
SMART CITIES IN INDIA: KEY AREAS AND CHALLENGES – CASE STUDY OF CHANDIGARH CITY

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Abstract

As the India's population shifts to urban territories, policymakers are pressed for answers to overcrowding, pollution, budget limitations, aging infrastructure, resource constraints and the requirement for continuing growth. 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 city concept can be used for transforming any city into a smart city. Smart cities have various overwhelming advantages & it a win – win situation for both, government & the citizens. Smart solutions can be helpful in controlling the ever increasing population in the cities. This paper focuses on the concept of smart city as the Government of India launched the smart city project for developing 100 smart cities (now 98 smart cities) in the country and also concentrates on the challenges as well as the key areas for development of smart cities in India along with the case study of Chandigarh.

Keywords: smart city, smart economy, smart solutions, urbanization.

Introduction

Most Cities of India do not have master plans therefore; unplanned urbanization is of great concern especially for provision of infrastructure and services. Most peri-urban areas are “no governance” areas as they are neither rural nor urban. As cities expand, the peri-urban areas, which are mostly unplanned areas, are brought into the cities’ jurisdiction. Thus, there is a need for planning to precede growth of cities, as retrofitting and redevelopment is a much more difficult exercise.

Recognizing that India is at present experiencing a high pace of urbanization and movement of its citizens from smaller towns and villages to urban areas, Finance Minister Arun Jaitley set aside 7600 Crore (\$1.24 billion USD) for the creation of 100 Smart Cities in the maiden budget that the new government presented to Parliament in July 2014. This plan envisions not only the building of new cities from the ground up but also modernizing older cities.

Many definitions of “smart city” exist, and “smart” approaches have been understood differently by different people and sectors. A few definitions take note of that smart cities are those cities with “smart (intelligent) physical, social, institutional and economic infrastructure while ensuring centrality of citizens in a sustainable environment;” refer to key characteristics defined by distinct factors (e.g., smart economy, smart mobility, smart people, smart environment, smart living, smart governance); and concentrate on the vital utilization of new technology and innovative approaches to improve the efficiencies and competitiveness of 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.

Cities are built on the three pillars of *Infrastructure, Operations and People*. In a Smart City, not only is each one of these pillars infused with intelligence, but more importantly the pillars work in an interconnected and integrated fashion to utilize resources efficiently. For instance, a Smart City’s power

distribution infrastructure will be based on Smart Grid technologies, which will integrate with local power demand patterns, grid supply variations, and a well-defined operational process – to manage the available energy most efficiently.

A Typology of Smart City Functions:

SMART ECONOMY (Competitiveness) <ul style="list-style-type: none"> ▪ Innovative spirit ▪ Entrepreneurship ▪ Economic image & trademarks ▪ Productivity ▪ Flexibility of labour market ▪ International embeddedness ▪ Ability to transform 	SMART PEOPLE (Social and Human Capital) <ul style="list-style-type: none"> ▪ Level of qualification ▪ Affinity to life long learning ▪ Social and ethnic plurality ▪ Flexibility ▪ Creativity ▪ Cosmopolitanism/Open-mindedness ▪ Participation in public life 	SMART GOVERNANCE (Participation) <ul style="list-style-type: none"> ▪ Participation in decision-making ▪ Public and social services ▪ Transparent governance ▪ Political strategies & perspectives
SMART MOBILITY (Transport and ICT) <ul style="list-style-type: none"> ▪ Local accessibility ▪ (Inter-)national accessibility ▪ Availability of ICT-infrastructure ▪ Sustainable, innovative and safe transport systems 	SMART ENVIRONMENT (Natural resources) <ul style="list-style-type: none"> ▪ Attractivity of natural conditions ▪ Pollution ▪ Environmental protection ▪ Sustainable resource management 	SMART LIVING (Quality of life) <ul style="list-style-type: none"> ▪ Cultural facilities ▪ Health conditions ▪ Individual safety ▪ Housing quality ▪ Education facilities ▪ Touristic attractivity ▪ Social cohesion

Literature Review

GIS Steering Smart Future for Smart Indian Cities by Anuj Tiwari & Dr. Kamal Jain (2014): The concept of a smart city is a new one. This paper depicts the smart city projects in India namely LAVASA: SMART HILL CITY & GIFT: GUJARAT INTERNATIONAL FINANCE TEC-CITY.

