



Tourism Smart Cities – Turning Point Towards Sustainable Development in Egypt: Concepts, Characteristics and Applications

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Abstract

Nowadays, the quality of life has greatly improved, particularly in terms of access to services. However, heavy industrialization and the increasing population in the urban areas have been a big challenge for administrators, architects, and planners. For this reason, the transformation of metropolises into smart cities is a crucial factor in improving the living conditions of their inhabitants. Despite the popularity of the phrase "smart city," there is still misunderstanding about its meaning, especially since several similar terms are often used. This paper aims to clarify the meaning of the word "smart" in the context of cities through an approach based on an in-depth literature review of relevant studies. It also identifies the main dimensions and elements defining the smart city. In addition, it demonstrates how we can consider a particular city a smart one, drawing on recent practises to make cities smart.

Keywords: Smart city, sustainability, urban development, smart technology.

1. Introduction

In the last two decades, the concept of "smart city" has become more and more popular in scientific literature and international policies. To understand this concept, it is important to recognise why cities are considered key elements for the future. According to the United Nations, the world's population will grow by 32% between 2015 and 2050, from 7.2 to 9.7 billion people, while the urban population will increase by 63%, from 3.9 to 6.3 billion

inhabitants (UN, 2019). Current estimations suggest that by 2030, over 60% of the world's population will live in cities, and the significant growth will be in Africa, Asia, and Latin America (UN, 2015).

Increasing urbanization and gradual migration of people from rural to urban areas, combined with the general increase in the global population, means that by 2050, urban areas will accommodate another 2.5 billion people (nearly 90% of this increase will take place in Asia and Africa) (UN, 2019).

Based on the forecasts, the next few decades should see cities undergo constant changes, including in their structures. With the expected increase in the number of urban residents around the world, the current scenario requires cities to find ways to manage the challenges and complexity of urban life (UN, 2019).

Cities worldwide have started to look for solutions that enable transportation linkages, mixed land uses, and high-quality urban services with long-term positive effects on the economy. For instance, high-quality and more efficient public transport that responds to economic needs and connects labour with employment is considered a key element for city growth. Many of the new approaches related to urban services have been based on harnessing technologies, including ICT, helping to create what some call "smart cities." (Herschel and Dierwechter, 2018)

The purpose of this paper is to define what a smart city is, what its key dimensions are, and how its performance can be measured. It is founded on a review of the literature, followed by a measurement of Egyptian society's awareness of smart cities in Egypt.

2. Literature Review

2.1 Smart City

Because of advancements in hardware and software design, information and communication technologies (ICTs) have grown rapidly in recent years. The use of ICT in cities in various forms for various city activities has increased the effectiveness of city operations, and these cities have been labelled using various terms such as "cyberville," "digital city," "electronic city," "flexicity," "information city," "telicity," "wired city," and "smart city." Smart city is the most abstract of the labels used because it encompasses other labels for cities (Mohanty et al., 2016).

A "smart city" is defined by IBM as "the use of information and communication technology to sense, analyze, and integrate the key information of core systems in running cities" (Caragliu et al., 2009). At the same time, a smart city can make an intelligent response to different kinds of needs, including daily livelihood, environmental protection, public safety and city services, industrial and commercial activities (Harmon, et al., 2015). Giffinger et al. (2007) highlighted that "a smart city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operations and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, and environmental aspects."

In short, "smart city" is the actual approach of "smart planet" applied to a specific region, thereby achieving the informational and integrated management of cities (Caragliu et al., 2009). It can also be said to be an effective integration of smart planning ideas, smart construction modes, smart management methods, and smart development approaches. Through the digital grid management of urban geography, resources, environment, economic, social, and other systems, as well as the digital and informational processing and application of urban infrastructure and basic environment, we can achieve intelligent urban management and services, thereby promoting the more efficient, more convenient, and harmonious operation of modern cities (Batty et al., 2012).

2.2 Smart Cities: Components and Characteristics

Dirks and Keeling (2009) stress the importance of the organic integration of a city's various systems (transportation, energy, education, health care, buildings, physical infrastructure, food, water, and public safety) in creating a

smart city. In his attempt to delineate the features of a smart city, Komninos (2011) indicated that these have four possible



Figure.1. Smart City Elements

Source: (Winkowska, 2019, Mushatat and Al Muhairi, 2013)

dimensions. The first dimension concerns the application of a wide range of electronic and digital technologies to create a cyber, digital, wired, informational, or knowledge-based city; the second is the use of information technology to transform life and work; the third is to embed ICT in the city infrastructure; and the fourth is to bring ICT and people together to enhance innovation, learning, and knowledge.

