

Social and Environment Sustainability of Smart Cities

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Abstract: The Smart City innovation has attracted relevant consideration for the urban growth over the last few years. While the time seems ripe to conclude that such initiatives have a constructive impact on urban growth, it is quiet unclear about its realization when looking at the usage of electric and electronic devices through Internet of Things(IoT) in typical Smart City projects. On one side sustainable manufacturing and consumption of electric and electronic goods has become a norm in recent years, with the awareness of various laws and regulations to protect environment, on the other side realization of Smart city innovation is exposing the environment and human health to more and more hazardous impact of E-Waste. In fact, a Smart City project imply the involvement of local and global companies, local public authorities and the people with the aim to translate technological solutions to the local needs of the people. This paper attempts to develop a conceptual model to understand the coalition between the technology and the modern urbanization to integrate social and environment aspects for making both the smart cities as well as the human life sustainable.

Keywords: Internet of Things, E-Waste, Sustainable, Coalition, Smart City

Introduction

Smart city has become the focus in last few years, due to vivid global urbanization all over the world. Performing city operations with aid of Information Technology has made cities well-organized in various aspects of day to day activities. The model of connecting routine objects via the network devices is highly constructive with the recent advancements in technologies. Internet of Things (IoT) has evolved from the usual networks ad it has the capability of connecting billions of electronic devices. IoT, strengthened by technological advancements in computing, wireless networks, sensors, talking machines has connected smart devices without or with minimal human interface(Khan, Silva, & Han, 2017). The concept IoT has established smart cities, smart homes and thus the smart living. The smart city aims to improve the living standards of urban society in terms of social, environmental as well as economical facets.

The relation among government, public facilities, human life, industry, GDP (Gross Domestic Product), technology advancement has been analysed by various researchers to measure the impact of technology on human life (Alawadhi et al., 2012). The studies emphasised that there are six dimensions of a smart city with respect to social, economical, physical and institutional aspects (Mohanty et al., 2016, Giffinger & Gudrun, 2010). Figure 1 depicts the these six dimensions. Physical infrastructure consists of natural and manmade infrastructure. Physical infrastructure ensures sustainability of resources for the current operations (Mohanty et al., 2016), whereas the performance of a smart city depends on advanced technology infrastructure. In addition Physical infrastructure is further extended to green urban planning with the use of renewable resources. Hence, the smart city initiatives focus on conserving natural resources of the city vis-a-vis water, green spaces and sewers (Vasseur & Dunkels, 2010). increasing the sustainability of natural resources

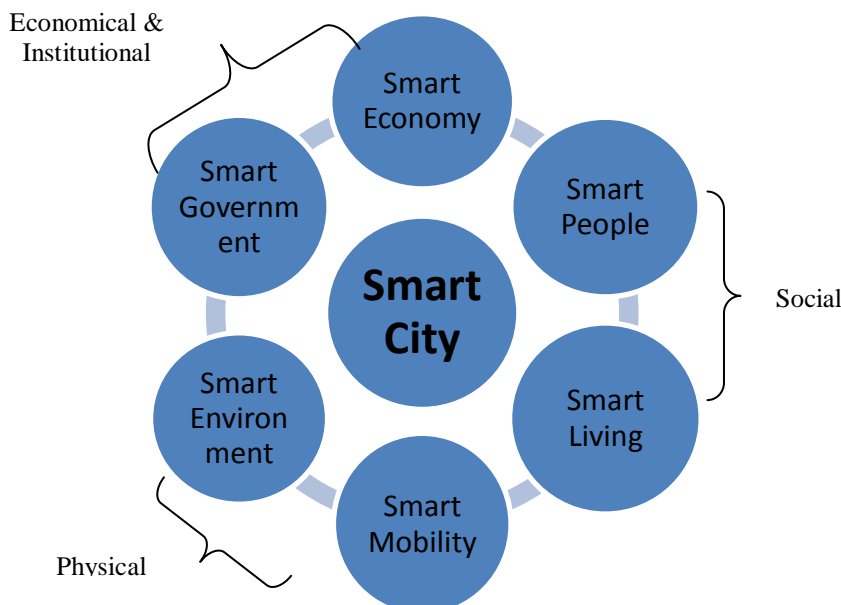


Figure 1: Dimensions of Smart city

The institutional infrastructure of a smart city is responsible to provide various services given by various public and private sector organizations which are required to run a smart city. It ensures that different organizations serve the citizens more efficiently and effectively. The social infrastructure of a smart city plays an important role in the awareness of smart city concept. It concerns about people and their relationships in smart environment. Thus social infrastructure is crucial for the sustainability of a smart city. Comparative to a conservative city, smart city serves human with a quality life. As a result educated citizens tend to group around smart cities, therefore encourage the growth of the city (Glaeser & Berry, 2006). Looking at Figure 1, there is a strong need to explore the meaning of smart sustainable citizens and smart environment. This conceptual paper is to explore that how realization of Smart city innovation is exposing the environment and human health to more and more hazardous impact of E-Waste.

