



Opportunities and Challenges of Emerging Smart Cities in India

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Abstract— Cities are the engines for social and economic growth of a country. The urban sector contributes nearly 50-60% to India's GDP. Cities are pivotal in the creation of employment and the economic growth in the country. Creation of job opportunities coupled with higher incomes and standards of living has led to an influx of rural population into urban areas. As a result, India has witnessed an unprecedented growth in the urban population. As per 2001 census, 28% of India's total population resides in urban areas. It is estimated that by the year 2030, the urban population would rise to 42% of the total population of the country. Urbanization, however, is coming at a price. Rapid growth in urbanization has placed immense strain on land and other natural resources. The shortage of housing has led to creation of slums and unauthorized settlements. Rising pollution levels, traffic congestions and inadequate waste management have resulted in a deteriorated quality of life and environment in the urban areas. It is estimated that nearly 70 new cities with a population of greater than 500,000 would be added to the country's landscape by 2020. This augurs well for the country and presents a wonderful opportunity to design these developments as green from day one. With the government initiative of —Smart Cityl concept, there are new opportunities of growth in this sector. Twenty cities are already approved for the up gradation to smart city and the town planners are working hard on these smart cities. This will lead to new urban India, where the inevitable questions will be do the smart cities really boost up the potential of inclusiveness with the rest of the rural India? Do the smart cities bring some more challenges regarding creating jobs and setting up new industries, which need more skilled human resource, to include the upcoming young India's labour force? Does India have potential to carry forward this draconian growth trajectory with proper monetary flow? To be optimistic we really are. This study carries feasibility analysis emphasizing on opportunities and challenges of setting up new Smart Cities in India.

Keywords— *Smart Cities, Challenges, Opportunities, Urbanization, Housing*

I. INTRODUCTION

Cities are the engines for social and economic growth of a country. The urban sector contributes nearly 50-60% to the nation's GD . Cities are pivotal in the creation of employment and the economic growth in the country.

Creation of job opportunities coupled with higher incomes and standards of living has led to an influx of rural population into urban areas. As a result, India has witnessed an unprecedented growth in the urban population. As per 2001 census, 28% of India's total population resides in urban areas. It is estimated that by the year 2030, the urban population would rise to 42% of the total population of the country [6]

Urbanization, however, is coming at a price. Rapid growth in urbanization has placed immense strain on land and other natural resources. The shortage of housing has led to creation of slums & unauthorized settlements. Rising pollution levels, traffic congestions and inadequate waste management have resulted in a deteriorated quality of life and environment in the urban areas.

It is estimated that nearly 70 new cities with a population of greater than 500,000 would be added to the country's landscape by 2020 (Census of India, 2001). This augurs well for the country and presents a wonderful opportunity to design these developments as green from day one. With the government initiative of —Smart Cityl concept, there are new opportunities of growth in this sector. Twenty cities are already approved for the up gradation to smart city and the town planners are working hard on these smart cities. This will lead to new urban India, where the inevitable questions will be do the smart cities really boost up the potential of inclusiveness with the rest of the rural India? Do the smart cities bring some more challenges regarding creating jobs and setting up new industries, which need more skilled human resource, to include the upcoming young India's labour force? Does India have potential to carry forward this draconian growth trajectory with proper monetary flow? To be optimistic we really are. This study carries feasibility analysis emphasizing on opportunities and challenges of setting up new Smart Cities in India

II. BACKGROUND

On 30th April, 2015, the government of India approved two flagship schemes in a bid to make urban areas more liveable, namely, 100 Smart City Missions and Urban Rejuvenation Program for 500 towns and cities. The aim of these schemes is to promote smart solutions for the efficient use of available assets, offer economic activities, investment and employment opportunities and improve the quality of life of residents.100 Smart Cities are distributed among the States and Union Territories (UT) on the basis of equitable criteria. The criteria give equal weight to urban population of the State/UT and the number of statutory towns in the State/UT (50:50 for both). Based on this formula, each State/UT will have a certain number of potential Smart Cities, with each State/UT having at least one.

The process of identifying smart cities is shown in figure 1.