Giffinger et al. (2007) identified four components of a smart city: industry; education; participation; and technical infrastructure. This list has since been expanded in a recent project conducted by the Centre of Regional Science at the Vienna University of Technology, which has identified six main components (Giffinger and Haindl, 2010). These components are a smart economy, smart mobility, a smart environment, smart people, smart living, and smart governance.

According to Nam et al. (2015), the key components of a smart city are technology, people (creativity, diversity, and education), and institutions (governance and policy). So, it

is understood that cities can be defined as smart if they have the following elements (Fig.1).

The smart economy is measured by entrepreneurship and a city's productivity, adaptation to changes, the flexibility of the labour market, and international cooperation (Winkowska, 2019).

Smart mobility is perceived by the accessibility of information and communication infrastructure, through the development of sustainable, innovative, and safe transport (Lennert et al., 2011). specific examples of smart transportation technology, such as sensors in vehicles for collision avoidance and anti-skidding to increase the safety of the system. Radio frequency identification (RFID) based toll collection is an example of smart transport technology. In RFID toll collection, drivers need not stop at a physical toll booth, which typically takes time, blocks the traffic flow, and requires manpower for toll collection. Automatic passport control at airports is an emerging technology deployed in smart transportation. In automatic passport control, passengers can use RFID-based passports or electronic passports for fast and reliable entry without the need for a manual passport check. Another example of smart transportation is the use of smart apps on mobile phones to hire taxis and even track the exact location of the taxi and driver information in the same smart app (Ibáñez et al., 2018).

The smart environment is measured by the attractiveness of the natural environment, pollution levels, environmental protection activities and resource management methods. For example, using smart energy such as solar energy or wind energy is a form of green energy source (Chel and Kaushikb, 2018).

Smart societies are characterised by the level of qualifications, lifelong learning, social and ethnic diversity, creativity, openness, and participation in public life (Gupta et al., 2017). Quality of life is measured by existing cultural facilities, living conditions (health, safety, and housing), educational facilities, tourist attractions, and social coherence. For example, a smart building can have different hardware,

software, sensors, and smart appliances for different automated operations, including data network, voice-over-IP (VoIP), video distribution, video surveillance, access control, power management, and lighting control (Dlodlo, 2016).

Smart governance is expressed by the transparency of city management, social participation, the level of public services, and the implementation of development strategies (Wilhelm and Ruhlandt, 2018).

2.3 Challenges to Realize the True Smart City

Smart cities today are more of a vision than a strategic end-to-end approach. In order to have a true smart city, there is a lot of work across the various activities, assets, and infrastructure that can be turned into smart versions. Realizing a true smart city can be incredibly complex as so many factors and parties are involved and cities have numerous tasks and functions (Monzón, 2015). Moreover, in a smart city, all these areas are connected as mentioned, and that doesn't happen overnight. There is a lot of legacy, there are several operations and regulations, new skillsets are required, many connections need to be made, and there is loads of alignment to do on various levels (city administration, public services, transportation services, safety and security, public infrastructure, local government agencies and contractors, education services) (Visvizi and Lytras, 2019).

Another challenge that can hardly be overlooked concerns the attitudes and willingness to change things for the better among citizens. Social adaption of such a system requires changing social habits of citizens generally and city management personnel specifically (Chourabi et al., 2012). Also, the development of ICT infrastructure, from communication channels to sensors and actuators in physical space, remains a huge barrier to implementing a smart city initiative. Lack of infrastructure is a significant barrier to achieving smart city objectives (Bawany and Shamsi, 2015).

Acquiring enormous IT infrastructure is evidently required for a smart city. A huge financial investment is to be obtained to put the

system in place. Millions of sensors, thousands and thousands of networking equipment and computing devices will be needed to get end-to-end connectivity. Similarly, the requirements of IT professionals and consultancies will make up a considerable amount of expense (Bawany and Shamsi, 2015).

