

INSIGHTS INTO THE INCIPIENT SMART CITIES PHENOMENA IN INDIA

CASE STUDY RESEARCH, FINDINGS AND
RECOMMENDATIONS

5/4/2017

Georgia Institute of Technology,
School of City and Regional Planning

Author - Jeena, Zahra Mehboob

Advisor - Associate Dean for Research, Nancey Green Leigh

Table of Contents –

1	Abstract	Page 3
2	History	Page 5
3	Definitions	Page 6
4	The ‘Smart City’ Concept	Page 7
5	Framework	Page 11
6	Case Study – Global Cities	Page 18
7	Smart Cities Mission	Page 42
8	Case Study – Indian Cities	Page 45
9	Framework Analysis	Page 59
10	Smart Cities and Economic Development	Page 66
11	Challenges	Page 69
12	Recommendations	Page 73
13	Conclusion	Page 75
14	References	Page 76

Abstract –

India is witnessing a continual economic boom, with the country's economy being the seventh largest in the world. The McKinsey Global Institute stated that between 2002 and 2012, the country GDP grew at 7.7% annually, 'the fastest ... in independent India's economic history.' Additionally, the country has witnessed rapid reduction in its poverty rate with the share of population below the official poverty line falling from 37% in 2005 to 22% in 2012. To promote sustainable and economic development, urban renewal, smart growth and citizen friendly cities, the Government of India launched the Smart Cities Mission in 2015 with the aim to develop over 100 smart cities across the country. By employing this scheme, the Government of India intends to commence a wave of development and urban infrastructure deployment focused on Information Technology and the Internet of Things in the country. The mission has an approved budget of 980 billion rupees [US \$15 billion] for the development of 100 smart cities and renewal of 500 others.

While there is no clear universally accepted definition of a smart city, one can interpret the term as an urban regeneration tool employed to integrate urban informatics in the fabric of a city to promote sustainable growth and economic development. The conceptualization of Smart City, therefore, varies from city to city and country to country, depending on the level of development, willingness to reform, resources available and desires of the city residents. This paper aims to understand smart city definitions, concepts, frameworks and challenges by reviewing literature and presenting two case studies of existing smart cities. The research aims to build on the body of existing literature concerning the concepts and theoretical frameworks engaged to analyze smart cities, namely the SMART model and the Smart City Reference

Model. Further, the paper aims to compare the structures, frameworks and guidelines used by the two existing cities to two smart cities selected under the Smart Cities Mission, India. Although all global smart cities are in their nascent stages, the paper aims to identify tools, references and policy recommendations that Indian cities could learn and deploy. A main goal of smart cities is to promote economic growth and development, and although there is no definite data to draw conclusions, this paper aims to identify economic development tools, [other than ICT and IoT techniques] used by the existing smart cities and summon recommendations for the Indian cities. With a full understanding of theoretical framework, governance structures and contextual barriers to smart city implementation, the research will provide recommendations to increase effective implementation of the Smart City Initiative in India.

History –

Since the late 1900's the world has witnessed a historic symbiotic relationship between information technology and cities that lead cities to grow physically and economically. Right from roadways and telegraph, to the current information technology trends, the digital economy revolutionized cities. Although the 'Smart City' terminology is relatively new with the phrase being adopted since 2005 [Cisco, 2005], [IBM, 2009] [Siemens, 2004], its genesis lies in the late 1990s' Smart Growth movement which campaigned for new urban planning policies. [Harrison & Donnelly] When in 2008, IBM initiated its work on Smarter Cities [IBM, 2009] as part of the Smarter Planet initiative, [IBM, 2008] the underlying aim was to integrate complex information systems with urban infrastructure processes. It has since advanced to include any form of 'technology-based innovation in the planning, development, and operation of cities.' [Harrison & Donnelly]

During the economic crises of 2008-2009, cities witnessed extreme competition with peer cities at not only the state and national level, but - as a result of wireless networks and the Internet – they were also competing at a global level. Cities were contending for economic growth, investment and jobs, and more importantly for the 'Generation Y and Z people' who were considered flag bearers of revived economic strength and vitality. [Harrison & Donnelly] This interest in attracting the millennial generation or in Richard Florida's term, the 'Creative Class' [Florida, 2003], increased interest by technology firms and governmental agencies in branding their cities as a 'Smart City.' These agencies hoped that creating a 'digital city' [Harrison & Donnelly] with an enveloping public wireless network access, to suit the needs of the millennial generation, would attract high value jobs and make their city more appealing.

Definitions –



<https://media.licdn.com/mpv/mpv/shrinknp.jpg>

Literature highlights that there is no universally accepted definition of a smart city. It means different things to different people. While some smart city definitions focus on physical attributes of a city, others talk more about social components that make a city smart. While the authors of the article ‘Smart Cities: Ranking of European Medium-Sized Cities’ define smart city as one that is “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.” [Hall, 2000] Hall in his article ‘The vision of a smart city’ defines otherwise. He asserts the smart city to be 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.” [Hall, 2000] While some authors focus more on smart cities as an initiative to create infrastructure to “leverage the collective intelligence of the city,” others focus on cities striving to “make itself ‘smarter’ (more efficient, sustainable, equitable, and livable)

The ‘Smart City’ Concept –

The smart city concept lies in its foundational approach of integration of information and communication technology (ICT) with urban infrastructure systems. [Chourabi, et al., 2012] ICTs are key drivers of the smart city concept. The integration of ICT with infrastructure projects can change the urban landscape of a city and create economic growth and development opportunities that, in turn can enhance the management and functioning of a city. In spite of proclaimed benefits of ICTs’ use in cities, their total impact is still uncertain. While Smart Cities can be conceptualized as a representation of a ‘sustainable and livable city,’ [Harrison & Donnelly] its core approach lies in ‘making the invisible visible’ [Harrison & Donnelly] by providing ‘access to real-time information’ at the individual citizen level.

DIMENSIONS	CONCEPTS
Technology	Digital city
	Intelligent city
	Ubiquitous city
	Wired city
	Hybrid city
	Information city
People	Creative city
	Learning city
	Humane city
	Knowledge city
Community	Smart community

[Jeena Zahra]

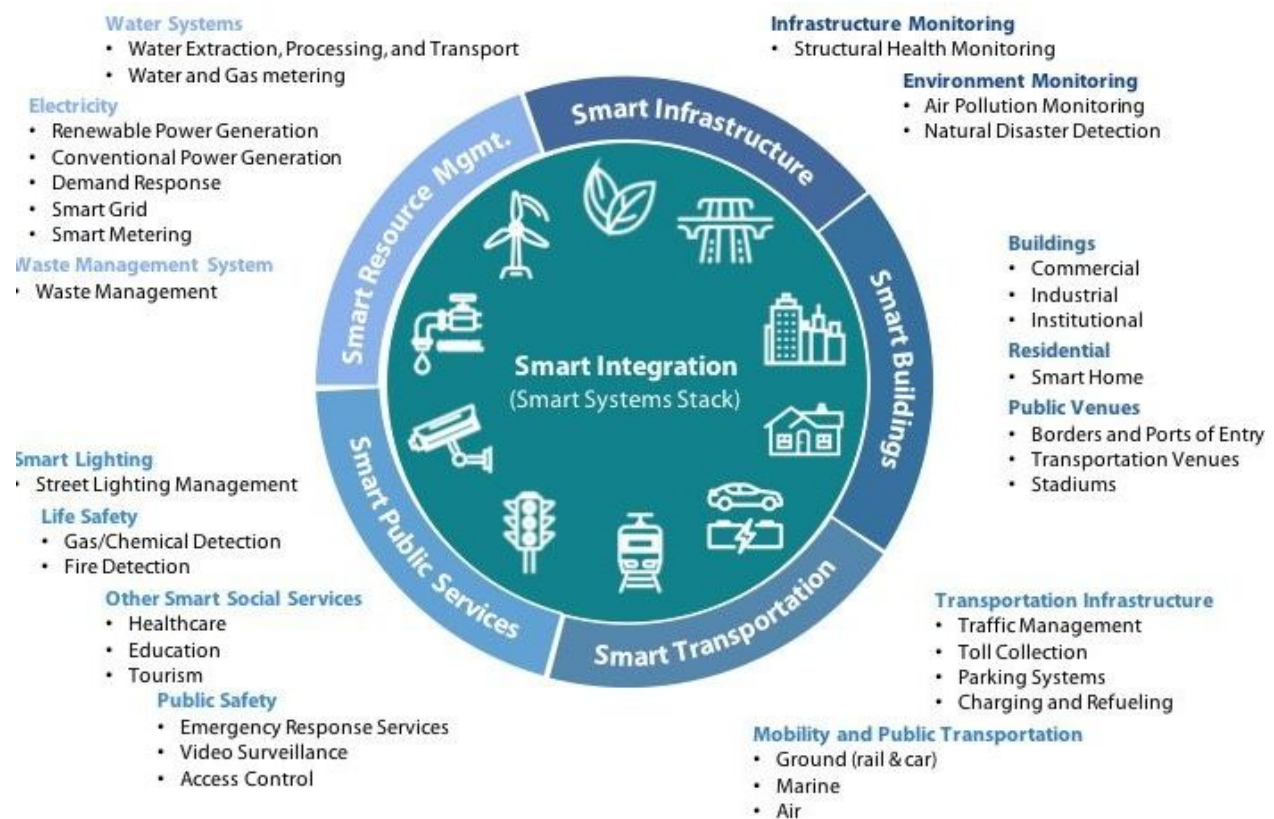
The Smart Cities concept is often considered to converge with the ‘digital city,’ others prefer to consider this convergence with ‘intelligent cities.’ Whilst a digital city refers to “a connected community that combines broadband communications infrastructure; a flexible, service-oriented computing infrastructure based on open industry standards; and, innovative services to meet the needs of governments and their employees, citizens and businesses” [Nam & Pardo, 2011], the idea of an intelligent city emerges at the convergence of a ‘knowledge society’ with the digital city. While the goal of the digital city is embedded in creating a platform for sharing of information, collaboration, and creating a user friendly experience for citizens, the intelligent city finds its proximity to being a city with the ability to ‘support learning, technological development, and innovation procedures.’ [Nam & Pardo, 2011] Therefore, not every digital city is essentially intelligent, but every intelligent city has a digital technology constituent.

Another concept that evolves as a concept of a ‘Smart City’ is the concept of a ‘virtual city.’ Unlike the digital city where every infrastructure related function is of concern, and the intelligent city where the primary involvement is around the intangible function of research and technology transfer; the virtual city functions with ‘cyberspace implementations.’ [Nam & Pardo, 2011] Another theme that relates to Smart Cities is the ‘hybrid city’, which consists of two parallel components, one being the physical entity with inhabitants and the second being its virtual counterparts of ‘real entities and people.’

A supplementary extension of the digital city concept is the ‘ubiquitous city’ (Ucity) which revolves around the ‘ubiquitous computing’ accessible to the basic components of an urban infrastructure that includes people, buildings and open space. The fundamental goal of the U-city is to create a setting where access to services through devices is crucial. Although the U-

city and the virtual city find similarity in their inclusion of digitization, the virtual city visualizes urban elements in virtual spaces and the ubiquitous city involves inserting sensors in those urban elements. Another conceptual development of the Smart City is the information city, which is involved in collection of individual information as well as information from communities, to provide it to citizens on web portals. The information city also relates to an “urban center for commerce, social and civic services, and social interactions among people, businesses and government institutions.” [Nam & Pardo, 2011]

SMART SYTEM INTEGRATION



http://harborresearch.com/wp-content/uploads/sites/8/2016/12/Artifact_Smart-City-Market-Structure-Segmentation-700x480.jpg

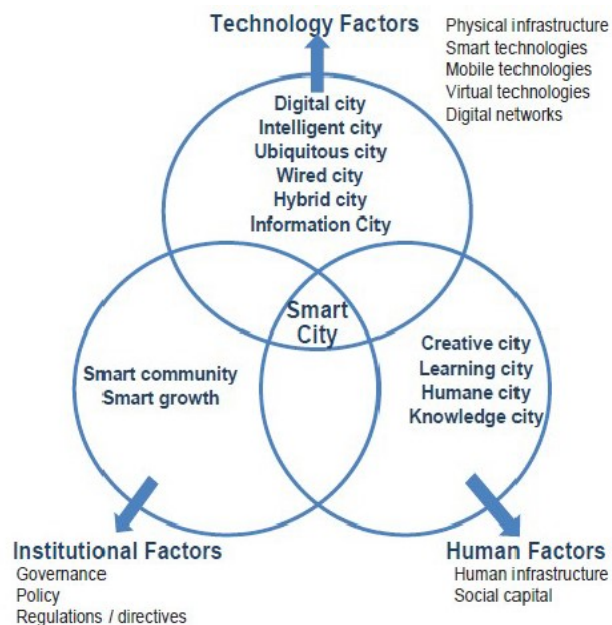
Every Smart City has two components – the physical and human component. In this regard, the smart city is a ‘humane city’ that provides its citizens with a variety of opportunities and focuses on creative human potential. Educated individuals and a skilled workforce form the main component of a humane society. The California Institute for Smart Communities elaborates the concept of a knowledge society as “a community in which government, business, and residents understand the potential of information technology, and make a conscious decision to use that technology to transform life and work in their region in significant and positive ways.”

[Nam & Pardo, 2011]

Framework –

The fundamental framework that characterizes the envisioning of a smart city includes three broad categories – technology, institutional and human factors. While physical infrastructure, smart technologies, mobile technologies, virtual technologies and digital networks lie under the technology category; governance, policy and regulation fall under the institutional category. Human infrastructure and social capital fall under the human category and the overlapping of these three categories forms the core concept of a smart city. The figure below illustrates the main eight clusters of smart city components including administration and organization, technology, governance, policy, people and communities, the economy, built infrastructure, and the natural environment. [Chourabi, et al., 2012]

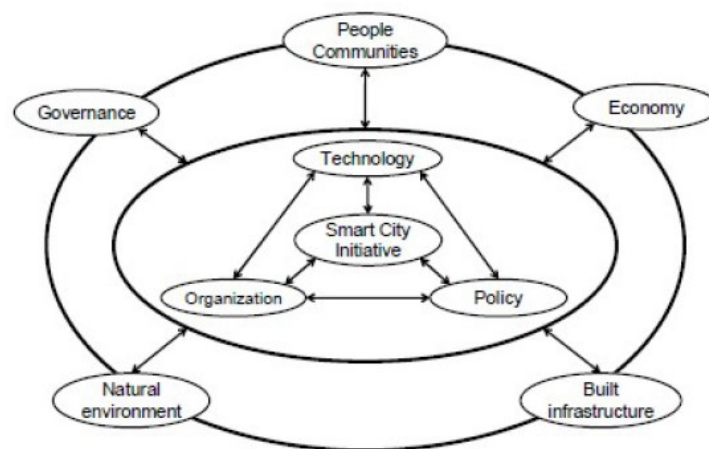
FUNDAMENTAL CONCEPTS OF SMART CITIES



[Chourabi, et al., 2012]

An integrated framework of all components forms the basis of smart cities and while all factors have a two-way impact, some are more significant than others. In order to reflect the differentiated levels of impact, authors of ‘Understanding Smart Cities: An Integrative Framework’, represent two different levels of influence, which is displayed in the graphic below. [Chourabi, et al., 2012] The outer factors, which include people and communities, natural environment, governance, infrastructure, and economy, have filtered influences than the inner factors of technology, management, and policy. This accounts for both direct and indirect effects of the outer factors. Technology is most influential in smart city initiatives, and can create bigger influences on the other seven factors. Thus, smart city initiatives intensively use technology, over the other factors.

SMART CITY INITIATIVES FRAMEWORK



[Chourabi, et al., 2012]

- **SMART Framework –**

Rudolf Giffinger in his article, ‘Smart cities – Ranking of European medium-sized cities,’ asserts that the six most-common indicators of smart cities are smart economy, smart people,

smart governance, smart mobility, smart environment, and smart living. [Giffinger, et al., 2007]

The figure below displays these indicators.

CHARACTERISTICS & FACTORS OF A SMART CITY

SMART ECONOMY (Competitiveness) <ul style="list-style-type: none"> ▪ Innovative spirit ▪ Entrepreneurship ▪ Economic image & trademarks ▪ Productivity ▪ Flexibility of labour market ▪ International embeddedness ▪ <i>Ability to transform</i> 	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 ▪ <i>Political strategies & perspectives</i> 	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

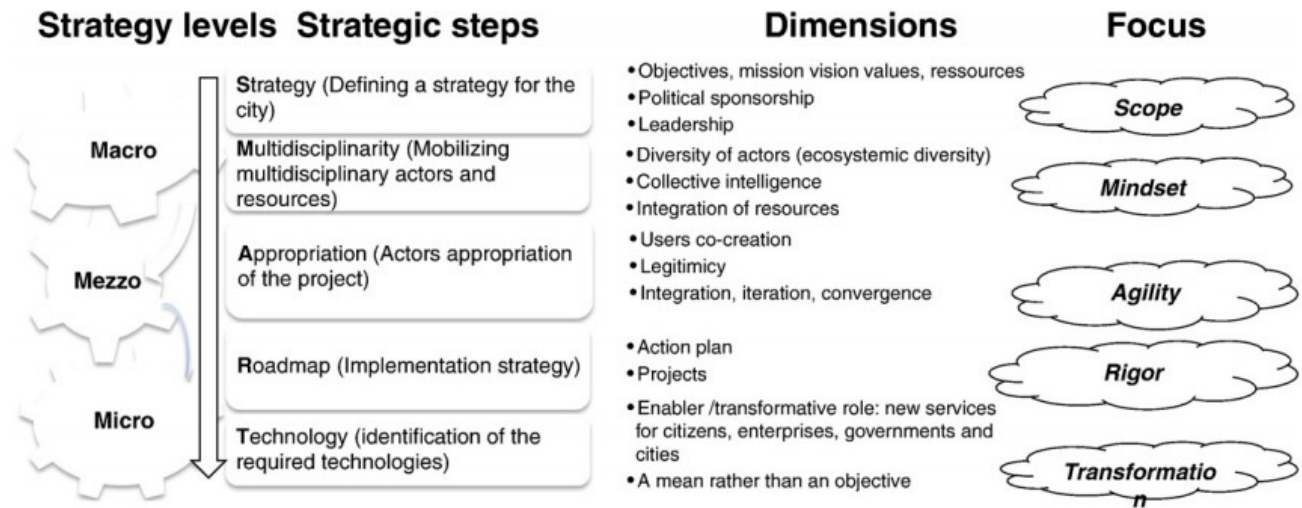
[Giffinger, et al., 2007]

Giffinger explains that Smart people or the social capital of an economy are the primary drivers of growth and development. Human resource development gives cities the “chance to unleash the creative, productive, and innovative forces found only in people, for the economic and social betterment of our cities, states and nations,” [Garmise, 2006, p146] and hence are primary indicators of a smart city. Smart governance that incorporates e-government frameworks and social media to create transparent decision-making processes are the second most important indicators of a smart city. Smart Economy includes innovation, entrepreneurship, regional

economic growth and flexibility of the labor market. Smart mobility includes the integration of multimodal transportation opportunities through the extensive use of information and communications technologies (ICT). Smart environment is an indicator of the city's efficacy in using innovative technologies to create sustainable development and energy efficiency. The final indicator of a smart city is smart living, which revolves around the concept of improving the quality of life of the people in terms of city services, safety, social inclusion and equity.