Smart City and IoT

In the whole scenario, IoT and other innovative technologies have evolved the smart cities, in which people, cars, buses, smart electronic device can smartly collaborate. As the IoT concept characterizes a collection of interconnected networks of diverse objects, there is a usual security issue related to the computer networks. The entire deployment architecture i.e. the hardware, bandwidth, efficient frequency utilization, sensors with limited power, communication protocols etc. needs to be secured from attacks which may hinder the services provided by IoT and may threat privacy, integrity or confidentiality of data which is asset of the smart citizens. These technical issues have been addressed by experts in the recent years and further research is carried out to harness maximum benefit from IoT for the development of smart cities. While analysing the challenges of IoT, it is imperative to look at the other side of the picture as well, which does not pertain to the technical aspect but the human aspect. Though IoT would lead to sustainable environment yet it may have adverse effect on sustainable society. There are three dimensions of welfare that define the sustainable society as

- **Environment:** Nature and environment, climate and energy and natural resources.
- **Society:** Basic needs, development(Personal and Social) and health
- **Economy:** economic needs

There is an overlap of all these dimensions which is reflected in Figure 2 below. Thus it is essential to maintain a balance of all three dimensions to have a sustainable smart city.

the IBM one of the leading business brands has reported that amount of data/information collected by the sensor-based IoT devices will be increased up to 42% by 2020 which is more than the 11% amount in 2005 (Alam Furqan , et al 2017) researchers have considered these critical issues of the key enabler of the smart city. Which means the proliferation of hand held electronic devices that in fact will be the major and important source of smart city operations.

Looking at Figure 1, there is a strong need to explore the meaning of smart sustainable citizens and smart environment. But there Smart city innovation is exposing the environment and human health to more and more hazardous impact of E-Waste.

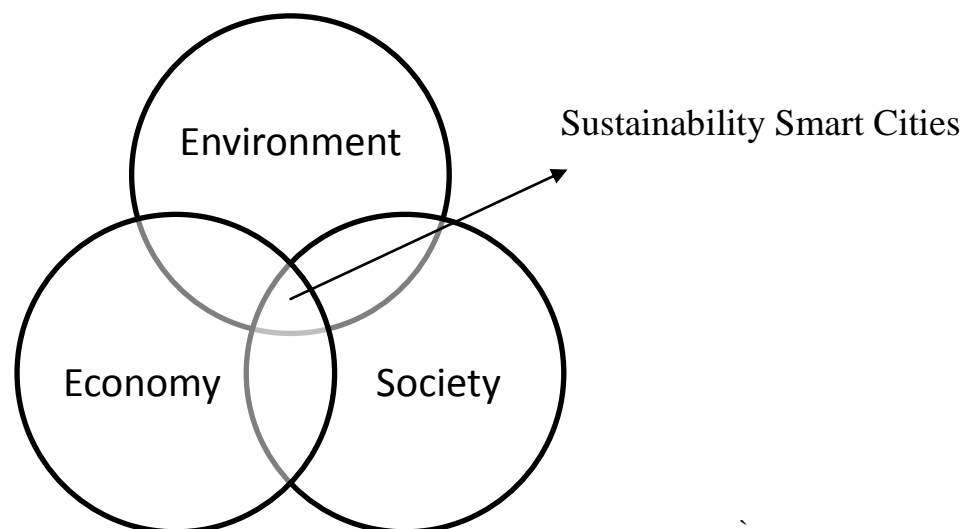


Figure 2: Sustainable Smart Cities

Discussion

Smart Cities and Smart People

The internet connectivity controls the things/objects remotely making a network of interconnected devices where the **human involvement and human control is minimum/negligible in comparison to tasks performed without IoT technology** (Garg 2018).The society dimension revolves around humans. In fact other two welfare dimensions are measurable pertaining their impact on society only. So it is imperative to have healthy body and mind. As quoted earlier smart people is one of the dimensions of smart city, smart is generally considered as 'intelligent'. Even the civilization has its root in human brain. Human brain remembers the task to be performed by the persons in everyday life, which i

fact are/will be facilitated by smart city (IoT) at large in future. Memory is a key role player in performing some tasks at a given time.

Working memory (WM) is a limited-capacity memory that keeps information for short period of time for some ongoing activity and is measured as a basis of human cognition such as learning, reasoning, problem solving, language comprehension and mental arithmetic (Daneman & Merikle, 1996; Halford, Wilson, & Phillips, 1998; DeStefano & LeFevre, 2004; Harrison, Shipstead, & Engle, 2015;). Working memory decomposes over a period of time thus the actions/ incidents/ thoughts are reactivated. (Barrouillet & Camos, 2012; Vergauwe & Cowan, 2014). This reactivation process is called refreshing, thereby thwart forgetting (Barrouillet et al., 2007). This is a piece of information readily accessible in mind to perform ongoing cognitive tasks – e.g., remember a list of grocery items to be purchased from market. While Long-term memory, is the part of the memory storage system that has an unlimited capacity to retain information for a long time.