2.4 Smart City Tourism

The fourth industrial revolution has bolstered development in the tourism industry, and many cities have tapped into their tourism competitiveness by developing a smart tourism ecosystem based on existing smart city digital technology infrastructures. These developments in tourism have worked to catalyse the idea of building smart tourism cities. If so, is it true that tourism becomes smarter when tourism meets smart cities? Making a movement to a smart city, visitors are guaranteed to indulge in smart tourism experiences. Examining the smart city phenomenon in the tourism context is definitely crucial, particularly regarding its influence on the travel experience and its citizens' quality of life. In this context, a smart tourism city is defined as an innovative tourist destination that guarantees sustainable development that facilitates (Bifulco et al., 2016) and enhances visitors' interaction with experiences at the destination and eventually improves the residents' quality of life.

Buhalis and Amaranggana (2013) emphasised that a smart tourism city is required to enhance the tourism experience through more personalised products and services to meet each visitor's unique preferences. Using big data could be the solution for providing the right services that suit users' preferences at the right time. However, emphatically connecting with stakeholders becomes critical for understanding the unique preferences of visitors and the competitiveness of cities. Smart cities embrace the five main stakeholders in tourism: governments; tourism organizations; local residents; tourists; and the environment (Neuhofer et al., 2012).

Collaboration between stakeholders and a user-friendly platform based on connected infrastructure ensures the enhancement of the

quality of life for locals, enriches the experiences of tourists, boosts private businesses, and increases governments' competitiveness in terms of smart personal experiences, occupations, and the highest value for the environment. (Buhalis and Amaranggana, 2013).

Most importantly, a smart tourism city provides intelligent services to visitors in terms of transportation, gastronomy, accommodation, ancillary services, and attractions throughout three phases: the pre-travel (planning) phase, the travel (onsite) phase, and the post-travel phase (evaluation). All those services are realised on the basis of the main domains of the smart city infrastructure: service, land, and infrastructure (Neuhofer et al., 2012).

3. Methodology

This study relies on a quantitative approach in order to measure the awareness of Egyptian local community about the concept of smart city the applicability of smart city services. This study also aims to identify the importance of smart cities for the local community and explore challenges that hinder the implementation of the smart city concept. To answer the research questions, an online questionnaire was distributed using Google Forms. As the study population consists of a random probability sample from the local Egyptian community. The sample consists of (340) questionnaires, the number of valid questionnaires is (287) answered by Egyptian local community with a response rate of 84.4 %.

3.1 Questionnaire Design

The questionnaire includes 14 questions divided into four sections: The first section consists of four questions to measure the local community's awareness of the smart city's concept. The second section consists of five questions that the possibility of applying smart city services. The third section consists of three questions that identifies the importance of smart cities for the local community. Finally, the fourth section consists of two question that explore challenges that hinder the implementation of the smart city concept.

3.2 Research Questions

Q1: Does the Egyptian community realize the concept of smart cities?

Q2: What is the possibility of implementing smart city services in Egypt?

Q3: What is the importance of smart cities for the local community?

Q4: What are the challenges that hinder the implementation of the smart city concept?

3.3. Reliability of the Study

In order to ensure the reliability and stability of the constituent elements of each variable in the study, the reliability coefficient (Cronbach Alpha) was calculated, which is one of the most commonly used measures to test the reliability. The value of Cronbach's alpha coefficient ranges between zero and one, values more than 0.70 express a high stability coefficient, and the lowest acceptable value is 0.60 (Straub et al., 2004). The Cronbach's alpha for all the constructs in the study sample ranged from 0.767 to 0.938 which in turn establishes the reliability of the study instrument as it meets the reliability threshold limit of above 0.6 (table 1).

Table (1): Cronbach Alpha for the study sample

Constructs	Items	Cronbach Alpha
The local community's awareness of the concept of smart cities	4	0.938
The possibility of applying smart city services	5	0.860
The importance of smart cities for the local community	3	0.841
Challenges that hinder the implementation of the smart city	2	0.767

3.4. Data Analysis

3.4.1 Sample Description

The sample consists of (340) questionnaires, the number of valid questionnaires is (287) answered by Egyptian local community with a response rate of 84.4 %. The sample included the 153 male by 53.3% and 134 female by 64.6%, the following table shows the classification of age, education and income.

Table (2): Age Classification

Age	Percentage
(16 less than 25)	21%
(25 less than 40)	60.5%
(40 less than 60)	10.5%
Over 60	2.6%

Table (2) shows that 21% of the sample ranged in age from 16 to less than 25 years, while 60.5 % were aged from (25 to less than 40 years) , and 10.5 % of the sample was aged from (50 to less than 60 years), and finally 2.6 % Over 60 years old.

