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Article in *International Journal of Computer Applications* · August 2019

DOI: 10.5120/ijca2019919291

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# Case study of Dubai as a Smart City

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## ABSTRACT

Recently, the world has witnessed a major development in information and communication technology in all areas of life. Cities have become unable to meet the needs of their inhabitants due to the huge increase in the population. In order to save these cities from their problems and give hope to their inhabitants, different non traditional solutions appeared to manage these cities and reduce the size of their problems. Among these solutions is the idea of Smart City, which sought to exploit the high-capacity modern means of communication to improve the lives of the inhabitants of these cities. By connecting all components of life in cities with high-speed wired and wireless networks in the transmission of information, which positive impacts such as reducing energy consumption and reducing carbon dioxide emissions and other solutions that have effectively contributed to raising the quality of life in some crowded cities.

In this research, I reviewed the experience of Dubai along with key pillars and phases and its transformation from a desert legend to the first smart city in the Middle East.

## Keywords

Information and Communication Technology, Smart City, Energy Consumption, Dubai

## 1. INTRODUCTION

A smart city is a community that is efficient, sustainable & liveable. The term smart city has become more and more popular in the field of urban planning. Smart cities can work as a tool for controlling the rapid urbanization and various problems caused by the ever increasing urban population. The implementations of the smart technologies can increase the value of the city [1].

The primary goals of the smart city include, offering digital means for supporting social needs in all daily transactions, to adapt the citizens to the notion of the information society and to collect information from the public departments and citizens in order to support sustainable growth of the city.

The purpose of this paper is to highlight smart cities its components, characteristics, aims, requirements, and key challenges related to information system management in smart cities. Further, highlights on Dubai model transformation from traditional city to smart city.

## 2. COMPONENTS AND CHARACTERISTICS OF SMART CITIES

There are various components and characteristics of the smart city as shown in Fig.1 [2]. The components of smart cities include the following: smart infrastructure, smart buildings, smart transportation, smart energy, smart healthcare, smart technology, smart governance, smart education, and smart citizens.

The different attributes of smart cities consist of sustainability, quality of life, urbanization, and smartness. The sustainability of a smart city is associated with city infrastructure and governance, energy and climate change, pollution and waste,

and social issues, economics and health. The quality of life can be measured in terms of the emotional and financial luxury of the citizens. The urbanization sides of the smart city involve multiple aspects and indicators, such as technology, infrastructure, governance, and economics. The smartness consist of smart economy, smart people, , smart mobility, smart living and smart governance.

There are four different themes for a smart city: society, economy, environment, and governance. The society theme of a smart city allocated that the city is for its citizens. The economy theme of a smart city signifies that the city is able to prosperity with continuous job growth and economic growth. The environment theme of a smart city refers that the city will be able to sustain its function and remain in operation for current and future generations. The governance theme of a smart city proposes that the city is strong in its capability to administer policies.

The infrastructure of the smart city consists of physical, information and communication technology (ICT), and services. The physical infrastructure is the real physical or structural entity of the smart city including buildings, roads, railway tracks, power supply lines, and water supply system. The physical infrastructure is typically the non-smart component of the smart cities. The ICT infrastructure is the main smart component of the smart city which together all the other components in essentially acting as the core centre of the smart city. Service infrastructure is depended on physical infrastructure and may contain some ICT components.

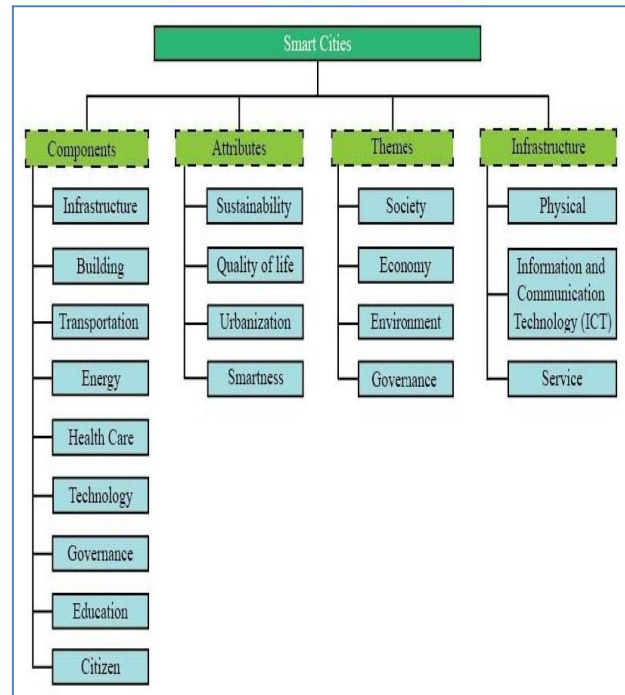


Fig.1 Components and Characteristics of Smart Cities [2]

### 3. THE AIMS OF THE SMART CITIES

Create a city infrastructure that meets the expectations and needs of the population.

Ensure quality of life for the population.

Provide a clean and sustainable environment for a city.

Providing smart solutions to serve the city and population in all areas.

Transforming the city into a "Human being friendly city".

Document important information based on ICT experts.

### 4. SMART CITIES REQUIREMENTS

The availability of a different telecommunications infrastructure and technology that achieves information networking among all aspects of society service providers, and at various levels.

Provide a vision and strategy for reaching a competitive city, taking advantage of opportunities and supporting stakeholders and sectors

multi-urban and various categories towards competitiveness and sustainability.

Availability of unified systems, regulations, legislation and legal frameworks for smart transactions.

Availability of a unified system for the applications of public sector information systems based on network services technology.

Portal of geographic information systems.

The need for specialized ICT experts.

Choose competent teams and train them on the latest technology in the world in the field of ICT.

