

## **A Conceptual Framework for Planning and Implementation of Smart Cities**

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### **ABSTRACT**

*In India, each person has a different perception to the question like what is smart city? Some say it is establishing good network of efficient and safe transportation, some express it is in terms of effective management of all government-citizen services like paying utility charges, traffic enforcement, energy consumption and many more by maximizing digitalization process. Few others believe that smart city facility will enable government to create more transparent policies related to citizen services. Few more perceive smart city with IOT (Internet of Things) and infrastructure communication technology. Most of the urban planner conceive smart city as implementation of sustainable solution through technology. India's urban population is set to increase one million a month up to coming four decades which is the most massive shift to urbanization in world history this century. In this paper, efforts have been made to conceptualize smart city for India with existing competitiveness around the global smart city. Indian cities are relatively young and culturally diverse, as such a realization of smart city possess many challenges which are very new for policy makers. This study focuses on review of the exhaustive research on the smart city.*

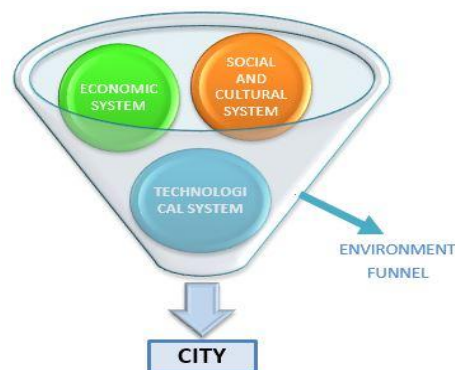
**Keywords:** Smart city, components, digitalization, service system, infrastructure system, urban managers, policy makers.

### **1. INTRODUCTION:**

In India, each person has a different perception about the smart city. Many people are of opinion that it is establishing good network of efficient and safe transportation, few express it is in terms of effective management of all government-citizen services like paying utility charges, traffic enforcement, energy consumption and many more by maximizing digitalization process. Some people believe that smart city facility will enable government to create more transparent policies related to citizen services. Few more perceive smart city with IOT (Internet of Things) and infrastructure communication technology. Most of the urban planner conceive smart city as implementation of sustainable solution through technology.

A city is a place, where different cultures and technologies blend together. City is combination of different systems like economic systems, in which different people dwell and work together, a social, cultural and demographic system, wherein people of all sectors are associated in a city. For sustainable development, efficient management of demographics is vital. More than 70% of world's population will be dwelling in cities by year 2050[1]. Without improving human settlements and cities, to be capable to handle this rapid and drastic urbanization, future cities will not be able to sustain its potentially vulnerable member.

### **2. CITY COMPONENTS AND INTERACTION SYSTEM:**



**Fig 1: Components of city.**

Components of conventional or traditional to the smart city remain same, but the way they interact is different. In convention or legacy system components interact each other physically more often (Fig.1). The components interaction will be visible in the form of services and infrastructure to its consumers i.e., to its citizens.

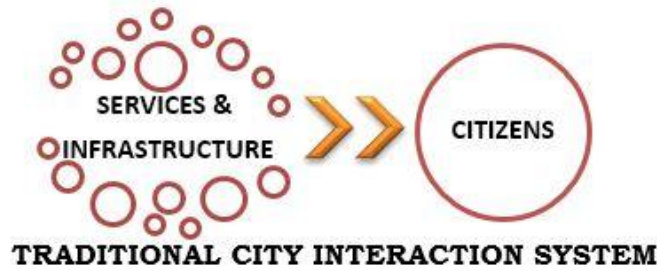


Fig 2: Convention/Traditional interaction System

In a smart city interaction of components through services and infrastructure remains virtual, more often and as such the system demand digitalization. Now the interaction is stored in form of a digital data. Thus smart city rely very much on digitalization or data system unlike legacy systems. Internet of things (IOT) forms a backbone of smart city which connects the services and infrastructure to customers/ citizens of the city (Figs.2 and 3).