The Smart City Cornerstone: Urban Efficiency by Charbel Aoun (2013): This paper shows a five stages approach for changing over our urban centers into more efficient and sustainable places to live.

1. Setting the vision
2. Bringing in the technology
3. Working on the integration
4. Adding innovation
5. Driving collaboration

Smart cities: Researches Projects and good practices for the cities by Rocco Papa, Carmela Gargiulo, & Adriana Galderisi (2013): The concept of smart city is giving the answer for making the cities more efficient & sustainable. It is quiet popular in the policy field in the recent years. During the 1990's the development of the information technologies was at the peak level & people felt that new technologies can produce new forms of productions, markets, society organization, industries, business districts, residential districts & so on. The term smart city has become more and more widespread in the field of urban planning. Urban planners could give the fundamental direction for making cities smart by using smart devices and smart concepts.

Hafedh Chourabi et al, (2012): A smart city relies, among others, on a collection of smart computing technologies applied to critical infrastructure components and services.

Faisal Razzak, (2012): The Internet of Things (IoT) empowered users to bring physical items into the circle of digital world. This was made possible by different tagging technologies like NFC (Near Field Communication), RFID (Radio Frequency Identification) and 2D (2-Dimensional) barcode which allowed physical objects to be recognized and referred over the internet.

Smart City and the Applications by Kehua Su, Jie Li, Hongbo Fu (2011): This paper chiefly concentrates on the recent research on concept of smart city. The relationships between the smart city and digital city are also described in this paper. The various application systems for a smart city are:

1. Construction of a Wireless City
2. Construction of Smart Home
3. Construction of Smart Transportation
4. Smart Public Service and Construction of Social Management
5. Construction of Smart Urban Management
6. Construction of Smart Medical Treatment
7. Construction of Green City

Smart Cities can be identified along six main dimensions (IBM Smart Cities: www.ibm.com/uk/cities), (Giffinger, R et al, 2007). These axes are

- ☒ Smart Economy - Innovation and Competitiveness
- ☒ Smart Mobility- Transport and Infrastructure
- ☒ Smart Environment - Sustainability and Resources
- ☒ Smart People - Creativity and Social Capital
- ☒ Smart Living - Quality of Life and Culture
- ☒ Smart Governance - Empowerment and Participation

The Vision of a Smart City by Robert E. Hall (2000): The vision of the smart city is the urban centre of the future. The systems and structure will monitor their own conditions and carry out self-repair. The smart materials and structures are also known as the intelligent or adaptive materials. The smart city concept was in a planning stage since late 1998, but it received its first funding in January 2000. The future will require reconsidering of the relationships between government, city managers, business, academia and the research community.

Objectives of the Study

1. To study the concept of smart cities.
2. To study the key areas for the development of smart cities.
3. To explore the challenges faced during the development of smart cities.

Research Methodology

This current study has been exploratory in nature where pertinent information has been gathered from various secondary sources of data, such as, journals, books, websites, reports, etc.

India's Smart City Project

India is witnessing a rapid pace of urbanization, which is expected to continue in the coming decades. According to recent studies, by 2030:

- ☐ 40% of India's population will be living in urban areas
- ☐ 68 cities will have a population of more than 1 million
- ☐ 70% of net new employment will be generated in cities

It is estimated that, on average, about 75% of the global economic production takes place in cities, and Indian urban areas will also follow the trend and account for nearly 70% of the country's GDP by 2030.

