Transportation Systems for Smart Cities: A Study

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Abstract

Smart City is an emerging programme in India towards the development. This is being attempted all over the world with different nomenclatures, context and meanings. A Smart City is a city that is well planned which provides for cost effective services, environmentally efficient and technologically sound services for the welfare of the citizens residing in cities. The Smart City focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model. The present study focuses on the issue of transportation systems in the development of Smart City and challenges therein, based on secondary sources of information.

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1. Introduction

The term Smart City was coined towards the end of the 20th century. It is rooted in the implementation of user-friendly information and communication technologies development by major industries for urban spaces. Its meaning has been expanded to relate to the future of cities and their development. Smart Cities are forward-looking, progressive and resource-efficient while providing at the same time a high quality of life.

Smart Cities promote social and technological innovations and link existing infrastructures. They incorporate new energy, traffic and transport concepts that go easy on the environment. Their focus is on new form of governance and public participation. Intelligent decisions need to be taken at the strategic level if cities want to become Smart. It takes more than individual projects but careful decisions on long-term implementations. Smart Cities forcefully tackle the current global challenges, such as climate and scarcity of resources. Their claim is also to secure their economic competitiveness and quality of life for urban population which is continuously on the rise.

The Smart Cities Mission is a Centrally Sponsored Programme of the Government of India (GOI) under the Ministry of Urban Development (MOUD). Under this Mission, the government envisaged to support 100 cities with an outlay of Rs. 50,000 crore with a matching

grant from State Government/Urban Local Bodies and the duration will be five years, i.e., 2015-16 to 2019-20.

Smart City – The Concept

SMART stands for Self Monitoring Analysis and Reporting Technology. According to Caragliu and Nijkamp (2009), "A city can be defined as 'Smart' when investments in human and social capital and traditional and modern communication infrastructure feel sustainable economic development and a high quality of life with a wise management of natural resources through participatory action".

2. Review of Literature

A brief review of studies is carried out. A Paper entitled *"Exploring the Relationship between Smart City Policy and Implementation"* by Ellie Cosgrave and Theo Tryfonas (2012), says that the implementation of smart technologies increase the value of the city. The authors viewed that government, professional and the stakeholders are facing various problems in achieving ambitions targets with limited resources. The Paper identified the core themes within the field of Smart Cities and future city policies. The ground model of Smart City is being explained in the paper. The model has two core influencing features 'Challenges and Opportunities' and 'Public Value'.

Another Paper entitled "*Smart City and the Applications"* by Kehua Su, Jie Li and Hongbo Fu (2011), focuses mainly on the recent research on the concept of Smart City, also the relationships between the Smart City and digital city are also described in the Paper.

A study carried out by Robert E. Hale (2000) on "*The Vision of a Smart City"* found that the vision of the Smart City in the Urban Center of the future. The systems and structure will monitor their own conditions and carry out self-repair. The smart materials and structures are also known as the intelligent or adaptive materials, the paper argued.

3. Research Gap

There are other research papers related to smart technologies, Smart City and Digital City and others. But there is no particular study related to the issue of transportation system to develop Smart City. The present Paper focused on the challenges of Smart City with respect to the transportation system in the context of Smart City.

4. Objectives of the Study

The present study has been undertaken with the following objectives:

1) To know as how transportation system helps to develop Smart City, and
2) To analyze the challenges of Smart Cities.
3) To suggest the recommendations for Smart Cities.

5. Methodology

The present study is based on secondary data gathered from Journals, Articles, News Papers and relevant Websites.

6. Analysis and Interpretation

According to a World Bank Study, by 2031 about 600 million people are expected to live in India's cities. However, only about 20 Indian cities with populations over 5,00,000have any kind of organized public transport systems. In fact the share of public transport in large Indian cities actually declined from about 70 per cent in 1994 to almost 40 per cent in 2007. Furthermore, India's accident and fatality ratesare among the highest in the world, mainly affecting the poor and vulnerable that does not have their own means of transportation.

