

## An overview of AMRUT and Smart City Projects in India

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### **Abstract**

The **Smart City Project** and **Atal Mission for Rejuvenation and Urban Transformation (AMRUT)** are Government of India's ambitious new schemes were launched by the Prime Minister of India on 25th June 2015. Citizens of India in different cities were invited to submit their innovative ideas and solutions for the questions in each category and the winning ideas were shared with the 98 Smart Cities. There is a clear idea today about the necessity and usefulness of making cities smarter. Economy has taken up the challenge to turn Modiji's ambition into reality in collaboration with the Municipality. Since cities were competing with each other for selection under the Smart Cities Mission, the SCPs were prepared with great care. The present paper looks into above and challenges faced for smart cities in India.

### **Introduction**

India has recently committed to the development and construction of 100 Smart Cities to meet the demands of its rapidly growing and urbanizing population. This effort will include construction of new municipalities and renovation of existing cities as the rural population shifts into urban areas. Smart Cities are the integration of information technology, telecommunications, urban planning, smart infrastructure and operations in an environment geared to maximize the quality of life for a city's population. A smart city uses digital technologies or information and communication technologies (ICT) to enhance quality and performance of urban services, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens. Such a coordinated approach from the inception of a metropolitan area is key to sustainable growth and development. This paper highlights how India can develop such infrastructure, address many looming concerns and open the pathway to a new era for the Indian economy. Many more other terms are also used for smart city include 'cyberville, 'digital city', 'electronic communities', 'flexicity', 'information city', 'intelligent city', 'knowledge-based city, 'MESH city', 'telecity, 'teletopia", 'Ubiquitous city', 'wired city'. Smart City enables and encourages the citizen to become a more active and participative member of the community." Urban development Minister M Venkaiah Naidu said the main objective of the twin projects is to change the landscape by addressing the issue of infrastructure gap in urban areas so that cities become more liveable and enrich the climate for business and investment. The union Cabinet had sometime ago cleared the projects of 100 smart cities and a new urban renewal mission for 500 cities named after former PM Atal Bihari Vajpayee, replacing the one christened after Jawaharlal Nehru, with a total outlay of Rs.98000 Cr for the next five years. Rupees 48000 Cr has been

earmarked for Smart City project, Rs. 5000 crore will be spent on AMRUT. Countries like Singapore, Japan, France and the US have shown interest in partnering with India on Smart City project. Twenty cities have been shortlisted for the smart city project in the first phase, forty cities will be selected in the next stage and forty more will be followed later. The project will be implemented through an area based approach comprising retrofitting and redevelopment. It will be linked to promotion of reforms such as e-governance, setting up of professional municipal cadre, improvement in assessment and collection of municipal taxes, credit rating of urban local bodies and citizen-centric urban planning.

AMRUT focuses on basic infrastructure services such as water supply, sewerage, transport and development of green spaces and parks. "The use of Smart Computing technologies to make the critical infrastructure components and services of a city which include city administration, education, healthcare, public safety, real estate, transportation, and utilities more intelligent, interconnected, and efficient" (Washburn, 2010). Thane City has been short-listed as one of the Smart City Mission in India. The most awaited and ambitious "100 Smart City Mission" was launched by the Prime Minister Narendra Modi. The Municipal Corporation of various cities requested for the engagement of local public for preparing the smart city proposal to participate in the second part of the smart city challenge and cities have to compete with others to make it to the top twenty to be taken up for the first stage of funding, for the year 2015-16. Union Minister Venkaiah Naidu announced the list of first 20 smart cities of the first batch. Some of the parameters on the basis of which the decision was taken were feasibility, result orientation, citizen participation, smartness of proposals etc. The cities are: Bhubaneswar, Pune, Jaipur, Surat, Kochi, NDMC (New Delhi) Ahmedabad, Jabalpur, Vizag, Solapur, Devangere, Indore, Coimbatore, Kakinada, Belgaum, Udaipur, Guwahati, Chennai, Ludhiana, and Bhopal.