There is little need even to remember/refresh when to meet a client for a business meeting where to meet, remembering the hospitality, bus routes, routine tasks and so on. This may pose a major to human memory where continuous refreshing of the working memory, so that it is used by some ongoing tasks. By the extensive use of IoT and now IoE(Smart city concept), there may not even be the human intervention required. Every communication will be through IoT devices. The people will be smart to what extent.

Smart Cities and Smart Environment

Further to the extensive use of electronic smart devices in various operations of smart city, in turn, will become a new environmental challenge – i.e., accumulation of waste. Presently, the major part of this garbage is widely known as ‘electronics waste’ (e-waste). Technically, e-waste is a chunk of electrical and electronic waste. E-waste has not been a problem as long as there were a few computers or other electronic devices on earth. Though electronic industry is the world’s largest and rapidly emerging industry (Radha, 2002) yet with the increasing use of computers, our planet has become a dump house for electronic wastes. Electronic products which have a relatively shorter life span often contain hazardous materials that lead to environmental degradation if they are destroyed and it is an emerging problem given the volumes of e-waste that would be generated with the realization of the concept of smart city where every other task will be performed rather will be dependent on the use of mobile electronic devices.

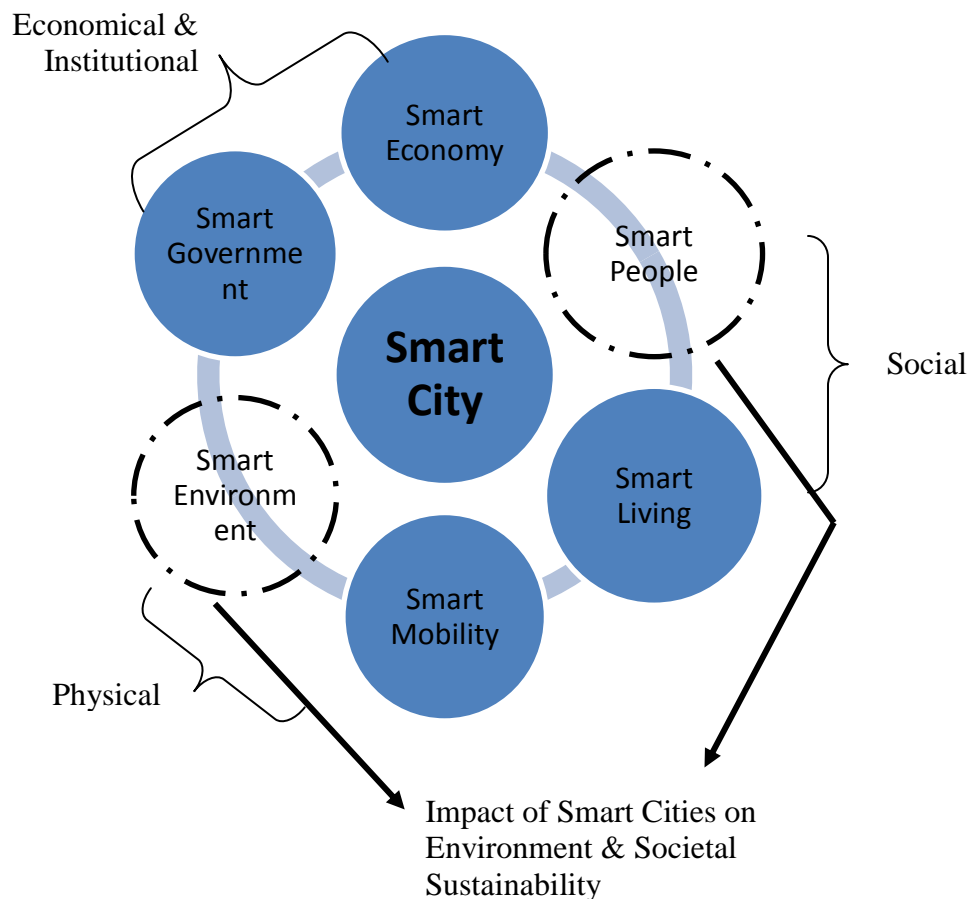


Figure 2: Smart Cities and Sustainable Smart cities from Environment & Societal Sustainability perspective

Conclusion

Smart cities are becoming the prospective applicant for every task from a small purchase to home security which would transform the human lives to a large extent. Thus, keeping in view this highly increasing demand of IoT-based smart cities it is very essential to encourage building sustainable smart cities to connect the entire globe. Smart city initiative should provide a balanced trade off between the sustainable use of electronic devices for the elimination of e-waste and resea

Limitation of Research

The research articles lacks in quantitative evidence of the social and environment impact of smart cities and requires an exploratory study among people who are inseparable part of smart cities.

Key Points

1. There is little emphasis on the human aspect of possible negative effect of smart cities.
2. Smart citizens are essential aspect of sustainable society.

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