



WHITE PAPER ON SMART CITIES



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LIST OF ABBREVIATIONS

1. ICT	-	Information and Communication Technology
2. CO ₂	-	Carbon Dioxide
3. CCTV	-	Closed Circuit Television
4. UAV	-	Unmanned Aerial Vehicle
5. MHA	-	Ministry of Home Affairs
6. IOT	-	Internet of Things
7. GDP	-	Gross Domestic Product
8. AMI	-	Advanced Metering Infrastructure
9. PPP	-	Public-Private Partnership
10. QOL	-	Quality Of Life
11. CAGR	-	Compound Annual Growth Rate
12. RTA	-	Road and Transport Authority
13. ITS	-	Intelligent Transportations System
14. BRT	-	Bus Rapid Transit
15. PM	-	Particulate Matter
16. GIS	-	Geographical Information System
17. UK	-	United Kingdom
18. TSA	-	Telecare Service Association
19. CFL	-	Compact Fluorescent Lamps
20. ZAR	-	South African Rand (1 ZAR= 4.75 INR)
21. RFID	-	Radio Frequency Identification
22. US	-	United States
23. UAE	-	United Arab Emirates
24. NSA	-	National Security Agency
25. ABB	-	Asea Brown Boveri
26. NDA	-	National Democratic Alliance
27. UK	-	United Kingdom
28. SCM	-	Smart City Mission
29. SPV	-	Special Purpose Vehicle
30. LEP	-	Local Enterprise Partnership
31. ULB	-	Urban Local Bodies
32. DIT	-	Department of Information Technology

1. EXECUTIVE SUMMARY

The present report outlines the increase in urbanization in India which is leading to increased migration from rural to urban India which in turn is putting pressure on the city infrastructure.

The overall objective of the report was to identify the current developmental initiatives to be taken in India's urban space and to derive principles for planning an Indian smart and sustainable city. It is also focused towards various international practices followed regarding Smart Cities that may help implementation in India.

The concept of a 'Smart City' is a relatively new phenomenon in India. This report is a step towards synthesizing various aspects related to smart cities.

There are multiple ideas, definitions and approaches to smart cities. An analysis of international approaches and the underlying semantics related to smart cities reveals that the concept has only evolved partially. This includes non-clarity in definition, indicators and measures, and standardization of critical aspects. The current scenario indicates a critical need for defining and contextualizing the various aspects of smart city development.

The report places the Smart Cities Mission as an opportunity to:

- Create an efficient urban management system
- Push a decentralization agenda
- Reduce conflicts in the urban environment
- Create enabling conditions for inclusive and equitable urbanization.

As the report is concluded it helps you with the revenue growth that the Indian telecom operators can achieve after a circumspect view of the whole Smart City agenda.

There are various challenges faced by the technology providers to implement Smart Cities.

The cities looking for achieving the Smart City status must have a broad framework and plan to achieve it. There should be a vision with some basic principles which they should follow like *Integration, Pragmatism & Participation*.

Integration means instead of drawing up smart city plans from scratch and in isolation from other initiatives, city authorities benefit most when they integrate smart initiatives within their existing economic development and public service plans.

Pragmatism means cities should focus the bulk of investment on smart projects that are practical, achievable and financially viable.

Participation means smart projects should be undertaken in partnership with businesses, the community and other partners.

2. INTRODUCTION

2.1 Overview:

As India's population continues to grow, more citizens will move to cities. Experts predict that about 25-30 people will migrate every minute to major Indian cities from rural areas in search of better livelihood and better lifestyles. Due to increasing population, demands are also rising. Hence, India needs to find better solutions in order to acquire resources with low expense, increased efficiency and better quality of life.

BY 2026, INDIA WILL ADD UPTO 534 MILLION URBAN INHABITANTS

Figure 2.1: Growth of urbanization



Source: www.uhrc.in

For smart city we need smarter governance and for smart governance there should be a budget and plan finalized by the government. According to survey approximately investments of about USD 1.2 trillion will be required over the next 20 years across areas like transportation, energy and public security to build smart cities in India. Interest in Smart Cities has triggered plenty of theoretical and technology-led discussions, but not enough progress has been made in implementing related initiatives. In addition, there are a number of factors hindering adoption of Smart City solutions: scaling of newer technologies is unproven; technology challenges the existing status quo in how cities are run; and technology is not well-understood across city sectors. However, the main barrier to adopting such solutions is the complexity of how cities are operated, financed, regulated, and planned. For instance, city operations are multi-

dimensional and comprised of multiple stakeholders whose dependencies and interdependencies affect and ultimately determine the built environment.

Smart Cities, however, present an opportunity to integrate physical city infrastructures—from utilities, transportation, and real estate to city services. Some definitional boundaries are required to guide cities in the Mission. In the imagination of any city dweller in India, the picture of a Smart City contains a wish list of infrastructure and services that describes his or her level of aspiration. To provide for the aspirations and needs of the citizens, urban planners ideally aim at developing the entire urban eco-system, which is represented by the four pillars of comprehensive development — institutional, physical, social and economic infrastructure. This can be a long term goal and cities can work towards developing such comprehensive infrastructure incrementally, adding on layers of ‘smartness’.

In the approach to the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of ‘Smart’ Solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model which will act like a light house to other aspiring cities.

2.2 What is a Smart City?

There is no universally accepted definition of a Smart City. It means different things to different people. The conceptualization of Smart City, therefore, varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents. A Smart City would have a different connotation in India than, say, Europe. Even in India, there is no one way of defining a Smart City.

*A **smart city** uses digital technologies or information and communication technologies (ICT) to enhance quality and performance of urban services, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.* Sectors that have been developing smart city technology include government services, transport and traffic management, energy, health care, water and waste.

3. THE NEED FOR SMART CITY

We define a Smart City as a city which uses information and communication technologies so that it's critical infrastructure as well as its components and public services provided are more interactive, efficient and so that citizens can be made more aware of them.

Fig 3.1: Need for smart city

Area of Application	Savings
Irrigation of parks and gardens	savings of 15% of the water consumed
Refuse collection	25% savings in transport requirements depending on the type of waste
Traffic management	17% reduction in CO2 emissions into the atmosphere
Smart Metering	10% decrease in electric energy consumption and 7% in personal water consumption

Source: www.telefonica.com

The Smart City itself becomes a genuine digital platform that maximizes the economy, society, environment and welfare of cities and facilitates the shift towards more sustainable behavior among all stakeholders: users, companies and administration. It also seeks to maximize public budgets specifically owing to the improvement of the processes of the city themselves and its inhabitants. On the other hand, it enables new business models, thus constituting an excellent platform for innovation in their environment.

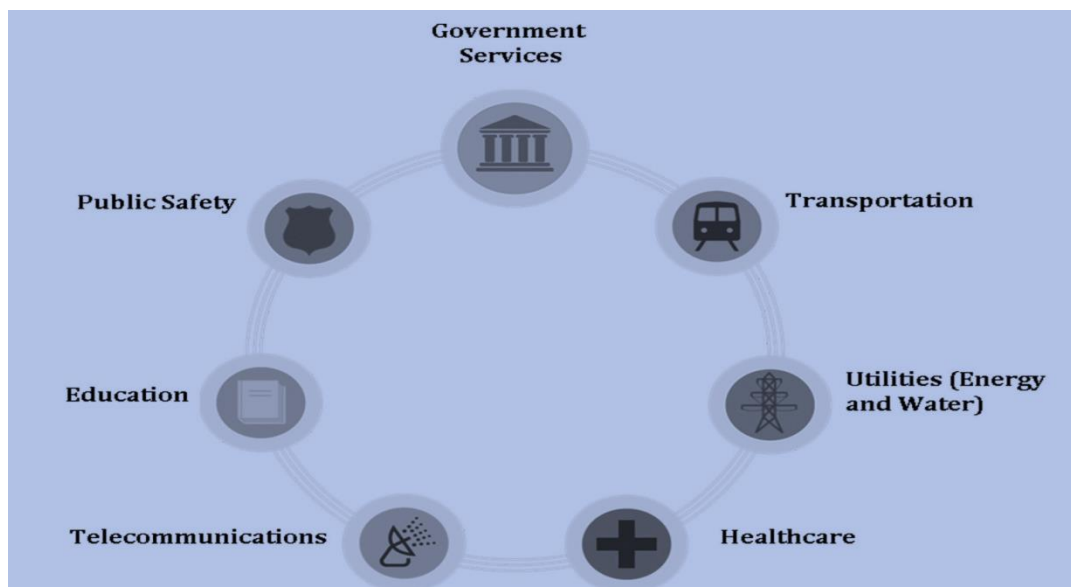
3.1 Sources of Value of a Smart City:

- *Reduced public spending*: public spending on the provision and management of public services is reduced
- *Increases efficiency and quality of services*: it makes it possible to manage resources more efficiently and improve the quality of the services provided
- *Provides support in decision-making*: facilitates the identification of the needs of the city and the approach for new services to provide them with support
- *Promotes innovation*: provides an ideal platform for innovating, incubating new business and, in general, promoting social development
- *Provides information in real time*: enhances the awareness of citizens about the environment in which they live by providing information that flows in real time and, at the same time, improves the transparency of the administration.

4. WHAT ARE THE VARIOUS ASPECTS OF A SMART CITY

Behind any work there is a plan on how to achieve it and for making that work complete one has to execute those plans in order to produce better results. There is a loose connectivity between the government and the people's expectations that leads to low results. One such example is India where a city dreams to be smart on its own but it takes years to make that dream into a reality. But before we can bring in smart technology, we need to know what to do with it. How do we build new cities and repair groaning urban settlements to provide clean water to all, to manage the growing mountains of garbage, to treat sewage before we destroy our rivers and to do something as basic as breathing without inhaling toxins?

Fig 4.1: Various aspects of Smart City



Source: IBM

4.1 Government Services: New Technologies enable the introduction of a new relationship between Local Governments and citizens; in particular regarding the introduction of public on-line services and the use of New Technologies to improve the participation of citizens in public decision-making.

Smart Governance includes political and active participation, citizenship services and the smart use of e-Government. In addition, it often relates to the use of new communication channels, such as e-government or "e-democracy".

4.2 Public safety: Smart cities also mean 'Safe cities' with **CCTVs**, command control centers, patrol cars, aerial surveillance and more women cops. Aerial surveillance through UAV's and

helicopters is also part of MHA's 'Safe City' plan which will make city a perfect place in context of safety.

Fig 4.2: Safe City



4.3 Transportation: As per a World Bank study, by 2031, some 600 million people are expected to live in India's cities. However, only about 20 Indian cities with populations over 500,000 have any kind of organized public transport systems. In fact, the share of public transport in large Indian cities actually declined from some 70 per cent in 1994 to almost 40 per cent in 2007. Furthermore, India's accident and fatality rates are among the highest in the world, mainly affecting the poor and vulnerable who do not have their own means of transportation.

Technology plays an important role by predicting demand and supply data to feed into transportation planning. Technology can also help in improving reliability of public transportation network by providing visibility on arrivals/departures/route information for travelers for hassle-free journey.

4.4 Healthcare: India is a destination of medical tourism. Yet, the urban poor do not have easy access to even the basic healthcare amenities. For making cities smart, we must make healthcare affordable first. The way forward is **Telemedicine**, which is in simple definition a doctor or specialist remotely monitoring a patient via an intermediary who is perhaps an intern or a doctor. With introduction of IOT and mobility technology, a lot more can be done.

4.5 Education: Technology is changing the way we deliver education. Migration from text books to dynamic learning content delivered through computers and mobile smart devices allows for more student focused delivery of education; at their pace, with relevant content and learning approaches. It also allows schools to stay up to date with current and timely information, and to leverage teaching resources across schools, campuses, districts and across the world.

At the building level, the kinds of intelligent systems we've developed can help schools, colleges and universities better manage their energy systems, security, communication, and transportation.

At a higher level, **intelligent systems** can help connect departments and campuses; they can enable virtual and online learning, and engage social media. At the very highest level, they can partner with contemporary education thinking to actually change the way that children learn.

Two broad advantages of the e-learning platforms are

- Maximizing the reach to the students/learners
- Maximizing the impact of education (to have positive impact on education's system in India and to solve its problems. Apart from making the system Digital equal focus should be given on the fact that imparting of education becomes more and more of an interactive process)

Based upon the advantages expected out of an e-learning platform following are the factors to be considered while choosing the e-learning platforms

- Cost
- Ease of Use & interface
- Organization's maturity to adopt the new system
- Ability of the new system to integrate with the existing systems
- Special features

Some of the E-learning platforms that various institutions, schools implemented are:

1. Efront
2. Moodle
3. Dokeos
4. Claroline, etc.

Efront: EFront is an eLearning platform (*also known as a Course Management System (CMS), or Learning Management Systems (LMS), or Virtual Learning Environment (VLE)*). EFront is designed to assist with the creation of online learning communities while offering various opportunities for collaboration and interaction through an icon-based user interface. The

platform offers tools for content creation, tests building, assignments management, reporting, internal messaging, forum, chat, surveys, calendar and others.