Soumaya Ben Letaifa in her article 'How to strategize smart cities: Revealing the SMART model' asserts that all cities follow a social, cultural, and institutional context. Based on extensive literature and inductive qualitative research, Letaifa (2015) developed a SMART framework to analyze the strategy used by smart cities. SMART, in this framework, is an acronym for Strategy, Multidisciplinarity, Appropriation, Roadmap and Technology and they represent the strategic phases that a city may go through. [Letaifa, 2015]. These phases are parallel with the micro, mezzo, and macro dimensions of strategy design. The macro level includes strategy design and multidisciplinary resource mobilizing. The mezzo level includes stakeholders and implementation strategies in the process. Finally, the micro level tackles the deployment of information and communication technology systems into the urban fabric of the city.

Although experts in the field and public officials consider technology to be the motivating force in transforming environmental, social, and economic change and development, the SMART model focuses on creating a 'healthy economy, effective use of real-time data intelligence, and stakeholders co-defining a vision that aligns with the city's identity and human, natural, and economic resources' [Zygiaris, 2012]



[Letaifa, 2015]

• Smart City Reference Model –

Sotiris Zygiaris in his article, ‘Smart City Reference Model: Assisting Planners to Conceptualize the Building of Smart City Innovation Ecosystems’ positions that cities prioritize their urban innovation systems from traditional urban character to innovative “green”, “smart”, “open”, “intelligent”, and “innovating”, aiming towards ecological and communal sustainability. In order to create a holistic framework, which includes conceptions, policies and processes related to smart city planning, Zygiaris (2012) developed a Smart City Reference Model. This model consists of seven layers, which each highlight important aspects of smart city strategy and its interrelation. Zygiaris proposes the Smart City reference model as an analytical tool that helps planners identify the innovation processes and policies that complement a city’s plan towards smartness.

The layers in this model include -

- **The City Layer**

It is the context of a city determining its ability to absorb smart features. The elements include the city's urban infrastructure, its governance and urban planning processes, as well as its overall identity and vision.

- **The Green City Layer**

The sustainable focus of a city referring to a city's vision, goals and the environmental impact of 'smart' solutions.

- **The Interconnection Layer**

The innovation support capacity of cities through physical internet infrastructure and its ability to connect communities, sectors, devices

- **The Instrumentation Layer**

The 'hardware' layer of cities comprised of its real-time connection outlets such as various sensors and meters, which provide real-time data.

- **The Open Integration Layer**

Referring to the provision of open and distributed information storage, for all available systems implemented with different technologies

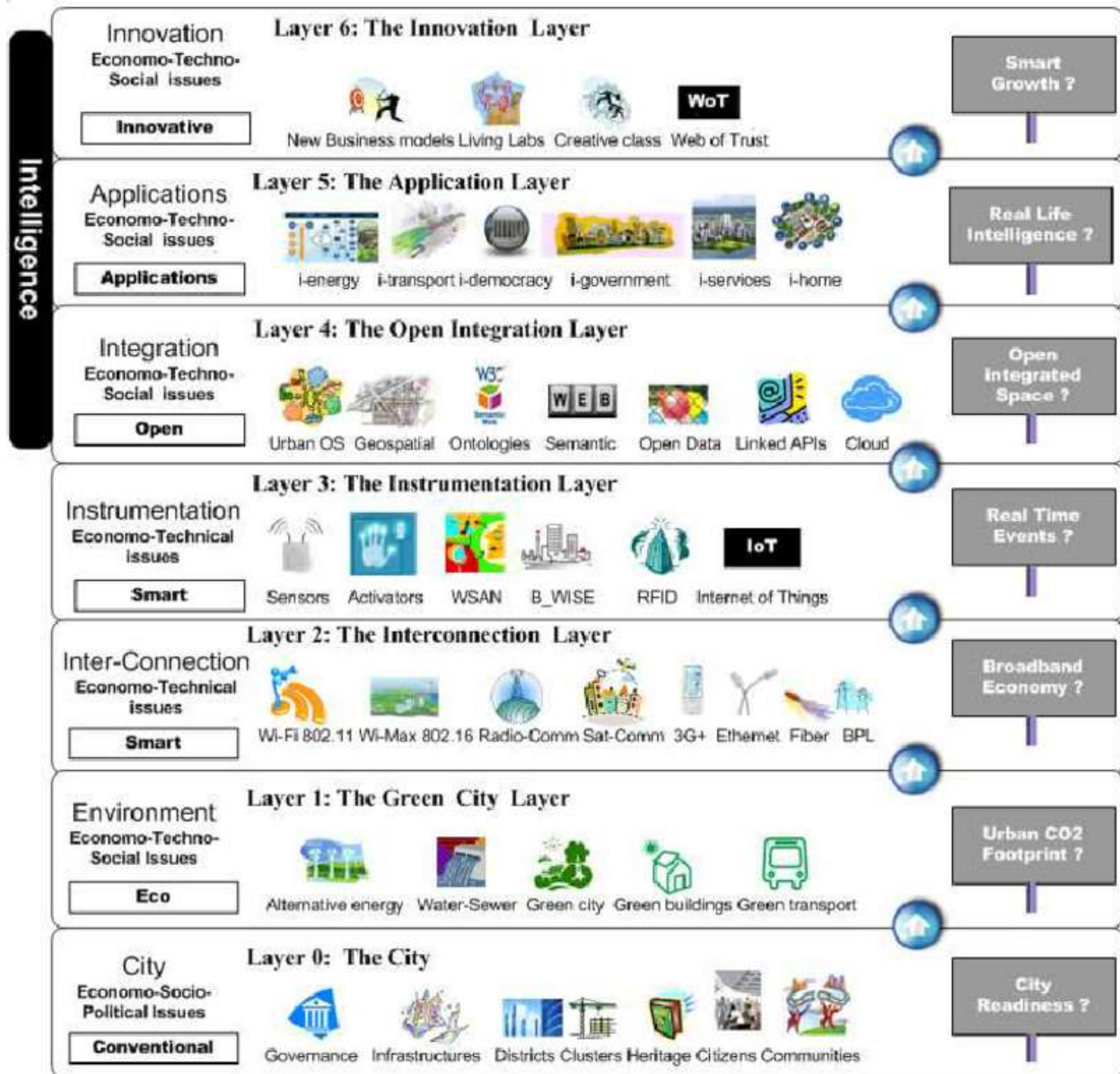
- **The Application Layer**

Combining the different layers, creating intelligence and optimizing the use of the real-time data stream assets provided by cities

- **The Innovation Layer**

The positioning of a city to become an attractive innovation hub for doing business, including its social relations in networks and communities.

ZYGARIS SMART CITY REFERENCE MODEL



[Zygiaris, 2012]

Case Study -

“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. Smart city generally refers to the search and identification of intelligent solutions, which allow modern cities to enhance the quality of the services provided to citizens.”

- Giffinger et al. (2007)

A continuum cycle of innovation and citizen inclusion is essential for a city to be smart. The section identifies four cities according to geography, density, priorities and approaches, and the availability of and access to information. While all cities are unique, they also have common objectives and face common challenges. Although there is an accelerated understanding of the impact of smart city technologies on city operations, service provision, quality of life, and local economic development, the case studies in this section aim at identifying common approaches, challenges and solutions that cities faced. The study focuses on the methodologies and challenges faced in adapting new digital systems, governance structures, open data and use of efficient technology, identifies key lessons from the global cities, and concludes recommendations for to the Indian cities.

The two global cities selected for analysis are Barcelona and Tel Aviv, while the two Indian Cities selected are Bhubaneshwar and Pune. Described below is the profile of each selected city –

1. City: Barcelona –

- Country: Spain
- City Category: Capital
- City Profile: Barcelona is the capital city of the autonomous community of Catalonia in the Kingdom of Spain, as well as the country's second most populous municipality, with a population of 1.6 million within city limits. Its urban area extends beyond the administrative city limits with a population of around 4.7 million people.

City Area	101.4 km2 (39.2 sq. mi)
Population (2015)	
Number	1,604,555
Density	16,000/km2 (41,000/sq. mi)

- City Highlights:
 - Barcelona is one of the world's leading tourist, economic, trade fair and cultural centers, and its influence in commerce, education, entertainment, media, fashion, science, and the arts all contribute to its status as one of the world's major global cities.
 - In 2012, Barcelona had a GDP of \$170 billion; it is leading Spain in both employment rate and GDP per capita change.
 - In 2009, the city ranked as Europe's fourth best city for business and fastest improving European city, with growth improved by 17% per year, and the city has been experiencing strong and renewed growth for the past three years.
 - Named European Capital of Innovation in 2014 by the EU, Barcelona hosts the annual Smart City Expo World Congress. It has more than 100 active smart city

projects ranging from smart traffic lights, telecare services and electric cars to ubiquitous public Wi-Fi.

2. City: Tel Aviv –

- Country: Israel
- City Category: Business and Industrial Center
- City Profile: Tel Aviv-Yafo is a major city in Israel, located on the country's Mediterranean coastline. It is the financial center and the technology hub of Israel, with a population of 432,892, making it Israel's second largest city.

Area	52 km sq. (20 sq. mi)
Population (2015)	
Number	432,892
Density	8,354.3/km sq. (21,638/sq. mi)

- City Highlights:
 - Tel Aviv is a global city, and is the thirty-eighth most important financial center in the world.
 - Tel Aviv is known to have the third-largest economy of any city in the Middle East after Abu Dhabi and Kuwait City
 - In November 2013, the ‘Digi-Tel’ program of the Tel Aviv Smart City initiative won the special merit prize at the 2013 Webi Awards, held by the “People and Computers” publication.
 - The City of Tel Aviv won the award for the ‘World’s Smartest City’ at the Smart City Expo World Congress in 2014. Tel Aviv was nominated for the prize due to its provision of an impressive array of technologies to city residents that include city-wide WiFi access (Tel-Net), location-based smartphone technology to help visitors

get around the city, and active measures to engage residents through public round-table policy discussions and a collaborative budget.

3. **City: Bhubaneswar –**

- State: Orissa
- City Category: Capital, Tier 2
- City Profile: Bhubaneswar is the capital of Orissa and a regional hub. Part of a larger metropolitan region with former capital Cuttack, the city has a growing IT and education hub.

Area	135 km sq. (52.12 sq. mi)
Population (2011)	
Number	885,363
Density	6228.4/km sq. (2404.7/sq. mi)

- City Highlights:
 - Known as the “Temple City”, Bhubaneswar has a unique position by virtue of the ability to integrate its rich cultural heritage with a strong regional economic base.
 - Only Tier-2 city in the country to host the top five Indian IT companies: Infosys, Wipro, Tata Consultancy Services, Tech Mahindra and Mind tree
 - Ranked 3rd Best Place to “Do Business in India” by World Bank
 - One of the planned four “Information Technology Investment Regions” in India
 - Bhubaneshwar won the Smart Cities India challenge in 2016, becoming the first city to be selected under the mission
 - Bhubaneswar was selected as the second runners up in the World Smart City Expo Awards 2016 held at Barcelona

4. City: Pune –

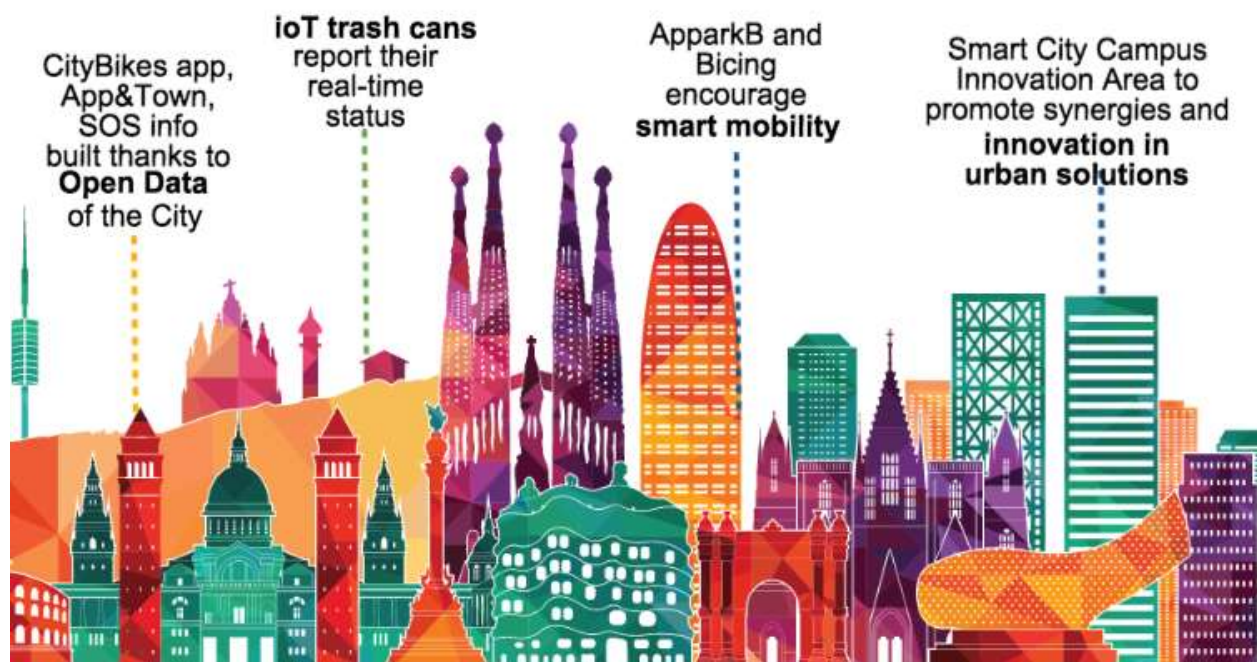
- State: Maharashtra
- City Category: Business & Industrial Centre, Tier 2
- City Profile: Pune is the ninth-most populous city in India and the second largest in the state of Maharashtra after the state capital city of Mumbai.

Area	276.4 km sq. (106.7 sq. mi)
Population (2011)	
Number	3,124,458
Density	11304/km sq. (4364.9/sq. mi)

- City Highlights:
 - Pune is the cultural capital of Maharashtra and one of the fastest growing cities in the Asia-Pacific region.
 - The ‘Mercer 2015 Quality of Living rankings’ evaluated local living conditions in more than 440 cities around the world where Pune ranked at 145, second in India
 - Pune is the second biggest software hub in the country and is the headquarters (south command) of the Indian Air Force and a large military training base.
 - Pune is also one of the successful start-up destinations in India with more than 400 start-ups from Pune.
 - Referred to as the ‘Oxford of the East,’ Pune has 811 colleges. This has contributed in more than 30% graduate workforce, which has triggered the IT revolution in Pune.
 - Pune won the second spot in the Smart Cities India challenge in 2016

Case Study 1 – Global City: Barcelona

Barcelona is the capital city of the sovereign community of Catalonia in the Kingdom of Spain. Spread over an area of 101.4 square kilometers (39.2 sq. mi), the city limits of Barcelona has a population of about 1.6 million and a density of 16,000 people per square kilometers. (41,000/sq. mi) In 2014, Barcelona won the European Capital of Innovation ("iCapital") award, an honor bestowed on cities that apply 'innovative solutions to their relevant societal challenges' by using the four E's - Experimenting inventive concepts and frameworks, engaging citizens for active participation, expanding the city's appeal to inspire other cities and empowering indigenous and innovative practices.



