bhubaneswar, Patna and Ranchi functioning efficiently, and building meaningful synergies among Industry and Government by addressing strategic issues of national significance.

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