Implications of Solid Waste and Traffic Congestion on Developing Smart City Program in India- A Prelude

K.N. Radhika[1] and B.C. Prabhakar[2]

[1]*Department of Civil engineering, East West Institute of Technology, Off Magadi Road, Bengaluru- 91*
[2]*Department of Geology, Bangalore University, Bangalore- 560 056.*

Abstract: - **There has been a serious debate in the urban sectors of India on the so called 'smart city' plans ever since the Central Government embarked on this ambitious program. However, it appears that the whole concept is still to be crystallized in the minds of planners. Yet, there has been a stiff competition amongst the cities to get enlisted for inclusion and funding for this program.**

Ever since the liberalization policies of the country and open market philosophies, there has been an unprecedented growth in the urban population especially in metropolitans. In this background, it becomes a dire necessity to appraise the contemporary urban infrastructure from the point of how effective it is to cater to the needs of its dwellers. A cursory synthesis of the available data very clearly shows that the two burning issues of focal attention from the point of sustainable urban development have been (1) solid waste and (2) traffic density. They have been the bane for the governments and municipal authorities, to the extent that they have assumed 'beyond control' dimension. They, in turn, have been responsible for auxiliary problems.

A study from Bengaluru metropolitan shows that the rate of MSW will rise from its present 1.4 million tonnes per year to almost double by 2025. Presently it is producing an overwhelming 4200 tonnes per day. Thus it has become extremely difficult for the authorities to manage it efficiently. Lack of cooperation by the common public is equally responsible for this debacle. This alarming situation is posing a grave concern for the authorities for sustainable management of the city. If this MSW is systematically handled, substantial quantity of biogas to the tune of 4274 tonnes/year (equivalent to 3,00,986 LPG cylinders of 14 kg each) and huge quantity of compost could be obtained. A look at the increase in vehicular traffic in Bengaluru is also staggering. Vehicles in Bengaluru are increasing at the rate of about 5 lakh per year which is creating another huge stress to handle. This situation is literally choking the streets of Bengaluru and it's suburbs.

Thus, any new smart city blue prints should have exhaustive plans to tackle the two focal issues, which are not only concerning to Bengaluru, but also to all the metropolitans in India.

Keywords: **Smart City, Urbanization, India, Solid Waste, Traffic Congestion**

I. INTRODUCTION

A World Bank report estimates that by 2030, 60% of the global population and more than 55 % of the Asian population will be urban [1]. India being the second most populous country in the world with around 1.21 billion population, is all set for rapid urbanization. India's current urban population of 410 million people is expected to grow to 814 million by 2050 [2] and is expected to contribute significantly to the country's growth. Urbanization in India has been steadily increasing from 17.3% in 1951 to more than 31% in 2011 with accelerated growth expected in coming years. Many researchers have also noted a phenomenal increase in population in Class 1 cities (also called Tier 1 cities with more than 1 million) and the number of Class 2 cities (also called Tier 2 cities with less than 1 million population) have increased from 23 to 35 in the last ten years. The present rate of urbanization in India is around 32% [3] and the contribution of urban areas to national GDP is projected to increase from the current level of 60% to 75–80% by the year 2030. The economic growth of India during the last two and half decades has been the most rapid in the world with an annual GDP growth being 6% and, measured in purchasing power parity (PPP), India represents the fourth largest economy in the world today. The economic progress shows no sign of slowing down and is leading to rapid industrialization and swelling of population in Indian cities. As a consequence, Indian cities are stressed with a variety of challenges related to urban life such as urban planning and management, municipal solid waste disposal, traffic management, urban safety, urban health and resource mobilization and utilization. Letting down to cope with any of the aforesaid challenges might be a threat to the city's prosperity and quality of life affecting its residents adversely. Hence, the Government of India has come up with the so called 'Smart City' program with a budget allowance of around seven hundred million rupees.