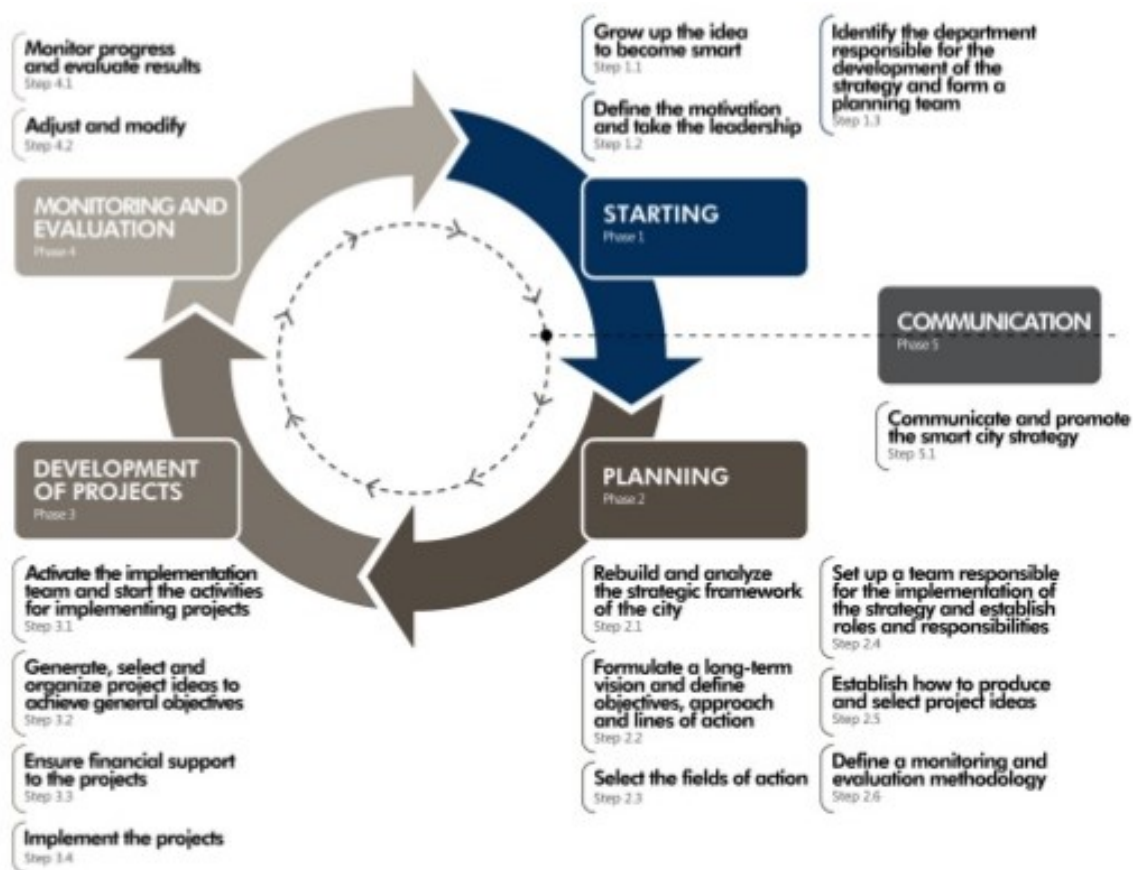
http://www.barcinno.com/wp-content/uploads/2015/04/smart_city_barcelona_barcinno.png

Spain was among the hardest hit economies in the 2008 recession, and appropriate to the situation, the Barcelona government decided to take charge and work towards creating an economically sustainable global city by deploying information and technology in everyday city dimensions. Mayor Xavier Trias and his municipal administration launched the "Barcelona as a

people city” project [Capdevila & Zarlenga, 2015] and initiated the idea to become smart in 2011. With the goal of harnessing technology to transform the city into a ‘model of data-driven, sensing, smart urban system,’ [Adler, 2016] Barcelona used a single to work with an all-inclusive and cross-sectoral approach in the city. The city governance provided leadership and political commitment in developing a planning team from the Municipal Institute of Information Technology and other civic departments. Set up in 2011, Area Urban Habitat of Smart City Barcelona is the umbrella organization aimed at identifying new opportunities for economic development in the city and enhancing existing infrastructure and systems in the city.

DEVELOPMENT PROCESS OF THE BARCELONA SMART CITY STRATEGY

[5 phases, 16 activities]



https://www.slideshare.net/mora_luca/the-development-process-of-smart-city-strategies-the-case-of-barcelona

The mission of the organization was to facilitate collaboration between the urban development departments and ICT administrations. The organization identified 12 areas of intervention that included the basics of city infrastructure and open government and initiated 22 programs, encompassing 83 diverse developments across urban systems. [Adler, 2016] The structure for these diverse developments included five principle initiatives – open data, social innovation, smart and sustainable growth, creating a knowledge economy, and providing “smart services” based on ICT [Barcelona City Council 2014].

The Barcelona advantage in creating the smart city relied heavily on its 30-year-old optic fiber cable system that lay across an area of 500 kilometers. The fiber grid currently provides 90 percent residential coverage and serves as the spine for integrated city systems. The fiber network serves provides citywide Wi-Fi services and since 2013, the number of hotspots in the city has increased by 62 percent to 670 Wi-Fi hotspots with a maximum distance of 100 meters from point to point. [Adler, 2016] This optic fiber network supported the creation of various smart infrastructure systems including a strong physical internet configuration, extensive use of sensors, actuators and others technologies, smart lighting and water irrigation, platforms for open data and transparency, various applications using open data, and high tech bus stops. Two public open data platforms were created, namely OpenDataBCN, aimed at providing access to large collection of data from various field such as population, economy and business, urban environment and Transparencia, aimed at providing transparency in all on-going projects of the Barcelona City Council.

22@Barcelona is the city’s innovation district and the focus of smart initiatives in the city. Although officially introduced in the year 2000, 22@District began as a government initiative to retrofit and renew the decrepit historic cotton-manufacturing locale of SantMartí into

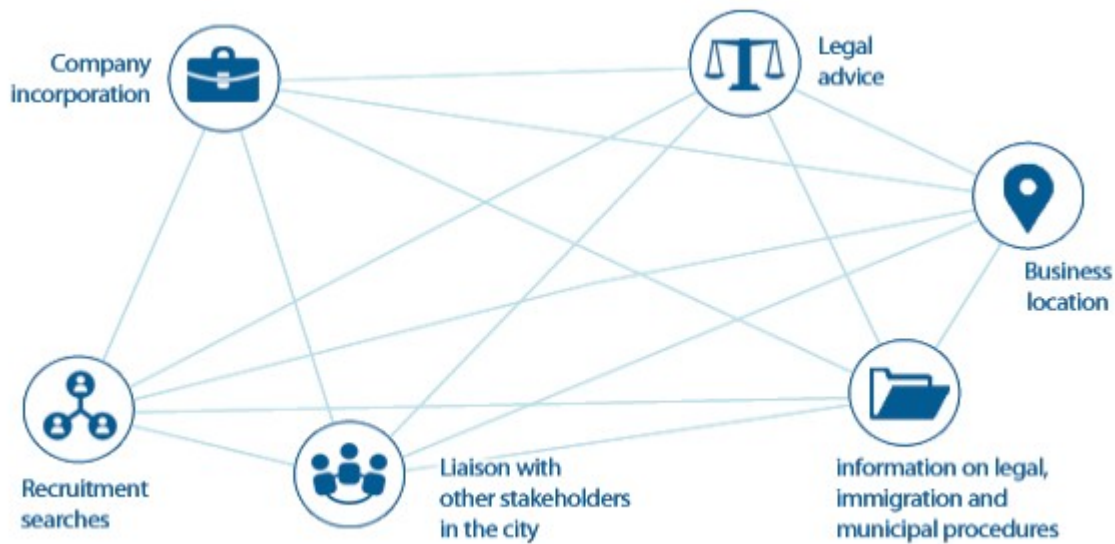
a flourishing knowledge district. Spread over an area of 200 hectares, the Poblenou neighborhood in Sant Martí created an urban cluster of diverse economic sectors that included information and communication technologies, energy, medical technologies, media and design [Barcelona City Council 2010]. This agglomerating economy represents over 56% of the total amount of businesses located in the district. [Capdevila & Zarlenga, 2015] Until 2011, a top down approach governed this industrial renewal scheme. With an aim to synergize local firms and create networking dynamics, 22@Barcelona hoped to encourage collaboration and innovation. However, the innovation district lacked social interaction and connection with the people outside of the cluster. The district witnessed withdrawal of local artist workshops leading to loss in local and social identity of the district. [Barcelona City Council 2010] In 2011, with the smart “people city” project, 22@ observed a renewed vibrant movement. The democratization of technology and creative competitiveness in adopting an open innovation approach resulted in the creation of physical spaces as environments of experimentation. These spaces or popularly referenced as Living Labs, became centers for social integration and co-creation of innovative endeavors. Barcelona has the highest number of Living Labs in any European city. The clusters, namely BDigital Cluster TIC Living Lab, i2Cat LivingLab, Hangar, Barcelona Laboratori, etc. [Barcelona City Council 2010]. Barcelona Laboratori, are an initiative by the city council to foster innovation through public and private partnerships between the arts, science and technology. The endeavor claims to be an integrative relationship between the City Council and different urban innovative tribes of the city, allowing the creation of a new kind of peer to peer relationship.” [Barcelona Laboratori 2012]

Another economic development tool used by the city of Barcelona was the creation of co-working spaces supported by ICT to attract millennials and international economic endeavors.

Shaped to assist freelancers and start-ups to create, collaborate and share resources, entrepreneurs introduced co-working spaces, a concept native to Catalan history. Flexible work environments and the opportunity to network with local social and professional organizations, with assistance of ICT and urban informatics, shaped these districts to be smart economic development tools for Barcelona. [Barcelona City Council 2010].

Barcelona Activa is the local economic development agency of the Barcelona City Council with the mission to foster the transformation of Barcelona through “supporting policies to develop employment, entrepreneurship and business, while promoting the city and its strategic sectors internationally, but from a regional perspective.” [<http://www.barcelonactiva.cat/>] Created in 1986, the agency aimed to be a business incubator. In 2011, under the smart city initiative, Barcelona Activa’s 2 Business Incubators and Technology Park hosted 139 pioneering start-ups and projects. Today, Barcelona Activa hosts the congresses DSI4BCN initiative, stimulating digital social innovation and welcomes more than 260.000 participants yearly. With more than 2.400 projects per year and a business creation rate of almost 70%, [<http://opencities.net/node/113>] the agency has actively used smart city initiatives to be a supporter for economic growth and vitality in the city. Today Barcelona Activa provides “a comprehensive and free one-stop-shop support service to accompany the Barcelona-based investment projects of companies and entrepreneurs living abroad.” [<http://empresa.barcelonactiva.cat/empresa/en/index.jsp>]

BARCELONA SMART CITY BUSINESS COLLABORATION



[<http://empresa.barcelonactiva.cat/empresa/en/index.jsp>]

In the transportation category, Barcelona pursued multi-modal mobility options, including transit, bike share programs and use of technology to organize parking. Barcelona extensively used sensors and traffic calming techniques to control traffic in the city. The city introduced applications to support drivers to locate parking and pay online. To promote environment efficiency, the city introduced low emissions zones and restrictions on polluting vehicles. The city also engaged in creation of super-blocks to promote pedestrian and bicycle movement. In addition, the city introduced the ‘Bicing Service’ – a bicycle-sharing platform, to facilitate biking and optimize the availability of bicycles at their ‘Bicing’ stations. To make transit a rider-friendly service, numerous bus stops were equipped with technological services such as QR codes to download transit apps, interactive screens and USB ports to charge mobile devices.

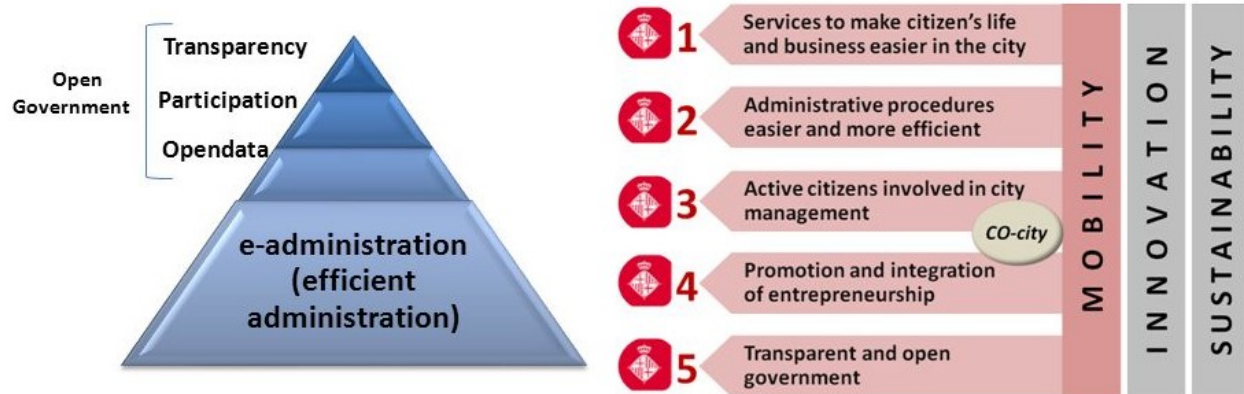


To promote energy efficiency, the city in 2012, initiated and implemented the Barcelona Lighting Masterplan. This plan aimed to expend smart technology to enhance the efficacy and utility of city lampposts. By 2014, the city had installed more than 1,100 LED sensor based lampposts. The city claims to have improved energy efficiency across the urban lighting system by 30 percent. [Adler, 2016] The city also introduced smart waste bins to monitor waste levels and optimize collection routes, along with possibilities to detect potentially hazardous materials. Park water irrigation was also reworked using smart technology to remotely sense and control water irrigation in parks.

The city governance structure was primarily a top down approach. Area Urban Habitat planned the strategy; external consultants like Cisco System, and Doxa Consulting supported the initiatives. While the main tasks of the agency included analyzing the city's strategic framework and formulating long-term vision for the city, a separate team called the Project Management Office implemented the initiatives. The PMO tasks also included fostering new partnerships with public and private entities and creating innovative financing mechanisms to support the

initiatives. Designed to be dynamic and cyclical in nature, the smart city initiative involves a continuous reviewing process and a change-adapting ecosystem.

BARCELONA SMART CITY GOVERNANCE STRUCTURE



http://images.slideplayer.com/35/10460297/slides/slide_3.jpg

With \$230 million in public funds, the city of Barcelona created 22@Barcelona and actively fostered its local technology industry. [Adler, 2016] Although there is no data to estimate investment amounts, the city estimates that Information and Technology systems have helped save \$58 million in park water consumption, increased parking revenues by \$50 million per year, produced 30 percent energy savings equaling \$37 million annually by employing the smart lighting systems, and generated 47,000 new jobs. [Adler, 2016] These values suggest that the smart city initiative by the city of Barcelona has been effective in devising strategy and implementing initiatives. However, the efforts are in its nascent stages and long-term effects and maintenance costs are unknown.

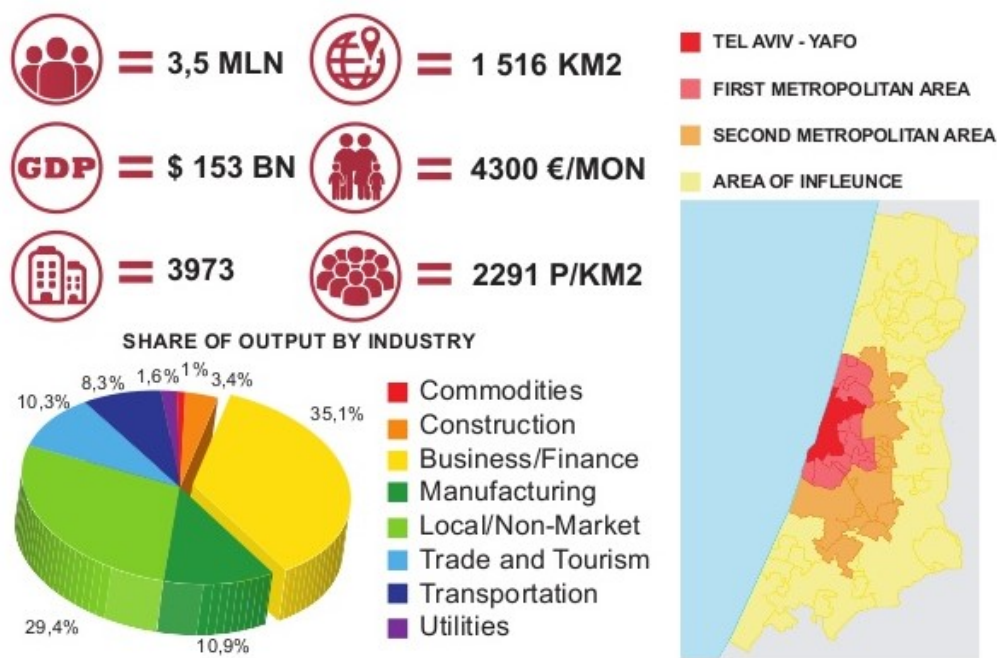
Although perceived to be a pioneer smart city, there are lessons other cities must learn from Barcelona before getting inspired and making efforts to replicate the model. Barcelona's success lay in its cohesive optic fiber system, which allowed for creating a network of sensors

throughout the city, effectively integrating Information and Communication Technology into the urban fabric. Investment in strong physical internet structure, extensive use of sensors, actuators and others technologies is significant in the smart city creation process. Although the city developed major advancements in the hard-infrastructure areas, soft infrastructure orientation remained underbalanced. The city incorporated an integrated approach to engage citizens at a very small scale; however an extensive civic engagement to define and develop smart city projects seems lacking. The city employed an effective strategy in integrating businesses, research centers and universities in the process, and continues to do so. The city also was an arena of a large number of test beds. While test beds play a significant role in trying and implementing strategies, Barcelona lacked citywide initiatives. The city administration paid an increasing focus on retrofitting and making use of the existing resources such as its infrastructure, however, these approaches were limited to certain areas of the city and lacked integration into the city fabric as a whole. Although every neighborhood should have its own initiatives, the city should have city wide initiatives throughout the city.