Fig. 1. Smart City Identification Timeline

A. City Challenge Process for Selection of Smart Cities

The 'City Challenge' (http://www.jll.co.in/india/en-gb/Research/Smart_Cities_e_version.pdf) is a positive approach towards bringing objectivity in selecting cities and thus increasing the chances of being successful in the Pilot projects. The pilot cities can serve a larger development agenda by addressing larger regional development goals; and vulnerability concerns. The process of selection requires a bottom-up as well as a top-down approach. While the bottom-up approach will give a platform for cities to show pro-activeness, the top-down approach will ensure that the larger goals of urban development are not pushed out of focus. The following steps are used in selection of Smart Cities.

Step 1: Develop indices for cities: Indicators that address the four objectives: probability of success, replicability and scalability, attaining larger development goals, and reducing vulnerability.

Step 2: Call for proposals from cities: This step will entail a bottom-up approach. Proposals can contribute towards two major aspects of the city selection process: the city-level data required to measure the indicators, and the city's vision towards its future development, which is necessary for any program's success.

Step 3: Evaluation of proposals: This step would involve evaluation of the proposals submitted based on the methodology decided during steps 1 and 2. An expert committee can be constituted in each state, with representation from academia, research, think tanks and independent experts. This committee can help state governments develop a framework for evaluation, be part of the evaluation process, and support cities in preparing proposals.

So, it is the high time to put our thought into this government endeavour as this initiative is going to have enormous impact on the day-to-day life of the common people of India. Smart cities are supposed to have a great deal of opportunity for new jobs, for 41% of youth (less than 20 years) among the total population of India (Census of India, 2011).

B. Objective

The principal objective of the research is to find out the challenges and opportunities of setting up Smart Cities in India. There are 100 cities to be proposed and developed as Smart Cities. Is not it a really draconian job to do so? Is there any common problem/s or any issues which are going to create a hindrance to realize this dream? Is any change of government can lead to decreasing this vision of creating 100 smart cities into 30? We need to put our thoughts in this too. It seems to get pessimistic but we need to address the common issues and their mitigation process at the outset of this big scale project. So, the objectives are:

- To find out the potential of Indian Cities in general to upgrade them into smart cities.

- To find out some generic problems which we are initially apparently ignored or underestimated.
- To discuss and critically analyze the policies regarding these development to find out whether they are prudent enough to carry out the development at the same time to serve the entire stake holders' interest/s.

C. Scope of work

There are some limitations because of the diversity of India. Out of 7 types of climatic regions all over the world India has 4 types of them. So if we consider a particular point called air-conditioning system it will have different uses in different regions of India. We have so many regional languages and versatile food habits all around the country. This diversity cannot be undermined while we are trying to develop Smart Cities all around the country with same characteristics and same ICT systems. Government, although is trying to define Smart Cities without considering the regional character of the particular city, it is definitely not going to happen. There is an opportunity to put all the smart cities in a single frame to create unified and smart India, with some important decisions and their implementations.

III. LITERATURE STUDY

A city is considered to be smart when investments in human and social capital and traditional and modern communication infrastructure foster sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance [2].

The literature study has been carried out to know more about the smart cities proposed by Government of India, Ministry of Urban Development. The Smart City should be defined first. Here is a definition from the Smart City Guidelines by Ministry of Urban Development, published on June 2015. The first question is what is meant by 'smart city'

([http://smartcities.gov.in/upload/uploadfiles/files/SmartCityGuidelines\(1\).pdf](http://smartcities.gov.in/upload/uploadfiles/files/SmartCityGuidelines(1).pdf)). The answer is, there is no universally accepted definition of a Smart City. It means different things to different people. The concept of Smart City, therefore, varies from city to city and country to country, depending on the level of development, willingness to change and reform, availability of resources and aspirations of the city residents. 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, the 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 '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 lighthouse to the aspiring cities.

The Smart Cities Mission of the Government is a bold, new initiative. It is meant to set examples that can be replicated both within and outside the Smart City, catalyzing the creation of same smart cities in various regions and parts of the country.