II. SMART CITY CONCEPT

The notion of smart cities was emerged in 1980s with a view to plan and develop urban centers for ensuring wellness to the residents. A smart city, as described in 'The Hindu' the leading Indian daily, "is an urban region that is highly advanced in terms of overall infrastructure, sustainable real

estate, communications and market viability; it is a city where information technology is the principal infrastructure and the basis for providing essential services to residents." The concept of smart city is still evolving day by day as more and more applications are being envisaged and developed to make cities more efficient, manageable and livable. The expected outcome in Indian context is to create a sustainable and a greener city with increased life standards for the citizens.

Generally, an urban locality has to cater the three important elements for being called "Smart" viz., (1) institutional, (2) physical and (3) social infrastructural elements. The institutional elements include, e-governance, safety and security of citizens. Physical elements include proper water supply, sanitation and sewerage system, waste disposal, unhindered electrical supply, shelter for everyone, efficient public transport, IT connectivity for effective communication. The social infrastructural elements include health, education, poverty reduction, quality life for civilians and sustainable and green environment.

In the recent past, smart city revolution has a been a big success in many cities like Singapore (Singapore), Masdar (UAE), Johannesburg (SA), Boston (USA), Dublin (Ireland), Amsterdam (Netherlands), Songdo (South Korea) and Barcelona (Spain). India has initiated this concept quite recently with a vision to urbanize systematically and the Ministry of Urban development has declared the establishment of 100 smart cities across the country. The government has incited multinational companies like IBM, ESRI and CISCO for the advancement. IBM will integrate information from all city operations into a single system to improve efficiency and deliver an enhanced quality of life for the residents while ESRI will work on spatial data acquisition, storage, processing and decision making systems and CISCO will spring the technological solutions using sensors solve a range of city's service deficiencies and environmental quality degradations.

III. THE BANE OF SOLID WASTE

Municipal solid waste, globally, is considered as a nuisance and an environmental threat. A report from the World Bank's Urban Development Department estimates the amount of MSW to rise from the current 1.2 billion tonnes per year to 2.2 billion tonnes per year by 2025[4]. Much of the increase is likely to happen in the rapidly growing cities of the developing countries. However, some advanced countries have achieved significant strides in managing the municipal wastes. Countries like Germany, Holland, USA, Canada and Australia have their own municipal waste management techniques wherein they reduce, reuse and recycle the waste. The Dutch's approach known as "Lansink's Ladder" (named after the Member of the Dutch Parliament who proposed it) is a very simple approach: avoid creating waste as much as possible, recover the valuable raw materials from it, generate energy by incinerating residual waste, and only then dump the left over in landfills but in an environmentally friendly way. In this process, about 65% of the waste is recycled and the remaining 35% is incinerated to generate electricity.

India today is generating around 4,01,50,000 tonne of waste per year with a per capita amount of 124.1 Kg per year and it is projected to increase to 10,07,40,000 tonnes per year with a per capita amount of 255.5 Kg by 2025. The reason for such anomalous expansion of waste is the unfortunate fallout of rapid urbanization without the adequate infrastructure backup in all Indian cities/towns. Unless serious attention is paid, this problem may be blown out of proportion to handle.

The concept of introducing smartness in cities needs to be embedded within strong principles of achieving sustainability. In this context, management of municipal solid waste has become a colossal problem for Indian urban authorities. The urban centres today, in India are generating around 50 million tonnes of MSW per year, and a World Bank report projects an increase in waste to 100 million tonnes per year with a per capita amount of 255 Kg by 2025. The class I cities (with population more than a million) like Delhi, Mumbai, Kolkota, Bangalore and Chennai generate about 7000 tonnes of waste per day (Tahir et al., 2015; PEARL, 2015) and Class II cities around 5000 tonnes.