### **Uncompleted projects under JNNURM extended under AMRUT**

Central government will help for the projects sanctioned under JNNURM (Jawaharlal Nehru National Urban Renewal Mission) extended under AMRUT but not completed till date. JNNURM projects were a massive city-modernisation scheme launched by the Government of India under Ministry of Urban Development. It envisaged a total investment of over \$20 billion over seven years. Named after Jawaharlal Nehru, the first Prime Minister of India, relating to urban development sanctioned during 2005 -2012 and achieved physical progress of 50 p.c availing 50 p.c of central help released and those sanctioned during 2012-2014 will be supported till March 2017. Accordingly, 102 and 296 projects respectively will get Central support for balance funding to complete these project.

Major technological, economic and environmental changes have generated interest in smart cities, including climate change, economic restructuring, the move to online retail and entertainment, ageing populations, and pressures on public finances. The European Union (EU) has devoted constant efforts to devise a strategy for achieving 'smart' urban growth for its

metropolitan city-regions. It has developed a range of programmes under 'Europe's Digital Agenda'. In 2010, it highlighted its focus on strengthening innovation and investment in ICT services for the purpose of improving public services and quality of life. It is estimated that the global market for smart urban services will be \$400 billion per annum by 2020. Examples of Smart City technologies and programs have been implemented in Milton Keynes, Southampton, Amsterdam, Barcelona and Stockholm. As the stride of migration from rural to urban areas is increasing, by 2050, about 70 per cent of the population will be living in cities, and India is no exception. It will need about 500 new cities to accommodate the influx. Interestingly, urbanisation in India has for the longest time been viewed as a by-product of failed regional planning. Though it is inevitable, and will only change when the benefits of urbanisation overtake the costs involved, it is an opportunity for achieving faster growth. With increasing urbanisation and the load on rural land, the government has now realised the need for cities that can get by with the challenges of urban living and also be magnets for investment.

A 'smart city' is an urban region that is highly advanced in terms of overall infrastructure, sustainable real estate, communications and market viability. It is a city where information technology is the principal infrastructure and the basis for providing essential services to residents. There are many technological platforms involved, including but not limited to automated sensor networks and data centres. Though this may sound futuristic, it is now likely to become a reality as the 'smart cities' movement unfolds in India. In a smart city, economic development and activity is sustainable and rationally incremental by virtue of being based on success-oriented market drivers such as supply and demand. They benefit everybody, including citizens, businesses, the government and the environment.

### Smart Cities in Each State/UT

Here is the breakdown for different states:

Tamilnadu	33 Cities
Maharashtra	37 Cities
Gujrat	31 Cities
Karnataka	21 Cities
Andhra Pradesh	31 Cities
Rajasthan	30 Cities
West Bengal	28 Cities
Bihar	27 Cities
Odisa	19 Cities
Haryana	19 Cities
Kerala	18 Cities
Punjab	17 Cities
Telangana	15 Cities
Chattisgarh	10 Cities

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The total numbers of 100 Smart Cities have been distributed among the States and UTs on the basis of 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 in the Annexure. 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). 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 reallocation of the remaining potential Smart Cities among States may be required to be done by Minister of Urban Development (MoUD).

### **Coverage:**

Five hundred cities will be taken up under AMRUT. The list of cities will be notified at an appropriate time. The category of cities that will be covered in the AMRUT is given below:

- i. All Cities and Towns with a population of over one lakh with notified Municipalities, including Cantonment Boards (Civilian areas),
- ii. All Capital Cities/Towns of States/ UTs, not covered in 1.1(i),
- iii. All Cities/Towns classified as Heritage Cities by MoUD under the HRIDAY Scheme,
- iv. Thirteen Cities and Towns on the stem of the main rivers with a population above 75,000 and less than 1 lakh, and
- v. Ten Cities from hill states, islands and tourist destinations (not more than one from each State).

