

# Analysing and Rating Smart City Development in India

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**Abstract:** India's recent stand on Smart City Development and involvement of various high income countries; initiates the talk of ideal variables for smart city evolution by our own standards. With a vision of Urban Governance for general livability, it becomes imperative to study these parameters and ensure the evolution of our own concept of a Smart City. Our spatial planning models based on unique factors such as Human Diversity, Physical-Social networks and ICT impact on urban fabric, City resilience, etc. make it all the more interesting to evolve a blueprint for Planning a Smart City.

The paper centers the infrastructural developments for the Smart Urban Development in India. The research helps us arrive at a general line of action for Urban Planning implications catering to the Infrastructure Sector, amongst others; thus affecting environmental, social and economic structure significantly. The study further finds the scope of progress, encouraged from various government policies for successful implementation of Smart City Development. It also allows a peek into future scenario of improvements and deliberations particular to Indian standards in consideration with the scenario of other countries.

**Keywords:** Human Capital, ICT based inclusive approach, Electronic Government, Smart Urban Development and Sustainability.

## 1. INTRODUCTION

A city can be defined as 'smart' when investments in human and social capital and traditional and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources through participatory governance.

A "smart city" would describe the integrated management of information that creates value by applying advanced technologies to search, access, transfer, and process information. "Smartness" here is seen as an infrastructure quality. Cost and benefit optimization takes place when information sources are connected and information is shared in real time as that will have a profound impact on how cities are planned and managed for bettering the quality of life for

citizens, provisioning water supply, transportation, entertainment, safety and security, delivery of government services etc.

At the beginning of urban studies and economic research of urban areas, cities were mostly seen as a 'by-product' of industrialization; currently however, they are rather treated as a catalyst of economic change with intensive correlation of urbanization and economic growth as well as increasing importance of high value added industries, mostly localized in cities. Increasing economic importance of cities is reflected in urban studies which transfers focus from social science (social relations in urban areas, segregation, social inclusion) increasingly towards economics (management, entrepreneurship, competitiveness). In context of economic research, cities are treated not only as a location for entrepreneurial activity, with institutional environment analysis, but also as an economic entity itself, capable of competing with other entities.

Urban development research points towards two pillars of urban growth, i.e. entrepreneurial environment and quality of life. Those two elements (represented by companies and people) are significant and necessary for a competitive city to develop [1]. Well elaborated in literature and implemented in urban practice concept of urban competitiveness gave grounds for the introduction of the idea of "smart city".

Papers objective is to analyse the country-wide movement for smart city development on policy level. Also we aim to rate this urbanization policy on smart service led development for future speculations of ICT inclusion for basing our conclusions.

### 1.1 India's Smart Urbanisation narrative

The reliance on western models of urban planning and containment has resulted in a catastrophic failure to manage the growth of cities in many low and middle income countries. The equity in Development of Indian cities relies largely on the resources allocation and ingenuity of Urban poor, leading

towards the sustainable urban development models which India seeks. Analysing the baffling numbers we understand that the measures to contain this is not an easy. Thus, out of necessity, the urbanisation policies of India are subjugated to ICT integrated governance systems.

JnNURM 1 had promoted e-governance focusing on eight areas, viz. B&D certification, property tax, payroll and personnel, e-procurement, building plan approval, water and utility payments, SWM, grievance system, trade licenses, project and ward works. Large scale investments in the urban sector were initiated. Soon it was realized that for improving services, reducing costs, process time, productivity gains, etc. i.e. bettering urban governance and service delivery, ICT revolution had to be capitalized. ICT synergizing with the emerging technologies is transforming businesses and societies in a significant way.

Phasewise evolution from good to smart cities;

- Inception (1990's): Information via cities' websites.
- Good Governance (2000's): City portals for Online information services.
- E-Governance (2005's): Intel-cities- Online web-based e-Learning system integrated & interoperable with other cities' platforms.
- Smart Governance (2010's): Smart cities- Having e-learning, participatory governance, support digitally inclusion, Intelligent buildings, Energy & environment efficient, Carbon emission & pollution controlled city development.