- **Global City : Tel Aviv –**

Tel Aviv-Yafo is a business and industrial city in Israel, located on the country's Mediterranean coastline. Spread over an area of 52 km sq. (20 sq. mi), Tel Aviv has a population of about 432,892 and a density of 8,354.3 people per square kilometers (21,638/sq. mi) within its city limits. The largest city in the Gush Dan region of Israel, Tel Aviv is the financial center and technology hub of Israel. In November 2014, the city won first prize in the Smart City competition held at the Smart City Expo in Barcelona (EU, 2014). The World Smart City Awards (WSCA) are instituted by the Smart City Expo World Congress [SCEWC] to promote cities, projects and ideas that nurture 'sustainable development in urban areas around the world, thus enhancing quality of life, stimulating creativity, supporting competitiveness, improving efficient management, protecting the environment, promoting shared prosperity and reducing inequality.' [Smart city expo website]

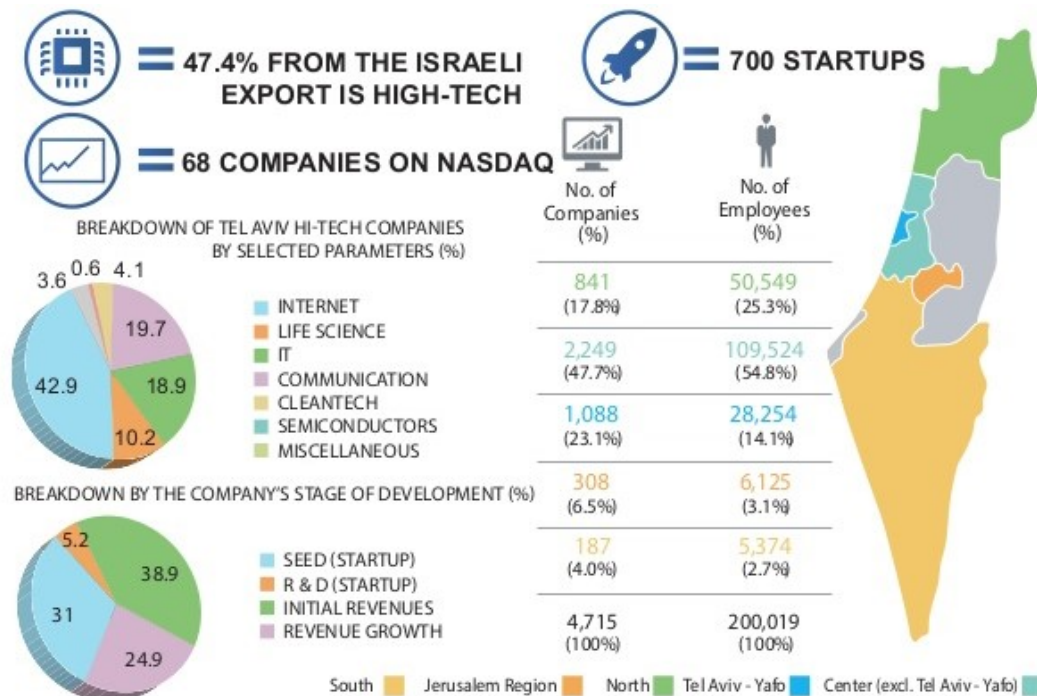
TEL AVIV METROPOLITAN AREA STATISTICS 2015



<https://image.slidesharecdn.com/smartcitytelaviv-160802113834/95/smart-city-tel-aviv-4-638.jpg?cb=1470138177>

The city of Tel Aviv is Israel's leading business center, and home to more than 700 startup companies and more than 1,000 entrepreneurs. Self-proclaimed to be the "Startup City," Tel Aviv boasts of a vibrant high-tech and entrepreneur friendly ecosystem. Ranked as the twenty-fifth most important financial center in the world, [Sedghi, 2015] Tel Aviv's geography of sand dunes deemed it unsuitable for farming, and hence the city developed as a business and scientific research hub. However, despite an average per capita GDP of 0.48 percent of the world economy [http://www.tradingeconomics.com/israel/gdp], Tel Aviv faced severe urban infrastructure, service distribution and environmental challenges. However, Tel Aviv's motivation to develop itself into a smart city goes beyond the necessity of resource allocation improvement, unlike many other cities [Batty, 2013]. To foster civic engagement and strengthen relationships between the citizens and the administration, the city government envisioned its own definition of smart cities.

TEL AVIV HIGH TECH ECOSYSTEM 2015



<https://image.slidesharecdn.com/smartcitytelaviv-160802113834/95/smart-city-tel-aviv-4-638.jpg?cb=1470138177>

The Tel Aviv governance conceptualized its smart city to focus on ‘city making.’ The vision included transforming physical space to create a sense of place, which ‘draws people, has a clear narrative, and is embedded with meaning.’ [Sedghi, 2015] The city adopted a unique bottom-up approach in designing, adopting and monitoring its smart city process. It organized the course of development to be a ‘continuing project, rather than a concluded reality’. With citywide initiatives, the city focused on creating integrated citizen friendly projects and schemes, rather than expensive, large-scale infrastructure.

TEL AVIV SMART CITY MODEL



<https://image.slidesharecdn.com/smartcitytelaviv-160802113834/95/smart-city-tel-aviv-4-638.jpg?cb=1470138177>

The Vice President of Planning in collaboration with the Chief Information Officer and the Chief Knowledge Officer identified a three-tier model for civic engagement strategy design. This included: (i) creation of applications and systems to address specific issues at specific

locations; (ii) logical infrastructure including software infrastructure, web applications and open data portals; and (iii) physical infrastructure to support connectivity and technology through the city.

The main smart city project, launched in 2011, was Digi-Tel, an initiative to foster active civic engagement and community development. The project aimed at dynamically involving citizens in the urban growth and development experience, with a strong emphasis on participation in the strategizing and decision making processes. The secondary goal of the project included use of advanced information and technology systems to create knowledge pools and promote collaborations between the people, public and private sector businesses and establishments and the city governance.

Designed to be a citizen engagement platform, Digi-Tel provides citizens access to personalized, curated information and services relevant to them. Digi-Tel provides citizens access to online services through web and mobile application or through postal services. Upon registration, residents can share private information, such as interests and select a method of communication—email, messaging, or telephone. Once registered, residents receive personal notifications on events or themes of interest. As of 2016, about 30 percent of Tel-Aviv's populace have signed up for the personal service. [Toch & Feder, 2016]The platform also allows citizens to access city archives and the city GIS system named I-view.

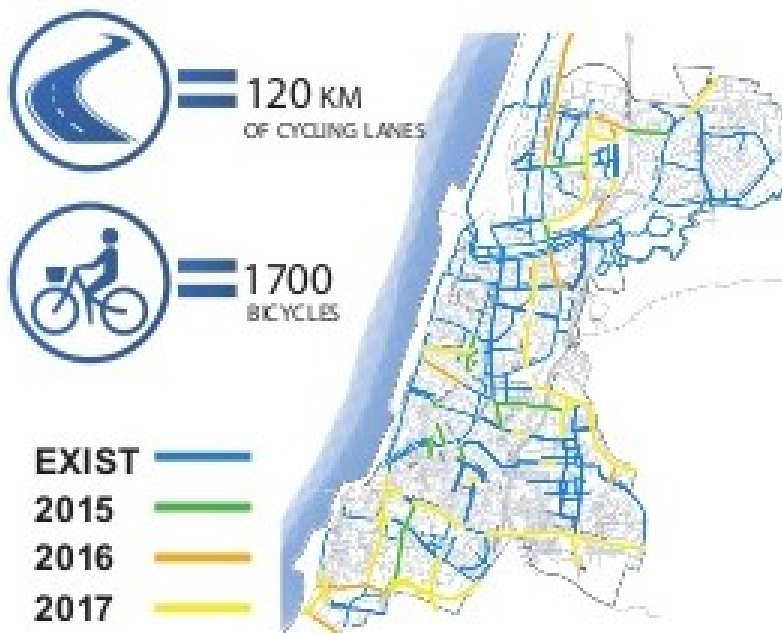
DIGITALISING TEL AVIV



<https://image.slidesharecdn.com/smartcitytelaviv-160802113834/95/smart-city-tel-aviv-4-638.jpg?cb=1470138177>

The second smart city initiative by the city governance aimed to integrate smart technology infrastructure into the physical and social urban fabric of the city. Providing free public Wi-Fi, installing security, surveillance and traffic management systems, and deploying environment and irrigation management systems were included under this initiative.

TEL AVIV BIYCYCLE IMPROVEMENT



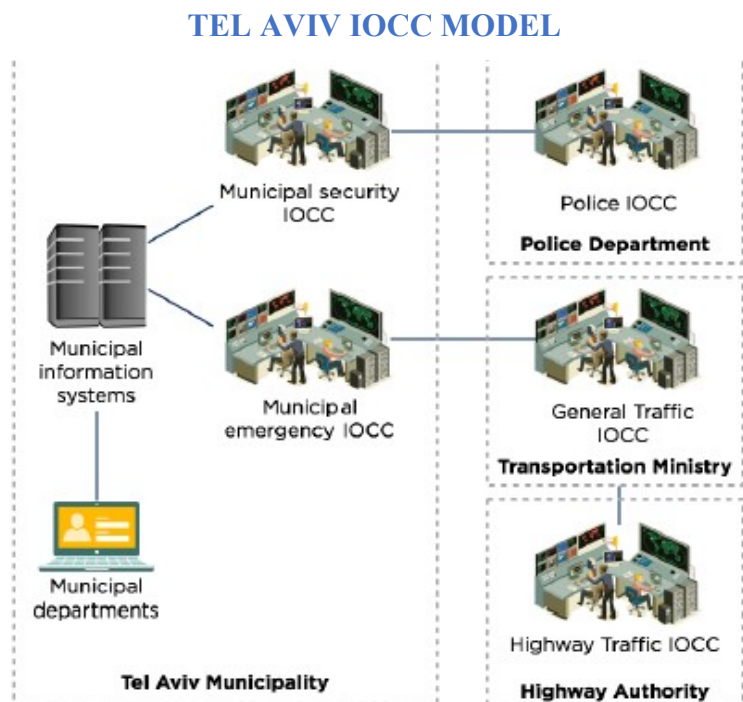
In the transportation category, Tel Aviv pursued multi-modal mobility options, including transit, bike share programs and use of technology to organize parking. Tel Aviv created an integrated traffic control center that uses an automated system called Avivim to collect data from

vehicle volume sensors and traffic cameras, to supervise traffic flow and solve immediate concerns. To promote bike – pedestrian movement, Tel Aviv initiated an application to include

real time data to locate station and bike availability. To increase public transit use, the city transformed its station into digital hubs to include solar powered information screens that displayed real time GPS data. In addition, the city launched an application called ZenCity, to enable people to compare mobility options in the city by sharing data about the options - time, cost, pollution, and effects on health.

In the parking category, the city launched mobile applications to allow drivers to pay for street side municipal parking and public parking facilities. The application also monitored and validated the parking tickets. All government parking lots shared data about the number and location of available spots; smart signage in the city and mobile platforms transmitted information to users. In addition, in specific locations, the government deployed camera-based enforcement. Safety officials and citywide alarms directly connect to the extensive camera surveillance system.

Challenged by unstable political and safety conditions in the region, Tel Aviv experienced numerous terror attacks. In 2014, it also suffered daily rocket attacks from Gaza. The city's Integrated Operation and Control Centers (IOCC) is the main tool addressing security issues where representatives from different agencies manage the



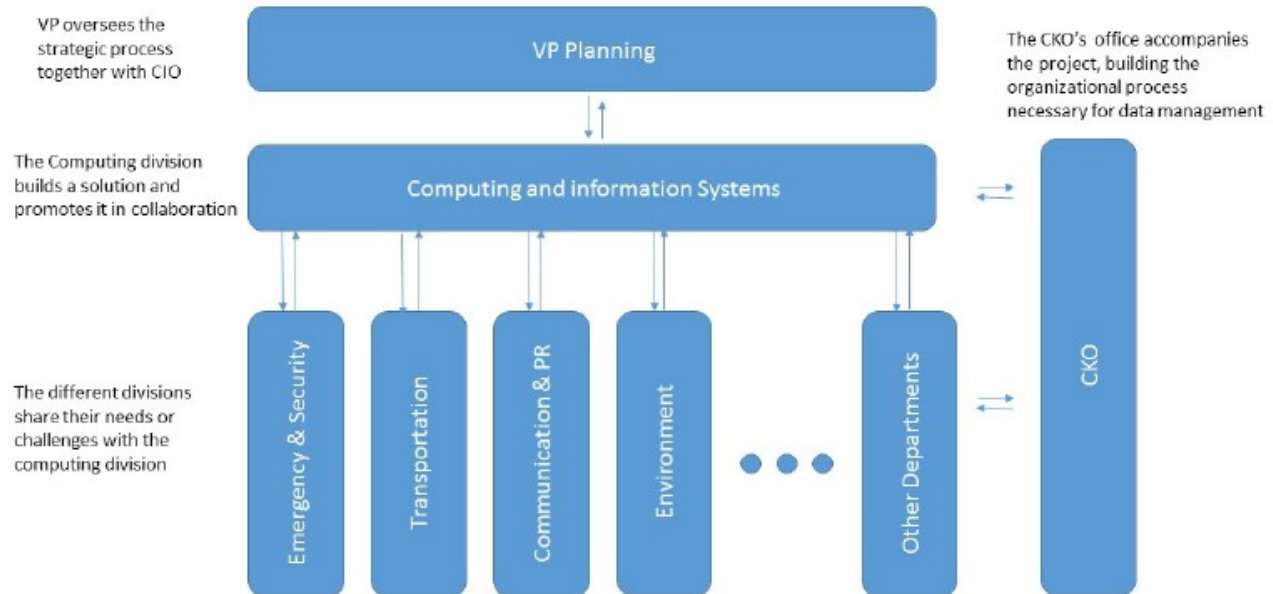
city in times of emergency. The municipal information systems form a link between municipal

departments and municipal security IOCC municipal emergency IOCC. These IOCC's in turn link to the police, transportation and highway traffic IOCC. The IOCC become first respondents in the city in times of emergencies or under security or terrorist attacks.

As an environmentally sustainable initiative, the city controls, in real time, public irrigation water and monitors pollution through monitoring stations with data accessible to the public. At the municipal level, the city is currently piloting a daylight controlled LED lighting system that includes reduced public lighting measures starting at 10:30 p.m. 95 percent of residents use solar water heaters in the city, 80 percent of the total water consumed is recycled. Around 72 percent of gardening sites connect to the city irrigation system.

As mentioned earlier, Tel Aviv has used a bottom up organizational approach with active collaboration with city entrepreneurs. The vital component of this system is the appointment of the city's Chief Information Officer (CIO) and the Chief Knowledge Officer (CKO), who supervise the overall municipal information systems and Digi-Tel, respectively. The organization also has a Vice President of planning, who oversees strategic process alongside the Chief Information officer. The structure has a Computing & Information Systems division that collaborates with city agencies to collect and analyze real time data. In collaboration with the Chief Knowledge Officer, the CIS builds datasets and implements supporting workflow systems.

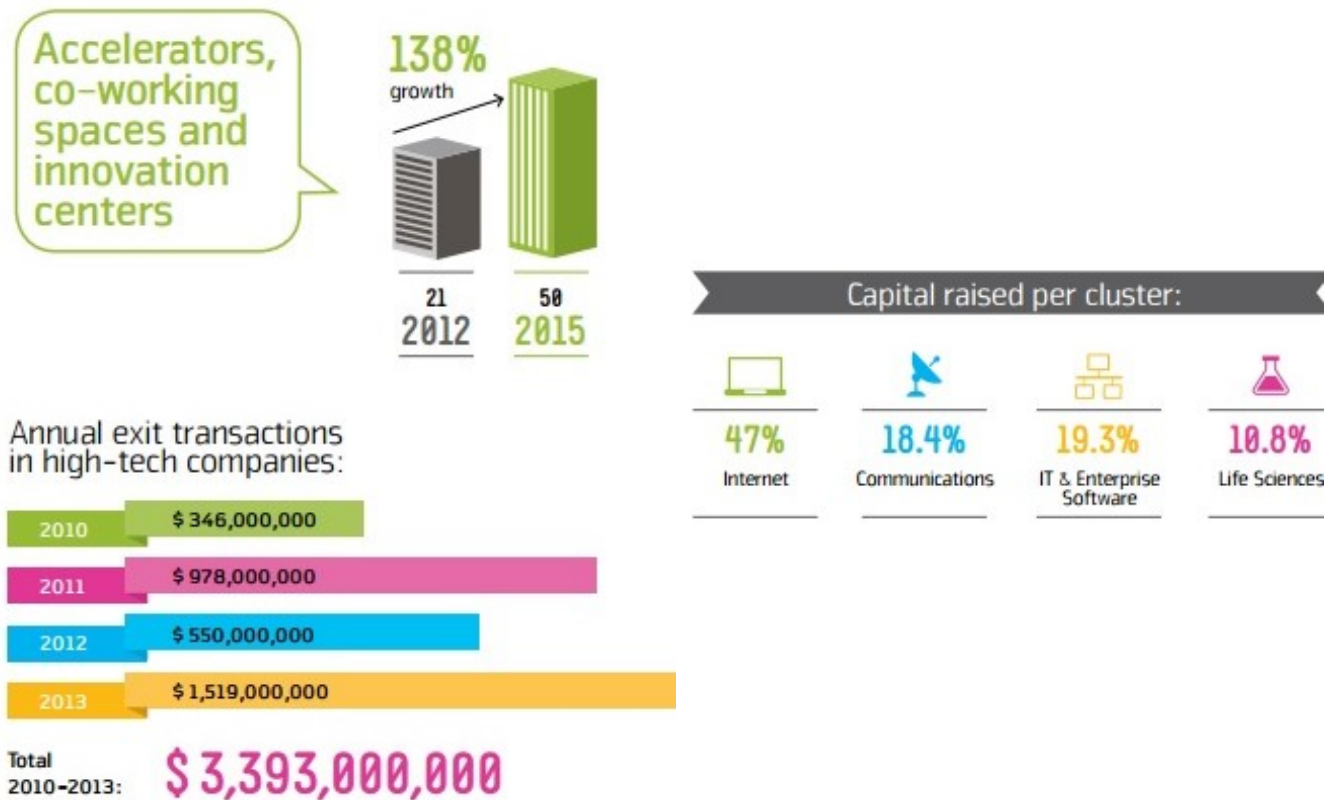
TEL AVIV SMART CITY GOVERNANCE MODEL



<https://image.slidesharecdn.com/smartcitytelaviv-160802113834/95/smart-city-tel-aviv-4-638.jpg?cb=1470138177>

“Tel Aviv is the Startup City of the Startup Nation; innovation is part of the basic DNA of the people of Tel Aviv,” asserts Gilad Uziely, director of economic development at Tel Aviv Global. With an overall estimated cost of 160million NIS per year, [44.28 million U.S dollars]the city employs a combined strategy ofprocurement and in-house development in addition to significant operation and maintenance budgets. According to IVC Research Center, startups in Israelraised \$3.2 billion in the first three quarters of 2015, in comparison to the \$2.3 billion in the previous year. Tel Aviv has 972 startups in the city, 30% of the startups in Israel; and experienced a 40 percent growth between 2012 and 2014. With 19 startups per square kilometers, and an average distribution of 1 startup for every 431 residents in the city, the 2015 Compass Global Startup Ecosystem Ranking places Tel Aviv as the number one start up ecosystem outside the United States.[<http://nocamels.com/wp-content/uploads/2015/09/Tel-Aviv-info.jp>]

TEL AVIV START UP ECOSYSTEM



<http://nocamels.com/2015/12/startup-high-tech-tel-aviv/>

Smart City Tel Aviv is a distinctive case that encourages not only inter-organizational policy building, but also allows for a bottom-up approach. From the case study, the extracted lessons include -

- Strategizing entrepreneurship – Tel Aviv’s success was a product of entrepreneur leadership that promoted explicit schemes to resolve urban concerns using smart solutions. This project-oriented approach increased the managing capacity of the city, both in terms of the budget and the city’s image.