In India, Efront is practised in partnering with Deeksha Systems Pvt. Ltd. Started in 2004 Deeksha Systems Pvt. Ltd. has quickly grown into is one of the leading player in the technology enabled training and training outsourcing in Indian subcontinent.

Moodle: Moodle is free and open-source software learning management system written in PHP. Moodle is used for blended learning, distance education, flipped classroom and other e-learning projects in schools, universities, workplaces and other sectors. With customizable management features, it is used to create private websites with online courses for educators and trainers to achieve learning goals. Moodle allows for extending and tailoring learning environments using community sourced plugins.

Moodle ELearning platform is widely practised in India. One example is of Moodle welcoming E-Learning service provider eAbyas Info Solutions as its new Moodle partner based in Hyderabad in 2014.

Dokeos: Dokeos is an environment of e-learning application and content management courses and also a collaboration tool. It is also certified by the OSI and can be used as a content management system (CMS) for education and educators. This feature to manage content includes content distribution, calendar, training process, text chat, audio and video, test management and records kept. Until 2007, it was translated into 34 languages (and several are complete) and is used (to September 2010) by 9900 organizations, reports the same website of the company, measured without filtering possible duplicates.

In India, Dokeos is headquartered in Kolkata and it is widely used platform across various parts of India.

Claroline: Claroline is a collaborative eLearning and eWorking platform. It allows hundreds of organizations worldwide ranging from universities to schools and from companies to associations to create and administer courses and collaboration spaces over the web. The platform is used in more than 100 countries and is available in 35 languages.

Claroline is also used widely across India.

Here a large portion of this section gives attention to only online learning management system but the concept of 'Smart Education' goes beyond LMS which includes.

- Classroom latest technologies
- Educational games and gadgets
- Educational institutions

- E-learning appliances and products
- Interactive white boards
- Laboratory / training equipment
- Teaching systems, etc.

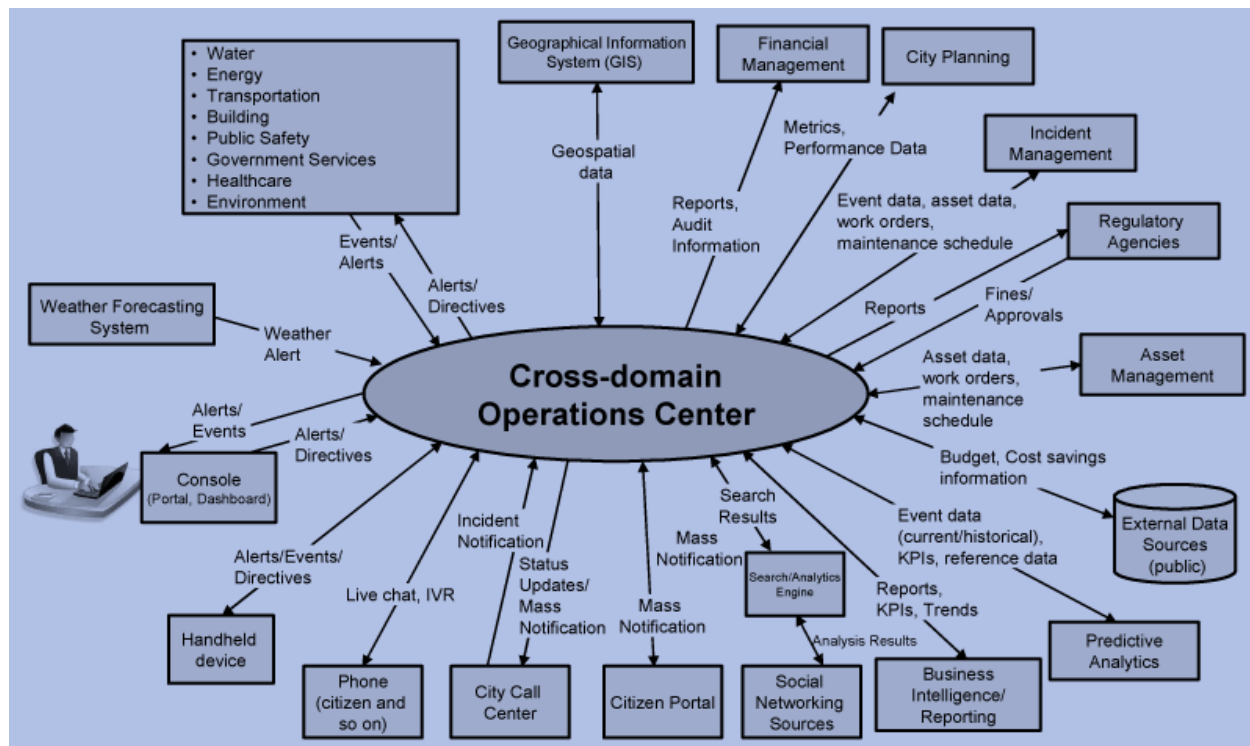
4.6 Telecommunication: Fast, reliable Internet access enables telecommuting, creating a more flexible and satisfying lifestyle while improving productivity. Broadband and high-speed Internet access are no longer a convenience, they are an economic and business requirement. Cities with superior telecommunications have an edge when courting business investment. This advantage was captured in a stunning 2011 study by the World Bank that found that GDP rises 1.3% for every 10% increase in broadband penetration. Similar effects have been found for mobile broadband.

It is anticipated that services and applications in smart cities will continue to evolve over time in response to changes in industrial activity and improvements in lifestyle. This will require service providers and network managers to provide new services and applications in a timely and economical manner.

4.7 Utilities: A fully integrated solution for gas, water and electric utilities that offers high performance and a low cost of ownership would make people comfortable sitting at home. Smart City initiatives and technologies have already captured the imagination of the **water industry**. Data sensors, smart metering and cloud-based analytics software offer water utilities unprecedented access to real-time information about consumption, system demand and pressure points to the customers. **Advanced metering infrastructure (AMI)** systems not only optimize systems but carry the potential for building partnerships with customers by offering data about their consumption.

5. SMART CITY ARCHITECTURE

Fig: 5.1 Smart city network diagram



Source: IBM Redbook 2011

A city can have two distinct types of operations centers: a *cross-domain operations center* (CDOC) and *domain-specific operations centers* (DSOC).

A *cross-domain operations center* provides a holistic view of the city by allowing access to information and data collected from a shared information space. This shared information space contains information from various sources in the city and enables domains to contribute relevant data and analysis. This approach ensures that all related information is provided to city officials, giving them a comprehensive view of problems. It also enables them to understand and take action in a coordinated manner across city domains.

A *domain-specific operations center* supports a specific city domain and provides officials access to applications and data related to that domain. By having a specific access point, these individuals can more easily access role-related information.

With a DSOC, city officials can make decisions and coordinate the sharing of information across departments. The CDOC can perform analysis on the data (in the shared information space) and

provide key information to city officials so that they can make well-informed decisions for the city.

The CDOC interconnects the domains within a city into a coherent whole. Figure 2 shows examples of the types of interaction that occur between typical city entities (various officials, citizens, and systems) and the CDOC.

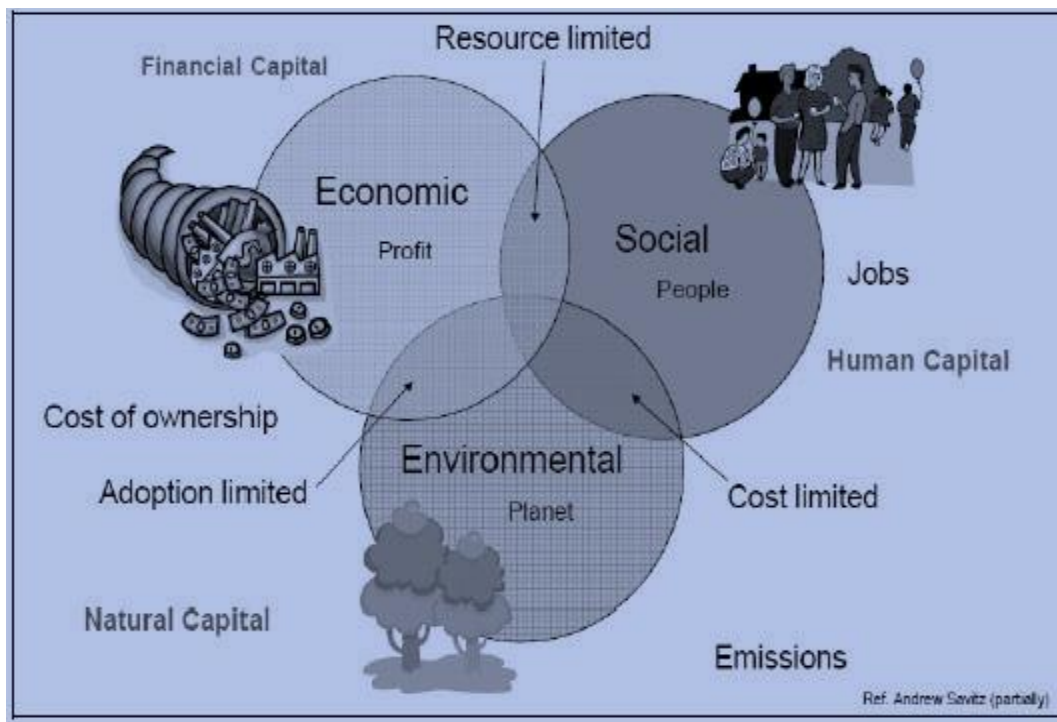
The CDOC can interact with citizens and visitors in numerous ways. This communication and interaction can be bidirectional between the city and citizens. The city can provide citizens with important safety information and city policy related-information. For example, if a serious traffic accident is blocking a main road through the city, the city can notify the citizens. As another example, if a hazardous waste material spillage occurs causing the need to evacuate people in a specific area, the city can notify those citizens in that area. In addition, citizens can report up-to-date situational information to the city. With this information from citizens, city officials can revise decisions or allocate resources as needed.

The CDOC also provides citizens with a platform to report less serious incidents, such as water leaks or street potholes in their area. This information can be used to schedule maintenance to fix such problems. Services can be provided to citizens so that they can subscribe to notifications pertaining to particular areas of the city. For example, public traffic notifications can identify unscheduled road works or other unplanned disruptions. These notifications might allow citizens to adjust their travel plans accordingly, such as taking a different route or transport service to work.

The CDOC can also be used to develop programs and initiatives with citizens. For example, if water or electrical meters share usage data with the CDOC, this data can be used to build usage patterns for individuals, streets, and districts. Motivational techniques can be used to help manage this usage. These techniques can include pricing models or incentives to those who participate in the program and actively reduce resource consumption. This approach has a positive benefit for the city by reducing dependency on resources and for the citizens who are making a difference and potentially getting paid for it.

6. PILLARS OF A SMART CITY

Fig 6.1: Pillars of a Smart City



Source: GAIA Smart Cities

6.1 Economic Sustainability:

Economic sustainability refers to the business environment and wealth generation capacity of the city. It is a proxy for gross domestic product (GDP) growth, but encompasses wider criteria than just GDP. Population growth, the quality of private undertakings, the attractiveness as an investment location as well as the ability of city authorities to tax the citizens for public services, all depend on the city's ability to attract business and capital. The development of smart cities, the financing of change and the fullest adoption of innovations by city inhabitants, require an understanding of the economic fabric of the city and the market for smart solutions. Smart city services contribute to the economic sustainability and the resilience of cities to economic shocks, as those generate a new level of economic diversification.

Economic sustainability is also closely linked to financial sustainability, particularly in the wake of the financial crisis. Many cities have seen their access to capital curtailed and their credit rating deteriorate, while financial institutions have restricted the access to credit. Thus even though well-designed investments in improved efficiency can make cities more sustainable financially short term investment capital may be unavailable at the required scale.

Nevertheless, investing in the city structures of the future can be done using novel financial models, which monetize savings and use them to finance the reimbursement of capital expenditures. In addition, the cities of the future are expected to have much more decentralized energy services and supply provision systems, creating new economic activities and allowing PPPs (public-private partnerships).