Now, with a vision of Indian cities of tomorrow as places of advanced social and environmental progress, while maintaining economic growth achieved by integrated approach, a need for including all aspects of sustainable development is being realized. Promotion of sustainable urban development while concentrating on issues of transport, mobility, energy for ICT implementation; various platforms of research to identify the tools for Smart development are being set up.

We are moving forward with a vision of regional development in Smart sustainable context for future India. It is thus imperative for us to list down and weigh the parameters as a means of comprehensive planning. Rating the cities will be the next step towards apprehending the pros and cons of such eccentric approach towards Smart Urban Development.

## **2. IMPORTANCE OF PARAMETERISING THE SMART CITY RATING: RESEARCH METHODOLOGY**

Urbanisation and globalization, with trade liberalization measures and fast technological changes altering the relations of production, distribution and consumption, has very

substantial effects on city development. As an important consequence, economies evolved with easier physical movement and globalized players made decisions with no regard to national boundaries [8]. Along with this progress private firms of the service sector and also of the production sector increasingly became footless and flexible in their location behavior. The ongoing reduction of differences and barriers between nations also made cities more similar in their preconditions. Thus, only a few out of many location-based characteristics gained importance for global actors [9-10] enforcing competition across cities by altering each city as potential competitor to improve its SMART Rating.

To enforce an endogenous development as per Indian standards, our urban centers have to aim on identifying their strengths and chances for positioning and ensure and extend comparative advantages in certain key resources against other cities as nodes of development. City rankings are a tool to identify these assets. Although they are quite common in recent time, rankings are very different in their approaches or methods. Due to different interests behind rankings and the indicators and methodological approaches used it is also normal that one city is ranked very different in different rankings.

We are thus establishing the following line of action or methodology for the research in our paper;

1. Analysing of major developments related to smart initiative in service delivery across India.
2. Establishment of elaborate sections for parameterising Smart City development, particular to Indian standards.
3. Deliberations or concise comparison of smart city development on Global scenario.
4. Basing the conclusions on general line of action for Smart Urban Planning.

## **3. SMART INITIATIVES IN URBAN MANAGEMENT ACROSS INDIA**

Service delivery or City infrastructure can be broadly subdivided into five sectors and further (refer figure 1). Although the concept of smart city goes beyond this narrow field of classification limited to ICT, it delivers infrastructure for social and economic initiatives concerning economic growth, social capital and higher resources efficiency.

In a broader approach, smart cities are treated as a new urban development paradigm, where we focus on phenomena such as human and social capitals, education and natural environment. Such models of urban development point to smart cities as areas which, on one hand, are a supporting factor for intellectual capital development and well-being growth by institutional system; at the other hand providing a knowledge transfer mechanism for system of innovation along with Sustainable development inclusions.

Following are the ideal smart services successfully implemented in various cities in India [7].

**Figure 1: Smart service delivery areas through ICT for Urban Management [7]**

<b>Water Supply</b>	<b>Waste water</b>	<b>Solid Waste Management</b>	<b>Municipal Services</b>	<b>Revenue and Management</b>
<ul style="list-style-type: none"> <li>• Water Resource Management</li> <li>• Distribution Management</li> <li>• Internal Business Process</li> <li>• Water Quality Management</li> <li>• Billing &amp; Collection</li> <li>• Grievances Handling</li> </ul>	<ul style="list-style-type: none"> <li>• Plant Management</li> <li>• Collection &amp; Distribution</li> <li>• Billing and Collection</li> <li>• Internal Business Process</li> <li>• Grievance Handling</li> </ul>	<ul style="list-style-type: none"> <li>• Attendance Monitoring</li> <li>• Bin Tracking System</li> <li>• Vehicle tracking System</li> <li>• Waste collection &amp; Transfer</li> <li>• Treatment and Disposal</li> <li>• Internal Business Processing</li> </ul>	<ul style="list-style-type: none"> <li>• Birth &amp; Death Certificates</li> <li>• Building Plan Approval</li> <li>• Grievance Management</li> <li>• Utility Bills</li> <li>• Licenses</li> <li>• Traffic</li> <li>• Street Lights</li> <li>• Flooding</li> </ul>	<ul style="list-style-type: none"> <li>• Property Tax</li> <li>• E-Procurement</li> <li>• Accounting System</li> <li>• Personnel Management</li> </ul>

Funding for these projects are being propogandized in various Central and State development policies. It has been established that investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.