- Investment in Information Infrastructure – Similar to Barcelona, Tel Aviv invested in strong physical and logical information infrastructure, creating efficient ecosystems for startup initiatives.
- Promoting the Startup Ecosystem - Tel Avivharnessed the potential of its thriving and innovative startup ecosystem providing increased citizen services, amplifying the market demand and encouraging new and innovative businesses.
- Citizen Engagement and Inter-department Data Sharing increases planning and monitoring efficiency and enables the city management to drive projects and schemes to improve city services.

Smart Cities Mission –

To promote sustainable and economic development, urban renewal, smart growth and citizen friendly cities, the Government of India under the leadership of Prime Minister Narendra Modi launched the Smart Cities Mission in 2015 with the aim to develop over 100 smart cities across the country. Between 2008 and 2030, Indian cities are projected to grow from 340 million to 590 million people. By employing this scheme; the Government of India intends to commence a wave of development and urban infrastructure deployment focused on Information Technology and the Internet of Things in the country. The mission has an approved budget of 980 billion rupees [US \$15 billion] for the development of 100 smart cities and renewal of 500 others. The Smart Cities Mission intends to set replicable and catalyzing model cities.

The central focus of the Indian Smart Cities Mission is on improving city infrastructure with an overlay of information and communication technology. The core elements of the guidelines document include the basics of urban infrastructure: adequate water and power supply, sanitation measures, efficient urban mobility, public transport, safety, sustainable environmental planning, health, education and affordable housing. In addition, the core elements include robust IT connectivity and digitalization, e-Governance and citizen participation. [<http://smartcities.gov.in/>]

The strategic mechanisms of area-based development in the Smart Cities Mission include retrofitting, urban renewal and redevelopment, Greenfield development in addition to citywide programs, referenced as Pan-city initiatives. While retrofitting cities will focus on adaptive reuse and planning in an existing built-up area to achieve smart city objectives, redevelopment will aim to include replacement of existing built-up environment to create enhanced infrastructure

systems using mixed land use and increased density. Infill development mechanisms aim to incorporate Smart Solutions for vacant lots using innovative planning, financing and implementation tools.

SMART CITIES MISSION – TOP 20 CITIES



To bring the Smart Cities Mission vision to fruition, the Ministry of Urban Development launched the India Smart Cities Challenge to identify cities for funding and to capture the spirit of ‘competitive and cooperative federalism’. Focused on improving the Quality of Life of the citizens, Bloomberg Philanthropies joined Smart Cities Mission in 2015 to assist the Ministry of Urban Development in design and delivery of the India

Smart Cities Challenge. To support 109 of India’s fast-growing urban centers, Bloomberg Philanthropies assisted competing cities in developing best practices for their proposals, with a special emphasis on civic engagement. Bloomberg Philanthropies also hosted the Ideas Camp to bring Indian leaders and global experts in urban innovation under one roof. The Urban Development Ministry budgeted around 30,000 USD per mission for the preparation of Smart City Plans in cities. Analyst firms like CRISIL, Jones Lang La Salle, Deloitte ToucheTohmatsu, Mott MacDonald, Ernst and Young LLP and AECOM India prepared smart city proposals under

the supervision of urban local bodies and state governments based on review of previous plans and interventions undertaken. These proposals included area development action plans and financing plan for the complete life cycle of the proposal. In January 2016, the Ministry of Urban Development declared the 20 winners of the first round of the smart cities challenge, which are listed in the table below.[<https://www.bloomberg.org/>]

FIRST 20 SMART CITIES			
1	Bhubaneshwar	11	Indore
2	Pune	12	New Delhi
3	Jaipur	13	Coimbatore
4	Surat	14	Kakinada
5	Kochi	15	Belgaum
6	Ahmedabad	16	Udaipur
7	Jabalpur	17	Guwahati
8	Vishakhapatnam	18	Chennai
9	Solapur	19	Ludhiana
10	Devanagere	20	Bhopal



<http://images.financialexpress.com/2016/01/smat.jpg>

- **Indian City : Bhubaneswar –**

The city of Bhubaneswar is the capital of the Indian state of Odisha. Spread over an area of 146 sq. km, Bhubaneswar is the largest city in the state and is a center of economic and religious activity in Eastern India. Referred to as the “Temple City,” and a popular tourist destination, Bhubaneswar has a population of 974,000 people with an average density of 6671.23 people per square kilometers. Around 35% of the population (340,860) live in slums in the city with 5% living in the Bhubaneswar Municipal Corporation area. Bhubaneswar is a Tier-2 city ranked Third Best Place to “Do Business in India” by World Bank, being the only Tier-2 city in the country to host the top five Indian IT companies. The German architect Otto Königsberger planned the city in 1946, and along with Jamshedpur and Chandigarh, it was one of modern India's first planned cities. [Bhubaneswar Development Plan Are]

BHUBHANESHWAR CITY PROFILE



Population :
8,85,363
Households :
2,06,014
Area :
135 sq km
Forest :
62,000 ha

ODISHA'S CAPITAL has proposed to redevelop a 985-acre area around the main railway station into a mixed-use, transit-oriented area. The city also proposed a railway station multimodal hub across 12 acres with transit-oriented development involving mixed-use of buildings. Another 40 acres of unused public land will be turned into a space for commerce, education and business. Along with this, the city has also proposed to build around 6,000 houses under slum redevelopment and affordable housing plan.

For the pan-city development, it has proposed a digital platform called Intelligent City Operations & Management Centre (ICOMC) to integrate various urban-management systems such as traffic management, video surveillance, e-challan, electronic parking system and citywide automatic vehicle locator among others. The total capital outlay for making the smart city has been estimated at Rs 4,537 crore.

Among the smart proposals, the city has proposed that in order to reduce transmission losses it will have an underground electrical wiring across the area plan around the railway station.

OUTLAY

₹4,537 Cr capital cost

AREA BASED DEVELOPMENT

Housing for all	2,128
Transit-oriented development	1,009
Urban mobility	280
Basic services	267
Technology for all	209
Future proofing	102
Economic development	42
Social development	32
Build basics	26

PAN-CITY DEVELOPMENT

Traffic management	215
Command & control centre	84
Bus service operations	72
Emergency response & incident management	30
Common payment card	25
Parking management	16

<http://indianexpress.com/article/india/india-news-india/smart-cities-first-20-moving-towards-a-concrete-plan-2811570/>

The proposal to develop Bhubaneswar as a smart city won the India Smart Cities Challenge, topping the list of 20 smart cities likely to change the face of urban growth in the country. [Pradhani, 2016] The city was the earliest in the challenge race to form a Special Purpose Vehicle (SPV), and employ two programme management consultants (PMCs) to fulfil its Smart City vision. The SPV — Bhubaneswar Smart City Limited (BSCL) — appointed Egis India and IBI Consultancy as PMCs. The role of Egis India is to provide consultancy for infrastructure-related projects while IBI Consultancy India Pvt. Ltd is to work towards ‘smart solutions.’ [<http://india.smartcitiescouncil.com/>]

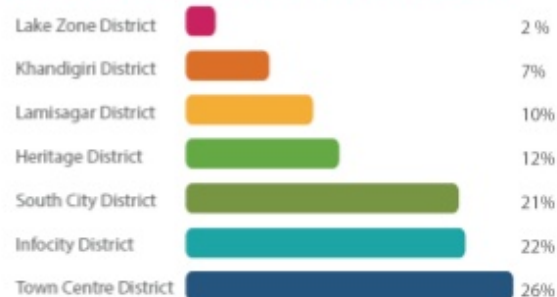
TOWARDS A SMARTER BHUBANESWAR- SELECTION PROCESS

POLLING RESULTS | CITYWIDE SMART SOLUTION



MOBILITY

POLLING RESULTS | AREABASED DEVELOPMENT



TOWN CENTRE DISTRICT

Total Votes: 2.69 Lakhs (26% of total populaton)

Bhubaneswar has employed a macro and micro scaled scheme to achieve its smart city status. The macro project includes citywide SMART solutions with a focus on mobility, while the micro project focuses on area based development of the Town Center district. The theme to form the basis of the proposal aimed at participatory decision-making, accountable governance frameworks and open access to information and communication technology. The proposal

focused primarily on city planning, urban infrastructure and smart growth techniques with ICT incorporation as the secondary theme. Five vision components for the city include –

- Creation of a transit oriented, compact urban development that promotes active, connected and sustainable mobility choices
- Improving the livability of the city by providing a diverse range of housing, educational and recreational opportunities; while preserving its heritage and culture
- Ensuring accessibility and safety in creation of inclusive, vibrant public places that are ‘child-friendly’
- Nurturing a resilient, clean, green, and healthy environment under the concept of an eco-city
- Attracting a knowledge economy through economic enterprises and sustainable tourism activities to transform itself into a regional economic center

To align the citizen’s aspirations and needs with city systems, the SPV identified seven ‘Smart City Pillars.’ The table below describes these pillars.

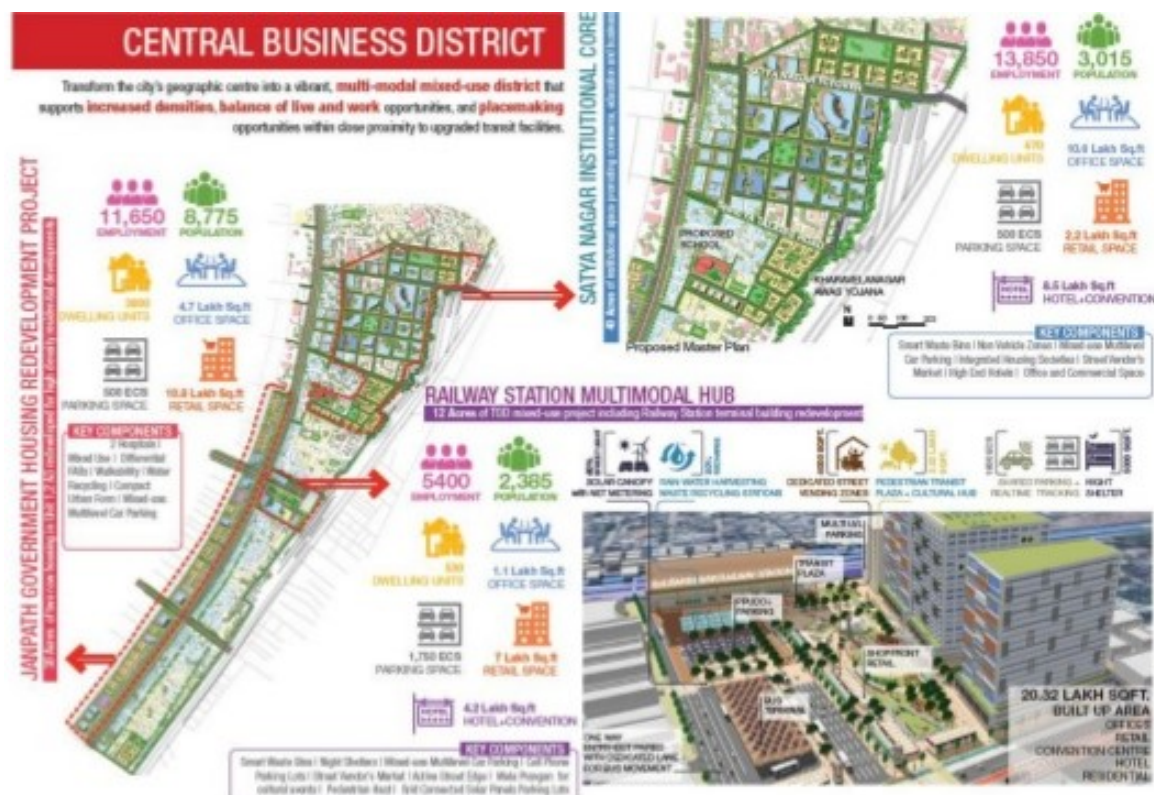
	SMART CITY PILLAR	COMPONENTS
1	Governance	Citizen Participation Intelligent Government Services
2	City Planning and Design	Mixed Land Use, Compact Cities
3	Urban Utilities	Water Supply, Water Management Solid Waste Management Sanitation, Waste water management Energy Supply, Energy Source, Energy Efficiency, Underground Electric wires ICT: IT Connectivity
4	Urban Mobility	Street Design Public Transport
5	Shelter- Inclusive Housing	Shelter- Inclusive Housing
6	Economic Development	Economy Employment
7	Social Development	Identity and Culture Education Health Open Spaces Safety and Security Air quality

<http://www.smartcitybhubaneswar.gov.in/townCentreDistrict>

The main project under the smart city umbrella is the Area Based Development project of the Bhubaneswar Town Centre District [BTCD]. Employed under the strategic mechanisms of retrofitting & redevelopment, the vision is to create a pilot ‘Smart District’ that applies the features of Smart Cities in a defined area. Spread over an area of 985 acres, the district inhabits the Bhubaneswar Railway Station, City Bus Terminal, Ashoka Market and Ram Mandir. With the potential of transforming into the Central Business District for the city, the area has the potential to transform into a transit-oriented development that promotes walkability and creates an agglomerating economy. The CBD is an integrated urban epicenter comprising financial, business, culture and service institutions, with supporting facilities, infrastructure, and flexible

mobility options to create an environment conducive for local economic development. [Yaguang, 2011]

The three main components for transforming the Bhubaneswar Town Centre into an active and flourishing Central Business District are mobility, smart infrastructure and social development. The BTCD Mobility plan aims to integrate multimodal transportation options [bus terminal and railway station] into the district. The plan also includes setting up of Non-Motorized Transport Zones or in simpler terms creating pedestrian friendly roadways and complete streets with dedicated, continuous pedestrian and bicycle network. The city has also proposed to initiate a Public Bike Share scheme and an Intermediate Public Transport & Rickshaw Management scheme.



<https://image.slidesharecdn.com/bhubaneshwarscp-160129043312/95/bhubaneshwar-smart-city-winning-plan-34-638.jpg?cb=1454043172>

The second core component of the BTCD CBD involves the deployment of smart infrastructure projects like the LED Street lighting Project, employing Solar Roof Tops, setting up Waste Recycle Centers, Sewerage Treatment and Water Recycling System etc. Under the BTCD social development category, the city of Bhubaneswar has proposed to undertake four slum redevelopment projects in the area. The city would promote public art installations in the district. The city would use community policing to be responsible for safety in the city. In addition, the plan also proposes to initiate health and education improvement initiatives in the district to create a sustainable, healthy and educated working pool.

The pan city initiatives under the Bhubaneswar smart city initiative for traffic management includes traffic signal timing improvements, video surveillance, e- challan [online traffic violation ticketing system. The pan city projects also includes positioning electronic parking systems that transmits parking availability data through a parking mobile application. To improve transit operations, the city has proposed fleet tracking, depot management and bus scheduling systems that would use real time data. The city proposed devising integrated prepaid tariff card facilities to ensure a singular payment and tracking system. In addition, to ensure safety and security in the city, the smart city proposal also included the employment of an Emergency Response and City Incidence Management System.

“Comprehensive development occurs in areas by integrating the physical, institutional, social and economic infrastructure. The Smart City Mission aims at urban transformation through an area based approach, which can be derived by seeking convergence of other Central and State Government Programs / Schemes with this Mission. ” [Bhubaneswar smart city website] the Bhubaneswar Municipal Corporation (BMC) is the municipal local body governing the city of Bhubaneswar. In order to support organized management of the initiatives, the city

has established a Smart City Advisory Forum to advise and enable collaboration among various stakeholders. The CEO of the Special Purpose Vehicle will be the convener of the Smart City Advisory Forum. An interdepartmental task force consisting of the Urban Local Body (ULB), Urban Development Authorities (UDAs) and other Government agencies targeted at overall monitoring of the project at city level.