The core infrastructure elements in a Smart City would include:

- adequate water supply,
- assured electricity supply,
- sanitation, including solid waste management,
- efficient urban mobility and public transport,
- affordable housing, especially for the poor,
- robust IT connectivity and digitalization,
- good governance, especially e-Governance and citizen participation,
- sustainable environment,
- safety and security of citizens, particularly women, children and the elderly, and
- Health and education.

As far as Smart Solutions are concerned, an illustrative list is given in Figure 2. This is not, however, an exhaustive list, and cities are free to add more applications.



Fig. 2. Smart Public Services in Smart Cities

Accordingly, the purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially the technology that leads to smart outcomes. Area-based development will transform the existing areas (retrofit and redevelop), including slums, into better planned ones, thereby improving liveability of the whole city. New areas (Greenfield) will be developed around cities in order to accommodate the expanding population in urban areas. Application of smart solutions will enable the cities to use technology, information and data to improve infrastructure and services. Comprehensive development in this way will improve

quality of life, create employment and enhance incomes for all, especially the poor and the disadvantaged, leading to inclusive cities.

A. Features of the Smart City

Some typical features of comprehensive development in Smart Cities are described below.

- Promoting mixed land use in area-based developments — planning for ‘unplanned areas’ containing a range of compatible activities and land uses close to one another in order to make land use more efficient. The states will enable some flexibility in land use and building by-laws to adapt to change;
- Housing and inclusiveness — expand housing opportunities for all;
- Creating walkable localities — reduce congestion, air pollution and resource depletion, boost local economy, promote interactions and ensure security. The road network is created or refurbished not only for vehicles and public transport, but also for pedestrians and cyclists, and the necessary administrative services are offered within walking or cycling distance;
- Preserving and developing open spaces — parks, playgrounds, and recreational spaces in order to enhance the quality of life of citizens, reduce the urban heat effects in areas and generally promote eco-balance;
- Promoting a variety of transport options — Transit Oriented Development (TOD), public transport and last mile Para-transport connectivity;
- Making the governance citizen-friendly and cost effective — increasingly rely on online services to bring about accountability and transparency, especially using mobiles to reduce cost of services and providing services without having to go to municipal offices; form e-groups to listen to people and obtain feedback and use online monitoring of programs and activities with the aid of cyber tour of worksites;
- Giving an identity to the city — based on its main economic activity, such as local cuisine, health, education, arts and craft, culture, sports goods, furniture, hosiery, textile, dairy, etc;
- Applying smart solutions to infrastructure and services in area-based development in order to make them better. For example, making areas less vulnerable to disasters, using fewer resources, and providing cheaper services.

B. Policies Relevant to Smart Cities

The major initiatives implemented along with the smart city development mission and ‘Atal Mission for Rejuvenation and Urban Transformation’ (<http://amrut.gov.in>) include ‘Pradhan Mantri Awas Yojana’ (<http://pmaymis.gov.in>) and ‘Swachh Bharat Mission’ (<http://sbm.gov.in/sbm>) with a forecast to jump from 377 million people in 2011 to 600 million people in 2031. The discussion about the relationship among them is as follows (Table no 1):