City transportation is an important pillar for quality of life of citizens living therein. Currently, in most of the cities, public and private road transportation are the key modes of commuting and logistics. Some large and mega cities have metro and local train network as the backbone transportation.

No doubt, good transportation system helps development of Smart Cities. Some of the important issues with reference to transport are mentioned below for the development of Smart Cities in India.

- **Bicycle Sharing System**

A bicycle sharing system, public bicycle system or bike share scheme is a service in which bicycles are made available for shared use to individuals on a very shortterm basis. For many systems, smart phone mapping apps show nearby stations. They show how many bikes and how many open docks are available at each station, increasing convenience for the users.

- **Geospatial-Enabled Efficient Transportation System**

Geospatial-enabled services provide periodic traffic forecast, journey planning mobile applications based on real time data etc.

- **GPS-based Tracking and Route Information of Public Transport**

Advanced vehicle tracking solutions enhances operations and optimizes public transportation and ridership. These solutions offer real time GPS tracking from mobile devices thus increasing the reliability of public transportation.

- **Integrated Transit Hubs**

Integrated Transit Hubs seamlessly connect multiple modes of transportation like bus system, metro system etc.

- **Public Transport Surveillance**

As the public transit population grows, it becomes increasingly important to launch surveillance on the public transport for examples buses, mass transit railway underground and trains to secure public transportation. The administrators can monitor the public transport remotely and take action against any accidents/incidents. The video footage can also be used as legal evidence against damage or criminal action on the public transport.

- **Road User Charging**

Road User Charges are direct charges levied for the use of roads, including road tolls, distance or time based fees, congestion charges and charges designed to discourage use of certain classes of vehicle, fuel sources or more polluting vehicles.

The charges help reduce peak hour travel and the associated traffic congestion or other social and environmental negative externalities associated with road travel such as air pollution, green house gas emissions and visual intrusion, noise and road accidents. It can be leveraged in certain busy areas or selected cities to discourage private transport usage.

- **Single Fare Card**

Single Fare Card can be suggested for fare payment on the various participating public transportation systems. The cards can be recharged by mobile applications/retail outlets. Potential extension of the cards could also be for street parking.

- **Smart Parking**

A Smart Parking leverages parking successors, cameras, smart parking solution etc., to provide efficient management of on-street and off-street parking spaces.

- **Smart Toll**

Smart Toll leverages technology like number plate detection, Radio Frequency Identification etc. to charge toll fees to users account, so that vehicles do not have to wait at toll gates on local, national and state highway.

- **Smart Traffic Lights**

Smart Traffic Light leverages technology to sense traffic condition to tune traffic lights which enable smooth flow of traffic.

- **Electric Vehicles**

This facility supports for electricity and renewable energy operated cars with the required infrastructure. Provision can be made tomake a few cities as pilot for ‘Plug-in’ ready cities by facilitating the expansion of a Public Electric Vehicle (PEV) infrastructure that ensures safe, reliable and efficient integration of Electric Vehicle (EV) charging loads with the power grid.

Transportation is a key pillar for quality of life in a city in particular. India needs a balanced focus in terms of improving transportation infrastructure andleveraging Smart technology solutions. Since, there is a lot of things that need to be done to improve public transportation infrastructure in Indian cities and the Government of India is investing in various national, state, local initiatives to improve public transportation specially in respect of development of Smart Cities.

7. Challenges of Smart Cities

Smart City is a new program in India, wherever the cities will be developed, the basic needs of people have to be fulfilled. There are some challenges of Smart Cities as mentioned below.

- **Retrofitting Existing Legacy City Infrastructure to make it SMART**

There are a number of latent issues to consider when reviewing a Smart City strategy. The most important is to determine the existing city's weak areas that need utmost consideration, cent per cent distribution of water supply and sanitation is challenging. The integration of formerly isolated legacy systems to achieve city wide efficiencies is also a great challenge in the process.