By 2020, housing shortage will reach about 30 million dwelling units, 200 million new water connections will be required, 250 million people will have to be given access to sewage, 160 GW of power generating capacity will have to be added and the number of vehicles on our urban roads will increase by 5 times.

Utilizing Smart Cities experience and technology accessible around the world, India can drive the much-needed transformation to a nation of Smart Cities. This ought to be continued along two streams: The first includes : modernization and overhaul of existing cities, where the focus will be on developing and implementing practical solutions that can work ideally with legacy systems and infrastructure. The other stream will include the creation of new Smart Cities from the ground up by leveraging international best practices.

In each case – as evident globally – along with requisite investment in all aspects of urban infrastructure, investment will be required in adapting ICT-enabled management systems and data-driven analytics and decision making in urban planning and operations.

Smart Cities require a holistic approach focusing all three pillars of a Smart City namely *Infrastructure*, *Operations* and *People*. For India, Smart Cities are the need of the hour to achieve significant progress and create a thought leadership position in the global economy.

Urbanization and economic development are two sides of the same coin. In 1800 just 2% of the world's population was urbanized. By 1900 this had ascended to 13%; in 2000 the figure had come to 47%; and in 2008 it passed 50%. On current patterns it is estimated to be 60% in 2030; 70% or even 75% in 2050.

According to the McKinsey Global Institute's extensive study of global cities⁵, 80% of global GDP is generated in cities with 50% in the 380 major cities of the developed world and 10% in the largest 220 cities of the developing world. In 2025, these top 600 cities will still be generating 60% of the growth in GDP but their membership will have shifted East with an estimated 100 new cities entering the rankings from China alone, where the urban population is expected to rise by 200 million, to over 800 million. Some 235 million households earning more than \$20,000 pa (at Purchasing Power Parity rates i.e. adjusting for the different cost of living) will live in the emerging economy cities, compared to 210 million in developed region cities. This growth of a global urban middle class, with correspondingly high expectations of public services and the quality of the urban infrastructure and environment, will have a profound impact on the market for smart city services.

Government should focus on following key areas for developing smart cities in the country:

1. High quality streets and public spaces: Well-planned streets and public spaces that shape the urban structure help support local economy, connectivity, culture, creativity, and future developments. A decent road system functions well for vehicles and public transport as well as for pedestrians and cyclists; at least half of the land to be used for public space; 30% to be allocated to streets for building well connected grids and 20% to squares, parks and open spaces.

2. Mixed Urban Uses and limited land-use specialization: Mixed land-use planning helps create employment opportunities in local areas, promote the local economy, reduce car dependency and commute, encourage pedestrian, cyclist and other non-motorised transport, reduce landscape fragmentation and green-house gas emissions, provide closer public services, support mixed communities and local economies, promote safer communities and create attractive neighborhoods.

3. Connectivity: The purpose behind expanding connectivity is to create access to jobs and services for all and to boost local economies. This encourages walking, public transport, and ICT-accessibility.

4. Waste management: Waste collection modelling and consistent supply to energy generation.

5. Mixed social structure: This principle aims to promote cohesion and interaction between different social classes in the same neighbourhood and ensuring accessibility to equitable urban opportunities by providing different types of housing.

6. Urban resilience: Resilience requires policies, disaster preparedness strategies, frameworks, plans and designs that promote both, the adaptation to climate change and mitigation of GHG emissions.

7. Energy and Resource Efficiency: This requires managing growth addressing consumption and resource exhaustion, through strategic planning, policies and measures concentrated on buildings, appliances, and transport and agricultural, industrial and services industries. By utilizing resources in a sustainable manner, assisted by smart technologies cities can minimize impacts on the environment and be responsive to the needs of the poor and vulnerable.

8. Smart grids or energy networks: Demand management, electronic vehicle support, energy efficiency program, and renewable energy integration;

9. Practical and enforceable norms and rules: To adapt up with the fast urban growth that cities are experiencing, it is critical to provide policies, plans, norms and rules that respond to the current needs of municipalities. The guidelines, norms and rules should be developed with a participatory approach based on the principles of equity and social cohesion.