TABLE I. LIST OF POTENTIAL SMART CITIES

No	State	City	No.	State	City
1.	Andaman & Nicobar Islands	1. Port Blair	18	Lakshadweep	1.Kavaratti
2.	Andhra Pradesh	1.Vishakhapatnam, 2.Tirupati, 3.Kakinada	19	Madhya Pradesh	1.Bhopal,2.Indore,3.Jabalpur, 4.Gwalior,5.Sagar,6.Satna,7. Ujjain
3.	Arunachal Pradesh	1.Pasighat	20	Maharashtra	1.NaviMumbai, 2.Naik,3.Thane,4.Greater Mumbai,5.Amravati, 6.Solapur,7.Nagpur,8.Kalyan-Dombivli,9.Aurangabad,10. Pune
4.	Assam	1.Guwahati	21	Manipur	Imphal
5.	Bihar	1.Muzaffarpur, 2.Bhagalpur, 3.Bhawanipatna	22	Meghalaya	Shillong
6.	Chandigarh	1.Chandigarh	23	Mizoram	Aizawl
7.	Chhattisgarh	1.Raipur, 2.Bilaspur	24	Nagaland	Kohima
8.	Daman & Diu	1.Diu	25	Odisha	1.Bhubaneswar,2.Raurela
9.	Dadra & Nagar Haveli	1.Dilwasa	26	Puducherry	Outgater
10.	Delhi	New Delhi Municipal Council	27	Punjab	1.Ludhiana,2.Jalandhar,3.Amritsar
11.	Goa	Pantaji	28	Rajasthan	1.Jaipur,2.Udaipur,3.Kota,4. Ajmer
12.	Gujarat	1.Gandhinagar,2.Ahmedabad,3.Surat, 4.Valodra,5.Rajkot,6. Dahod	29	Sikkim	Namchi
13.	Haryana	1.Karnal,2.Faridabad	30	Tamil Nadu	1.Tiruchirappalli, 2.Tirunelveli, 3.Dindigul, 4.Thangapar, 5.Tiruppar, 6.Salem, 7.Vellore, 8.Coimbatore, 9.Madurai, 10.Erode, 11.Theotokadi, 12.Chennai
14.	Himachal Pradesh	Dharamshala	31	Telengana	1.Greater Hyderabad,2.Greater Warangal
15.	Jharkhand	Ranchi	32	Tripura	Agartala
16.	Karnataka	1.Mangaluru,2.Belga vi,3.Shivamogga,4.Hibballi-Dharwad,5.Tumakuru, 6.Davanegiri	33	Uttar Pradesh	1 Meerut, 2. Aligarh, 3.Saharanpur, 4.Bareilly, 5.Jhansi, 6.Kanpur, 7.Allahabad, 8.Lucknow, 9.Varanasi, 10.Ghaziabad, 11.Agra, 12.Rampur
17	Kerala	1.Kochi	34	Uttarakhand	Dehradun

C. AMRUT

The AMRUT project was launched back in May 2014, as an urban renewal project of 500 cities of India, succeeding JNURM. JNURM was a scheme implemented between 2005 and 2012 to encourage urban infrastructure improvement with a focus on upgrading public services like water supply, sewage and probably one of the most important i.e. urban transport systems. In some aspects it embraces the feature of smart city development.

D. PMAY

PMAY, in 2015, announced their Scheme Guidelines from the Ministry of Housing and Urban Poverty Alleviation. It was renamed as Housing for All (Urban). The initiative aims to provide housing for all citizens by constructing 20 million housing units with basic civic infrastructure for the poor and slum dwellers in cities from 2015 through 2022. The cities covered under the scheme include all cities and towns in India (4,014 locations) (determined by the 2011 census). The components of PMAY include basic civic infrastructure, water treatment, sanitation, electric power supply, etc. The beneficiaries are eligible for an interest subsidy at a rate of 6.5% on housing loans. Financial support of 100,000 to 230,000 rupees per house is also available to subsidize the construction of housing.

E. SBM

The SBM aims to improve sanitation in cities. The guidelines for Swachh Bharat Mission were announced in

December 2014. The mission will be implemented through February 2019 with a focus on eliminating open defecation, improving waste management, encouraging community-managed solid waste management and generating awareness about sanitation. All 4,041 cities and towns in India are covered by the mission. The following components are provided in the guidelines.

IV. CHALLENGES TO ENSURE ACCESS FOR URBAN INFRASTRUCTURE

As India is the second most populated country in the world, and keeping the current development scenario in consideration, the urban population of the country has to continuously struggle for the access to urban infrastructure such as water supply, drainage, sewerage, scientific solid waste disposal, housing and urban transport. Here is a comparative analysis between the most populated cities in USA and India. Selection and comparison of cities has been carried out between Mumbai, Chennai, Kolkata, Bangalore, Hyderabad, Delhi with New York, Boston, Chicago, Philadelphia, Miami, and San Francisco respectively. It has been observed that the cities of USA have more area with respect to the Indian cities whereas the population of those is less in comparison to Indian cities. Eventually, the population densities of Indian cities are very high. Here is the illustration:

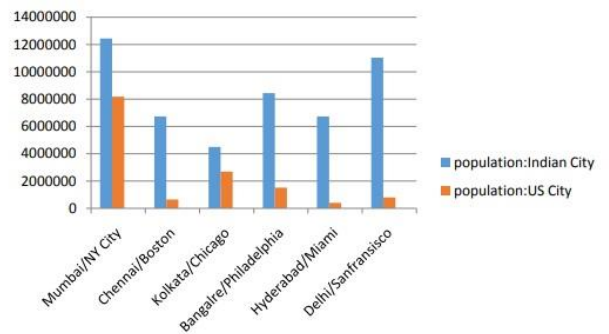


Fig. 3. Population Comparison between Indian Cities and US Cities

At the same time the area of the city has been taken into consideration where the data does not show this consistency:

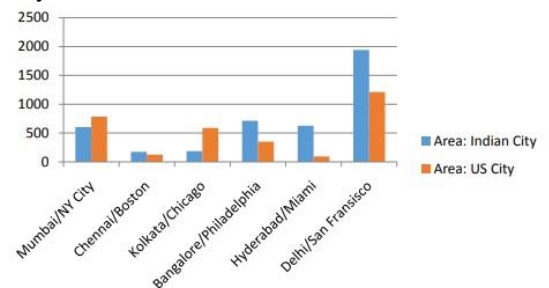


Fig. 4. Area Comparison between Indian Cities and US Cities

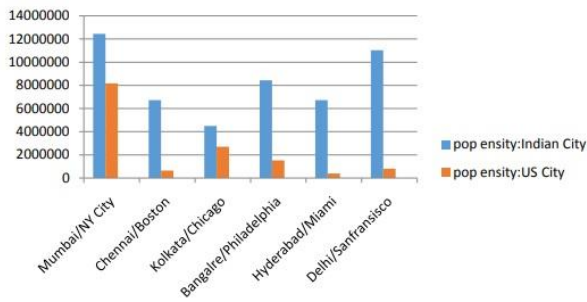


Fig. 5. Population Comparison between Indian Cities and US Cities

Thus, it is pretty obvious that the smart city implementation in India faces more challenges in terms of providing urban facilities to the dwellers. Infrastructure inadequacy and inequitable distribution, accompanied by inefficient and ineffective management has led to ineffective linkage and losses and deficiencies in service in urban areas. These are largely absorbed by the low income and poor section of the population. The sector wise problems and challenges are discussed in the following section.

A. Housing Shortage and Slums

The last few decades' massive urbanization, changing demographics, increasing income level have led to increasing pressure on housing, transportation, land and other urban services. It was estimated that the total urban housing shortage was 18.78 million units in 12th Five Year Plan. With these 18.78 million units, the housing shortage among the Economically Weaker Section and Lower Income Group is extraordinarily high with a 96% share of the total shortage.

Further, as per Cushman and Wakefield (<http://www.cushmanwakefield.co.in>), India is likely to witness the urban housing demand of nearly 13 million units by the end of 2018. Of this about, 19% demand (2.47 million units) would arise from the top 8 cities namely, Ahmedabad, Bangaluru, Chennai, Delhi-NCR, Hyderabad, Kolkata, Mumbai and Pune with LIG (0.85 million units) and Middle Income Group (0.88 million units) segment likely to account for the major chunk (About 80%) of the total demand.

As per census 2011, 52.4 million people lived in slums in 1743 towns, which constitute 23.5% of the urban population. There is acute shortage of housing in urban areas as much of the available accommodation is qualitatively of sub urban variety. These problems have tended to worsen over the years due to rapid increase in population, fast rate of urbanization and disproportionate addition to the housing stock. Millions of people pay excessive rent, which is beyond their means thereby making the housing especially in a million plus cities an unaffordable proposition. The major constraints in developing housing in India are:

- With growing population and expanding cities, there is paucity of land that can be developed for creating a new housing stock.