6.2 Social Sustainability:

When large numbers of people live in agglomerations, actual or perceived social inequalities and social exclusion of sections of the population can lead to social unrest. City authorities have a key interest to ensure social inclusion, which starts with a basic level of services for all citizens. In a smart city, it is important to take into account the risks of alienating important groups of citizens. This may happen because smart services are limited to richer areas of the town, or because user charges make many important services unaffordable for certain parts of the population. All models of development of cities have to ensure that public transport, water, sanitation, electricity, and telecommunications are affordable and accessible to all population groups.

Smart city approaches strongly focus on technology and often rely on sophisticated applications. Badly understood or poorly implemented, they may be pursued for their own sake and divert cities from real issues (employment, education, crime, etc.). Ideally, smart city projects should be carried out only if they help cities to meet their needs, with a quantifiable added value facilitated by technology integration, usability or cost reductions.

6.3 Environmental Sustainability:

Environmental concerns are growing in cities. Three pressures arise. The first is on resource limitations, such as water scarcity and quality, or fuel requirements. The second is on QOL (Quality Of Life) and health. Not only are citizens and authorities more environmentally aware, but the economic implications of pollution can be serious, due to the impact on health and the attractiveness for businesses to operate from the city. The third is risk management and resilience to environmental shocks (such as heat waves and flooding caused by climate change).

One of the first stages to address sustainability is to increase resource efficiency in all domains, such as energy efficiency in buildings and networks, fuel efficiency in transport, water efficiency and new methods to transform waste to energy. Technology is not the only aspect required for sustainability, but is an important and necessary step forward. Efficiency gains can need significant investments, and the integration of different technologies can be complex. Resilience and risk management need to be integrated in city planning, based on estimated future risks. The smart city is essential and possibly our best bet to move towards sustainability. The integration of different technologies in the areas of ICT, transport, energy, water etc.,

which form the infrastructure backbone of cities, currently offers the best prospect for sustainability.

The **features** of a Smart City are as follows:-

1. Smart Transport
2. Smart Health
3. Smart Energy
4. Smart Waste
5. Smart Building

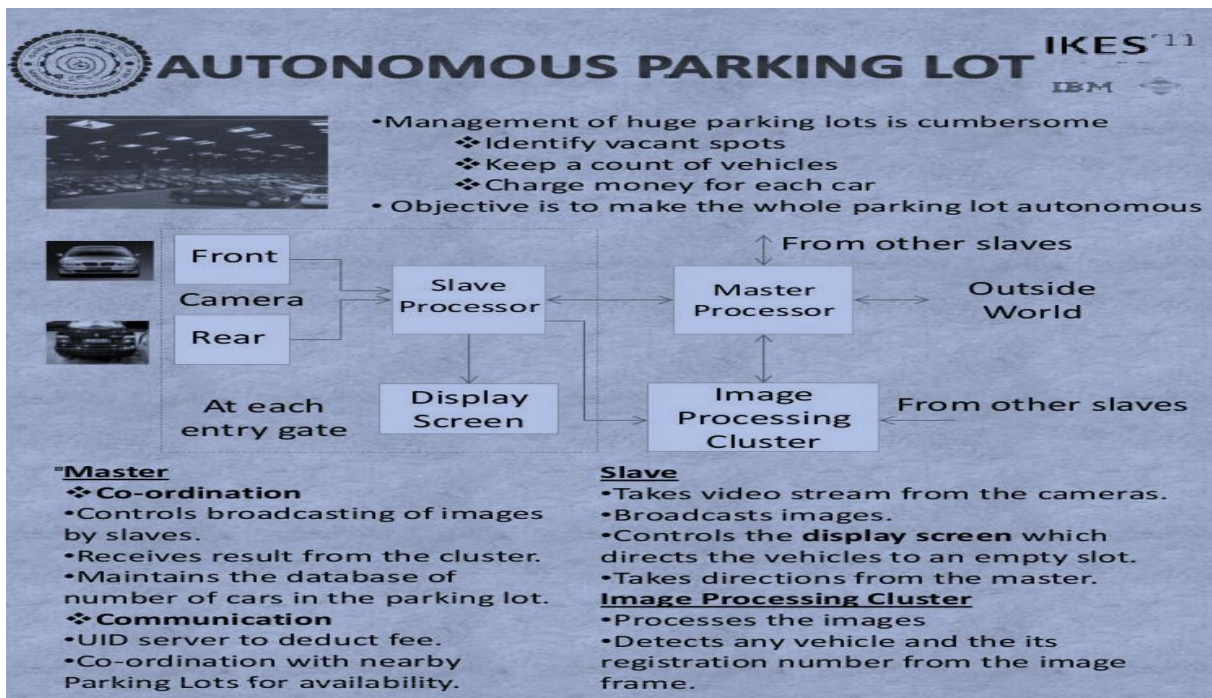
7. SMART TRANSPORT

7.1 Smart parking:

The report *Global Smart Parking Market 2015-2019* from *ReportsnReports.com* reveals that the smart parking market is growing at a CAGR of 31 percent until 2019 globally. The report stated that the growth is brought upon by the replacement of old parking meters with new smart parking meters. The new smart parking meters are seen as more reliable in vehicle detection and issuing of tickets, not to mention how they are able to send notifications regarding maintenance issues to parking providers, allowing for faster action and repair.

Cisco has implemented successfully smart parking, smart street lighting, use of Wi-Fi in Electronic City, Bangalore, to demonstrate that one can actually do these on a broader area. There has been widespread implementation of smart parking in abroad. For example:-City of Chico installs a new smart meter enabling drivers to pay with either card or coin on downtown parking spaces, the roads and transport Authority(RTA) in Dubai has announced that 124,466 customers have downloaded the smart parking app during the first half of 2015 & 283,103 transactions were made on that app during that period.

Fig 7.1: Smart parking implementation



Source: IBM

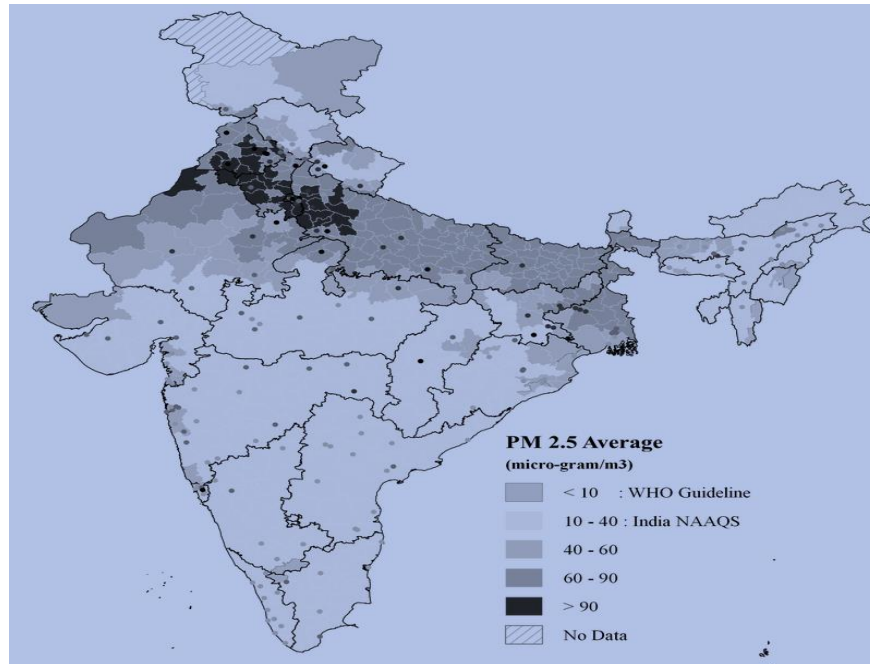
7.2 Intelligent transport system:

Intelligent transportation systems (ITS) are advanced applications which, without embodying intelligence as such, aim to provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks.

One of the greatest urban challenges is congestion and the inefficiency that it brings to citizens, corporations and governments. Congestion – and the productivity hit that comes with it – is moving transit systems up the political agenda in emerging economies. There are eight or more cities in China that have adopted limitations on motor vehicle registration along the same lines that Shanghai and Singapore have done. This has spread to Guangzhou, Beijing and some other cities.” In India, BRT is a huge opportunity and a better option than rail.

According to the Institute for Transportation and Development policy, seven months after the Ahmedabad BRT opened, 34% of Commuters had moved from private transport to the buses. The success of BRT in Ahmedabad has encouraged other Indian cities to adopt BRT; Pune, Pimpri, Chinchwad are currently working on new BRT systems while other cities such as Chennai, Coimbatore, Nashik and Bhubaneswar are conducting feasibility studies. Every kind of mode [of transport] is going to get smarter.

Fig 7.2: Estimates of PM2.5 concentrations across India



Source: India Climate Dialogue

7.3 Traffic Management:

Smart city utilizes Information, Communication and Technology (ICT) to inter-connect various technologies and optimize delivery of smart services like traffic, utilities, surveillance etc. To achieve this, it is imperative to have the communications infrastructure designed in a way that avoids common points of failure.

An example where traffic took a toll on people in a city is the 'China National Highway 110' traffic jam that occurred in 2010. This traffic jam spanned over a 100 kilometers, lasted over 10 days and is considered to be the longest traffic jam in history.

The introduction of vehicle telematics could reduce traffic congestion and related economic losses by enabling every vehicle to function as a traffic probe and anonymously report critical data such as location, driving speed and direction headed. It is estimated that the implementation of vehicle telematics in the 10 largest Chinese cities could potentially save drivers up to 20 minutes a day.

7.4 Smart Analytics:

Smart analytics can reduce traffic congestion on a busy road. A Connected Traffic Management System (traffic signals and Traffic Command centers) with a GIS enabled digital road map of the city, coupled with the power of analytics, is the key to smooth traffic management. After collecting information from the Traffic Management System, the data analytics tool aligns the data in real time with GIS mapping and parking management, to provide information to motorists on the best route to take, thereby helping reduce traffic pile up. The analytics platform gets real-time data from sensors, traffic signals & GIS mapping of roads. When a threshold is reached, analytics software sends a message to the nearest digital signage. Motorists driving towards the signal are asked to divert to another road.

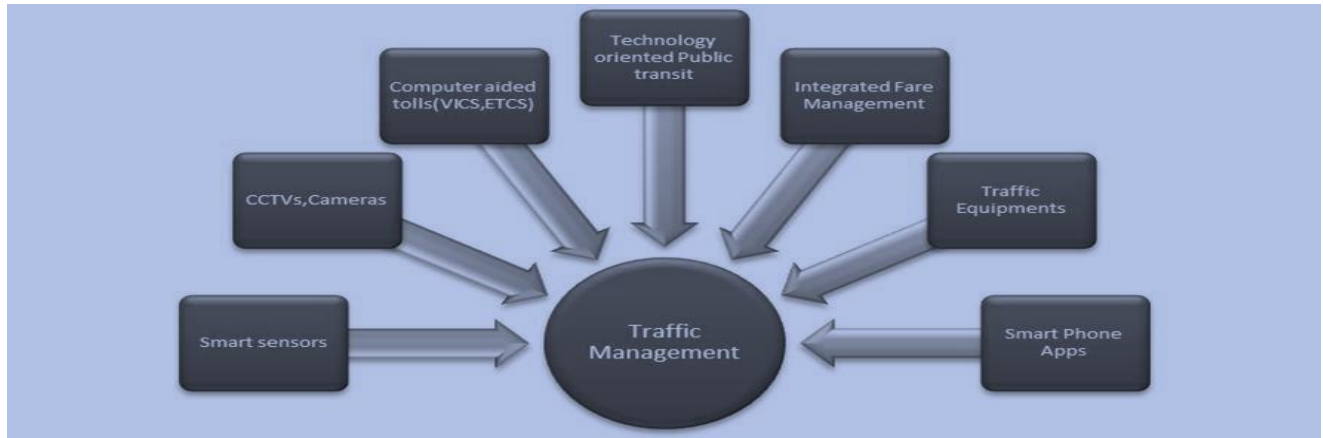
Smart analytics can save life on road. The analytics platform gets real time data from sensors and traffic signals on the way to the hospital and GIS mapping of all roads leading to the hospital. A message is sent to the ambulance display panel in front of the driver informing him which road to take. All signals towards the hospital are asked to display a particular color signal (Red or Green) enabling a free passage for the ambulance to move.

An example we can consider is of the city Hyderabad, where the concept of smart policing is under-process. Traffic police in Hyderabad will start using body worn cameras for reducing crimes and to improve public-police interface.

Such technologies will provide a greater advantage for everyday commuters all across globe which will move to faster implementation of smart cities.