Challenges for Smart Cities in India:

The Smart Cities Mission still has its own challenges to face.

- 1. Retrofitting existing legacy city infrastructure to make it smart:** There are various latent issues to consider when reviewing a smart city strategy. The most essential 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.
- 2. 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. It is very important 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).
- 3. Three-tier governance:** Successful implementation of smart city solutions needs effective horizontal and vertical coordination between various different institutions giving various different municipal amenities as well as effective coordination between central government (MoUD), state government and local government agencies on various issues identified with financing and sharing of best practices and service delivery processes.
- 4. Providing clearances in a timely manner: It may be a significant challenge as everyone knows the level of corruption in our country.** 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.
- 5. Availability of master plan or city development plan:** In our country most of the 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.
- 6. Technical constraints of ULBs:** 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.
- 7. Capacity building programme:** Building capacity for 100 smart cities is not an easy task and most ambitious projects are delayed owing to lack and absence of quality manpower, both at the centre and state levels. 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.

- 8. Reliability of utility services:** For any smart city in the world, the focus is on reliability of utility services, whether it is power, water, telephone or broadband services. Smart cities should have universal access to electricity 24x7; this is not possible with the country's existing supply and distribution system. Cities need to shift towards renewable sources and concentrate on green buildings and green transport to reduce the need for electricity.

Chandigarh: The City Beautiful - A case study for becoming a smart city:

Chandigarh is in the list of 98 cities which are under the Smart City Project of Government of India. Chandigarh is among four cities which the French government has identified to invest in as part of the Indian government's smart city project and has allocated as much as two billion Euros to be spent over the next few years.

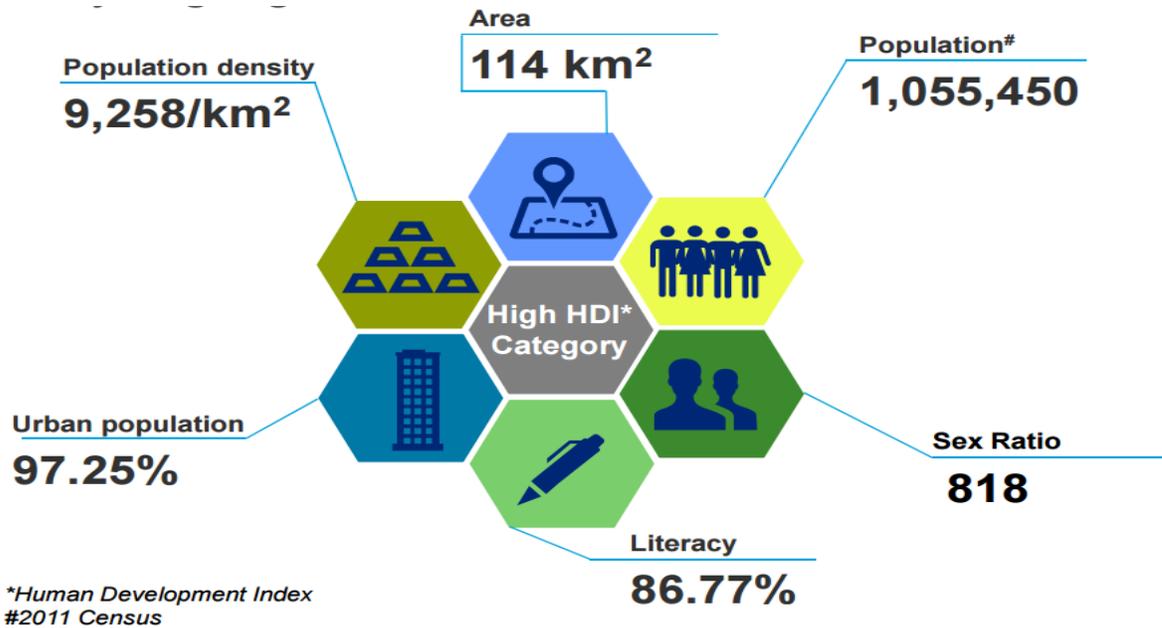
Profile of "The City Beautiful – Chandigarh":