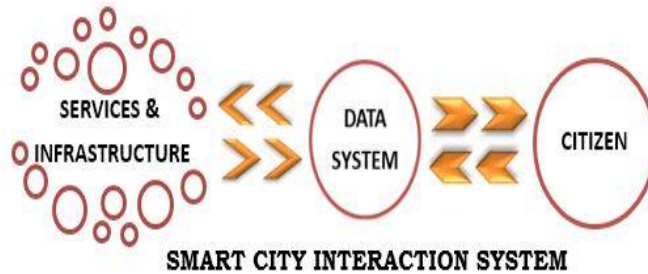


Fig 3: Smart city interaction system

India occupy second place in number of mobile phone usage with around 90% of population owning them [2]. With sky rocketing progress of wireless technology, the everyday life of citizen has undergone extreme changes like using smart devices based on latest technology for daily needs [3].

### 3. FRAMEWORK FOR INDIAN SMART CITIES:

Framework for any smart city consists of following three vital systems

1. Infrastructures
2. Services
3. Data system

IOT is foundation of any smart city. Efficient IOT is network of above three systems (Fig.4).

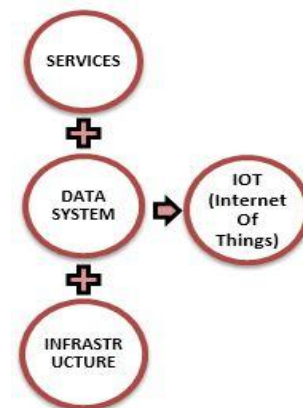


Fig 4: IOT Composition

Information and communication technology forms a network of systems in IOT. Around 462 million people in India have access to internet and the number is expected to further increase to 500 million in June 2018[4], which will enhance more internet penetration. It is necessary to combine IOT with Artificial Intelligence (AI) in 'Smart Machines' to simulate intelligent behavior to arrive at an accurate and reliable decision without human intervention. With the advancement of technology every day many of devices are capable of talking each other through internet with an added advantage of speed, at which responses are shared is reaching almost in real time.

### 3.1 Smart Infrastructure:

Smart city demands smart infrastructure for its survival. Sensing technologies are implanted in these infrastructures for their interactions. These interactions are communicated through a skeleton of wired or wireless internet network. The changes happening to system can adequately be transmitted to end user. The gathered information will assist in better decision making.

Information gathered through the sensors for a city is enormous and analysis of data is crucial to obtain a meaningful interpretation. The analysis of vast digital data is done by Big Data Analytics Technologies.

### 4. SERVICES:

Primary services for a city can be categorized as follows:

1. Transportation
2. Energy
3. Water
4. Housing
5. Others

These primary services are lifeline for urban dwellers. Recent innovations on these service sectors have enabled many cities to implement some of technologies for transition of city towards being smart city. Technologies are used to give the solution to the needs of city population. The subdivisions of transportation, energy, water and housing are discussed.

#### 4.1 Transportation

Cab/Bike sharing  
Toll collection  
Smart card  
Traffic surveillance  
Real time traffic information to drivers  
Smart parking

#### 4.2 Energy

Smart meter  
Street lighting  
Smart grid

#### 4.3 Water

Water leak detection  
Surface water management  
Digital meters

#### 4.4 Housing

Smart home appliances  
Security system  
Smart lighting system  
Heating and cooling systems

### 5. SMART ENERGY SYSTEM:

Energy requirement of city comprises of following elements

**Electricity generators:** The facilities which produces the electric energy can be government or private operated. The technology includes wind, solar, nuclear, natural gas, coal, hydropower etc.

**Transmission operation:** For transmitting electricity from production end to the demand end by means transmission infrastructure.

**Distribution operation:** For technology development, transmission and efficient distribution in a region. Here end user is connected by means of transmission network.

**Utilities:** End unit of services are given to citizen. Utilities can be like water, electricity, internet, sewage etc.

**Energy grid:** Smart electrical grid is a combination of decentralized units of production facilities nearer to the end user. Energy is to be balanced at all instances of time.