This can be a step towards making our cities smart cities as these high resolution audio-visuals will be recorded in the camera and stored in a memory card. Feeds can be seen live from the police control room through 4G technology. The use of information communication and transfer technology in policing in Hyderabad will be a role model for implementation in other cities and learning from the same can be implemented in further implementations.

Fig 7.3: Traffic Management flow diagram



8. SMART HEALTH

8.1 Telemedicine:

Telecare is support and assistance provided at a distance using information and communication technology. It is the continuous, automatic and remote monitoring of users by means of sensors to enable them to continue living in their own home, while minimizing risks such as a fall, gas and flood detection and relate to other real time emergencies and lifestyle changes over time. Telecare is support and assistance provided at a distance using information and communication technology. It is the continuous, automatic and remote monitoring of users by means of sensors to enable them to continue living in their own home, while minimizing risks such as a fall, gas and flood detection and relate to other real time emergencies and lifestyle changes over time. Many centers (135 across the UK) are now accredited to the nationally recognized Telecare Services Association (TSA) Telecare Code of Practice, which includes stringent standards for call handling response times.

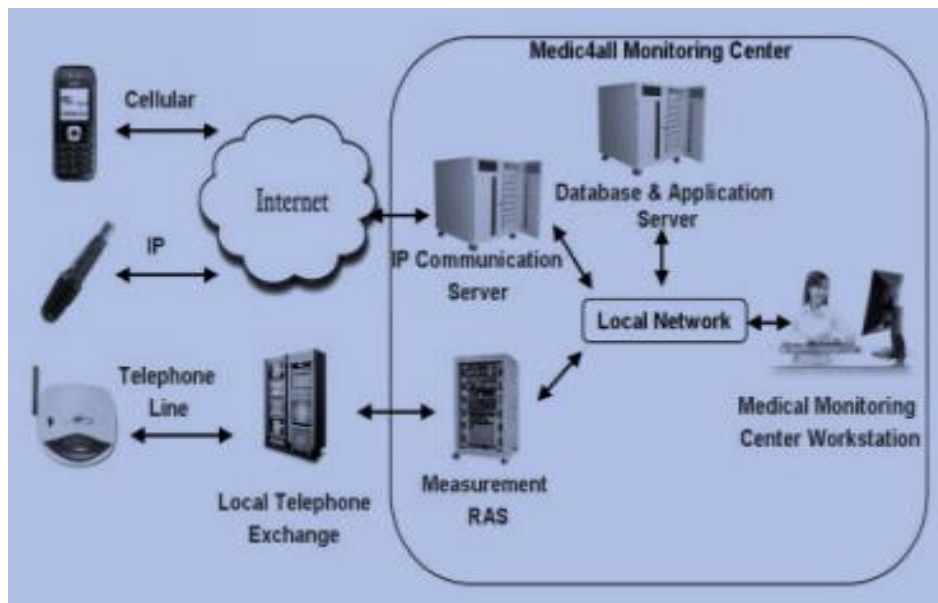
Telecare is specifically different from telemedicine and telehealth. Telecare refers to the idea of enabling people to remain independent in their own homes by providing person-centered technologies to support the individual or their careers.

Some of the DIT initiatives that are taken for telemedicine across India are:

- Telemedicine module for Tropical medicine in West Bengal- Webel (Kolkata), IIT Kharagpur and school of Tropical Medicine, Kolkata.
- Telemedicine and Telehealth education facilities in Kerala- 3 specialty hospitals with 4 District/Rural hospitals.
- Telemedicine network (CME programme) for Naga hospital, Kohima with Apollo hospital, Delhi.

- Onconet network- Kerala and Tamil Nadu states.
- State wise Telemedicine network based on Terrestrial communication in the state of Himachal Pradesh, Tamil Nadu, Punjab.
- Telemedicine network for Tripura- 2 referral hospitals with 4 nodes.
- Networking of district hospitals of Mizoram and Sikkim with Apollo hospitals, Delhi.
- Setup community information centers in 30 blocks of the North Eastern states and Sikkim in collaboration with National Informatics Centre using NICNET.

Fig 8.1: Telemedicine Services



9. SMART ENERGY

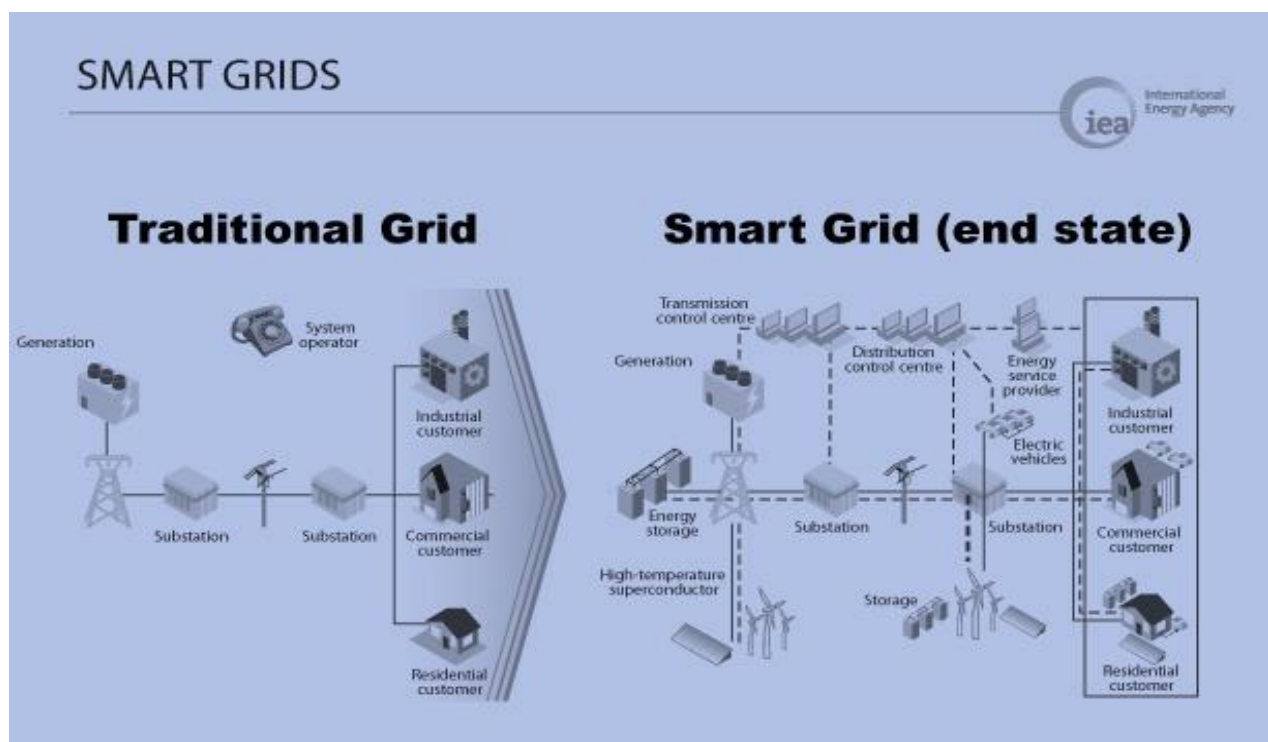
Fig 9.1: A LED Bulb (Saves 35% of the total power usage)



9.1 Smart grids:

A smart grid is an evolved grid system that manages electricity demand in a sustainable, reliable and economic manner, built on advanced infrastructure and tuned to facilitate the integration of all involved. Electrical systems will undergo a major evolution, improving reliability and reducing electrical losses, capital expenditures and maintenance costs. A smarter grid will provide greater control over energy costs and a more reliable energy supply for consumers. Environmental benefits of a smarter grid include reduced peak demand, integration of more renewable power sources, and reduced CO₂ emissions and other pollutants.

Fig. 9.2: Smart Grids



There are cities that have adopted smart grid technology and made into reality like Texas, Hawaii, California, etc. The upgrade will facilitate a range of new technologies, from more efficient appliances to solar and wind farms. While it will take decades for the entire grid to wise up, it is already a reality in dozens of cities around the country, as utility companies operate pilot programs to test the technology before rolling out the systems nationwide.

Uttar Gujarat Vij Company Pvt. Ltd (UGVCL) rolled out India's first modernized electric grid, or the smart grid system in Naroda. The smart grid will work on the 'time of day' concept, based on which tariffs will be set. For example if the demand is at peak during 7pm to 11pm, the tariffs will be higher for that period. UGVCL will have access to the data of the company and hence will use it to fix the tariffs based on time.

The project which was started in 2014 got a boost from central government in 2015. It was delayed due to some reasons. Five companies had showed interest in the project and had installed 300 new meters each, equipped with SIM cards. All the companies have successfully completed the testing and submitted their consistency report.

9.2 Smart Meters: Smart meters put consumers in control of their energy use, allowing them to adopt energy efficiency measures that can help save money on their energy bills and offset price increases. For example they can tell you how much energy you are using through a display in your home. They can also communicate directly with your energy supplier meaning that no one will need to come and read your meter in future.

Most of the smart meters that are being installed today use mobile phone-type signals to send meter readings to your supplier, and other wireless technologies to send information to the in-home display. However, there are a number of other technologies available.

The magnitude of stress that puts on existing power infrastructure can be seen from the fact that in July 2012, India's blackout was the largest power outage in history and affected over 620 million people (nearly a tenth of the world's population), spreading across 22 states.

Mobile enabled smart meters dissuade consumers from stealing power by letting them know that the utility has the tools to detect and record theft. In conjunction with analytics tools, unusual activity such as meter bypassing or the tapping of live wires can be easily tracked as mobile enabled smart meters provide them with widespread real-time visibility of consumption and distribution points. Mobile enabled smart meters are highly tamper-resistant as they are able to alert utility providers almost instantaneously during unauthorized access.




9.3 Smart urban lighting:

The subjects of sustainability, energy saving and increasing awareness of the use of resources, have featured heavily in cultural debates of recent years. Public lighting systems need no longer be defined by the yellow light of high-pressure sodium lamps, which were chosen purely based on their efficacy. Now there is another option, one that is simply better.

Advancements in light source technology now allow us to introduce a new light to our public spaces, a light that combines properties of daylight with energy efficiency. That light is high-quality white light, which is perceived as brighter and more natural than the light emitted by conventional light sources. White light sources have comparable or better efficacies than high-pressure sodium lamps, with another benefit being that the light emitted is more visually effective.

Current standards for public lighting, with a focus especially on the illumination of roads, do not fully implement the findings of modern research and understanding of light. In order to achieve the greatest energy savings it is important that all involved in the creation of standards and the manufacture of luminaires and light sources use the available knowledge to make our streets safer and more efficient.

Fig 9.3 Smart Energy

			
	Incandescent	CFL	LED
Lifetime (Hour)	1 000	8 000	50 000
Lifetime (year)	1	7	60
Electricity used (Kw)	3285 Kwh/year	767 Kwh/year	329 Kwh/year
	VERY HIGH	LOW	VERY LOW
Operating cost	ZAR367/year	ZAR90/year	ZAR38/year
Turn on immediately	Yes	No	Yes
Sensitive to Humidity	Some	Yes	No
Durability	No – glass or filament break easily	No – glass break easily	Yes – LEDs are highly shock resistant
Environmental Impact			
Contains TOXIC Mercury	No	Yes	No

10. SMART WASTE MANAGEMENT

With the total volume of waste generated globally expected to increase by nearly 50% over the next decade, the adoption of innovative technologies will result in more integrated waste management solutions that move beyond the traditional use of labor, diesel trucks and conventional landfills. Here are some of the waste management methods:-

10.1 Enevo:

Enevo One is a comprehensive logistics solution that saves time, money and the environment. It uses wireless sensors to measure and forecast the fill-level of waste containers and generates smart collection plans using the most efficient schedules and routes. The solution provides up to 50% in direct cost savings.

10.2 GIFT (Gujarat International Finance Tec-City) City Agenda:

A smart solid waste management system is being put in place using Swiss technology at GIFT City where garbage will be disposed of with minimum human interference. Not only that, the waste will be recycled to make organic manure and generate power that will be consumed in GIFT City itself.

The solid waste from the towers will be sent to the waste collection center, about 2 km away from buildings, using vacuum suction pipes. The waste will be transported at the speed of 110-140 km per hour through a network of underground pipes. The speed and direction of the waste will be controlled by a fully computerized console.