- **Financing for Smart Cities in India**

The High Power Expert Committee (HPEC) on investment estimates a need for improved urban infrastructure, for which a Per-Capita Investment Cost (PCIC) of Rs. 43,386 for a 20 years period is forecast. Using an average figure of 1 million people in each of the 100 cities, the total estimate of investment requirements for the Smart City comes to Rs. 7 lakh crore over 20 years. This translates into an annual requirement of Rs. 35,000 crore. One need to see how these projects will be financed as the majority of projects' need would move through complete private investment or through PPPs, which is really challenging.

- **Availability of Master Plan or City Development Plan**

Most of our cities do not have Master Plans or a City Development Plans, which is the key to Smart City Planning and implementation and encapsulates all a city needs to improve and provide better opportunities to its citizens. Unfortunately 70 to 80 per cent of Indian cities do not have a particular Master Plan. Thus, preparation of Master Plan may pose challenge in Smart City development.

- **Financial Sustainability of Urban Local Bodies (ULBs)**

Most of the ULBs are not financially self-sustainable and tariff fixed by the ULBs for providing services often do not mirror the cost of supplying the same. Even if additional investments are recovered in a phased manner, inadequate cost recovery will lead to continued financial losses.

- **Capacity Building Program**

Building capacity for 100 Smart Cities is not an easy task and most ambitious projects are delayed owing to lack of quality man power both at the centre and state levels. In terms of funds, only around 5 per cent of the central allocation maybe allocated for capacity building programs that focus on training.

- **Three-Tiers Governance**

Successful implementation of Smart City solutions needs effective horizontal and vertical co-ordination between various institutions providing various municipal amenities as well as effective co-ordination between central government (MOUD), state governments and local government agencies on various issues related to financing and sharing of best practices and service delivery processes.

- **Technical Constraints of ULBs**

Most of the ULBs have limited technical capacity to ensure timely and cost-effective implementation and subsequent operations and maintenance. Owing to limited requirement over

a number of years along with inability of the ULBs to attract best of talent at market competitive compensation rate would be a challenge in developing Smart Cities in the Indian context.

- **Dealing with a Multi-Vendor Environment**

Another major challenge in the Indian Smart Cities Mission is that the software infrastructure in cities constrains the components supplied by different vendors. Hence, the ability to handle complex combinations of Smart City solutions developed by multiple technology vendors may also become significantly challenging.

- **Reliability of Utility Services**

For any Smart City in the world, the focus should be on reliability of utility services, whether it is electricity, water, telephone or broadband services. Smart City should have universal access to electricity 24x7, but this may be not possible with the existing supply and distribution system of the same in the Indian context. Cities need to shift towards renewable sources and focus on green building and green transport to reduce the need for electricity in the event of shortages in power supply.

The Smart Cities Mission also requires smart people who actively participate in the governance and reforms taking place time to time. Citizens' involvement is much more than a ceremonial participation in the governance. Therefore, all the above challenges should be faced at a single point of time which is a difficult job indeed!

8. Suggestions

Based on above, the following suggestions may be made:

1) The Government should think of increased PPP.
2) The Urban Local Bodies (ULBs) should actively support Smart City Mission whole heartedly.
3) There should not be any delay in financing the projects envisaged.
4) There is a need for the political commitment and will, which should play a very important role in the execution of Smart City Mission.
5) Harnessing of the human resources should also be a priority.

9. Conclusion

The concept of Smart City envisioned by the central government is a much needed and timely one. The current urban population is about 1.5 billion and over a period of time this may reach upto about 60 per cent of the total population contributing an estimated 75 per cent of the GDP. In this context, making the city smart is both necessary and challenging. The international comparison clearly shows that in Europe and elsewhere a great deal of emphasis is being laid for preserving and developing Smart City. Multidimensionality of Smart Cities concept crosscutting ICT application on transport, energy management, water management, healthcare etc., is also an important aspect in this direction. Let us all hope for a better and vibrant India in the near future.

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