### **Fund Allocation**

The total expenditure for AMRUT is Rs. 50,000 crore for five years from FY 2015-16 to FY 2019-20 and the mission will be operated as a centrally sponsored Scheme. The AMRUT may be continued thereafter in the light of an evaluation done by the MoUD and incorporating learning's in the Mission. The Mission funds will consist of the following four parts:

- i. Project fund - 80% of the annual budgetary allocation.
- ii. Incentive for Reforms - 10% of the annual budgetary allocation.
- iii. State funds for Administrative & Office Expenses (A&OE) - 8% of the annual budgetary allocation.
- iv. MoUD funds for Administrative & Office Expenses (A&OE) - 2% of the annual budgetary allocation. However, for FY 2015-16 the project fund would be 90% of the annual budgetary allocation as incentive for Reforms will be given only from FY 2016-17 onwards.

## Smart Cities: Opportunities

UP again leads the pack, as they can nominate 64 cities under this project. Under this scheme, Central Govt. will provide 30% of the overall cost, if the city has a population of more than 10 lakh; and 50% if under 10 lakh.

Adequate housing, electricity, water supply, net connectivity, health and most important education, Applying Smart Solutions to infrastructure and services in area-based development in order to make them better. For example, air pollution, congestion and resource depletion will get reduced, using fewer resources, and providing cheaper services; local economy will get a boost, interactions and security will be more. The road network is created or refurbished not only for vehicles and public transport, but also for pedestrians and cyclists, and necessary administrative services are offered within walking or cycling distance. Preserving and developing open spaces like parks, playgrounds, and recreational spaces in order to enhance the quality of life of citizens, Promotion of variety of transport options like Transit Oriented Development (TOD), public transport and last mile Para-transport connectivity. Making governance citizen-friendly and cost effective will increasingly rely on online services to bring about accountability and transparency, especially using mobiles to reduce cost of services and providing services without having to go to municipal offices. Forming e-groups to listen to people and obtain feedback and use online monitoring of programs and activities with the aid of cyber tour of worksites. Giving an identity to the city based on its main economic activity, such as local cuisine, health, education, arts and craft, culture, sports goods, furniture, hosiery, textile, dairy, etc.

## Difference between AMRUT and Smart City

Though the 2 missions are interrelated in the sense that AMRUT seeks to lay a foundation to enable smaller cities and towns to eventually grow into smart cities, they differ in the following ways While smart Cities Mission focuses on a select larger urban areas, the AMRUT mission is intended to improve infrastructure in small cities having population of 1 lakh and above and cities of special importance only. While smart Cities Mission adopts area based approach that specialize in improving amenities in a specific area of a larger town, the AMRUT mission adopts functional based approach focusing on improving the delivery of services in the selected cities and smaller cities.

## Review of Literature

Giffinger *et al.* suggest a smart city framework consisting of six main components (smart economy, smart people, smart governance, smart mobility, smart environment, and smart living). Their operational definition of a smart economy includes factors all around economic competitiveness as innovation, entrepreneurship, trademarks, productivity and flexibility of the labor market as well as the integration in the national and global market. Kanter and Litow (2009) consider a smarter city as an organic whole—a network and a linked system. While systems in industrial cities were mostly skeleton and skin, post industrial cities—smart cities—are like

organisms that develop an artificial nervous system, which enables them to behave intelligently. The eight clusters of factors include (1) management and organization, (2) technology, (3) governance, (4) policy, (5) people and communities, (6) the economy, (7) built infrastructure, and (8) natural resources.

Ebrahim and Irani (2005) also presented a set of factors related to the implementation of ICT. According to him a set of IT challenges for smart city can be grouped in three dimensions; IT infrastructure, security and privacy, and operational cost.