**Prosumer:** Very vital part of smart city is ability of end user to generate small amount of energy by his own.

**Smart balancing:** Everyday home Energy appliances are programmed to work optimally like turning off themselves when there is no user.

**Pricing:** Compensation should be considered for prosumer who partially generates electricity on his own.

**6. SMART TRANSPORTATION:**

Urban transportation is a complex process and it is an aggregate of mobility, urbanization, efficiency, user experiences transition policies and implementation. The mobility mass service is another component where all available modes are unifies under single managing platform like Make my trip.

**7. CHALLENGES FOR SMART CITY PROJECTS:**

Challenges for any smart city implementation can be in terms of technology, finance, political, social and environmental.

Above challenges takes a form of matrix where in each challenge is associated with main components of smart city like data system, services system and infrastructure system. One such matrix of challenges for urban manager point of view is shown in Table 1.

**Table: 1: Challenges for Urban Managers**

Particulars	Technology Concerns	Political Concerns	Finance Concerns	Social Concerns	Environmental Concerns
Digitalization system	Specifications	Regulation	Cost	Privacy concerns	Affects
Services system	Unification	solution	Competition	Owning information	Behavioral changes
Infrastructure system	Transition	Long duration impact	Payers of infrastructure	Consequences	Overall affect

**7.1 Challenges for Urban Managers**

Technology challenges are concentrated towards specifications of devices required for digitalization, with their unification of existing and upcoming services and infrastructure system.

Political challenges will be to create a regulation, create a platform for discussing on problem and its solution on long term basis.

Finance related challenges will be the cost of digitalizing data components like sensors and so on. Availability of competition in order to avoid monopoly of services desired from the vendor. The next big question is who will pay for this entire massive infrastructure, by public or private players?

Social challenges from urban manager’s point of view have to be who will address the data privacy concerns, data owner/generator and right to data sources. Environmental challenges are to be addressed in terms of impacts brought over by the changes or the anticipated changes on physical environment and environmental data.

**7.2 Challenges for Policy Makers:**

Challenges for policy makers are slightly different from that of urban managers (Table 2). On technology components, policy makers have to decide whether to hire a service from local firms or reputed firms across the globe. Decision for the new infrastructure support is needed or existing infrastructure will be sufficient. Platform to be given directly to the end user or to a third party it manages or caters to the need of customer seeking the service.

**Table: 2: Challenges for Policy Makers**

Particulars	Technology Concerns	Political Concerns	Finance Concerns	Social Concerns	Environmental Concerns
Digitalization system	Global players or start ups	Regulation	Market or public	Digital awareness	Impacts
Services system	Platform	Governances	New services or to improve	obligation	Subsidize
Infrastructure system	New or existing network	Infrastructure development	Sustainable	Smart city for all	Impacts

On political grounds, regulation like privacy concerns and ownership of data have to be taken care. Decision on the structure of governance for entry and exit of the service providers. Decision on to start actual implementation of smart city infrastructure or to promote the smart city.

On financial level, policy makers have to decide on transition whether it is driven by market or by public policy. Decision regarding the services to be developed by themselves or to hire a service provider. Sustainable financing system has to be created with reserved fund for further requirements.

On social level, policy makers take decisions related to creating awareness amongst citizen regarding through education or by self-adaptation. Service obligations must be defined to service provider for accessing the service equally by all citizens. Decision like smart city is for its citizen or for business development must be taken by policy makers.

On environmental levels, policy makers define impacts of digitalization from both bad and good outcomes view. Decision on promoting the newcomers in service sector by subsidizing or providing some incentives or else let new service providers evolve by their own. Overall broader consideration must be taken care for environmental impacts throughout the smart city planning and implementation.

## **8. CONCLUSIONS:**

Still our country is in its very early stages of smart city concept. Primarily it is vital to understand the basic framework of smart city planning and implementation for an evolving country like India. All important and possible attribute like digitalization, services system, and infrastructure system has been considered. Challenges for policy makers and urban managers are discussed considering various parameters like technology, finance, political, social and environment.

## **9. ACKNOWLEDGEMENT:**

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