Fig 10.1: Automatic Collection and Transportation System

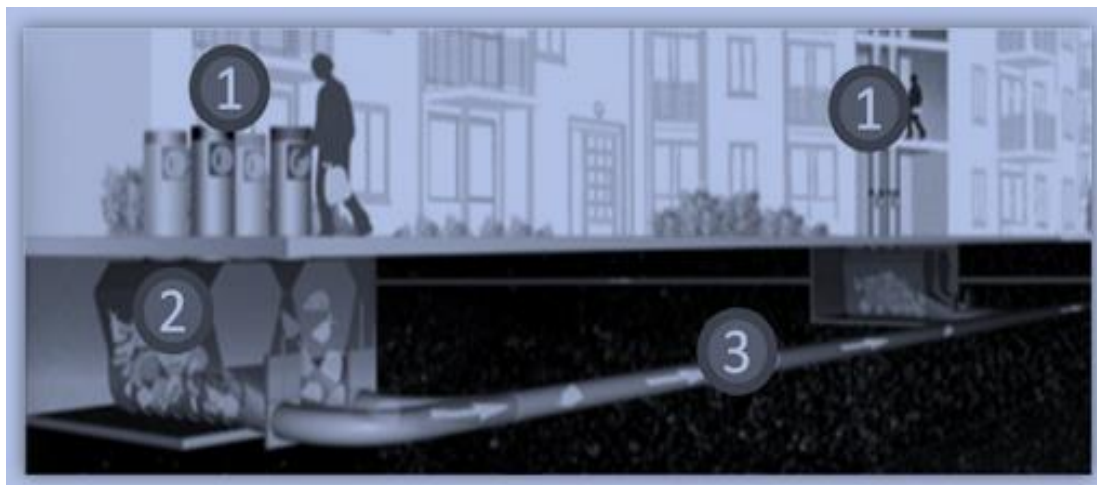
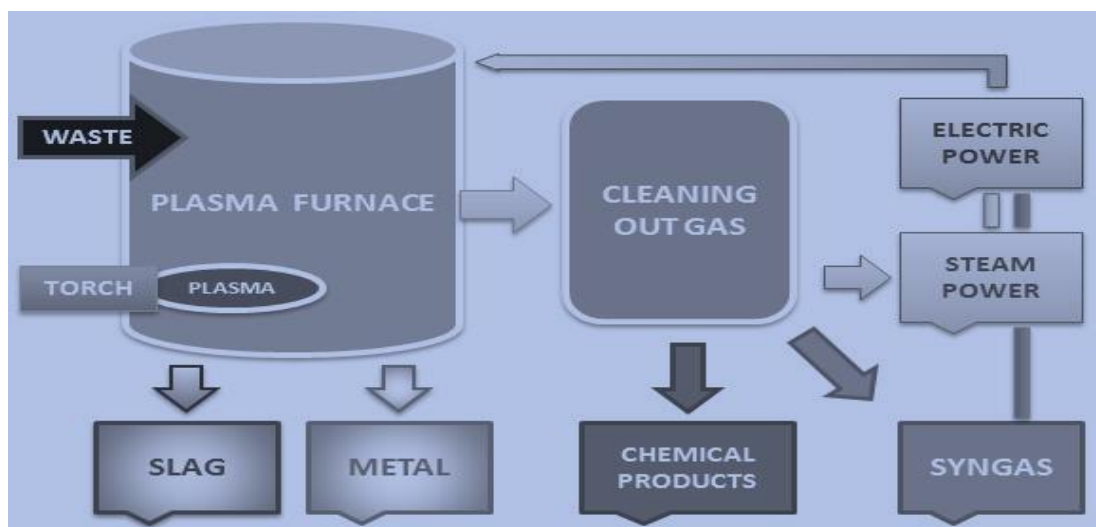


Fig 10.2: Plasma Technology for Waste Treatment



One of the most promising technologies for the treatment of various types waste is Plasma Technology based on high temperature complete decomposition of the treated waste by means of arc plasma. The main element of plasma technologies is arc plasma torches. On its basis plasma reactors are created for the treatment basically liquid and finely disperse waste, and also plasma mine furnaces for neutralization of firm waste.

Plasma process enables essentially to raise temperature in the furnace up to 4500F of degrees for destruction and decomposition of organic components. The same temperatures provide fusion of nonflammable inorganic component and their transfer in slag and metal. Plasma heating will not lead to mixture of departing combustible gases (CO₂, H₂, CH, etc.) with combustible gases that the pair or the electric power will allow to use them warmly for development, having compensated power inputs on plasma heating. The heat in the furnace enables to drive away valuable, rather flying metals (zinc, lead, tin, etc.) and their connections and to collect them in the form of a commodity product. Process is ecologically clean.

Output gas of a plasma reactor and the furnace do not contain toxic components since pass systems of a mechanical filtration and absorption of alkaline clearing which remove the dust inorganic rests and gaseous impurity NO, HCL, H₂S, etc. In gaseous products there are no pitches, phenols and complex hydrocarbons. The ashes deleted from a reactor in a liquid condition, is safe at a burial place. Vitrifying slag is possible to granulate and direct to construction and metal to use for release of the alloys, the refined repartition, etc.

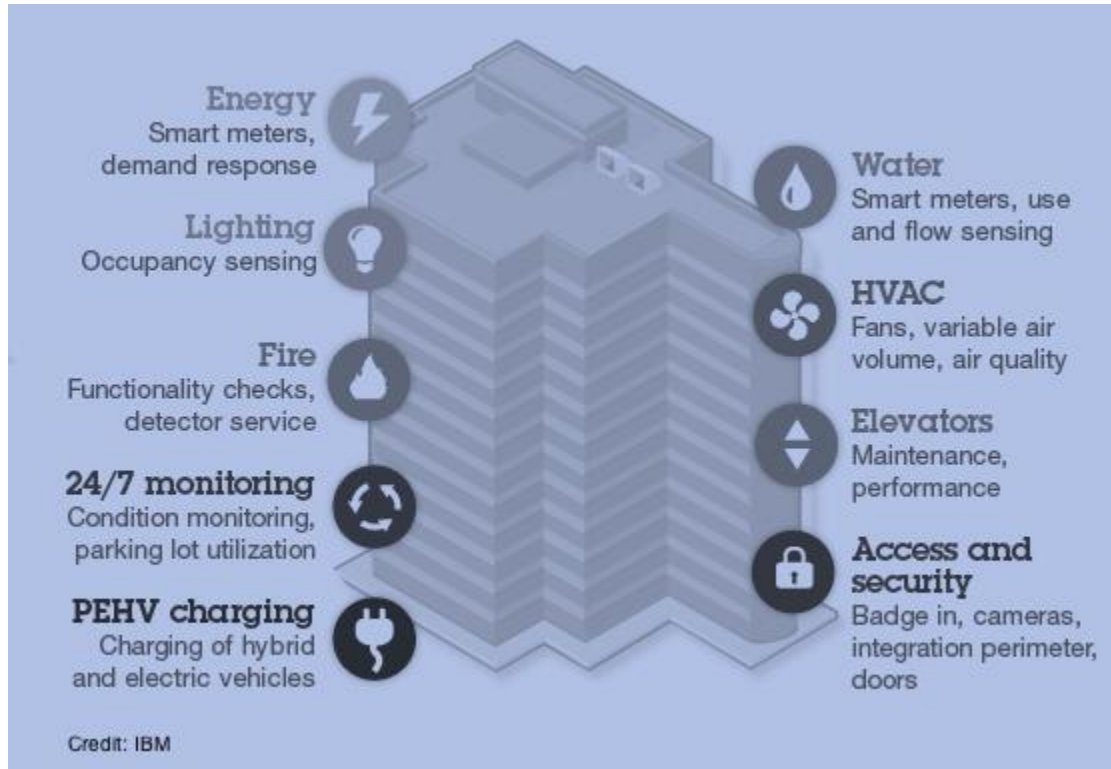
11. SMART BUILDING

A smart building involves the installation and use of advanced and integrated building technology systems. These systems include building automation, life safety, telecommunications, user systems, and facility management systems. Smart buildings recognize and reflect the technological advancements and convergence of building systems, the common elements of the systems and the additional functionality that integrated systems provide.

Smart buildings provide the most cost effective approach to the design and the deployment of building technology systems. The traditional way to design and construct a building is to design, install, and operate each system separately as shown in the below figure:

Schneider Electric, the global specialist in energy management has launched the Smart Panel concept to ensure sustainable energy savings in buildings, such as public and commercial offices, modern retail premises, hospitals and hotels apart from industrial setups. Based upon Schneider Electric's energy management principle of 'measure, connect, and save', Smart Panel is a simple-to-deploy plug and play solution contributing towards addressing the urgent need to curb energy costs and meet norms for green buildings.

Fig 11.1: Smart Buildings



12. CASE STUDIES INDIA

1. PALAVA CITY, Mumbai

Fig 12.1: Palava City



Consider these scenarios: an office that's walking distance from home. A complete Wi-Fi enabled city. A smart card for cashless transactions that is also capable of facial recognition and acts as a key to enter your building with advanced security systems. The same smart card also allows you to operate the electrical equipment at home through motion sensor technology with a promise of 30% savings on electricity and water costs.

These features may appear to be somewhat futuristic, but are likely to become a reality in India in less than a decade, as the smart city concept takes hold.

The first-of-its-kind partially completed smart city project in Mumbai, which is expected to be completed in 2025, is Palava city by the Lodha Group. It will span 4,000 acres, and cost INR 14,000 crore.

For Palava, the Lodha Group has a franchisee agreement with Maharashtra State Electricity Distribution Co. Ltd for 24-hour electricity supply; solar panels will power street lights. It has a tie-up with General Electric Co. (GE) for 100% water recycling, and automated water metering and billing to ensure transparency and zero water loss. It will run a fleet of CNG buses within Palava city and connect people to nearby Dombivali station and Navi Mumbai. The Lodha World School will offer all established Indian and international syllabi. And the Lodha Group is in talks with hospitals as well as several commercial establishments and multi-brand retail giants to set up shop in Palava. It has the potential to create 350,000 jobs by 2025.

2. WAVE CITY, GHAZIABAD

Fig 12.2: Wave City



Wave City - A first of its kind project that truly personifies the concept of creating a city that thinks for you. Spread across 4500 acres, Wave City is one of India's largest self-sufficient Hi-Tech City based on "Hi-Tech City Concept". This Hi-Tech City offers smart features like Central Command Centre, Smart Meters, Intelligent Traffic Management, Waste Management, 24x7 CCTV surveillance, Weather substation, Water management, Complete Fiber Optic Connectivity and lot more. Master plan and designed by world renowned town planner and landscape designer – AECOM, Wave City features open spaces and contemporary designs. This project boasts of more than 750 acres of green spaces, wide roads and congestion-free BRT network for smooth traffic flow, health care provisions including hospitals, medical university, ISKCON Temple, educational institutions, local shopping centers, malls and multiplexes, etc. It is a city full of vigor and vitality, which makes it the perfect place to enjoy a comfortable, convenient and uncluttered lifestyle.

Conceptualized & developed by the prestigious Wave Group, this mixed-use destination focuses on creating an entire new way of living. With its ready-to-use infrastructure & amenities, Wave City promises its residents a nurturing environment that aims at offering an unparalleled living experience.

13. TOP 5 SMART CITIES IN THE WORLD

12.1 BARCELONA:

<i>Population</i>	<i>Surface Area</i>	<i>GDP</i>
1.7 million (approx.)	100.4sq.km	759 million euros

The reason why Barcelona tops the chart for smart cities are due to following reasons:-

1. Its stellar bus transit system.
2. Its bicycle sharing system, Bicing.
3. Its installation of smart parking spaces.
4. Its pneumatic waste management system.
5. Its installation of smart lighting.
6. Its use of renewable and more effective energy systems.
7. It's the Mobile World Capital.
8. Its urban mobility through apps.
9. Participatory citizens and transparent government.
10. Barcelona's Innovation District.

12.2 NEW YORK:

<i>Population</i>	<i>Surface Area</i>	<i>GDP</i>
19.75 million (approx.)	1214sq.km	1,350,286 million dollar

The reasons why New York is the second ranked smart city in the world are:-

1. A vibrant digital sector.
2. A citizen-centric digital experience
3. Open government
4. Internet connectivity for all.

12.3 LONDON:

<i>Population</i>	<i>Surface Area</i>	<i>GDP</i>
8.63 million	5490sq.km.	731.2 billion dollar

London has been ranked 3rd in the smart city rankings. Let us see why:-

1. A leader in the provision of open data

2. Management of London's passenger and road transport systems is amongst the most advanced in the world
3. Congestion Charging using number plate recognition, the intelligent road network management systems trialed during the Olympics and Wi-Fi on the Tube.
4. Technologies to re-use waste heat, such as from underground shafts and sub stations, and showcasing how hydrogen energy and fuel cell technology can be an emission free way to power London's transport, homes and businesses.
5. Technology companies are establishing London as a center for showcasing new technology and innovation, collaborating with London's world class research institutions.