Chandigarh is a city and a [union territory](#) in the [northern part](#) of [India](#) that serves as the capital of the states of [Punjab](#) and [Haryana](#). As a union territory, the city is ruled directly by the [Union Government](#) and is not part of either state. Chandigarh and adjoining cities of [Mohali \(Punjab\)](#) and [Panchkula \(Haryana\)](#) are together called Chandigarh Tricity.

Chandigarh is located near the foothills of the [Shivalik](#) range of the [Himalayas](#) in northwest India. It covers an area of approximately 114 km². It shares its borders with the states of Haryana and Punjab. The exact cartographic co-ordinates of Chandigarh are 30.74°N 76.79°E. It has an average elevation of 321 metres (1053 ft).

The city of Chandigarh was the first [planned city](#) in India post-independence in 1947 and is known internationally for its architecture and urban design. The master plan of the city was prepared by Swiss-French architect [Le Corbusier](#), transformed from earlier plans created by the Polish architect [Maciej Nowicki](#) and the American planner [Albert Mayer](#). In 2015, an article published by [BBC](#) named Chandigarh as one of the perfect cities of the world in terms of architecture, cultural growth and modernization.

The roads in Chandigarh are surrounded by trees and it has the third highest forest cover in India at 8.51% following [Lakshadweep](#) and [Goa](#).



SWOT Analysis – Chandigarh City:

Strengths	Opportunities
<ul style="list-style-type: none"> • Distinct Identity and Heritage • Planned with green, open & public spaces • Basic / core infrastructure well in place <ul style="list-style-type: none"> ○ Coverage of water supply ○ Regular Electricity supply ○ Increasing prevalence of solar energy ○ Coverage of toilets & sewage network ○ Scientific Segregation and waste management ○ Well planned roads, pavements, cycle tracks ○ Housing for different segments; Rehabilitation • Highest on Human Development Index 	<ul style="list-style-type: none"> • Leveraging IT for delivering of citizen services • India's 1st Model Solar City • Geography - Gateway to 3 states • Formulating policies enabling: <ul style="list-style-type: none"> ○ Water recycling ○ Usage of renewable energy ○ Promoting green buildings • Develop Innovations/ Knowledge hub • Enhance position of service sector hub
Weaknesses	Threats
<ul style="list-style-type: none"> • Limited employment opportunities • Inadequate public transport facilities • Pressure issues in water distribution • Limited availability of land for future development 	<ul style="list-style-type: none"> • Increasing citizen safety concerns • Rising traffic congestion, parking issues • Competition from neighboring cities for investment • Outward migration of youth for employment

Agreed Vision and Goals:



Challenges for Chandigarh in becoming the Smart City:

1. Healthcare:

- Chandigarh is the cradle of healthcare in the region, but lacks even basic infrastructure and manpower requirements for the city's residents. Against a total requirement of 80 dispensaries for nearly 13 lakh residents, with each catering to 15,000 residents, the city has only 43.

2. Education:

- This year Chandigarh's colleges have crossed the student enrolment figure set by the college population index according to which against one lakh students, one college is required.
- In the city's seven government colleges, though well equipped, the laboratories need to be converted into virtual labs. The colleges have a shortage of hostel seats while students of Sector 42 and 46 colleges face a connectivity problem.
- Panjab University has been bagging the top position in international platforms, but is struggling for funds. It is yet to come up with smart classrooms and new hostels.
- Chandigarh has 107 schools but these lack proper furniture, laboratories and space; there is a shortage of regular staff too, librarians have not been appointed by the Education Department, and neither do schools have regular counsellors. Toilets in some schools are without taps, playgrounds have restricted space with floodlight poles in the middle to check thefts, and sports

are a neglected field. The student-teacher ratio is not being maintained as per the provisions of the RTE Act in a few schools and the students have not been issued health cards as required.