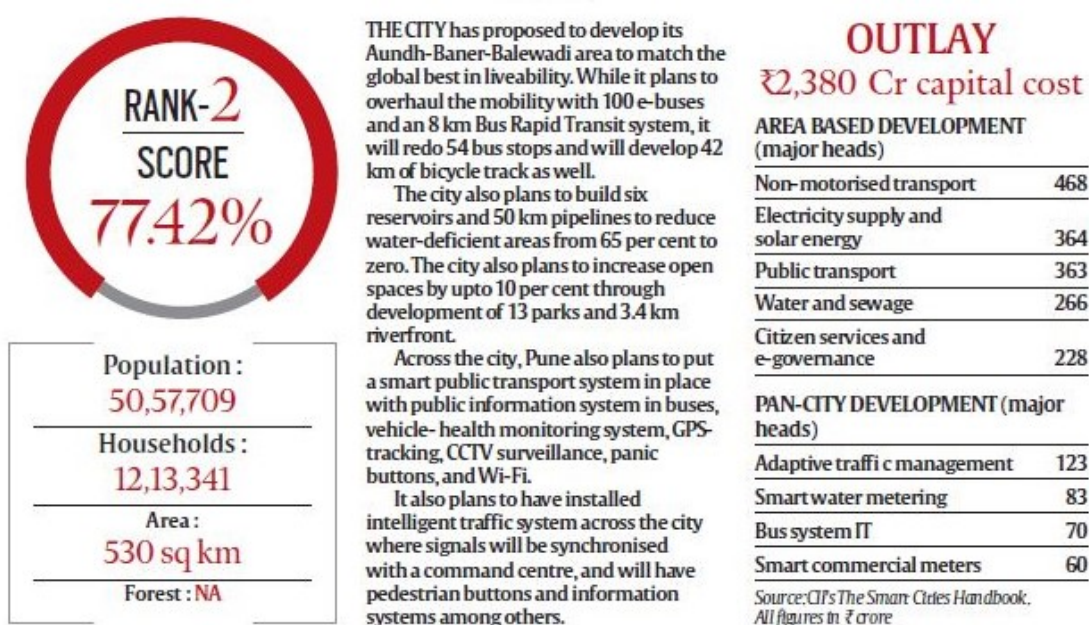
<https://image.slidesharecdn.com/smartcitybbsr2-160615194808/95/smart-city-bhubaneswar-investment-pitch-30-638.jpg?cb=1466273947>

- **Indian City : Pune –**

Pune is a tier 2 business and industrial city in India, the ninth-most populous city in the country and the second largest in the state of Maharashtra after the state capital city of Mumbai. Spread over an area of 276.4 km sq. (106.7 sq. miles), the city of Pune has a population of about 3,124,458 and a density of 11,304 people per square kilometers. The city positioned itself at 145 out of 440 global cities and second in India in a local living conditions evaluation report by the Mercer 2015 Quality of Living rankings. Considered the cultural capital of Maharashtra, Pune is also one of the fastest growing cities in the Asia-Pacific region, with the second biggest software hub in the country. It is also the headquarters of the Indian Air Force and military training base. Referred as the “Oxford of the East,” Pune boasts of 811 colleges in the city, creating more than 30% of the graduate workforce and more than 400 start-ups.

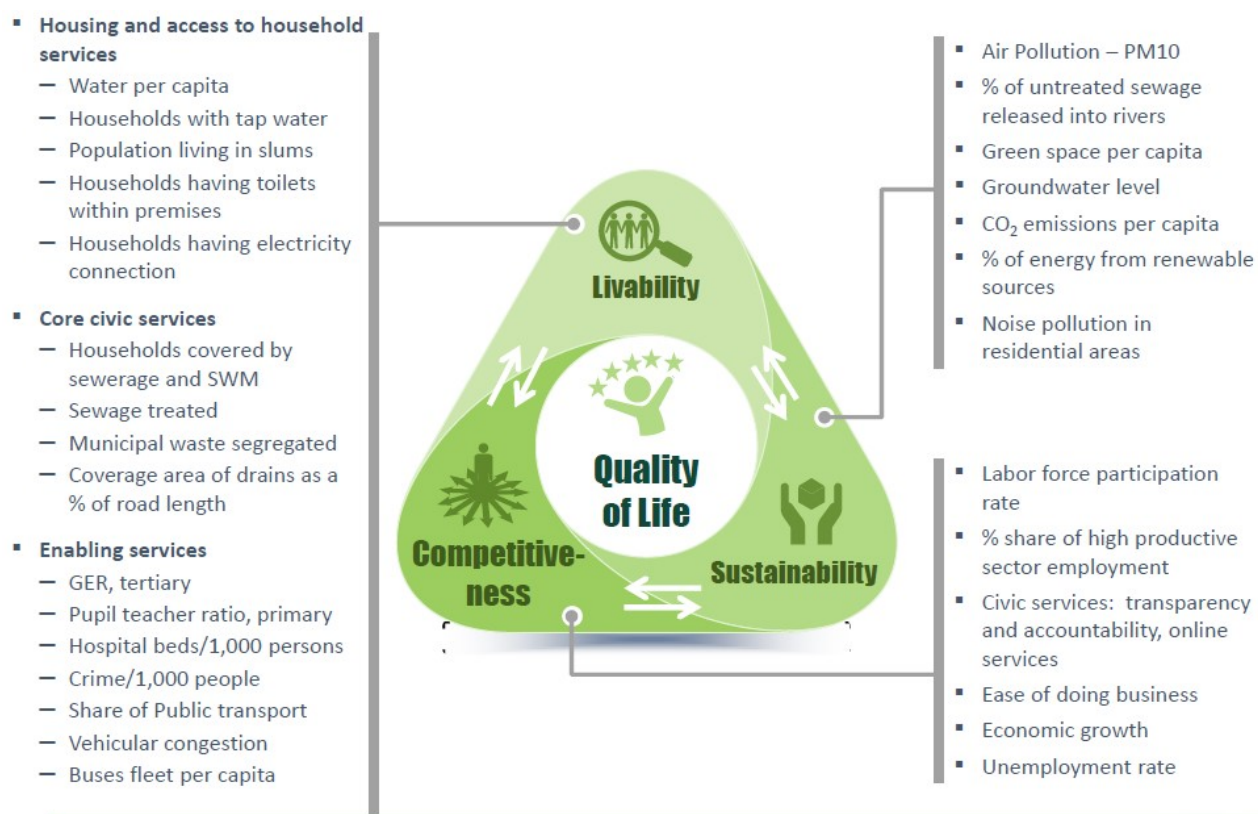
[[<http://smartcities.gov.in/content/innerpage/cities-profile-of-20-smart-cities.php>]]

PUNE CITY PROFILE



<http://indianexpress.com/article/india/india-news-india/smart-cities-first-20-moving-towards-a-concrete-plan-2811576/>

The Smart City proposal by the city of Pune won the second position in the India Smart Cities Challenge, with the theme of improving the quality of life of the citizens by addressing competitiveness, livability and sustainability. Pune has strategized the Smart City initiatives to include a macro and micro scaled scheme to address its ‘Quality Of Life’ vision. The macro project includes citywide SMART solutions with a focus on mobility & water supply, while the micro project focuses on area based development of the Aundh-Baner-Balewadi (ABB) district. With the aspiration to become the most “livable City in India by solving its core infrastructure issues in a ‘future proof’ way and by making its neighborhoods beautiful, clean, green and livable,” [[<http://www.punesmartcity.in/>]]



Pune towards Smart City, July 29, 2015, Final Presentation

The focus areas based on the vision include -

- Creating an extensive citizen engagement scheme with nine different phases to capture more than 50% of the city's households.
- Emphasis on 'More with Less' solutions which have a high impact on quality of facility and infrastructure but are less investment exhaustive
- Financially self-sustainable infrastructure projects with low dependency on State or Central funds
- Employing low-cost ICT solutions to improve quality of infrastructure
- Focus on implementation, viability and impact to ensure efficacy of solutions

The smart city initiatives structured around phased approach of citizen engagement. The citywide process included the following phases -

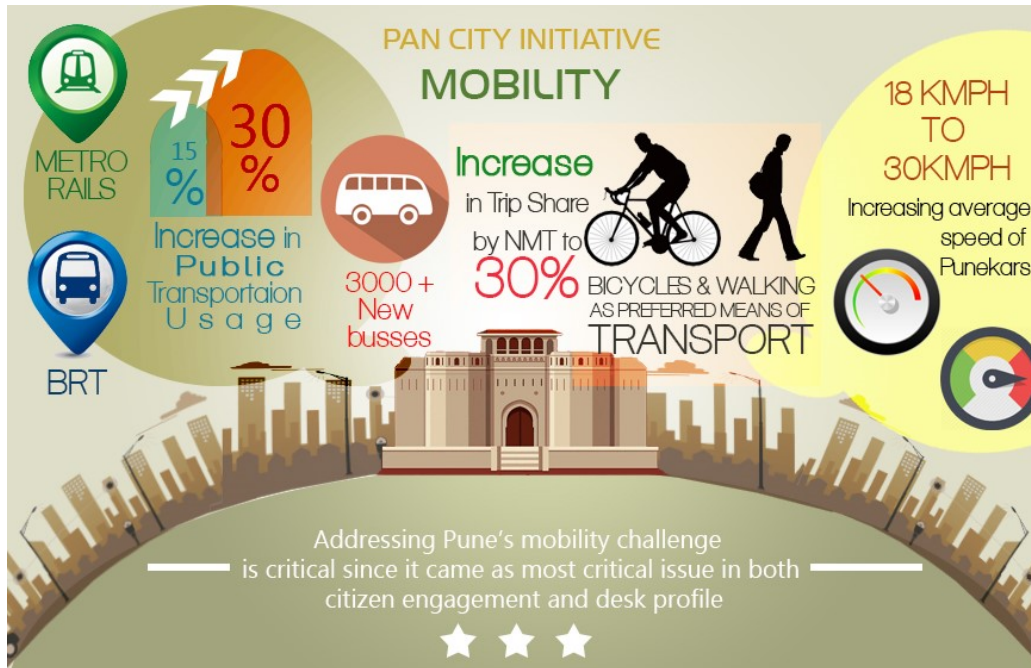
- Envision - create a vision for the city by identifying the top issues
- Diagnose - identify goals within priority sectors
- Co-create – produce specific solutions for prioritized goals
- Refine - improve the project identification with citizens' inputs in mini-labs
- Share – produce a final set of solutions for feedback

The Local Area Development structured around a four-phase approach that included exploring issues, collaborating with citizens through public representatives, learning and gaining feedback; and designing.

The local development expanse identified was the Aundh-Baner-Balewadi (ABB) area. With a total investment of Rs. 2,000 crore over the next five years, the Aundh-Baner-

Balewadi(ABB) area under the Smart City Program (SCP) is aimed at transforming ‘livability across all dimensions so that it is in line with best-in-class global cities. Kunal Kumar, commissioner of the Pune Municipal Corporation & director of Pune Smart City Development Corporation asserts that the transformation would support a population growth from 40,000 to 150,000 by 2030 in the area. [[<http://www.punesmartcity.in/>]] The 1,000-acre Aundh-Baner development is based primarily on the city improvement (retrofitting) aspect of urban renewal as per the smart city scope. Pune PMC envisions ABB to be a model ‘neighborhood of livability and sustainability matching global standards’ in the selected local area.

ABB mobility related goals aims to increase public transit ridership from 18 to 50 percent, through the deployment of 100 e-buses and e-rickshaws , a 26 km BRT route and 54 bus stop overhauls. The project also intends to add a 27 km bicycle track network and 60 km footpath redesign. To support economic growth and development, ABB ambitions to revive 3.5 kilometers of the riverfront with walking promenade, recreation zone and entertainment zone. The area has a defined 8-acre start-up zone and 36acres of designated commercial space to create around 45,000 jobs by 2030 to promote mixed-use development and walkability. [[<http://www.punesmartcity.in/>]] Smart infrastructure in the area would include seamless Wi-Fi connectivity, ABB-Pune Smart “DigiTel” Card for a connected community, intelligent operations center with integrated data across utilities, transport and public safety and a citizen web application. A feature included is the Digital Special Purpose Vehicle (SPV) to improve SPV functioning with Geo enabled city operations and a comprehensive ABB online portal across all departments.



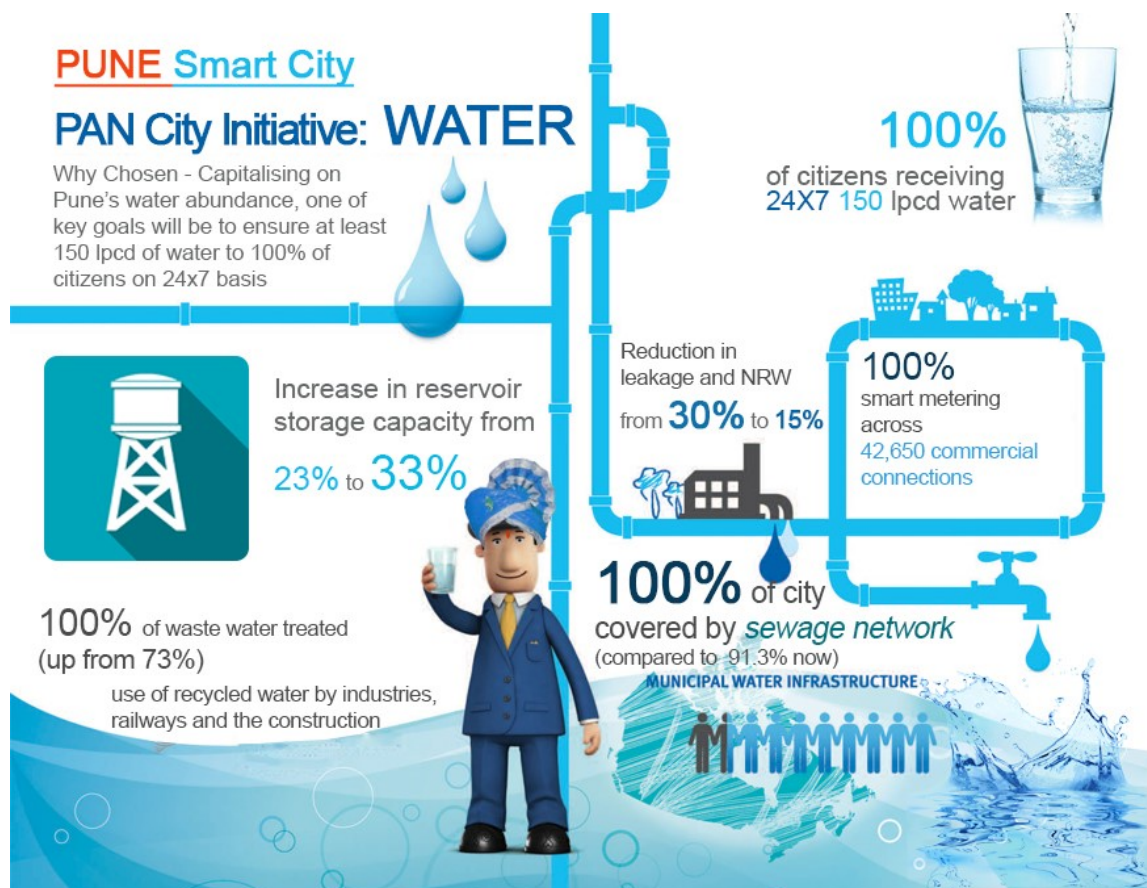
<http://www.punesmartcity.in/wp-content/uploads/internal/mobility.jpg>

On the social front, ABB aims to be a slum-free region through redevelopment of 500 slum households and pioneer socio-economic transformation of slums by focusing on four concerns – sanitation, healthcare, education and skill building. Smart streetlights with 85% LED lamps to improve energy savings by 30 percent, air pollution sensors, panic button, Wi-Fi access points and CCTV surveillance cameras are included in the project. An important component of the project includes installing solar rooftops to cover 15 percent of energy requirements. [http://www.punesmartcity.in/]

Citywide service spectrum initiatives focus on two primary aspects – mobility and water efficiency. The Smart Pune Public Transport System envisions improving availability, reliability and passenger comfort, with real-time tracking; and CCTV surveillance and panic buttons to improve security. Public information systems (PIS) and LED screens depicting estimated time of arrival and bus routes, along with mobile applications and website providing real-time

information are included. The Smart Pune Traffic Management System focuses at reducing congestion in the city by incorporating the use of adaptive traffic signals and pedestrian activated HAWK signals. The city proposal also included smart parking, intelligent road asset management and mobile applications and online portal with live and forecasted traffic.

To address water scarcity issues in the city, the plan proposes bulk metering of water usage, with 100 percent smart metering across 42,650 commercial connections. A 24x7 water supply to the city and developing an ICT based solution to address 37,000 grievances annually is the focus of the proposal. [<http://www.punesmartcity.in/>] Another important area of focus under the initiative is to significantly increase the use of solar power, especially rooftop solar PV (RTPV) within the city.



[<http://www.punesmartcity.in/>]

Under the Smart City Mission for implementation of Smart City Projects in Pune, the city created the Pune Smart City Development Corporation Ltd (PSCDCL) as the Special Purpose Vehicle. (SPV) The structure includes the Smart Cities Mission governing body as its apex, with a Chief Vigilante Officer, CVO to ensure propriety in the organization and functionality of the organization. A Public Relations Officer is crucial to this structure and his efforts direct towards improving and increasing citizen interactions. The General Consultants are designated to support PSCDCL through a variety of activities and play a critical role in innovatively structuring and raising finance from the market to bridge the funding gap in the project. Unlike other cities, the Pune SPV is citizen centric and therefore transparency is of paramount importance to the organization.

FISCAL PLAN – Major Infrastructure Projects for next 5 years (2016-20)

S. No.	Sector/Project	Cost (Rs. In Cr.)
1	PUNE METRO PROJECT	12 500
2	Pune BRTS	300
3	NMT	525
4	HCMTR	5000
5	Slum Housing	2500
6	Water Supply – 24X7	2800
7	Water Supply- River Conservation	1000
8	River Front Development	1000
9	Solid Waste Management	500
10	Smart Cities Mission	3000
11	Other Projects – Water & Sewage and SWD Sector	1895
	Total Capex Required	31020



Framework Analysis–

This section of the paper uses Rudolf Giffinger’s six most-common indicators of smart cities, Soumaya Ben Letaifa’s SMART model and Sotiris Zygiaris’s Smart City Reference Model to analyze the case study cities and compare the structures, frameworks and guidelines to the two smart cities selected under the Smart Cities Mission, India.