### **3.1 Water Supply**

Distribution and monitoring system thru GIS, Hydraulic modeling, Online water quality monitoring, Sustainable operations- metering and online billing, etc. are some of the successful systems implemented in Indian cities which can be listed under smart water supply services.

A lot of 24/7 water supply programs in urban and rural sectors were implemented across India. GIS based mapping integrated with the hydraulic modeling, Metering with analyzers and online billing systems, centralized real time web based monitoring of water supply services improved water availability due monitoring of input and output points and checking of water distribution losses.

### **3.2 Waste water**

Integration and automation of water treatment plant and sewerage systems, Enterprise resource planning (Oracle) system and grievance management funded under state projects and many local bodies.

Generation of database for sewerage services and grievance management services along with the grievance management services led to improvement in service delivery, bill collection

and procurement leading to efficiency and transparency in waste water sector.

### **3.3 Solid Waste Management (SWM)**

Off-site real time monitoring system, GIS and GPS enabled services, biometric attendance systems for sanitary workers, sensor based applications for smart solid waste management services.

GPS and GPRS technologies through cell phone images are taken and stamped with time and location and put in public domain for scrutiny on real time basis thus improving the SWM service delivery.

### **3.4 Municipal Services**

Integration of all operations of municipal corporation through GIS (land based services), Computerised building plan scrutiny and approvals, Standardized online citizen administration (GIS based), Traffic information system initiative and many others as smart governance in Urban bodies. Land being the base of all operations for municipal services, GIS mapping and integration of various databases was initiated in JnNURM 1 for improving the services. Building Plan scrutiny and Approvals automation on a comprehensive level and its integration with GIS database accelerated the pace of development.

### **3.5 Revenue and Management**

Municipal e-revenue systems using GIS linked property database, Tulana: online application for service level benchmarking, M-Governance, e-tendering, Dynamic

integration of property registration and land records administration system, Comprehensive Public Works Management Information and Management system for PWD's (State level) and many more advanced applications, catering to the smart service delivery in this sector.

Augmentation of municipal revenues for financing and maintenance of municipal services and infrastructure with focus on reforms in property tax using the GIS integrated with property database systems improved tax administration greatly. Submission of tenders, documents, EMD's, security deposits, tenders integrated with the accounting and ICT enabled services led to speed-up in service delivery of infrastructure through e-tendering and related smart services.

#### 4. PARAMETERS FOR SMART CITY DEVELOPMENT

Summing up, smart city as a concept of urban development assumes it should include multiple spheres of growth: economy, people, urban governance, geographic mobility, natural environment, quality of life, etc. These areas should be further supported by information technology systems, provided they are a tool not a goal of development strategy. Smart strategy should also include not only multi-dimensional approach but also city's stakeholders, i.e. enterprise sector, inhabitants and local government.

Interesting approach to urban development determinants of a smart city is presented in P. Lombardi's paper [6]. Using Analytic Network Process (ANP) method, over 60 indices of urban development is analyzed. Indices are first grouped according to triple helix model, however helix is in this case extended to four dimensions, fourth dimension being civil society. ANP analysis, including relations between priorities (dimensions of the helix) and alternative solutions, gave grounds to grant following weights to particular determinants: (1) entrepreneurial city – 48 per cent, (2) innovative city – 20 per cent, (3) people friendly city – 17 per cent, (4) networked city – 13 per cent.

The criteria chosen for a analysis in OECD [2] should be significant for policy-making and application value; have good degree of analytical soundness and be quantifiable. Ever since the report was published, i.e. for over two decades, the state of urban research has changed significantly. The statement that: "It is still not common to study economic processes and products at the scale of cities" [2] is inadequate, however urban economics may not be considered leading concern of economists. Still, some challenges and recommendations presented by OECD remain current, e.g. still quantitative research in urban studies are rather fragmented and concern chosen spheres of economy (innovation or energy market), they are also territorially limited (regard few Western European cities or are a case study). Moreover, still quantitative analysis is biased by heterogeneity of statistical

systems for local level. Therefore, OECD proposed best practices separately for different spheres of urban economy: natural environment protection, energy, economics, and sustainable development. Unfortunately, suggested by OECD "mission information" i.e. the need for data collection in urban areas in international dimension, is still valid. Lack of comparative (including international comparisons) and updated data is one of the challenges urban researchers and researchers have to overcome [3-4-5].