3. Solid Waste Management:

- Chandigarh MC spends crores on purchase of garbage-lifting vehicles, bins and rehris, but has failed to put in place the process for collection and segregation of garbage at household level and at Sehaj Safai Kendras. So, garbage which can be recycled is being dumped at open spaces.
- Bio-medical waste management is also not effective in city.
- Chandigarh generates 370 tonnes of waste daily; 270 tonnes goes to garbage processing plant in Dadumajra and 100 tonnes to the dumping ground in Dadu Majra.
- MC has 53-dumper placers to lift garbage from 550 garbage bins in the city, but garbage is lifted from most bins on alternate days. On a daily basis, MC lifts garbage from 190 bins. In some sectors, it empties bins once in three days, once a week and even once in 15 days.

4. Regulating Traffic:

- In Chandigarh, regulating the traffic is a big challenge, because of the number of vehicles — 9.75 lakh, while 2 lakh vehicles use city roads daily from the periphery.

5. Transport Service:

- Chandigarh offers only a local bus service. At present, the bus service on most routes shuts down by 9 pm.
- A user-friendly bus route information system eludes the city. For many destinations, two buses have to be changed, but there are no route plans to guide commuters. The bus numbers are mentioned at every place, but not the route and the time it will take to reach its destination.
- Mobile-based application “Chandigarh bus guide” informs about the bus routes and shelters, but not about the running schedule of buses.

Conclusion

In India, administration in the cities are often confronted with a multitude of key problems, like unplanned development, informal real estate markets, inevitable population growth, lack of infrastructure, inadequate transport facilities, traffic congestion, poor power supply, in competent health services, and lack of basic services both within the city and in the suburban areas, poor natural hazards management in overpopulated areas, crime, water, soil and air pollution leading to environmental degradation, climate change and poor governance arrangements are leading the urban citizen life in unhappy. So it is the need of the hour to plan and build the smart cities in view of resolving these problems.

References

1. Anuj Tiwari and Dr. Kamal Jain, "GIS Steering Smart Future for Smart Indian Cities." International Journal of Scientific and Research Publications, Volume 4, Issue 8, August 2014.
2. Charbel Aoun, "The Smart city Cornerstone: Urban Efficiency."Schneider Electric White Paper, 2013
3. Faisal Razzak, "Spamming the Internet of Things: A Possibility and It's probable Solution", The 9th International Conference on Mobile Web information Systems, Procedia Computer Science 10(2012) 658-665.
4. Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., & Meijers, E., "Smart Cities: Ranking of European Medium-Sized Cities. Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology, (2007).
5. Hafedh Chourabi, Taewoo Nam, Shawn Walker, J. Ramon Gil-Garcia, Sehl Mellouli, Karine Nahon, Theresa A. Pardo & Hans Jochen Scholl, "Understanding Smart Cities: An Integrative Framework." Hawaii International Conference on System Sciences, 2012.
6. Kehua Su, Jie Li and Hongbo Fu, "Smart City and the Applications."IEEE, 2011.
7. Pinank R. Patel, Himanshu J. Padhya, review paper for smart city, International journal of advanced research in Engineering, Science and Management.
8. Robert E. Hall, "The Vision of a Smart City." 2nd International Life Extension Technology Workshop, 2000.
9. Rocco Papa, Carmela Gargiulo and Adriana Galderisi, "Smart cities: Researches Projects and good practices for the cities." TeMa Journal of Land Use, Mobility and Environment, 2013, 5-17.
10. Somayya Madakam, R. Ramaswamy, The State of Art: Smart Cities in India: A Literature Review Report (Dec 2013)
11. realty.economicstimes.indiatimes.com
12. www.smartcitieschallenge.in/Draft-Smart-Cities-Proposal-chandigarh
13. www.tribuneindia.com