12.4 NICE:

<i>Population</i>	<i>Surface Area</i>	<i>GDP</i>
3.5 lakh (approx.)	71.92sq.km.	Not found

Nice follows London to become the 4th best smart city in the world. It is because:-

1. MUE (Urban Environment Monitoring)
2. Smart grids
3. Traffic and street light management
4. Social cohesion
5. In February 2015, the Nice Côte d'Azur Metropolis opened its '**Smart City Innovation Center**', the first French platform to bring together stakeholders in research and learning as well as leading smart city-focused companies in a single location.

12.5 SINGAPORE:

<i>Population</i>	<i>Surface Area</i>	<i>GDP</i>
5.5 million (approx.)	718.3sq.km.	452.686 billion dollar

1. Congestion pricing
2. Special RFID cards that extend crossing times when tapped against traffic light poles.
3. City's water management system is among the world's most advanced
4. A super-fast, next-generation broadband network already reaches 95 percent of homes and businesses in Singapore.

14. GLOBAL TRENDS

1. Why Cycling should be mandatory in Smart Cities?

- a. The vast majority of city street journeys take place in cars. Despite being clean and green with a host of health benefits, cycling is really popular in only a few countries. Potential accidents, the lack of a cycle-friendly infrastructure and worries about rain and cold keep many from hopping on a two-wheeled horse, even though bicycles are fast, clean, healthy and inexpensive. *In the UK, US and Australia, for example, only about 1 per cent of all journeys are made on a bike. But there are exceptions, of course: in the Netherlands, the number is 27 per cent, and in Danish capital Copenhagen, over half the population cycles regularly.* An intelligent city planner while planning a smart city should assume that cycling, walking and public transport would be the main forms of transport while trying to figure out how to accommodate inefficient, polluting and dangerous modes like private car use. *Amsterdam has shown that a transition in modalities of transport is possible. Currently, 53 per cent of all travel in the city is by bicycle, compared to 23 per cent by car.*
- b. Studies from Denmark tell us that for every kilometer cycled, society enjoys a net profit of 23 cents. For every kilometer driven by car we suffer a net loss of -16 cents.

2. Smart grid Mexico: 30.2 million smart meters by 2025:

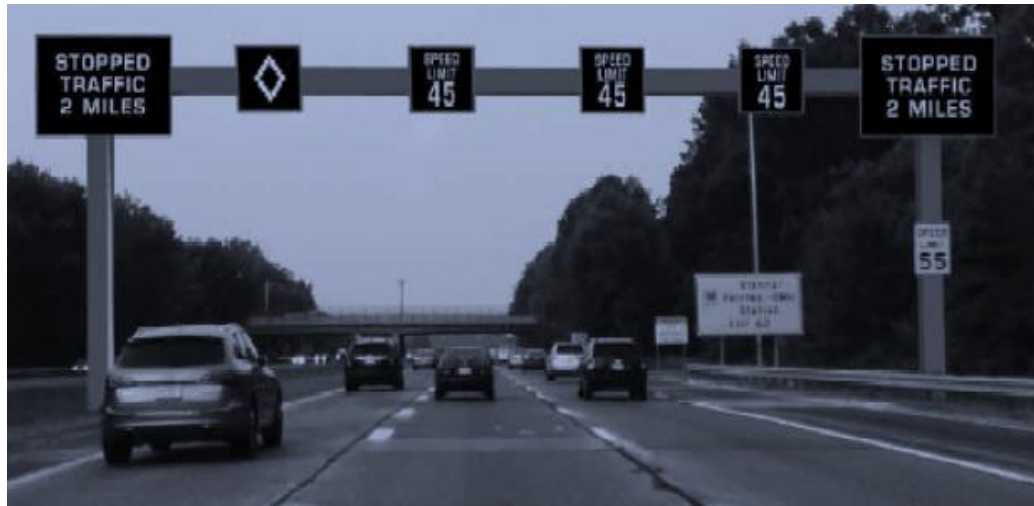
- a. In Latin America, Mexico has kick started investment in smart grid technology by issuing a number of tenders for more than two million smart meters.
- b. Mexico is the second largest consumer of smart grid technology behind Brazil in the Latin America region. Mexico's US\$10.9 billion smart grid infrastructure investment will see significant deployments across a number of market segments including smart metering, distribution automation, battery storage, home energy management, information technology and wide area measurement.

3. Implementation of I-66 Traffic management system:

- a. *Red "X" Lane Relief:* Expanded use of the shoulder lanes between routes. The shoulder lanes, also known as the red 'X' lanes, will routinely be opened to traffic when congestion builds, regardless of the time of day or day of the week. Currently, the shoulder lanes are used only during weekday peak periods.
- b. *Advance Notice of Lane Conditions:* Motorists will be able to see which lanes are usable or blocked well in advance of incidents.
- c. *More Cameras and Signs:* The cameras will improve monitoring of the highway and enable transportation, safety and law enforcement personnel to respond more quickly and appropriately to incidents. The dynamic message signs will advise drivers on incidents and delays.

- d. Ramp Meter Upgrades: The ramp meters that help manage traffic merging onto I-66 will be able to adapt to traffic conditions.

Fig 14.1: I-66 Traffic Management System in Virginia



15. WORLD VS INDIA DEVELOPMENT

Fig 15.1: Growth Rate India vs World

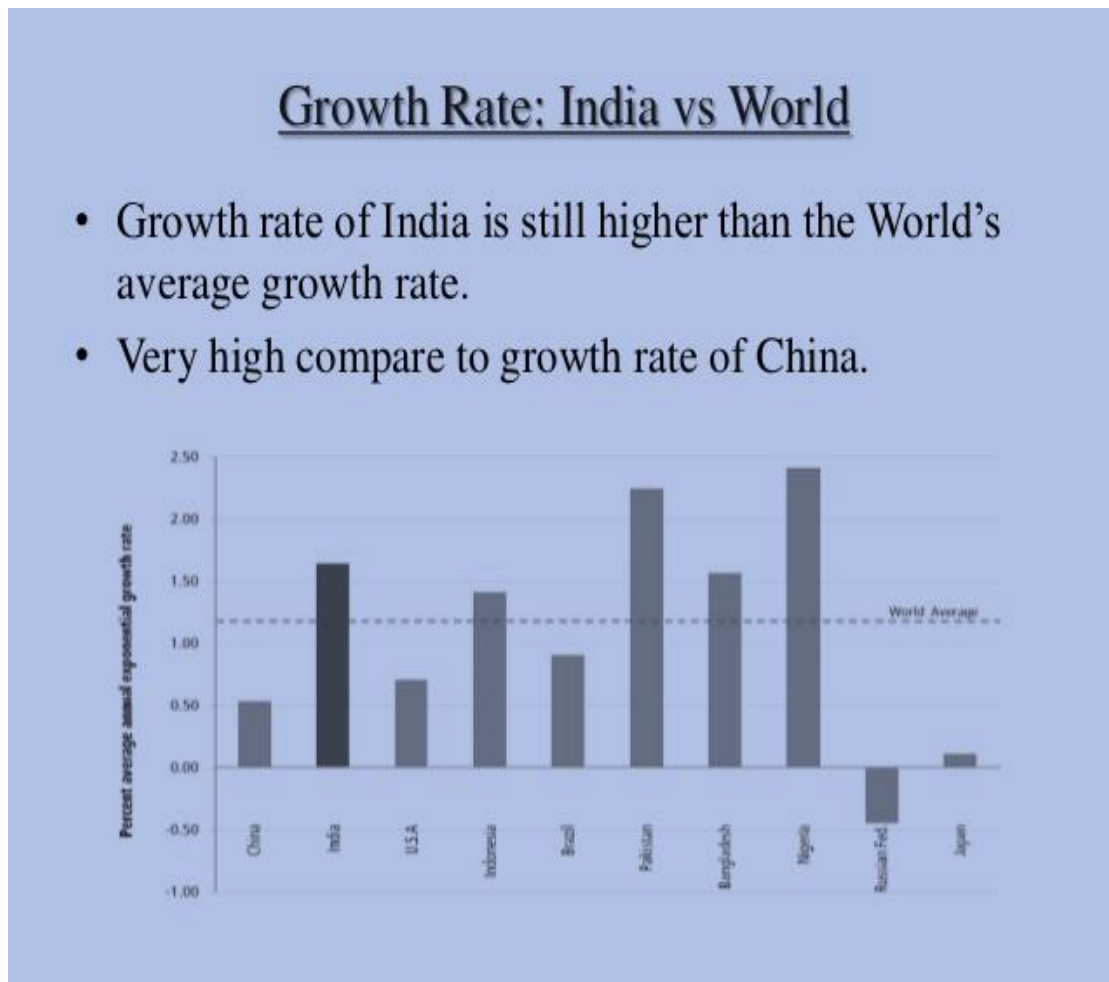
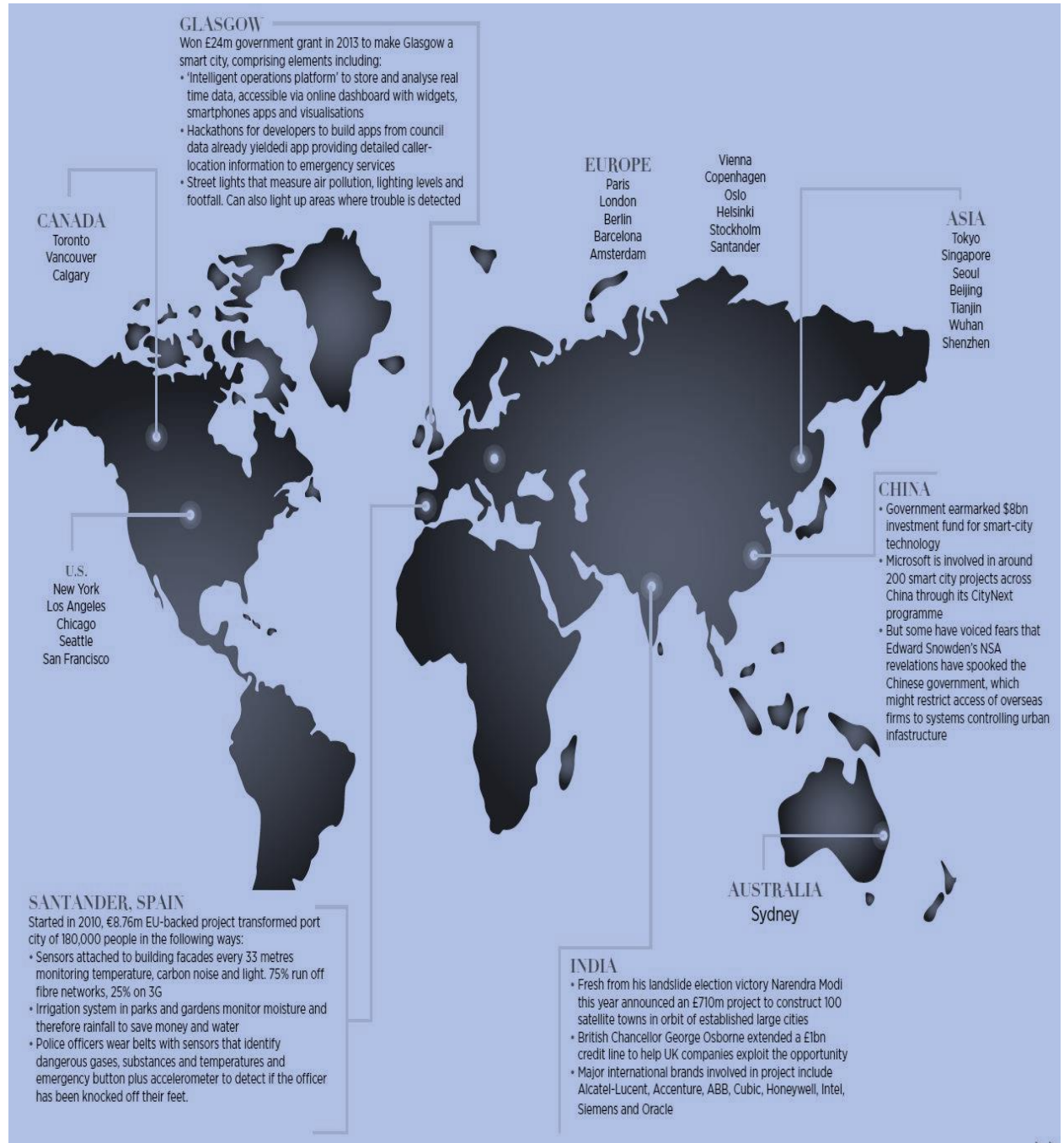


Fig 15.2: India vs World Smart City measures



16. ROLE OF TSPs IN SMART CITIES

A smart city uses information and communication technologies to enhance quality of services delivery at affordable costs to the entire population of the city. Be it healthcare, water or waste management. Embedded telecom infrastructure across the smart city works as a mesh in which data flows seamlessly and enables tasks like routing water to water deficient areas or responding to an emergency in the quickest and shortest possible way.