The city of Bengaluru generates about 1.4 million tonnes of municipal solid waste at a rate of 0.35kg/day/person [5]. The total population of Bangalore is about 1.2 crores. Managing and processing this waste is a challenge faced by the local urban authorities. The villages in the urban fringe have become the dumping yards for all these waste and this in turn has degraded the environment, besides severely affecting the health and hygiene of local residents. If this waste is properly harnessed, methane, the biogas which is produced by the organic decomposition, could be tapped and used as fuel. Any smart city plan should seriously adapt the viable technology to tap the said methane for sustainable development.

Off late, electronic waste (E-waste) is also added to the problem of municipal solid waste. The global volume of e-waste generated is expected to reach 130 million tons in 2018 from 93.5 million tons in 2016 at a compound annual growth rate of 17.6 percent from 2016 to 2018, according to a study on 'Electronic Waste Management in India,' [6]. The city of Bengaluru stands third in generating about 92,000 metric tonnes of e-waste annually, only next to Mumbai and Delhi which are generating about 120,000 and 98,000 metric tonnes per year respectively. When compared to 2014 survey Bengaluru, the IT hub has overtaken the other two cities in e-waste generation (38%; Mumbai 20%; Delhi 31%), which clearly demonstrates rapid growth of Bengaluru and the correspondingly adverse waste generation including e-waste. Hence, management of e-waste is also a growing concern.

Improper disposal or contact with E-waste can lead to contamination of the surrounding ecology and can be a major health hazard [7]. E-waste accounts for approximately 40 percent of the lead and 70 percent of heavy metals. These also

lead to ground water, air and soil contamination. Prolonged exposure to these pollutants leads to damage of nervous and blood systems, kidneys and brain, respiratory organs and skin. It could also lead to bronchitis, lung cancer and heart, liver, and spleen damage [6].

IV. VEHICULAR CONGESTION IN INDIA

Coupled with economic development and higher aspirations, there has been a significant increase in demand of vehicles in the cities of developing countries like India. Presently, Indian cities are struggling for smooth commuting due to increased urban activities, rising motorization, inadequate transportation management system, inefficient transport planning, execution, etc., Transportation system is found to be plagued by various challenges of accessibility and mobility, traffic congestion, traffic crashes, high fuel consumption in addition to environmental ailments such as carbon emissions. Policies like National Highway Development Program, National Urban Renewal Mission, National Urban Transport Policy and the new scheme of 100 Smart cities have long recognized traffic congestion as a major challenge in urban context. According to the IIM-Transport Corporation of India study conducted in 2012, about 60,000 crore rupees ($9 billion) are lost annually due to traffic congestion. Inadequate and inappropriate public transit system, unscientific route rationalization and slow progress of construction of metro rails have increased congestion in many large cities of India including Bangalore.

Peer Mohamed (2013) [8] states that during the ten-year census period of 2001-2011, Karnataka has posted a growth of 15.9% in population, while vehicle registrations grew up by 181.3% in the same period. In Bengaluru, the average speed on main roads during the peak hour is a paltry 15km/hour, making it the 6th most painful city to commute on IBM's 2011 commuter pain index. Bangalore is ahead even to the densely populated city Delhi. The road density (Ratio of the length of the city's total road network to the city's land area) of Bangalore is 8.2 km/km^2 and that of Delhi is 21.6km/km^2 though vehicle density in both cities are similar. According to the Bangalore city traffic police, the annual growth rate of vehicle population is around 7-10% and personalized modes of transport have grown at a tremendous rate and two wheelers along with the cars almost comprise 90% of the total registered vehicular population in the city. In the recent years Bangalore has the worst vehicle density in the country – one vehicle for every two people [8].