- Private sector's participation in the creation of low cost housing stock in India has been limited due to the reasons such as limited margins, longer time frames of such projects, rigid institutional and regulatory frameworks, etc.
- Financial exclusion of the vulnerable and weaker section from the formal system limits their prospects of buying or building their own homes.
- High construction cost creates a hindrance to include the weaker section to get accommodated in the housing subscribers' group.
- The regulatory framework being rigid and tedious for approval can be one of the most important constraints.

B. Water Supply, Sewage and Sanitation

Inadequate water supply is one of the common problems of most of the Indian cities. As per Census 2011, 29% of urban household do not have access to treated and piped water and only 71% of the urban population has access to water connections that too have only 1 to 6 hours of supply per day. The annual per capita availability of water has reduced from 1,816 Cubic meters in 2001 to 1,545 cubic meters in 2011. Many small towns have no piped water supply at all, and they are dependent on underground water that is fast depleting and contaminated.

In the urban areas, the condition of sewerage and sanitation is far from satisfactory. As per census 2011, around 8.8% of urban households have no latrine. Around 44.5% of urban household are connected with underground sewerage while 18.2% household do not have any drainage facility. Out of the 38,000 MLD urban sewerage generated, the treatment capacity exists for only about 12,000 MLD. The sewerage treatment capacity for 35 million plus exists for 8,040 MLD i.e. 51% treatment capacity. The sewage generated in Class-I cities has the treatment capacity of 11,553 MLD, which is 32% of the sewerage generation.

The drainage situation is equally poor in urban areas due to improper drainage system. A large pool of stagnant water can be seen in cities even during summer months. Removing garbage, cleaning drains, and unclogging sewers are the main task of ULBs. There are both fund constraint and lack of capacity of the system with respect to the residents of the city.

C. Solid Waste Management

ULBs are responsible for providing the basic essential service like solid waste management. However, it is among the poorly rendered services. Unscientific and outdated systems along with the low population coverage are one of the indispensable challenges of Indian cities. With rapid urbanization this is becoming a serious issue today. Waste generation is a direct contribution of urbanization and the unscientific way of handling this can create health hazards and degrade urban environment. Increasing consumerism, changing lifestyle and rapid growth of urbanization is making the job of solid waste management a mammoth task.

Daily amount of generated solid waste in Indian cities is 1, 88,550 MT. The million plus populated 53 cities of India together create 86,000 MT solid waste as the per capita generation of solid waste is 500 Gm. a day. Cities with 1lakh plus population contribute 72.5% of the waste generated in the country.

Collection of solid waste in urban areas is a big challenge. The so-called metro cities are only able to collect 50-70% of the total generated solid waste. The amount comes to about 50% in case of smaller cities. The estimates also reveal that about 2% of uncollected solid waste is burnt on the road itself. 10% of collected waste is openly burnt releasing 22,000 tons of pollutants into the lower atmosphere and hence degrading the natural environment.

The detrimental aspects of these challenges are financial constraints, rudimentary technology used, institutional weakness and public apathy. Uncontrolled dumping of waste outside the city or town has already created a serious problem to the environment and public health.

D. Power Shortage

As each segment of the modern society like domestic, agriculture, industrial and government operation requires electricity and energy to function, it is being an indispensable responsibility of the ULBs to take care of the same. As India comes at the fifth position on the global scale in terms of power sector, we are still falling short to meet the demand with an installed capacity of 2, 07,006 MW. This excess demand creates a strain on the power production facilities which are mostly conventional like thermal and hydroelectric power generation. Insufficient power supply due to shortages is often attributed to inadequate investment in distribution and transmission.

Aggregate Technical and Commercial (AT & C) losses, which can be the cumulative result of theft, non-billing, incorrect billing, insufficiency in collection and transmission, exceeded 40% of the country's total electricity generated as a whole in 2005. That is the reason why the state electricity boards remain financially unviable and unable to attract finances or investment to gear up.