Telecom is the key area to create a smart city which will react to needs of its population digitally and also keep the city ticking with the least human intervention, in the smartest possible way.

That means embedding the infrastructure with sensors that talk to each other—if a power line is short circuited an embedded chip will relay that information to the power hub where engineers can react to the fault immediately—the embedded sensors will use telecom links to convey this data. Similarly if water supply is impacted due to leakage, spotting and fixing that leak can be done in super quick manner with smart sensors using telecom infrastructure to communicate the fault to the engineers.

- a. Key to the smart city is connectivity—fast, easy and always on. Be it lighting, safety of traffic on the roads, security of citizens via connected CCTVs, connecting buyers to market, fulfilling needs of the modern population, healthcare and related services, the essence of a smart city is connectivity. That actually means robust telecom backbone.
- b. In fact, it's difficult to visualize a smart city without a telecom backbone. The role of telecom increases multi-fold in a smart city. The objective is not just people-to-people communications, but creating an infrastructure that automatically responds to needs of citizens.
- c. Around the world cities like Songdo in South Korea, Masdar in UAE and Barcelona, London, Dubai already have smart solutions to run the cities. *For example Songdo, built on reclaimed land from Yellow Sea, uses tele presence to connect every home, office and school through video. Songdo has been designed with sensors to monitor temperature, energy use and traffic flow. These sensors, using Wi-Fi alert users, say at a bus stop, when a bus is due.* Malmo, in Sweden, another smart city, plans to entirely run on renewable energy by 2030!
- d. As per the GSM Mobile Policy Handbook, TSPs (Mobile operators) have the following role to play in the development of the smart cities.
 - Managing Connectivity: Connecting infrastructure & individual handsets to central servers and databases.
 - Data aggregation and analysis : Combining data from multiple sources to produce new insights
 - Service Delivery: Delivering real time information to people and machines that will enable to adapt and respond to the prevailing situation in the city.

- Customer interface :Providing customer support operations such as web portals and call centers as well as delivering the

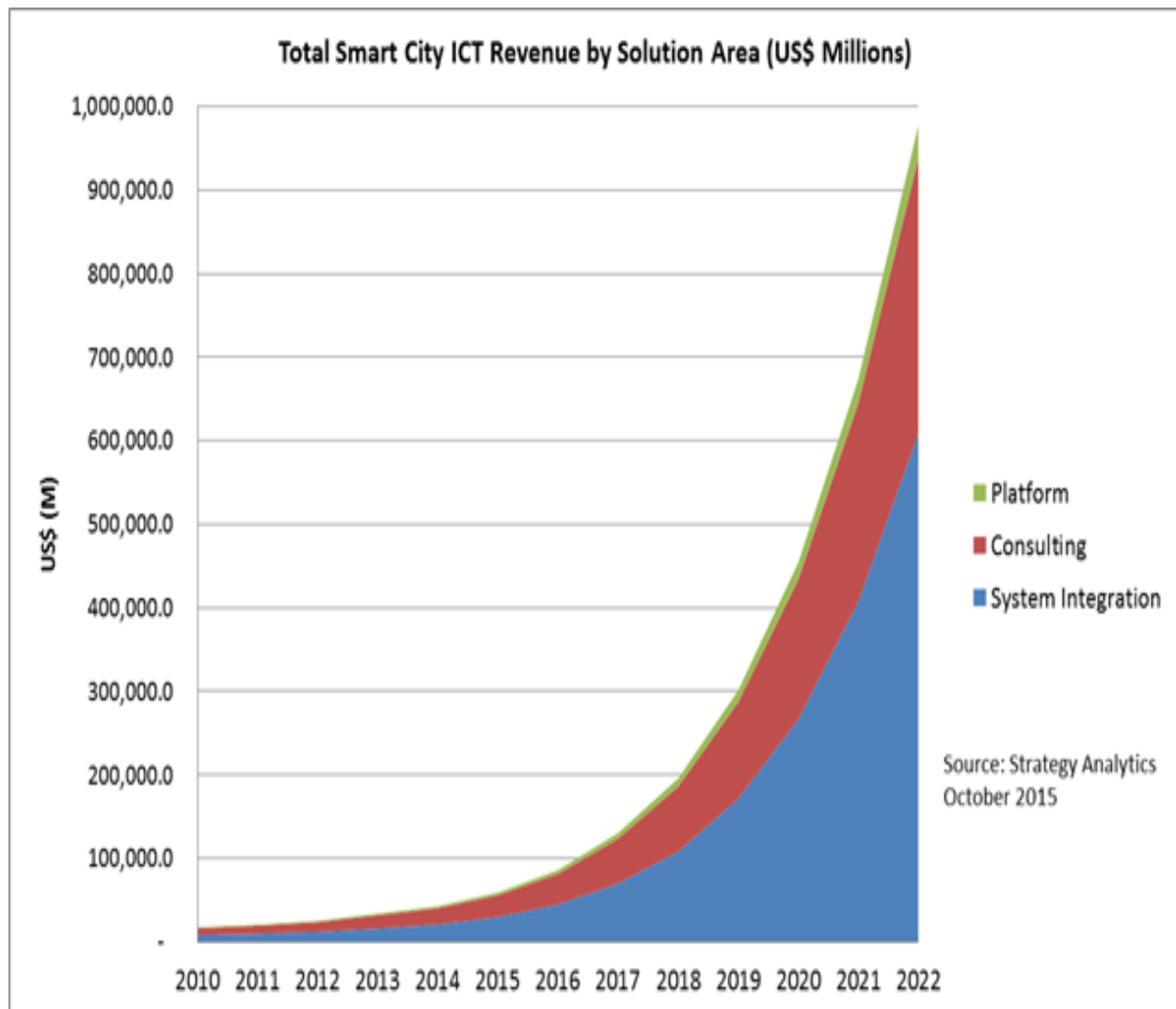
e. Revenue to ICT:-

The worldwide population shift to urban centers is spurring the adoption of “Smart Cities” to maximize the efficiency of crucial resources like utilities, water supply and transportation services. These cities of the future will combine and leverage Internet of Things (IoT) and Information and Communications (ICT).

A new Strategy Analytics report “The Future of Smart Cities - Opportunities, Solutions and Players” forecasts that *Urban ICT revenues will reach \$977 Billion by 2022* globally. Currently, about one million people are added each week to the world’s cities.

The study reveals that North America and Europe will dominate urban ICT revenue by 2022, with Asia-Pacific the fastest growing market. Smart Health, Smart Infrastructure and Smart Government represent the largest ICT opportunities.

Fig 16.1 Global Smart City ICT revenue graph



f. The four areas where TSPs could be benefitted from smart cities in India are:

Table 1: Smart City revenue growth in India

Area	Description	Cost Saving (USD Billion)	Revenue (USD Billion)	Total EBITDA (USD Billion)	Online business in FY17
E-Store & E-Care	<ul style="list-style-type: none"> Rapidly move recharges, acquisition & customer service online. Give critical priorities with immediate 	0.8	0.4	1.0	<ul style="list-style-type: none"> 7.4 USD billion recharges per year 15% of customer

	effects.				service calls. <ul style="list-style-type: none"> • 15% of acquisition
Media content & Services.	<ul style="list-style-type: none"> • Boost data usage • Assess risk appetite & emerge as major content player (music & video) 	-	6.2	1.5	<ul style="list-style-type: none"> • 3x data consumption per user • 1.6 USD billion per year in paid content.
Mobile apps for SMEs	Drive widespread adoption of apps, data, devices in the untapped SME market	-	1.2	0.3	0.7 USD billion per year in untapped market opportunity.
M-payments	Enable E-store & m-commerce transactions through wallet & carrier billing	-	0.2	0.05	0.6 USD billion of recharges for online users.
	Total	0.8	8.0	2.9	

Source: A.T. Kearney analysis

Note: The above information is the revenue growth not from the smart city development but from various other sources which may help building Smart Cities.

17. CONCLUSIONS

Yet despite some pilot projects being implemented, take up of smart technologies amongst cities is slow for two main reasons: -

1. **There is a lack of consensus on what ‘smart’ means and how cities should approach this agenda.** Becoming ‘smart’ means different things to different audiences, and this is causing confusion in the market, meaning that cities have no clear sense of which issues they should focus on and which technologies they should implement.
2. **The smart technologies market suffers from a number of barriers (financial, technical and institutional) that need to be overcome if the market is to grow and mature.**

Smart technologies are part of a new and emerging market where many of the products and services are still in their pre-commercial stage of development. Market weaknesses, ranging from the lack of risk financing to the shortage of capacity and cross-departmental working, are slowing down progress.

Cities wishing to take advantage of smart technologies need to set out their own vision for a ‘smart city’ based on three basic principles: -

- **Integration:** instead of drawing up smart city plans from scratch and in isolation from other initiatives, city authorities benefit most when they integrate smart initiatives within their existing economic development and public service plans and identify how new technologies can help them achieve the goals they already have.
- **Pragmatism:** cities should focus the bulk of investment on smart projects that are practical, achievable and financially viable, while also leaving some room to develop and pursue innovative initiatives.
- **Participation:** smart projects should be undertaken in partnership with businesses, the community and other partners (such as LEPs or neighboring authorities) to make sure that they respond to local issues and needs.

Also, overcoming the barriers to growth of the smart technologies market requires joint working between national government, cities, businesses, users and other stakeholders. They should work together on sharing capacity, identifying the required standards and regulations and developing new risk-sharing models that will allow new technologies to be adopted at scale.

18. ANNEXURES

INDIA SMART CITIES CHALLENGES:

BY 2030, 7 INDIAN CITIES WILL HAVE POPULATION OVER 10 MILLION

The Indian smart cities challenges designed to inspire greater creativity from municipal officials and their partners, more involvement and inspiration from citizens and the development of proposals that will produce concrete benefits in people's lives.

As a first step, all states will use standardized criteria to pick up their cities for the competition. Every state is guaranteed at least one city in the competition. All total, 100 cities will compete. Cities judged to have the best proposals will receive funding. The remaining cities will have chance to compete next year.

A. Monthly agendas by the states & the government:

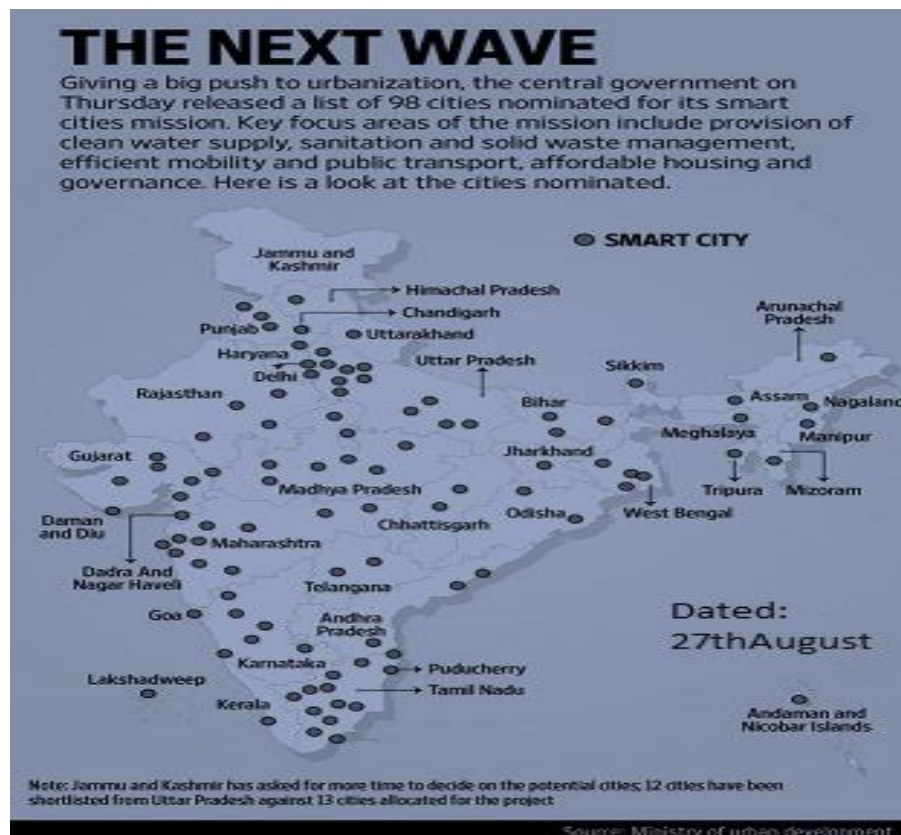
Table 2: Monthly agendas by the Indian government for smart cities

YEAR	AGENDA
JUNE-JULY 2015	States nominate cities to compete.
AUGUST	100 cities enter the competition.
AUGUST-OCTOBER	Cities develop a bold vision and smart proposals
DECEMBER	Early winners announced and short listed cities progress
DECEMBER 15'-FEB 16'	Short listed cities engage in 'Good to great 'program.
MARCH-APRIL 16'	Winners announced

On 27th August 2015, The National Democratic Alliance (NDA) released the guidelines and mission statement of 98 cities of which Uttar Pradesh has been allotted the largest number of 13 cities. The mission, a flagship programme of the NDA, has been allotted a budget of 48000 crore for five years. Arindam Guha, senior director at Deloitte, said "The implementation

challenges for the cities with the population below 1 lakh would be somewhat different from large cities. While complexity would be higher in the large cities the main components for the smaller cities is likely to be that of technical capacities in areas like urban planning, financial management, engineering, procurement & programming management. It is here that state governments may need to think of some common support mechanism for fast tracking implementation. There are four capital cities which are not included in the race-Patna, Bengaluru, Kolkata, Shimla.