Table (3): Education classification

Education level	Percentage
High education	47.3%
Post graduate	5.2%
Master degree	15.7%
PHD	34.2%

Table (3) illustrates that 47.3% of sample have a higher education, while 5.2% postgraduate, and 15.7% of sample have a master's degree, finally 34.2 % have a PHD.

Table (4): Income classification

Income	Percentage
No income	21%
(1000 less than 5000)	39, 4%
(5000 less than10000)	18, 4%
(10000 less than15000)	2, 6%
(15000 less than20000)	2, 6%
Not mentioned	16%

Table (4) shows that 21% of the sample have no income, while 39% of the sample have income ranging from (1,000 to less than 5,000), and 18% (5,000 to less than 10,000), the results also indicate that 2.6 % of sample for both (10000 less than15000) and (15000 less than20000), finally 16% of respondents did not mention the level of income.

3.4.2 Regarding the local Community's Awareness of the Smart City's Concept

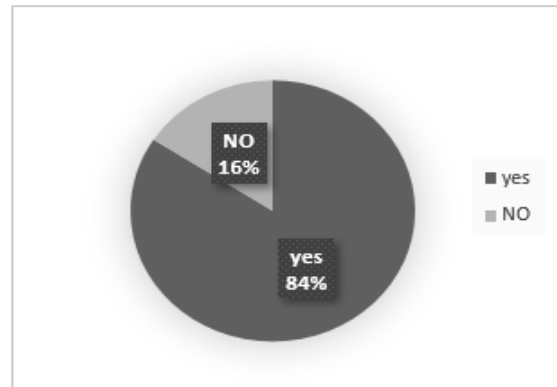


Figure 2: knowledge of smart cities

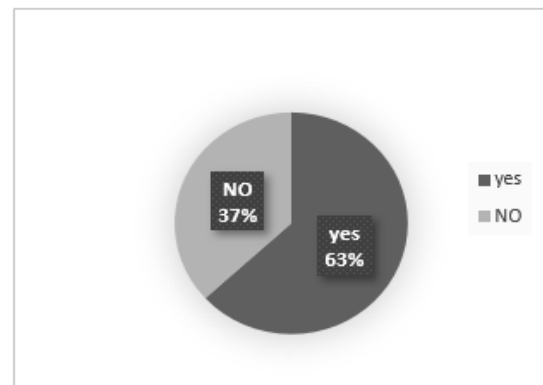


Figure 3: knowledge about the existence of smart cities in Egypt

Figure (2) shows that 84.2% had previously heard of smart cities, while 15.8% had never heard of smart cities before. Figure (3) also shows that 63.2% are aware of the existence of smart cities in Egypt, while 36.8 % of the sample do not know about the existence of smart cities in Egypt. This means that a large

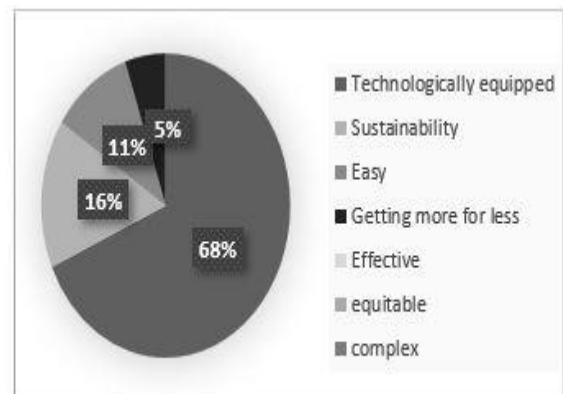


Figure 4: The meaning of smart cities in the belief of Egyptian local community

percentage of the study sample had previously heard about smart cities and their presence in Egypt as well.

As for the meaning of smart cities in the belief of the Egyptian local community, figure (4) indicated that 68.4% believe that smart cities are technologically equipped cities, while only 15.8% believe that smart cities mean sustainability, and 10.5% confirmed that it means Easy, finally 5.3% indicated that it means getting more for less.

This means that the largest proportion of the study sample, which represents 68.4%, believes that smart cities are technologically equipped cities, while a small percentage of the sample, which represents 15.8%, believes that smart cities mean by sustainability.