Many other elaborate smart city parameters for various cities worldwide can be found in the publishing's as noted below;

- "Quality of Living Survey" by Mercer Human Resource Consulting in 2007 (200 cities world-wide)
- "Canada's most Sustainable cities" by Corporate Knights: The Canadian magazine for responsible business in 2007 (Large Canadian urban centers)
- "How the world views its cities" by Anholt City Brands in 2006 (60 cities world-wide)
- "World-wide cost of living" by Economist Intelligence Unit in 2006 (130 cities world-wide)
- "Dritter Großstadtvergleich" by IW Consult GmbH / Institute of the German industry in 2006 (50 cities world-wide)

As discussed earlier the parameters can only help us in realizing the needs for a smart city. The key lies in location and regional approach.

#### 4.1 Indian Smart City development

Understanding the comprehensive overview of the issues in smart city development in India, we can point out that;

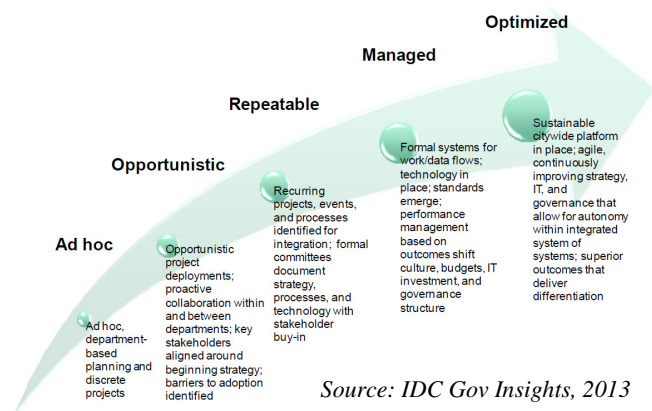
- The population explosion has brought upon an urgent need to transform the Urban centers into ICT enabled smart cities for controlled service delivery systems.
- The twelfth Five Year Plan set out an approach for planned, inclusive, sustainable urban development and there is a need to consider the economic sustenance of the urban centers, if smart development is to be implemented.
- There are many organisations, Ministries and Government agencies with overlapping responsibilities some of whom support research, but it is not clear who has the main responsibility for supporting research on sustainable urbanization.
- Research on cities has been largely sectoral and lacks holistic focus combining society, economy, environment and technology.
- The idea of research on sustainable cities is gaining traction but needs to develop research on processes for

practice linking – policy plan, programs and projects to address rapid urbanisation.

- Whatever happens in the future, it is very likely that large scale informal development will continue in India and it was important to understand this and develop alternative pathways and theories to achieving sustainability and resilience.
- The economic restructuring, combined with the economic downturn, has raised levels of unemployment, particularly among young people, and so economic growth and building resilience to further change is a key priority for city authorities.
- The urban infrastructure has grown piecemeal and rising urban populations are putting pressure on housing and transport.
- Concerns about climate change, and the fact that 80% of the countries' population lives in cities, inevitably means that cities have a key role in improving energy efficiency and reducing carbon emissions, while promoting energy resilience in terms of security of supply and price.

How does the market penetrate informal cities and what are its impacts? What is the impact of peri-urban development on sustainability of cities? Which areas of research might prove useful of India when utilized as dealt with in other countries? The answers to these trigger the integration of smart notions of urban development on global scale. It can also be understood that we are in need to enforce our infrastructure management for service delivery realizing the above notions for a smart urban development.

Transformation of a city to Smart does not happen instantly. Strategy Development requires understanding of the issues and challenges for the particular city.



**Fig. 2: Stages in Smart City Development**

We need to develop a long term strategy for the city; prioritize on the projects; Integrate smartly; optimize the services and

operations through the effective ICT and be ready to discover new opportunities for growth and optimization. The following generalized parameters can be considered for furthering a holistic approach towards smart city development;

**Smart Governance (Participation):** We need to inculcate public participation in decision-making, strengthen public and social services, have a certain level of transparency in governance, Evaluate political strategies & perspectives.