V. SMART SOLUTIONS FOR MSW

Following intergovernmental panel on climate change (2005) formula [9], the methane (biogas) that could be tapped from the MSW of Bangalore is about 4274 tonnes per year. This means around 3,00,986 LPG cylinders, considering 14.2 Kg gas in each cylinder, could be saved annually if the energy potential of the municipal waste is properly harnessed. The residue after harnessing the biogas could be used as organic manure. If this methane potential is not harnessed, then so much methane will escape to atmosphere greatly contributing to global warming because methane has 25 times more global warming potential as compared to carbon di oxide. Chemical reactions in waste lead to produce CO2, CO, NO etc., besides methane and lend a helping (!) hand to methane for polluting atmosphere. The health hazards of gases like benzene, toluene, xylene etc., caused by the decay of organic –rich waste are also of great concern. Even the production and quality of agricultural crops are affected by these gases. Burning of MSW in the dumping areas has also assumed severe environmental challenge. This is mainly because the poor infrastructural facilities for sustainable management of MSW, that the Indian cities have. Thus effective management of MSW, assumes paramount importance from the view point of deriving sustained energy from it and prevent it (MSW) from contributing adversely to climate. The preliminary studies in this regard on Bengaluru are also perceptible forever growing urban enclaves in Karnataka as also in the country. Hence the authors call for a serious view of MSW, to manage it properly, and to minimize its contribution to global warming.

VI. SMART SOLUTION FOR TRAFFIC CONGESTION

Speaking from a larger perspective, Indian cities were never planned with a futuristic growth. This obviously has resulted in a sudden chocking due to the narrow lane like roads with very few multilane roads. As already mentioned, the industrial boom especially the unprecedented growth of software industries and auxiliary activities have resulted in enormous inflow of people from rural to urban centers. As the cities were never prepared in terms of infrastructure, it has suddenly led to more vehicles on the narrow roads. This is the root cause for the rapid urbanization and the consequent traffic jams and this situation is expected to continue unless through urban designs and planning are executed as long term plans. From the point of Indian cities, issues like (1) checking the urban growth, (2) developing new smart cities, (3) Spreading out software and other industrial sectors to Class – 2 and smaller cities with proper road, rail, air network, (4) starting of new government offices in Class – 2 cities, (5) widening the existing roads, (6) encouraging people to use public transport, (7) providing the robust technology to enable people to access real time information on traffic mobility and congestion and (8) developing a new network of metros should be addressed on top priority. A very crucial issue in implementing the above mentioned strategies is the countless litigations by the public, which has severely hampered the developmental projects. Hence, the governments should make strong legal provisions to quickly dispose off such litigations and to implement the developmental projects in the larger interest of urban development.

VII. CONCLUSIONS

A smart city could take between 8 to 10 years to build from scratch, while it takes even more time – between 13 to 15 years – to turn an existing city into a smart city as it involves replacing the existing legacy infrastructure with smart ones [10]. Given the wave of smart cities coupled with the lack of technologies to process solid waste, as well as increasing generation of waste, the wave of "Swachh Bharat Abhiyan" (cleanliness drive) embarked upon by the Government of India seems to be under tremendous threat unless we come up with 'out of box solutions' to minimize as well as treat and reuse the waste. The questions which arise during the sustainable management of waste include (1) what is the major challenge in managing the municipal solid waste in Bangalore? (2) what is the major hindrance is continuing the implemented initiatives? (3) what kind of standards are needed to be designed and created? (4) what measures would be required for reducing risk to investors in this sector? (5) which potential enablers would be required for a holistic planning of solid waste for implementation of the ambitious plan for 100 Smart Cities?

Equally important concerns to be addressed are vibrant transport systems for the Indian cities to a path of sustainable mobility. Specific questions that one has to be addressed are (1) are the current trends related to transport sector growth in Bangalore Metropolitan region sustainable? (2) what are the key barriers to promoting smart and sustainable transport system for the city (3) how should the city address the needs of millions of non-motorized transport users? (4) has the city reached the stage where it needs to avoid the use of personal vehicles? (5) how can technology help address the current traffic trends in the city?

Thus, the authors call for integrated and in depth research on the multifarious issues revolving around solid waste and traffic congestion in Indian cities, which is vital before the implementation of smart city programs.

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