The availability and quality of the ICT infrastructure are important for smart cities (Giffinger, 2007). Indeed, smart object networks play a crucial role in making smart cities a reality (Vasseur, J. 2010). According to Al-Hader & Rodzi, (2009) ICT infrastructure includes wireless infrastructure (fiber optic channels, Wi-Fi networks, wireless hotspots, kiosks), service-oriented information systems (Anthopoulos & Fitsilis, 2010). The implementation of an ICT infrastructure is fundamental to a smart city's development and depends on some factors related to its availability and performance. A city "connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city" (Harisson et.al, 2010). A city striving to make itself "smarter" (more efficient, sustainable, equitable, and livable) A city "combining ICT and Web 2.0 technology with other organizational, design and planning efforts to dematerialize and speed up bureaucratic processes and help to identify new, innovative solutions to city management complexity, in order to improve sustainability and liveability (Toppeta, 2010). Actually, digital cities must be much more than cables, broadband, and web portals. While there are evidences on the impact of ICTs on urban environment (Graham and Marvin, 2001a, Webster, 1995), there is a belief that information technology will on its own deliver a smart city. Paquet (2001) also suggests that although technology is an enabler, it is not necessarily the most critical factor in digital cities. Rather such new internet applications must be developed which will support local government officials.

With regards the physical capitals, in the future the successful provision of services throughout cities, which are rapidly increasing both in size and population, will depend on physical infrastructure which new digital technologies are able to interlink and operate (Gann et al., 2011). Telecommunications networks are going to be used for a large volume of machine-to-machine data transmission. Sensors and actuators will be an essential component in the digital cities of the future. Gann et al. (ibid) points out that to improve existing services and the creation of new ones, it is necessary to integrate the various component systems within a city. Hence, physical-digital integration of infrastructure will be of utmost importance for the success and survival of the next generation of cities. Embedding new technological infrastructure in cities and makes it work in favor of its dwellers also requires taking a serious consideration not only on the physical capital, but also on the human and social capital.

A Triple-Helix model of smart cities was introduced by Leydesdorff and Deakin in 2011 and

emphasizes smart cities as a process of cultural reconstruction underpinned by policy, academic leadership and corporate strategy in their guidance. Simultaneously, the Triple-Helix model frames the relationship between industry, government and academia as reflexive and an overlay which influences how technologies co-evolve. In 2011, Nam and Pardo introduced a model of Three Dimensions - technology, people, and institutions –by which smart cities strategize. The authors viewed a smart city as model for improving city services and economic development catalyzed by local governments. Final conclusions highlight a recurring concept found in all smart city models: that of variable social components and their importance within outcomes of smart city planning and their linkage with the technologies which have power to transform economy, environment and community.

A city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens (Giffinger *et. al*,2007) 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, and plan its maintenance activities, and monitor security aspects while maximizing services to its citizens (Hall, 2000).

Krassimira *et.al* (2009) in their study on Enabling the Smart city has assessed that how can electronic governance (e-governance) assist in helping cities make better decisions and become more competitive, as well as engaging with citizens in democratic activities and decision-making processes? Their paper suggested that e-governance may provide a new vehicle for the emerging 'smart city'. The paper assessed the conceptual landscape for city e-governance, with a focus placed on how cities can foster collaborative digital environments to enable local competitiveness and prosperity through knowledge networks and partnerships, integrated e-services and e-participation. Drawing from the literature and the results of a comprehensive survey study in twelve European cities, they have put forward a series of propositions on the future of e-city governance in Europe and the implications for strategic policy innovations to foster smart cities.

A series of studies of Dirks and Keeling (2009) released by the IBM Institute for Business Value identified business as one of core systems of smarter cities, which comprise city services system, citizens system, business system, transport system, communication system, water system, and energy system. Capacities for smart business systems include ICT use by firms, new smart business processes, and smart technology sectors. The smart city initiatives are designed to develop information technology capacities and establish an agenda for change by industry actions and business development (Cairney & Speak, 2000). Creating an environment for industrial development is pivotal to a smart city (Bronstein, 2009). The economic outcomes of the smart city initiatives are business creation, job creation, workforce development, and improvement in the productivity.