**Smart People (Social and Human Capital):** The level of qualification, affinity to life-long learning, Social and ethnic plurality, flexibility, creativity, open-mindedness and Participation in public life should be necessitated.

**Smart Economy (Competitiveness):** The innovative spirit, Entrepreneurship, Economic image & trademarks, Productivity, Flexibility of labour market, Ability to transform or respond to change are the requisites.

**Smart Mobility:** Local accessibility; availability of infrastructure (ICT); Sustainable, innovative and safe, transport systems.

**Smart Environment (Natural resources):** Attractive natural conditions, Pollution free environments, Environmental protection, Sustainable resource management are necessary for sustainable conditions.

**Smart Living (Quality of life):** The availability of Cultural facilities, Health conditions, Individual safety, Housing quality, Education facilities, Tourist attractions, and Social cohesion can contribute greatly towards our goal.

## 5. DELIBERATIONS AND COMPARISONS OF CITY DEVELOPMENT GLOBAL FRONT: CHINA STUDY

India has the complexities and issues of a developing, middle income country; our base concern being population explosion. Comparing the urban development approach of China we can realize the concerns and deliberations for India for a smart city approach. The scale and speed of urbanization for both countries are almost proportionate. However, China's urban expansion has clearly outpaced India's despite the fact that China had started with a lower proportion of population living in cities than India. The most significant difference between the urbanization paths of India and China has been China's deliberate and systematic effort to manage its urbanization, to ensure the sustainability of rapid economic growth and improvement in quality of life. While India has barely paid attention to its urban transformation, China has developed a set of internally consistent and effective practices across every element of the urbanization operating model: funding, governance, planning, sectoral policies, and shape.

Where India has underinvested in its cities, China has invested ahead of demand and given its cities the freedom to raise substantial investment resources by monetizing land assets and retaining a 25 percent share of value added and income taxes. While Indian cities have devolved little real power and accountability to the cities, China's major cities have powerful and empowered political appointees as mayors. While India still runs services in Indian cities out of city government departments, China has experimented with innovative delivery models including the use of corporatized agencies and special-purpose vehicles. While India's urban planning system has failed to address competing demands for space, China has a mature urban planning regime that emphasizes the systematic redevelopment of run-down areas consistent with long-range plans for land use and transportation. Where India has paid little attention to shaping its overall portfolio of cities, China's urbanization had a early focus on the dynamic coastal cities, with the result that these cities now deliver higher than national growth averages. This is the starkest contrast between the two countries: China, that has embraced and shaped urbanization, and India, which is still waking up to its urban reality and its inherent opportunities.



Fig. 3: World concentration of Urban centers

Both India and China will need to expand and build infrastructure on a grand scale to meet the needs of their surging urban populations. This is a significant market opportunity for international firms. From 2002 to 2007, India invested about 5.7 percent of its GDP on infrastructure to China's 9.3 percent. Over the next 20 years, both countries will need to at least maintain, and, most likely, materially increase this level of infrastructure spending to meet the challenge of urbanization. In 2007, India made urban capital investments of only \$17 in per capita terms compared with \$116 in China. Take impending demand for residential and nonresidential space. Depending on which urbanization planning scenarios each country pursues, India could potentially need to build 700 million to 900 million square meters of new residential and commercial space every year for the next 20 years, compared with 1.6 billion to 1.9 billion

square meters per year for China. Or take metro railways and subways as an example. India could potentially have to construct nearly 350 to 400 kilometers of new metro railways and subways per year, while China may need to construct nearly 800 to 1,500 kilometers per year. Investors and businesses should prepare themselves to address the dynamic new opportunities that this massive transformation of the two most populous countries in the world will unlock.

## 6. INFERENCES

The smart city development is more concerned with making progress as concerns the smart indicators rather than rating a city, which inevitably is a snapshot in time. Consideration of different characteristics, factors and parameters in a non-weighted way expresses that the Urban Development is a complex process in different dimensions and evaluation, finally depends on the actors, their preferences and individual objectives. Perhaps it would not be an exaggeration to say that truly smart city may use the parameters and rating as a tool to benchmark with other cities, and draw lessons from better performing cities, perhaps resulting in policy transfer.

Smart city concept and parameterising presented in this paper requires further research, alterations and improvements.

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