E. Transport and Traffic

The increased congestion is directly attributed to rapid urbanization. Public transport shares only 22% of total urban traffic. Only 20 cities out of 85, which have more than 5 lakh population, have a dedicated city bus service. In 2007, a study commissioned for the ministry of urban development, Government of India found that the average journey speed in Delhi was around 16 km/h and it was only slightly higher in Mumbai. The major problems of the urban centres of India are absence of planned and adequate arrangement for traffic and transport. Majority of people use buses and tempos while a few use rails as a

mode of transportation. This problem gets worse when more number of two and four wheelers is added in everyday traffic. Moreover, the numbers of buses running in and around the metropolis are inadequate and consume long hours for the commuters.

V. CASE STUDIES TO ADDRESS CHALLENGES

Here are some of the case studies from different regions all around the globe to understand how the solutions are achieved for the energy, transportation and water resource issues etc.

A. Slum Redevelopment of Thailand

1) The problem

In the early 2000s, many of Thailand's poorest citizens were living in rundown slums that lacked sufficient homes and basic infrastructure. With an increasing population, the health and welfare of citizens in these neighborhoods was in danger.

2) The solution

The central and local government officials called on affected citizens and communities to offer solutions, and a pilot project was launched within the informal settlements along the Bang Bua Canal in Bangkok. Instead of just building houses, the Baan Mankong project empowered some of the poorest people in Thailand to be directly involved in shaping their whole community and encouraged people to see informal settlements as part of the wider city.

3) The results

Through the scaling of Baan Mankong, more than 1,000 communities innovated and implemented projects in 226 towns and cities, improving 54,000 households. The United Nations commended the initiative for using community action to upgrade slums.

B. Automating Traffic Congestion Pricing at London

1) The problem

In the late 1990s, London suffered from some of the worst traffic in the U.K. In Central London, average traffic speeds would often dip below 10 mph, the lowest since the city started collecting traffic data. Delays cost both the city and its resident's time and money.

2) The solution

In 2003, the city levied a surcharge for decreasing congestion in Central London. It began charging single-occupancy vehicles a fee to enter, drive, or park in Central London during working hours. The daily fee could be paid before or on the day of travel through various means—online, by telephone or text message, at select shops and petrol stations, and by post. For convenience, customers could also register to pay via an automated payment system. The system recorded the number of days a vehicle travelled to the congestion zone each month and billed a credit or debit card accordingly.

3) The results

Within a short time, traffic levels in Central London fell by 20% and traffic congestion by 30%. The city recorded a 16% reduction in carbon emissions and an estimated 40-50 million litres reduction in fuel consumption. Many citizens switched from private to public transport, and the city saw an 83% rise in the

bicycle trips. In 2007, the city extended congestion pricing to other areas of London, and raised £122 million in fees annually. This money was reinvested in improving public transport, road safety, and energy efficiency.

C. Promoting Solar Energy at Barcelona

1) The problem

Barcelona, which has the second largest metropolitan population in Spain, was heavily dependent on costly and environmentally damaging fossil fuels. The city was pushed to identify a different solution to take the city's energy policy in a new direction.

2) The solution

The city government of Barcelona issued a Solar Thermal Ordinance in 1999. The ordinance set targets for public and private buildings, making it compulsory to use solar energy to supply 60% of running hot water in all new or renovated buildings. It also put solar powered bus stops on Barcelona's streets.

3) The results

Barcelona has reduced its energy consumption by 25,000 MWh annually compared to 2000 usage levels. It has achieved this by creating a more environmentally friendly energy supply, including more solar and more photovoltaic energy. More than 70 other Spanish cities have followed Barcelona's example.

VI. OPPORTUNITIES

City infrastructure and strategic urbanization is one of the foremost important approaches to overcome the existing challenges of Indian cities. A planning level improvement is the most important implementation where the foresight of the future cities aspects and provisions will be taken care into consideration while planning. It will bring some of the very recent time implementation for upcoming smart cities. This will be considered as an array of opportunities for future India.

A. Housing

Despite the shortage in housing in India we have comprehensive opportunities to address these issues by involving and sometimes by incentivizing the stakeholders of low cost housing projects. Government of India is providing subsidized land and facilitating financing opportunities. Non-Govt. Organizations are identifying beneficiaries and collecting monthly rent from them by SHGs (self-help group). Housing partners are taking responsibilities of monthly rent paying. Investors are being incentivized by tax exemption on low cost housing bonds. With the private players having good construction and project management cell as well as good financing from their side, it seems to look as a brighter picture in the road ahead.