In Harrison *et al's* study, a smart city denotes an instrumented, interconnected, and intelligent city. Instrumentation enables the capture and integration of live real-world data through the use of sensors, kiosks, meters, personal devices, appliances, cameras, smart phones, implanted medical devices, the web and other similar data-acquisition systems, including social networks of human sensors. Interconnection means the integration of those data into an enterprise computing platform and the communication of such information among the various city services. Intelligence refers to the inclusion of complex analytics, modelling, optimization, and visualization in the operational business processes to make better operational decisions. In contrast, the Natural Resources Defence Council defines smarter in the urban context as more efficient, sustainable, equitable, and livable.

Toppeta (2009) emphasized the improvement in sustainability and liveability for a smart city. Washburn *et al.* (2010) viewed a smart city as a collection of smart computing technologies applied to critical infrastructure components and services. Smart computing refers to a new generation of integrated hardware, software, and network technologies that provide IT systems and real time awareness of the real World and advanced decisiveness, and strategic behavior (Giffinger *et. al*,2007).

### Challenges

The concept is not without challenges, especially in India. For instance, the success of such a city depends on residents, entrepreneurs and visitors becoming actively involved in energy saving and implementation of new technologies. There are many ways to make residential, commercial and public spaces sustainable by ways of technology, but a high percentage of the total energy use is still in the hands of end users and their behaviour. Also, there is the time factor — such cities can potentially take anything between 20 and 30 years to build.

Some of the factors identified for the slow implementation of projects are related to project design, process of tendering, cost escalation due to delays and delay in calling and settling tenders and difference in approved cost and cost shown in Detailed Project Reports (DPRs). In order to overcome these constraints, the States/ULBs should follow an approach in which end-to-end support for project design, development, implementation and management is provided to ULBs/States by external entities. Specifically, the assistance will be given for preparation of the SLIP, SAAP, DPR, etc. The external entities will be called Project Development and Management Consultants (PDMCs).

A model Scope of work for providing end-to-end assistance by external entities is there and this will enable States/UTs to procure PDMCs.

**Availability of master plan or city development plan:** Most of our cities don't have master plans or a city development plan, which is the key to smart city planning and implementation and encapsulates all a city needs to improve and provide better opportunities to its citizens. Unfortunately 70-80 per cent of Indian cities don't have one.



### ***Financing smart cities***

The High Power Expert Committee (HPEC) on Investment Estimates in Urban Infrastructure has assessed a per-capita investment cost (PCIC) of Rs 43,386 for a 20-year period. Using an average figure of 1 million people in each of the 100 smart cities, the total estimate of investment requirements for the smart city comes to Rs 7 lakh crore over 20 years (with an annual escalation of 10 per cent from 2009-20 to 2014-15). This translates into an annual requirement of Rs 35,000 crore. One needs to see how these projects will be financed as the majority of project need would move through complete private investment or through PPPs (public-private partnership).

### **Modifying or Retrofitting existing City Infrastructure**

Under retrofitting, deficiencies in an identified area will be addressed through necessary interventions, the statement added. Pan-city components could be interventions like Intelligent Transport Solutions that benefits all residents by reducing the commuting time. In retrofitting, an area consisting of more than 500 acres will be identified by the city in consultation with citizens. Depending on the existing level of infrastructure services in the identified area and the vision of the residents, the cities will prepare a strategy to become smart. There are a number of latent issues to consider when reviewing a smart city strategy. The most important is to determine the existing city's weak areas that need utmost consideration, e.g. 100-per-cent distribution of water supply and sanitation. The integration of formerly isolated legacy systems to achieve citywide efficiencies can be a significant challenge.