1. Rudolf Giffinger’s Six Most-Common Indicators of Smart Cities –

Rudolf Giffinger identifies a Smart City, as one that performs on the six characteristics – smart economy, smart people, smart living, smart governance, smart mobility, and smart environment. While all four cities have developments in the smart city category, the city of Pune has no proposal under the smart people category, a consequence of the increased presence of existent educational institutions in the city. The cities have distributed proposals over all other categories; however, under the Smart Living category; Barcelona and Tel Aviv have no specific proposals. [Giffinger, et al., 2007]

RUDOLF GIFFINGER’S SIX MOST-COMMON INDICATORS OF SMART CITIES				
	Barcelona	Tel Aviv	Bhubaneswar	Pune
Smart Economy	22@Barcelona - city innovation district, industrial dynamics amid co-localized companies to encourage collaboration & innovation, strategic economic fields used – clusters -	High-tech & startups as focus for business development - lower city taxes, running several co-working spaces, special work visas for international entrepreneurs	Transform BTCD into a CBD comprising financial, business, culture & service institutions, with ancillary facilities, infrastructure, & flexible mobility options	8 acre start-up zone and 36 acres of commercial space to create 45,000+ jobs by 2030 in the ABB district

	urban living laboratory to test new technological solutions			
Smart People	Alliances between research centers, universities, private & public partners	Entrepreneurship as Policy— Building the Smart City from the Bottom Up	Modern Education Facility provision	-
Smart Governance	Data sharing with a small number of agencies & various central government departments, open data platforms for transparency, low efforts on civic engagement	IOCC - agents of many different entities manage the city in emergencies, mobile application, social media, municipal website	Citizen Connect Initiative - competitions, ward meetings, seminars & street plays	Create an interconnected ABB with a suite of citizen services/ e-governance on top of it (ABB card, e-ABB customer services, 911 emergency, pan-area Wi-Fi connectivity)
Smart Mobility	Extensive use of sensors & traffic calming, mobile applications for transit & parking, Bicing service - bicycle sharing platform	Integrated traffic control center, Avivim, applications for transit & parking, Bicing service - bicycle sharing platform	Multimodal Integration- Integrated bus terminal and railway station NMT Zones- Pedestrian friendly roadways Complete Streets NMT Network- Dedicated, continuous pedestrian and cycle network Public Bike Share Scheme IPT & Rickshaw Management	Smart Pune Public Transport System to improve availability, reliability and passenger comfort, 26 km BRT route, 54 bus stop overhaul and 100 e-rickshaws; take NMT to 8% from 1% through 27 km bicycle tracks, 60 km footpath redesign and placemaking

Smart Environment	low emissions zones, restrictions on polluting vehicles, smart waste bins, remotely sensing & controlling water irrigation, smart lighting	public irrigation operations center - conserving public irrigation water, remotely controlled in real time and oversees garden sprinklers, Pollution monitor stations, reduced lighting in public spaces starting at 10:30 PM, LED program	LED Street lighting Project Solar Roof Tops Waste Recycle Centres Sewerage Treatment System Water Recycling System Integrated Water Management Initiatives	Smart grid in ABB for 100% power supply and 3% reduction in AT&C losses Solar roof tops to contribute 15% of energy requirements, smart bulk metering, use of solar power, especially rooftop solar PV (RTPV) within the city
Smart Living	Lack of City Wide Initiatives - too many test beds	Urban experience as a tool for urban development	4 Slum Redevelopment Projects Public Art Installations Safety: Community Policing "AMA Police" Modern Education Facility Women & Child Health Care Health Care Centre	Make ABB region slum-free by redevelopment of 500 slum households Drive socio-economic transformation of slums by focusing on 4 problem areas – sanitation, healthcare, education and skill building

Jeena Zahra

2. Soumaya Ben Letaifa's SMART Model

As outlined before, the SMART framework has three strategic levels: macro, mezzo and micro. While Barcelona scaled its projects on a macro and micro level, Tel Aviv, Bhubaneswar and Pune have macro, micro and mezzo-scaled schemes. Under this framework, all four cities have covered each of the category relatively well. [Letaifa, 2015]

SOUMAYA BEN LETAIFA'S SMART MODEL				
	Barcelona	Tel Aviv	Bhubaneswar	Pune
Scale	Macro & micro	Macro, mezzo & micro	Macro, mezzo & micro	Macro, mezzo & micro
Strategy	Design a single strategy - formation of a dedicated department in the government, area urban habitat	Citymaking as a concept with a focus on direct resident-oriented services; Designation of a chief knowledge officer & chief information officer	Proposal focus on city planning and smart growth techniques and incorporating ICT in the planning fabric	"Five-s" principle: Speed, scale, structure, solution identification, social audit
Multidisciplinarity	Urban habitat department - formed by stakeholders from the different sectors - involved in smart city initiatives	Unique bottom-up approach: high-tech companies, startups, & creative industries as focus; Digi-Tel citizen engagement platform	Participatory decision-making, citizen connect initiative - competitions, ward meetings, seminars & street plays	Extensive citizen engagement scheme with nine different phases to capture more than 50% of the city's households
Appropriation	Citizen involvement & further co-creation processes are not directly present in the majority of Barcelona's smart city projects - future focus with citizens at center	Mobile application, social media interaction, municipal website, consultation platform for community engagement	Stakeholders to include local youths, technical experts, representatives of residents welfare association, tax payers association / NGO's or Mahila Mandali	Participatory governance, public private partnerships - Pune city connect, consisting of citizens, corporates, NGOs to plan and scale up activities
Roadmap	Reconstruction & analysis of strategic framework – approach, identify & select fields of action, activate the	VP planning & chief information officer [oversee strategic process], chief knowledge officer - build the datasets, IOCC - agents of many different	Interdepartmental task force consisting of parastatal bodies, urban local body (ULB), urban development authorities (UDAs)	War room/ delivery unit - visual operations control center (or war room) with weekly/monthly

	implementation team and start the development of projects	entities manage the city in emergencies	and other government agencies	dash-boards and updates to the honorable chief minister & and various ministries
Transformative	Strong physical internet structure - build out individual IoT systems - large-scale execution of sensors, actuators & other technologies	IOCC framework, free public Wi-Fi, security; Digi-Tel citizen engagement platform, focus on start-ups	Retrofitting & redevelopment, 7 'smart city pillars' to align the citizen's aspirations	'More with less' solutions, city funding using own sources, self-sustainable infrastructure, retrofitting

3. **Sotiris Zygiaris's Smart City Reference Model**

While Giffinger's model focused on 'Quality of Life' improvement as a measuring tool, Zygaris measured smart cities based on the information and communication technology deployment in the city. In this respect, although the Indian cities have a focus on integrating digital platforms into the urban infrastructure, a large portion of the proposal focuses on smart growth tools rather than expensive smart grid and network deployment.

SOTIRIS ZYGIARIS'S SMART CITY REFERENCE MODEL				
	Barcelona	Tel Aviv	Bhubaneshwar	Pune
The City	City-wide reforms with an integrated planning approach, combining various underlying plans into a comprehensive city renewal approach	Municipal policies executed at the regional level by central government offices & at the municipal level, vibrant high-tech & startup ecosystem; unstable political & security situation	Only Tier-2 city in the country to host the top five Indian IT companies, German architect Otto Königsberger planned the city in 1946	Cultural capital of Maharashtra, second biggest software hub in the country, HQ of the Indian Air Force and military training base, 811 colleges in the city & more than 400 start-ups
The Green City Layer	Setting up low emissions zones, restrictions on the most polluting vehicles	Public irrigation operations center - irrigation remotely controlled in real time & oversees garden sprinklers, Pollution-monitoring stations	LED Street lighting Project, Solar Roof Tops, Waste Recycle Centers, Sewerage Treatment System, Water Recycling System, Integrated Water Management Initiatives	Smart street lights with 85% LED lamps, Smart grid in ABB for 100% power supply, Solar roof tops, 100% smart water metering
The Interconnection Layer	Strong physical internet structure - 500 kilometers of fiber optic cable - provided 90% fiber-to-the-home (FTTH) coverage, Wi-Fi service allows residents and visitors to connect	Free public Wi-Fi, city GIS system	Focus on city planning and smart growth techniques and incorporating ICT in the planning fabric	Focus on low-cost Information-Communication & Technology (ICT)
The Instrumentation Layer	Individual IoT systems - large scale	Municipal IOOC - Extensive camera	Sensors & real time data tracking for	Seamless Wi-Fi connectivity at 1Mbps+ speed

	implementation of sensors, actuators & other technologies	surveillance system, citywide alarm system,	transit & parking	with 100+ access points for 10,000 concurrent logins in ABB area
The Open Integration Layer	2 platforms: OpenDataBCN - access to large collection of data from various field, Transparencia - transparency in all on-going projects of the Barcelona City Council	Computing & information systems - data sharing with a small number of agencies & various central government departments	-	Intelligent operations center with integrated data across utilities, transport and public safety
The Application Layer	Use of various information sources provided by the open data platforms; bus stops equipped with technological services such as QR codes to download transit apps, interactive screens and USB ports	Integrated traffic control center – oversee traffic flow & solve immediate issues – uses automated system, Avivim - application to allow drivers to pay for municipal parking; iView GIS and through mobile applications	Parking availability data, Parking mobile applications, Fleet tracking, Depot management, Bus scheduling, Public Information Systems	Smart parking across with PIS and real-time mobile app, Traffic mobile apps and online portal with live and forecasted traffic
The Innovation Layer	Less focus on capital attractiveness, opportunities for social collaboration - Barcelona Activa - economic development tool	High-tech companies, startups, & creative industries priority for business - efforts - lower city taxes, several co-work spaces for & special work visas	Proposal focus on city planning and smart growth techniques and incorporating ICT in the planning fabric	Focus on low-cost Information-Communication & Technology (ICT) based solutions to improve quality of infrastructure.

Smart Cities and Economic Development –

“Economic development is defined as the expansion of capacities that contribute to the advancement of society through the realization of individuals’, firms’, and communities’ potential. It is the means to achieve sustained increases in prosperity and quality of life realized through innovation, lowered transaction costs, and the utilization of capabilities toward the responsible production and diffusion of goods and services.” [Feldman et. al, 2016] Economic development is the endeavor that develops capacities to comprehend the potential of communities that contribute to the advancement of society, addressing growth, prosperity and advanced quality of life. A main goal of smart cities is to promote economic growth and development. Realizing these goals through sustained innovation, receptive regulation, improved infrastructure, and increased literacy by appreciating the role of government as a “vehicle for collective action, and not simply a corrective against market failure, can we ensure our economic future.” [Feldman et. al, 2016]

Leigh and Blakely in their book, Planning Local Economic Development, identify four key goals for economic development strategy. These goals include -

- Provision of quality employment for the current population
- Attaining local economic stability – for economic development to be successful, the community must have a support system to meet all needs of commerce (land, finance, labor, infrastructure, and technical assistance)
- Shaping a diverse economic and occupation base to provide continuing employment to the residents
- Promoting local sustainability by considering impacts of industries on environment

Based on the four components of local economic development, locality, economic base, employment and community resources, the authors demonstrate a shift in the concepts. These concepts are identified in the table below.

COMPONENT	OLD CONCEPT	NEW CONCEPT
Locality	Physical location (near natural resources, transportation, markets) enhance economic options	Quality of environment and strong community capacity multiply natural advantages for economic growth
Business and economic base	Export base industries and firms create jobs and stimulate increased local business	Clusters of competitive industries linked in a regional network of all types of firms create new growth and income
Employment resources	More firms create more jobs, even if many are minimum wage	Comprehensive skill development and technological innovation lead to quality jobs and higher wages
Community resources	Single purpose organizations can enhance economic opportunities in community	Collaborative partnerships of many community groups are need to establish a broad foundation for competitive industries

[Leigh and Blakely, 2013]

Additionally, the authors highlight the shift of economic growth towards a knowledge-based economy, where quality of jobs and community capacity hold precedence. The four strategic approaches to economic development identified by the authors include—

- Locality or physical development
- Business development
- Human resource development
- Community based development

Location or physical development as a local economic development tool aims at ‘place making’ and creating a sense of identity by improving community services and amenities to increase livability. The efforts aim at improving attractiveness with smart growth and effective city planning strategies to increase local business and advance quality of life. Leigh and Blakely identify community and business development as an amalgamated tool used “to mobilize essential community resources for the generation of shared wealth, both in terms of individual and collective well-being and in terms of a stronger set of economic institutions that can compete both locally and globally.” [Leigh and Blakely, page 265, 2013]

While cities must focus on refining their current service delivery capabilities by improving their core urban systems – transport, public safety, government services, education and health and making them “smarter,” citizen inclusiveness must be considered crucial to the process. The UN Habitat: Promoting Local Economic Development through Strategic Planning document defines local economic development as a “participatory process in which local people from all sectors work together to stimulate local commercial activity, resulting in a resilient and sustainable economy. It is a way to help create decent jobs and improve the quality of life for everyone, including the poor and marginalized.” [UN Habitat] As city agencies strive to capture economic competitiveness and growth, strategic use of technology and mainstreaming of smart cities aims to create unprecedented opportunities for civic leaders to improve quality of life through cost effective initiatives in the areas of economic development, civic engagement and digital inclusion.

Challenges –

In ‘Technocratic Values and Uneven Development in the “Smart City,” Shelton & Clark focus on the ‘inequity and socio-spatial fragmentation’ that can be caused by smart city initiatives, creating more physical and social problems than they solve. While there is a focus on ‘corporate dominated visioning’ rather than the physical and social visioning of creating ‘smart cities,’ the size, scale and infrastructure of smart cities are in question. [Shelton & Clark, 2016] Many city governments focus on creating Tech Hubs and IT Parks that act as pseudo ‘smart cities,’ are much smaller in scale, and although they are exemplary models of efficiency, they create social and physical divisions in the broader city. However, whether these are project specific efforts, and creation of test beds to identify suitability and acceptability of programs, addressing issues of equitable conditions, remains a question of concern. Shelton and Clark emphasize that the ‘vision of the smart city promoted by a district-centric implementation remains one of significant socio-spatial fragmentation and differentiation.’

The paper, “Current trends in Smart City initiatives: Some stylized facts”, Neirotti, et al., (2014) highlight three key issues with the smart cities framework. Economic and physical aspects that influence the way cities blueprint their ‘smartness’ is the first issue. This means those wealthier cities and “those with more ‘open’ democracies exhibit higher investments in fields that are related to the development of innovative capabilities.” [Neirotti, et al., 2014] In addition, cities focus more on infrastructural domains of communities rather than on improving human capacities, capital, legacy, and improvement. The second issue is concerned with geographies of innovation, where technologies and systems do not disperse easily among cities across the globe and where ‘exportation of best practices’ does not come about. Scoping the

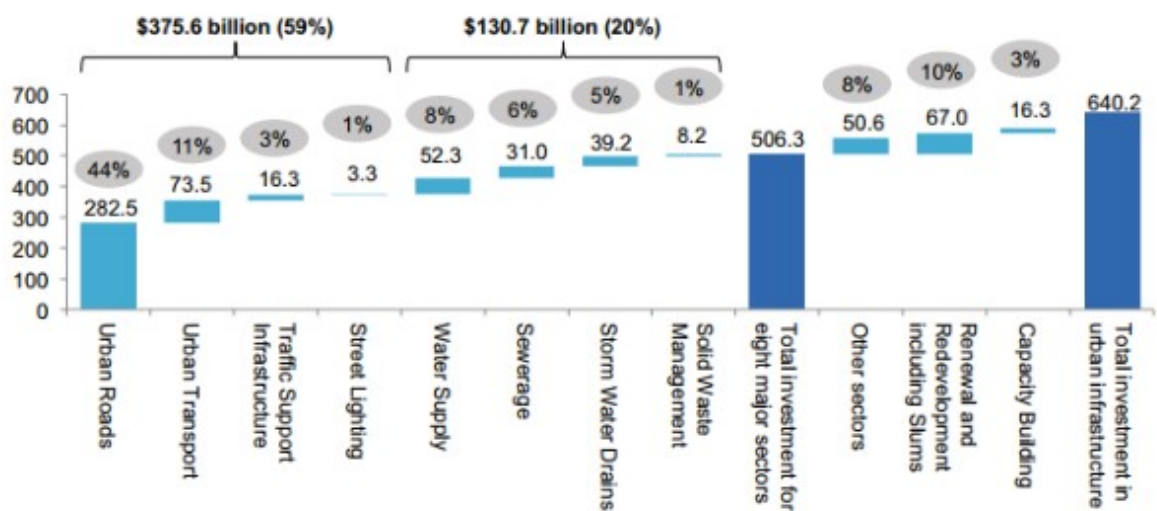
scale of smart city policies where initiatives do not correlate to the size of the city is a challenge. This means that smaller cities represent a good “ecosystem” to commence digitalization and smart initiatives, while large cities face more significant problems that entail attracting technology vendors to a ‘larger potential market of more educated citizens.’ [Neirotti et. al]

Having recognized that cities are the engines of growth and aiming to promote cities that provide core infrastructure and offer quality of life to citizens, the Smart Cities Mission has its own challenges to face. These challenges include –

- Retrofitting urban infrastructure – identifying lacking existing city infrastructure and integration of isolated systems to achieve citywide efficiencies can be a significant challenge.