B. Water Supply, Sewerage, Sanitation

Urban water supply in India is improving by:

1. Governance and institutional strengthening: improved city water supply of Nagpur is one of the examples of this category.
2. Information and efficient improvement: Bangalore city has already seen this initiative

implemented by Bulk Metering with Intelligent Operating System.

3. Environmental sustainability and technology use: a pilot project of successfully running Helium Gas-Based Leak Detection Tool at Pimpri-Chinchwad area at Pune is an example of this category.
4. Citizens' participation and good improved customer service are the opportunities to work upon to address the problems of water supply systems in Indian cities. Community Managed Toilets at Trichi is the best example of this category.
5. Financial Sustainability creates a new hope of opportunity in this segment. The city of Pallavaram has successfully implemented User-Financing in Sewerage Projects. At Nagpur the Municipality has implemented Energy Audit of Water Supply project to optimize energy consumption during water supply.

C. Solid Waste Management

If city managers of various stakeholders, who deal with municipal solid waste management, work to improve this system in design and execution in a cost-effective frame of mind the present challenges will fade away one day very soon.

1. An approach with sustainability and integrated process implementation frame of mind will easily address the challenges of Solid Waste Management (SWM) in Indian cities.
2. Raising financing resources will address the fund problem easily.
3. Facilitation of private stake holders in SWM projects of different cities are needed to attract and retain more and more private agencies in SWM services.
4. ULBs are the most important key players in improving this system.
5. Implementation of 3R Practice (reduce, reuse and recycle) in this segment is creating an opportunity in SWM segment.

D. Power Shortage Problem

This sector is slowly reviving itself with the help of advanced tools and techniques to address a huge power demand for Indian cities.

1. Renovation and modernization of Generation Sector.
2. Development of National Grid shows signs of reviving the existing legacy systems.
3. Implementation of modern technique for electric power conservation which is named as DSM, are improving system efficiencies as well as minimizing system losses thus improving plants' life.
4. Strengthening the role of Renewable energy in the sector in terms of long term policies are showing the rays of hopes.

5. Introduction of Cogeneration System are gaining popularity nowadays to address the challenges of power shortage.
6. Institutional Energy Auditing Systems of electric power at intervals ensuring the future of electricity industry at the same time not to jeopardize the growth of national economy.
7. Emerging opportunities of adopting innovative business models in terms of peak demand based capacities could emerge in a big way in the future.

E. Transport and Traffic

This is the most important factor to the growth of the cities because an efficient supply chain in terms of transportation can be one of the powerful leverages for growth, i.e. emerging smart cities to accommodate more and more growing urban population.

1. Efficient Mass Rapid Transport System (MRTS) are being financed and developed nowadays all across the geographical location (mostly emerging cities) of India.
2. Vehicular growth and availability of transportation infrastructure in and between metropolitan cities are the indications showing the emergence of support system for growth of urban areas as well as national economy.
3. Vehicular emission, congestion and road safety issues are being addressed nowadays. Road accident fatality risk in the metropolitan areas has decreased significantly between 1999 and 2009, ensuring that the system is also growing in terms of operation quality.
4. Policy measures to improve urban transportation are leading to the growth of the cities.
5. Transport demand in most of the Indian cities has increased substantially due to increase in

population as a result of both natural increase and migration from rural areas and smaller towns.

VII. CONCLUSION

Smart city India is a project which has already been proposed by Government of India with a vision of planning and timely implementation for the future urbanized India. Many small or growing cities are also under the radar to transform it into a Smart City. As the urbanization grows, with an expectation of assured jobs, standard living, this project should go on to meet the demands of growing Indian youth population. With such a vast repository of human resource, Indian economy could not flourish if urbanization process slows down. Let's hope that our future and upcoming generation, who are going to replace us in building of our Nation, don't blame us for not giving them a livable smart city.

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