Fig 17.1: Indian Smart Cities



B. List of Consulting firms appointed to prepare Smart Cities:-

Table 3: List of Consulting Firms

S.NO.	CONSULTING FIRMS	LIST OF SMART CITIES
1.	CRISIL in association with Pri Move Infrastructure Development Consultants Private Ltd and Probity Soft Private Limited	Nagpur, Kalia-Dombivali, Nasik, Thane, Solapur & Amravati.
2.	ICRA	Rajkot, Kochi, Ajmer, Erode, Coimbatore.
3.	All India Institute of Local Self Government	Chandigarh, Raipur, Bilaspur, Karnal, Faridabad
4.	Jones Lang La Salle Property Consultants India Pvt. Ltd in association with Townland Consultants Pvt. Ltd and Tata Consulting Engineers	Vadodara, Bhubaneshwar, Amritsar, Karnal, Faridabad.
5.	Darashaw & Co in association with IDOM Ingenieria Consultoria SAU and FUNDACION CARTIFF	Surat, Belgavi, Hubli-Dharwad & Dhind
6.	Mahindra Consulting Engineers in association with SUEZ Environment Consulting & Akara Research & Technologies	Biharshariff, Oulgaret, Tiruppur & Thoothukudi.
7.	Feedback Infra in association with Happold Engineers India & Cisco Systems.	Ahmedabad, Rourkela, Kota, Agartala.
8.	Mehta & Associates in JV with Oswal Computers & Consultants.	Gandhinagar, Indore & Jabalpur.
9.	Voyants Solutions in association with MINRAJ Consultants.	Gwalior, Sagar & Satna.
10.	Dorsh Holding in association with Dorsh Consult India & LR Kadaliya & Associates.	Maharashtra, Jharkhand Andhra Pradesh, Telangana Karnataka, Goa
11.	Alia Consulting Solutions & Genesis Fin Tech	GreaterMumbai, Muzaffarpur, Durgapur.
12.	Haskoning DHV Consulting in JV with Haskoning DHV Nederland & Grant Thornton Green Boulevard.	Ujjain, Dahod.
13.	Deloitte Touche Tohmatsu in association with Urban Management Consultant & Hijli Inspiration.	New Town Kolkata & Bidahannagar.
14.	Lea Associates South Asia in association with Crux Consultants & VB Soft.	Tirupati, Tumakuru.
15.	IIDC in association with Urban Mass Transport Company and Building Design Partnership.	Mangalore & Udaipur.

16.	Aarvee Associates Architects, Engineers & Consultants in association with Mars Telecom System.	Allahabad, Aligarh
17.	Data World in association with Innovest Advisory Services & Caritas Eco Systems.	Lucknow & Namchi
18.	Engineers India in association in JPS Associates.	Rampur & Moradabad
19.	Infrastructure Development Corp (Karnataka) in association with IDFC Foundation.	Selum & Madurai
20.	Shah Technical Consultants.	Vellore & Tirunelveli
21.	International City Management Association with Urban Management Centre and Edge Soft India	Agra & Bareilly
22.	Arki Techno Consultants (India) and IRS Systems South Asia	Aizawl and Haldia
23.	Knight Frank (India) with Fortress Infrastructure services and PSP Financial Consultants	Hyderabad, Aurangabad
24.	KPMG	New Delhi Municipal Council
25.	Ecorys Nederland with Ecorys India	Bhagalpur
26.	TERI with Tractebel Engineering SA and Avalon Infrastructure Solutions Ranchi – IK Worldwide with SCP Consultants	Dharmashala
27.	IK Worldwide with SCP Consultants.	Ranchi
28.	CRP Risk Management with Infrastructure Management and Advisory Services	Davanagere
29.	Srei Infrastructure with Navayuga spatial Technologies and RSP Design Consultants	Shivamogga
30.	McKinsey	Pune
31.	Tandon Urban Solutions with Spatial Decisions and Maha Infortech	Navi Mumbai
32.	Price Waterhouse Coopers with Rudrabhishek Enterprise and CPG Consultants	Bhopal
33.	Mott MacDonald with Ernst and Young.	Jaipur
34.	Soft Tech Engineers with Design Point Consult	Saharanpur
35.	DDF Consultants with MSN Infrastructure and SGI Studio Galli Ingenieria.	Dehradun
36.	AECOM India with AECOM Asia Company	Visakhapatnam and Ludhiana
37.	NK Buildcon	Varanasi and Jhansi

C. DIFFERENT APPROACHES FOR SMART CITY DEVELOPMENT:

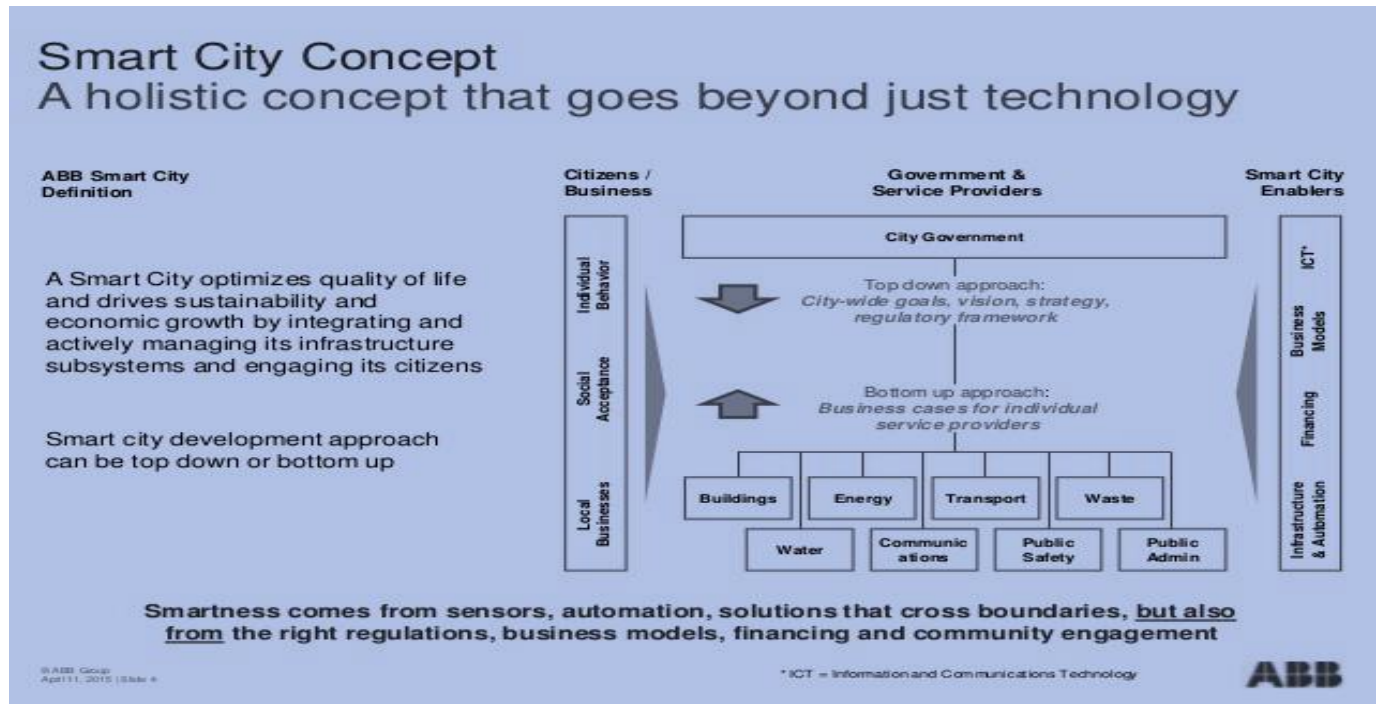
- i) **City type:** The output of Cities depends on a comprehensive infrastructure to deliver physical and social resources, without which both the effectiveness of the City as an economic unit and its economic performance will be impaired. For example, the ease with which people communicate, travel and meet plays a key part in the City's ability to foster a thriving business community, creating requirements for development of the transport and communications Infrastructure and services. The physical and social resource systems can be thought of as delivery channels, enabled by supporting information flows.
- ii) **Project Scope:** India is drawing on the development of smart cities at the global level.

Indian cities are projected to require 700-900million square meters of commercial and residential space by 2030.

Digital India envisages making India a leader in digitally delivering services in the health, education, banking sectors. Modi announced an investment of \$1.2 billion in smart cities with more funding coming from private sectors and abroad. A number of new cities are already under construction, especially, in the corridor between Delhi and Mumbai. Many of the planned cities include Special Investment Regions or Special Economic Zones, which relax regulations, reduce taxes, and generally make it easier for foreign companies to invest.

The U\$D100 billion Delhi-Mumbai corridor effort has a 26 percent investment from Japan, Singapore foreign minister K. Shanmugam on his visit to India offered to build one smart city, British Chancellor George Osborne extended a 1 billion pound credit line to help U.K. companies invest in Indian infrastructure, etc. Although as of now, there are enough foreign funds for the government's smart city project, there still remains a concern associated with the dream. However hard the government might be trying to execute its ambitious plan, this project seems to be turning into an elitist concept, leaving out or marginalizing the underprivileged section of society.

Fig 18.2: Project scope



of smart solutions. Indian corporate sector has an important opportunity to support the cause of sustainable living. It can contribute towards the mission by many ways. For me, a smart city should first and foremost mean a more livable city, which offers basics to every citizen, no matter rich or poor — be it good roads, water, consistent power supply, affordable transport, schools, open play grounds, cultural hot-spots, accessibility to differently abled and environmental care.

As for the housing shortfall, it is enormous as 60 million housing units are estimated to be needed for the entire population. This is expected to rise to 110 million units by 2022. The investment needed is \$2 trillion while land requirement is pegged at 1.7 to 2 lakh hectares just for urban areas. Under the new scheme, 20 million new houses are proposed to be set up over the next seven years. Besides, a central grant of roughly R.s 1 lakh per house will be provided for slum rehabilitation, apart from interest subvention of 6.5 per cent on housing loans for weaker sections.

D. Special Purpose Vehicle (SPV):

The implementation of the Mission at the City level will be done by a Special Purpose Vehicle (SPV) created for the purpose. The SPV will plan, appraise, approve, release funds, implement, manage, operate, monitor and evaluate the Smart City development projects. Each smart city will have a SPV which will be headed by a full time CEO and have nominees of Central Government, State Government and ULB on its Board. The States/ULBs shall ensure that, (a) a dedicated and substantial revenue stream is made available to the SPV so as to make it self-sustainable and could evolve its own credit worthiness for raising additional resources from the market and (b) Government contribution for Smart City is used only to create infrastructure that has public benefit outcomes. The execution of projects may be done through joint ventures, subsidiaries, public-private partnership (PPP), turnkey contracts, etc. suitably dovetailed with revenue streams.

Funds provided by the Government of India in the Smart Cities Mission to the SPV will be in the form of tied grant and kept in a separate Grant Fund. These funds will be utilized only for the purposes for which the grants have been given and subject to the conditions laid down by the MOUD.

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