### 5. KEY CHALLENGES FACING SMART CITIES

Smart city is a huge information system, smart city initiatives are basically based on ICT. The latest developments in cloud computing, Internet of Things, open data, semantic web, and future internet technologies will be leading technologies to enable smart city development. All these technologies have their challenges and limitations. All these technologies together form a complex system, like smart city, will increase the challenges [3].

#### A. IT Infrastructure

One of the huge obstacles in smart city is the development of ICT infrastructure, from communication channels to sensors. This infrastructure has to be completed before smart city services are offered to stake holders. [4] [5][6].

#### B. Security

Threats from worms, viruses, hackers, Trojans has formidable potential to disrupt the services resulting in huge losses. Security policies are required to secure sensitive data . Security and privacy are important for making data and services available, and are also essential in building citizens trust and confidence in using these systems. [4][5][6][7][8].

#### C. Big data Management

Huge data will be generated from all smart city systems. To handle different types of data, with varying velocity an efficient big data management system is required. This system has to be reliable and scalable with no downtime. Persistent

generation, processing and storage of huge heterogeneous data from smart city sensors form big challenges.

#### D. Cost

Smart city require acquiring huge IT infrastructure. Millions of sensors, thousands of networking equipment and computing devices are required, consequently smart city requires huge budget permanently.

#### E. Application development

Citizens are needed faster development of applications so that they can take maximum advantage of data that is being collected. People will be frustrated by slow application development If application development is restricted to city management. For example, one of the most important key reasons behind Android's success is its play store, millions applications are uploaded every day via its huge app base.

### 6. CASE STUDY OF DUBAI AS A SMART CIT

During the last century, Dubai has been through a remarkable transformation. The city has evolved from a 10,000 desert-residence population in the early 1900, into one of today's most global cities, with a population of over 2.7 million people.

Climate change and increasing of urban population , has created important challenges on how Dubai can improve the quality of the lives for its citizens, whilst also reducing their impact on the environment. In the last few decades, Dubai becoming a sustainable and smart city because UAE has consistently ranked as having one of the highest annual carbon dioxide emissions per capita.

There are different examples of Dubai projects in 2020 as shown in Fig.2 [9] such as a new ultra-fast Hyperloop train that will travel from Dubai to Abu Dhabi in 12 minutes reaching a top speed of 750 mph, as well as plans for the world's greenest eco resort as shown in the following below:



Hyperloop Dubai      Oasis Eco Resort

Fig.2 Dubai projects in 2020 [9]

Dubai's smart city project consists of eight key pillars - telecoms, tourism, utilities, education, buildings, public safety, transportation and healthcare all of which are based on technology as shown in the Fig. 3 [10] below:

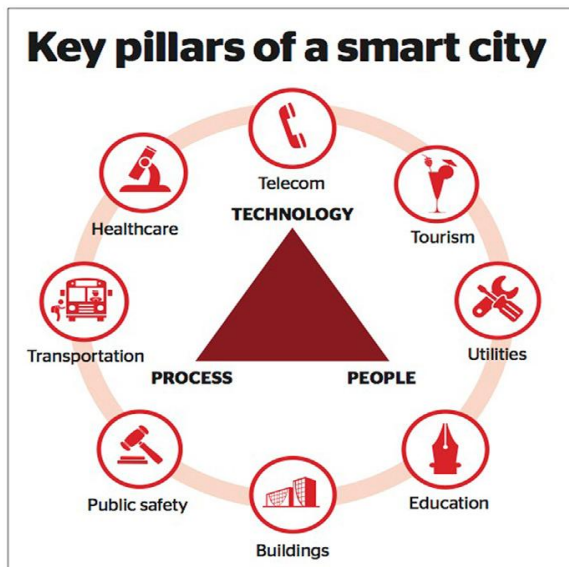


Fig.3 Key pillars of a smart city [10]

Three phases happened for Dubai's transformation into a smart city: Smart Life, Smart Economy, and Smart Tourism. Smart Life is to do with services - education, transportation, healthcare, telecommunication, and energy. Smart Economy is related with airports, ports, while Smart Tourism will associated with services including that related to visas, aviation, hotels and restaurants.

The most important goal for Dubai Smart City is to become the happiest city in the world for its people, residents and visitors [11][12]. Dubai's vision is to be happy not only by adopting the latest technology but also by being the happiest place to live and work in the world. Dubai Smart City aims to be the world's best-connected cities, which has a positive impact in raising the standard of living and quality of life of those who live in it.

## 7. RESULTS

The relationship between smart cities and their citizens is the biggest characteristic of the traditional city. Services provided by ICTs in traditional cities cannot cope with changing economic, cultural and social conditions in the way smart city services can.

Smart City focuses primarily on the human element.

Smart cities derive their energy from natural sources through solar energy and wind power.

The application of the Smart Cities concept contributes to increased economic growth and security.

Smart cities seek to solve urban challenges in new ways by changing business processes and institutionalizing the process of innovation.

## 8. CONCLUSIONS

The smart city is one of the technical applications that transformed many imaginations about the lifestyle of the future

to amazing a reality. Smart Cities use new technologies to improve the quality of life of their citizen by using information and communication technologies. The "smartness" of a city describes its ability to bring together all its resources, to effectively operate with maximum possible efficiency to fulfil the purposes it has set itself. There are several smart cities with some form of smart components operating at present at various parts of the globe. A smart city can have one or more smart components, including smart transportation, smart grid, smart health care, and smart governance. Smart cities with minimal implementation and operation cost are the keys for long-term sustainability. The need for smart cities is increasing day by day with the increase of population. The success of Dubai Smart City depended less on the implementation of technologies and more on the engagement of the people who live in them.

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