Redevelopment envisages an area of more than 50 acres, identified by Urban Local: Bodies (ULBs) in consultation with citizens. For instance, a new layout plan of the identified area will be prepared with mixed land-use, higher FSI and high ground coverage. Two examples of the redevelopment model are the Saifee Burhani Upliftment Project in Mumbai (also called the Bhandi Bazaar Project) and the redevelopment of East Kidwai Nagar in New Delhi being undertaken by the National Building Construction Corporation.

### ***Financial sustainability of Urban Local Bodies***

Most urban local bodies 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.

### ***Technical limitations of Urban Local Bodies***

Most ULBs have limited technical capacity to ensure timely and cost-effective implementation and subsequent operations and maintenance owing to limited recruitment over a number of years along with inability of the ULBs to attract best of talent at market competitive compensation rates.

### ***Providing timely clearance***

For timely completion of the project, all clearances should use online processes and be cleared in a time-bound manner. A regulatory body should be set up for all utility services so that a level playing field is made available to the private sector and tariffs are set in a manner that balances financial sustainability with quality.

### ***Three-tier governance***

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.

### ***Dealing with a multivendor environment***

Another major challenge in the Indian smart city space is that (usually) software infrastructure in cities contains components supplied by different vendors. Hence, the ability to handle complex combinations of smart city solutions developed by multiple technology vendors becomes very significant.

### ***Building Capacity***

Capacity building understands the obstacles that inhibit people, and government from realizing their development goals while enhancing the abilities that will allow them to achieve measurable and sustainable results. Building capacity for 100 smart cities is not an easy task and most ambitious projects are delayed owing to lack of quality manpower, both at the centre and state levels. Investments in capacity building programs have a multiplier effect as they help in time-bound completion of projects and in designing programs, developing faculty, building databases as well as designing tool kits and decision support systems. As all these have a lag time, capacity building needs to be strengthened right at the beginning. In terms of funds, only around 5 per cent of the central allocation may be allocated for capacity building programs that focus on training, contextual research, knowledge exchange and a rich database so it needs urgent focus.

### ***Trustworthiness of utility services***

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. Twenty-first century technologies offer newfound promise for the future of cities: more efficient resource usage, greater connectivity between people and places, and broader opportunity for all. They also promise a competitive and sustainable edge relative to other cities slow to adapt. But achieving those impressive goals will require more than major

capital investments and bottom-up innovations. Cities need a clear vision for their economic future, one that is grounded in reality and leverages unique local assets. Only with such a vision, and the accompanying policy framework, can cities truly deploy technology in the smartest ways possible.

### Conclusion

A city which is two steps ahead of its citizen's needs is a smart city. AMRUT and Smart city is a huge mission which relates primarily to development in the context of urban conglomerates focusing to the Indian cities. The twin project aim is creating economically productive, efficient, equitable and responsive cities by a strategy of upgrading the social and economic infrastructure in cities, provision of basic services to urban poor and wide-ranging urban sector reforms to strengthen municipal governance in accordance with the Modiji's vision. As the next two decades are going to see unprecedented rural to urban migration; even various countries have offered huge finance for smart city. The concept is not without challenges as mentioned above. This project lacks master plans, financial sustainability, technical viability and retrofitting. 24×7 electricity, water, telephone or broadband services, metro trains, premium higher education Institutes, Retrofitting of railway stations and other public transport system is not possible with the existing supply and distribution system which is full of corruption. An aggressive monitoring is required for fund utilization; most union government initiatives announced over the last year will work only if citizens of India become better. 'Swachh Bharat' demand may be created by PM Modi, but supply of sanitation and efficient waste disposal system will be done by city governments aka Municipal Corporations and various cities' citizens. A city becomes smart with the smart citizens. Achieving the goal of developing 100 smart cities in India will require a lot more than the right technologies, all the citizens need to join this mass movement to take India to greater heights. Each city needs to overcome above mentioned challenges. The various competitions have been kept at various levels so that all citizens get involved and can give shape to the dream of 98- 100 Smart cities in India.

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