URBAN INFRASTRUCTURE REQUIREMENT TO MAINTAIN ECONOMIC

GROWTH 2012 - 2031

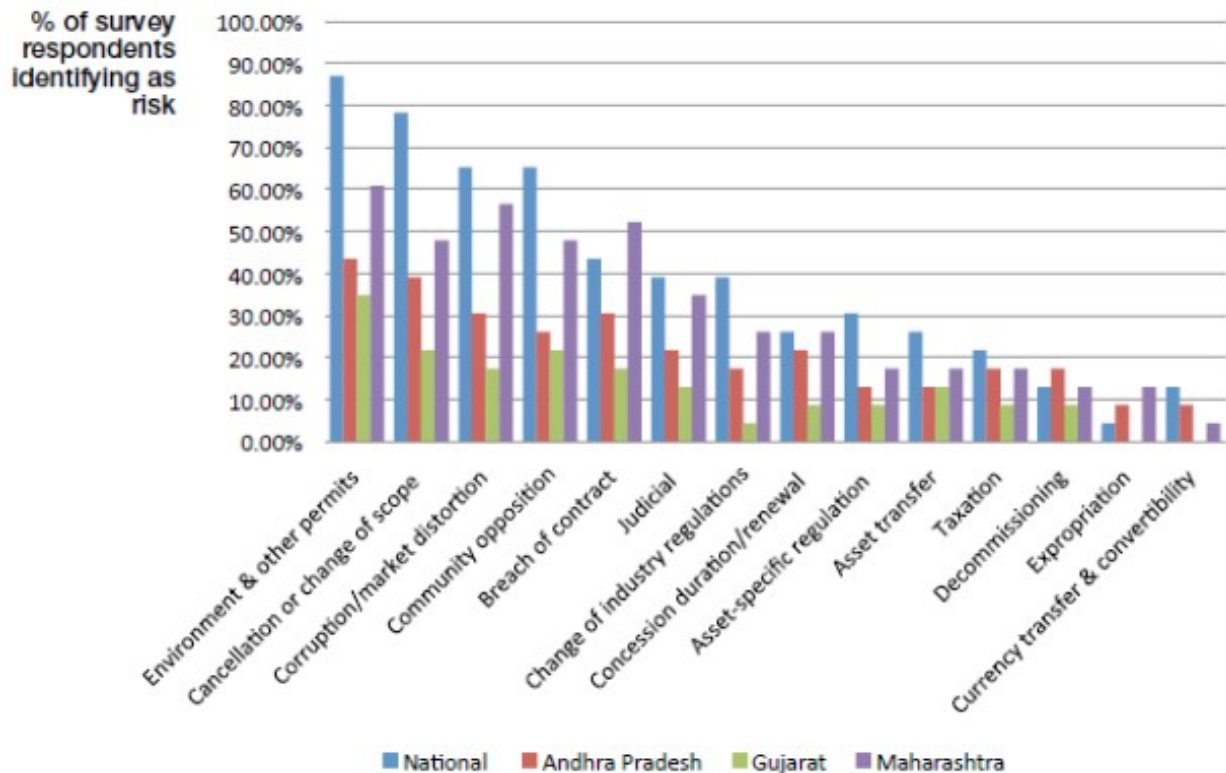


<https://www.wetorum.org/agenda/2016/04/india-wants-to-create-100-smart-cities-how-can-it-get-there/>

- Financing mechanisms – the annual cost assessed by the High Power Expert Committee (HPEC) on Investment Estimates in Urban Infrastructure, estimates a requirement of 35,000

crore rupees. [542.5 million U.S dollars] While cities are looking into private public partnerships, and allowing foreign city funding, the investment amount is large and getting continual funding is a challenge.

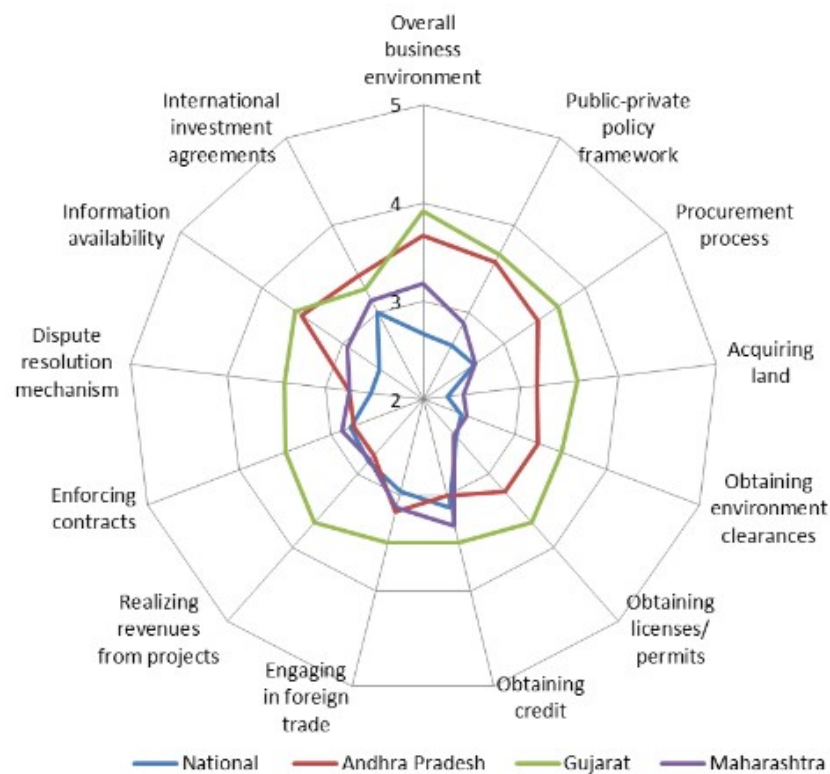
MOST SIGNIFICANT RISKS IN PUBIC PRIVATE PARTNERSHIPS IN INDIA



<https://www.weforum.org/agenda/2016/04/india-wants-to-create-100-smart-cities-how-can-it-get-there/>

- Capacity building – with only 5 per cent of the central allocation for skill development and capacity building that focus on research and development, training, creating a knowledge pool, the implementation of smart city initiatives in India is a challenge.
- Incentivizing area developments – the central government has incentivized small area developments under the smart city proposals. Although considered an effective economic development strategy, the mission lacks citywide initiatives that promote growth and development.

- Institutional challenges – Urban Local Bodies (ULBs) play a critical role in executing the Smart Cities Mission, but they lack supporting resources. The World Economic Forum survey highlighted that ULBs are the least prepared to execute the mission, with the lack of empowered leadership, inadequate institutional capacity, inadequate revenues, a lack of collaboration between multiple planning and administration bodies.



<https://www.weforum.org/agenda/2016/04/india-wants-to-create-100-smart-cities-how-can-it-get-there/>

- Detached mission proposals – the mission fails to account for the convergence of multiple policies for urban India: the Swachh Bharat Mission, Housing for All, National Urban Livelihoods Mission, the National Urban Information System. The Smart Cities Mission proposals do not highlight how they intend to converge with all these schemes.

Recommendations –

Many cities in developed and developing countries are pioneering smart city ecosystems and creating efficient urban spaces infused with technology. Learning from the case studies, some recommendations for the Smart Cities Mission identified include –

- Recognize infrastructure gaps and prioritize city needs and facilities – taking inspiration from Barcelona that identified significant areas for improvement and then devised programs to confront these. “There are some cities who have already improved a lot in sustainability or mobility, but Barcelona has a balance between sustainability, energy and developing technology platforms in order to connect all the information around the city,” states Pilar Conesa, founder of the innovation consultancy Anteverti, as well as the annual Smart City Expo in Barcelona. Cities must not just concentrate on improving a single area, but must create a balance between all urban infrastructure systems. [[Devex, 2017]]
- Invest in development and implementing a modular, robust data infrastructure as a way to enable smart city applications.
- Start with implementing specific, lean projects in areas with pressing needs, measure success, and move on to the next project, earning the trust of the stakeholders in the process.
- Foresightedness is essential – achieving a balance in urban infrastructure systems requires planning ahead of time. India is in many ways replicating this idea. “It’s not only about the next step and where the next wave of cities are going, [and] it’s not about finding out what the city needs to do today — that’s a journey they have already started. It’s what they need to

be doing for tomorrow [that's important]." – MunishKhetrapal, Managing Director - Smart Cities and IOT, Cisco Systems. [[Devex, 2017]]

- Civic involvement and inclusion is vital – keeping residents informed in the process and focusing on a collaborative approach is significant in the conceptualizing and implementing process. "Local governments have to look at people and place at the same time, this is our main aim — how we develop or urbanize to make sure this is for the well-being of the people living there." Josep Roig, secretary general of United Cities and Local Governments [[Devex, 2017]]
- Consider the contextual importance of cities – local significance is crucial, for replication of technologies and concepts implemented in one city might be unsuitable in other cities, with varying geographical and cultural contexts. Cisco's Khetrapal states, "in a smart city it's not just about technology, it's about understanding what culture is there — what works well in one city doesn't necessarily translate to another." [[Devex, 2017]]
- Maintain local relationships - the relationship between the municipality and local industries to incentivize business activity and create sustainable solutions is of importance in smart city ecosystem creation.
- Balance area specific and citywide schemes – while specific area development initiatives as an economic development tool is crucial in the success of a smart city, large-scale city wide initiatives must be taken into consideration.

- Invest in a knowledge economy – Barcelona and Tel Aviv’s success lay in its fostering of startup companies, central business district, co-working spaces and integration of universities and research institutes in the process.

Conclusion –

Smart cities need to be efficient but also preserve opportunities for spontaneity, serendipity, and sociability. Crang and Graham, in their article *Sentient Cities: Ambient Intelligence and the Politics of Urban Space* talk about public and personal spaces being defined by communication, information, and digitalization, ‘where we not only think of cities but cities think of us, where the environment reflexively monitors our behavior.’ [Crang & Graham, 2007] Although the Townsend article talks about how the linking of humanity to the global mobile web has made us a ‘minority online’, we must account for data which needs to be ‘secure, but not at the risk of becoming surveillance chambers’. [Townsend, 2013] How governance should be focused on policies that foster innovation whilst maintaining security and safety of data and how much data would be sufficient to make our lives smart is a question in concern. How smart cities can act as drivers of economic growth whilst maintaining equity and protecting the ecology of a city is also of crucial importance and must be explored further. How must policy diffusion occur in the case of smart cities and to what scale should the “smartness” of a “Smart City” be restricted must be delved into more by planners and agencies? Also when looking at “Smart Cities,” should we be looking past data and more toward processes and planning and can a city be smart without the technology is a subject to be addressed. While addressing issues of economic growth and equity one key issue to be addressed is if cities should join the smart cities initiative just for the buzz and branding, or should they rather focus on investing in social programs.

References -

1. /. (2017, March 27). 5 lessons for cities on the cusp of a smart revolution. Retrieved May 04, 2017, from <https://www.devex.com/news/5-lessons-for-cities-on-the-cusp-of-a-smart-revolution-89452>
2. Adler, L. (2016, February 18). How Smart City Barcelona Brought the Internet of Things to Life. Retrieved March 04, 2017, from <http://datasmart.ash.harvard.edu/news/article/how-smart-city-barcelona-brought-the-internet-of-things-to-life-789>
3. Batty, M. (2013). Big data, smart cities and city planning. *Dialogues in Human Geography*, 3(3), 274-279. doi:10.1177/2043820613413390
4. Bhubaneswar Development Plan Area . (n.d.). Retrieved May 4, 2017, from http://www.bing.com/cr?IG=64B2A0911A2C4779B21FD3E9BE14F1E0&CID=0597EE20F02665EF23CBE458F1B66445&rd=1&h=qFJbsUVMxoyoFJR-Ix1lRxAZOKBOJWd_owh5m5jIJZw&v=1&r=http%3a%2f%2fwww.orissalinks.com%2fbigfiles%2fDraft%2520Proposal_CDP%2520BDPA-2008%2fPre%2520Content%2fPreface.pdf&p=DevEx,5038.1
5. BHUBANESWAR SMART CITY PROPOSAL. (2015, December). Retrieved from <http://www.inawe.in/wp-content/uploads/2016/04/Draft-Smart-Cities-Proposal-Bhubaneswar1.pdf>
6. Bhubaneswar Smart City races ahead by appointing two consultants. (n.d.). Retrieved May 04, 2017, from <http://india.smartcitiescouncil.com/article/bhubaneswar-smart-city-races-ahead-appointing-two-consultants>
7. Blakely, E. J., & Leigh, N. G. (2013). *Planning local economic development theory and practice*. Thousand Oaks, CA: SAGE.

8. Bloomberg Philanthropies Partners with the Government of India to Encourage Smarter Urban Development that Improves People's Lives. (n.d.). Retrieved May 04, 2017, from <https://www.bloomberg.org/press/releases/bloomberg-philanthropies-partners-with-the-government-on-india-to-encourage-smarter-urban-development-that-improves-peoples-lives/>
9. Capdevila, I. and Zarlenga M.I., 2015. Smart City or smart citizens? The Barcelona case. *Journal of Strategy and Management* 8(3), 266-282
10. Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., . . . Scholl, H. J. (2012). Understanding Smart Cities: An Integrative Framework. *2012 45th Hawaii International Conference on System Sciences*. doi:10.1109/hicss.2012.615
11. Cities Profile of 20 Smart Cities. (n.d.). Retrieved May 04, 2017, from <http://smartcities.gov.in/content/innerpage/cities-profile-of-20-smart-cities.php>
12. Crang, M., & Graham, S. (2007). SENTIENT CITIES Ambient intelligence and the politics of urban space. *Information, Communication & Society*, 10(6), 789-817.
doi:10.1080/13691180701750991
13. Feldman, M., Hadjimichael, T., Lanahan, L., & Kemeny, T. (2016). The logic of economic development: a definition and model for investment. *Environment and Planning C: Government and Policy*, 34(1), 5-21. doi:10.1177/0263774x15614653
14. Florida, R. L. (2003). *The rise of the creative class: and how it's transforming work, leisure, community and everyday life*. New York, NY: Basic Books.
15. From Creative Spirit To Innovative Startups: What Makes Tel Aviv One Of The World's 'Techiest' Cities. (2015, December 19). Retrieved May 04, 2017, from <http://nocamels.com/2015/12/startup-high-tech-tel-aviv/>

16. Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., &Meijers, E.
(2007). Smart Cities: Ranking of European Medium-Sized Cities. Vienna, Austria: Centre of
Regional Science (SRF), Vienna University of Technology. Available from
17. http://www.smartcities.eu/download/smart_cities_final_report.pdf.
18. Hajer, M. (2003). Policy without polity? Policy analysis and the institutional void. Policy
Sciences, 36(2), 175–195. [Http://doi.org/10.1023/A:1024834510939](http://doi.org/10.1023/A:1024834510939)
19. Hall, R. E. (2000). The vision of a smart city, In Proceedings of the 2nd International Life
Extension Technology Workshop, Paris, France, September 28
20. <http://www.osti.gov/bridge/servlets/purl/773961oyxp82/webviewable/773961.pdf>.
21. Harrison, C., & Donnelly, I. A. (n.d.). A Theory of Smart Cities. Retrieved May 04, 2017,
from <http://journals.issn.org/index.php/proceedings55th/article/view/1703>
22. Letaifa, S. B. (2015). How to strategize smart cities: Revealing the SMART model. Journal
of Business Research, 68(7), 1414-1419. doi:10.1016/j.jbusres.2015.01.024
23. Madakam, S., & Ramachandran, R. (n.d.). Barcelona Smart City: The Heaven on
Earth(Internet of Things: Technological God)(Internet of Things: Technological Go.
doi:10.3969/j. issn.167355188.2015.04.001
24. Mora, PhD, Postdoctoral Research Fellow at Politecnico di Milano and Edinburgh Napier
University Follow, L. (2015, September 07). The development process of smart city
strategies: the case of Barcelo... Retrieved February, 2017, from
[https://www.slideshare.net/mora_luca/the-development-process-of-smart-city-strategies-the-
case-of-barcelona](https://www.slideshare.net/mora_luca/the-development-process-of-smart-city-strategies-the-case-of-barcelona)
25. Nam, T., & Pardo, T. A. (2011). Conceptualizing smart city with dimensions of technology,
people, and institutions. Proceedings of the 12th Annual International Digital Government

Research Conference on Digital Government Innovation in Challenging Times - dg.o '11.
doi:10.1145/2037556.2037602

26. Neirotti, P., Marco, A. D., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current trends in Smart City initiatives: Some stylised facts. *Cities*, 38, 25-36.
doi:10.1016/j.cities.2013.12.010
27. PCAST Releases Technology and the Future of Cities Report to the President. (n.d.). Retrieved May 04, 2017, from <https://obamawhitehouse.archives.gov/blog/2016/02/23/pcast-releases-technology-and-future-cities-report-president>
28. Pradhani, A. (2016, January 29). Bhubaneswar ranked country's smartest city - Times of India. Retrieved February, 2017, from <http://timesofindia.indiatimes.com/city/bhubaneswar/Bhubaneswar-ranked-countrys-smartest-city/articleshow/50766312.cms>
29. Padode, P. (n.d.). The top 10 implementation challenges for smart cities in India - RealtyCheck by Pratap Padode | ET RealEstate. Retrieved May 04, 2017, from <http://realty.economictimes.indiatimes.com/realty-check/the-top-10-implementation-challenges-for-smart-cities-in-india/776>
30. Pune Smart City. (n.d.). Retrieved May 04, 2017, from <http://www.punesmartcity.in/>
31. Sedghi, A.(1 September 2015). "TheGlobalFinancialCentres Index 18" (PDF). QFC. Retrieved 1 September 2015.
32. Singh, S. (2016, May 25). Smart Cities, First 20: Moving towards a concrete plan. Retrieved May 04, 2017, from <http://indianexpress.com/article/india/india-news-india/smart-cities-first-20-moving-towards-a-concrete-plan-2811576/>

33. Smart City Labs. (n.d.). Retrieved May 04, 2017, from <http://www.smartcitybhubaneswar.gov.in/>
34. Taylor Shelton and Jennifer Clark, (2016) “Technocratic Values and Uneven Development in the “Smart City,” Metropolitiques 10 May 2016. URL: <http://www.metropolitiques.eu/Technocratic-Values-and-Uneven.html>
35. Toch, E., & Feder, E. (2016). International Case Studies of Smart Cities: Tel Aviv, Israel. Inter American Development Bank. doi:10.18235/0000416
36. Townsend, A. M. (2013). Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia. WW Norton & Company.
37. What is Smart City. (n.d.). Retrieved November 04, 2016, from <http://smartcities.gov.in/content/innerpage/what-is-smart-city.php>
38. Written by Alice Charles, Community Lead, Infrastructure and Urban Development, World Economic Forum. (n.d.). India wants to create 100 'smart cities' - how can it get there? Retrieved May 04, 2017, from <https://www.weforum.org/agenda/2016/04/india-wants-to-create-100-smart-cities-how-can-it-get-there/>
39. Yaguang, S. (2011). Development and Characteristics of Central Business District Under the Philosophy of Health. Procedia Engineering, 21, 258-266. doi:10.1016/j.proeng.2011.11.2013