Regarding the method preferred by the local community to spread awareness about smart cities, the results indicated that the local community prefers social media by 48.4 %, whereas 21.4 % prefers TV ads and 11% prefer to display successful experiences then 9.5% prefer documentaries, and Local councils at 7.5 %, finally 2.2% prefer other methods.

3.4.3 Concerning the Possibility of Applying Smart City Services

First, the results indicated that 97.4% of the local community want their city to become a smart city. This is due to the presence of many negative aspects such as traffic congestion, government procedures - infrastructure - slums -pollution – hygiene.

transport by 47.4 % and infrastructure by 42.1 %.

With regard to the most important factors that will help the community to implement smart city services. First, utilize of successful smart city experiences is 55.3 %, followed by the availability of technical expertise at a rate of 15.8 %, then the participation of the local community 13.2% Both the state incentives and the partnership between the private and public sector are equal at 7.9 %.

The results also indicated that 68.4 % of the local community doesn't find it difficult to deal with the electronic services that will characterize the smart city in the future, while 31.6 % of the local community finds it difficult to deal with electronic services.

3.4.4 Concerning the Importance of Smart Cities for the local Community

The results indicated that the most important services that will benefit the local community when implementing smart city services are electronic services 26.3% and a decrease in pollution 21.1%, followed by transportation and communications 21.1%, waste management 15.8%, then energy-saving 10.5%, finally, both electricity services management and water and heating services are equal at 2.6%.

The results also showed the most important benefits that will stimulate the local government to implement smart city services

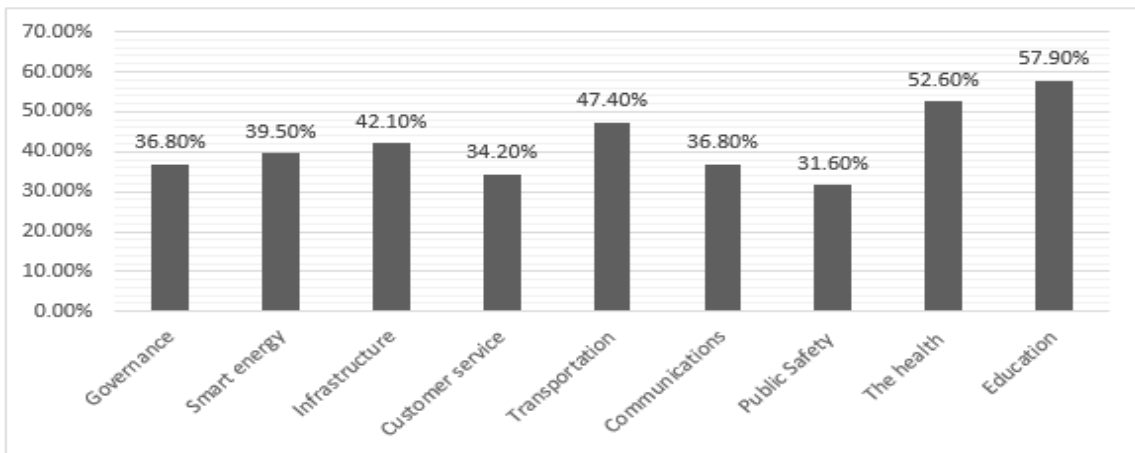


Figure 5: the most priority sectors that need to be smart services

Figure (5): shows the most priority sectors that need to be smart, which are represented in education by 57.9 % and health by 52.6 % and

which are represented in economic growth 31.6%, enhance the services for citizens 26.3%, Health and education 21.1%, Provision of

capital / operational cost 18.4% Safety and security benefits 2.6%.

Moreover, the results clarified a number of the shortcomings of smart cities from the point of view of the local community, namely: The high standard of living 42.1% and the difficulty of dealing with technological services 23.7%, then the difficulty of adapting to smart cities and the distance from major cities are equal by 10.5%, finally the difficulty of obtaining job opportunities 7.9%.

3.4.5 Regarding Barriers to Implementing Smart City Services

smart cities, but a large proportion of the local community believes that smart cities are technologically equipped cities, while a small percentage realizes that smart cities are sustainable cities.

Concerning the possibility of applying smart city services, the results illustrated that 97.4% of the local community want their city to become a smart city and 68.4 % of the local community doesn't find it difficult to deal with the electronic services that will characterize the smart city in the future. The results also showed the most priority sectors that need to be smart which are represented in education by 57.9 %

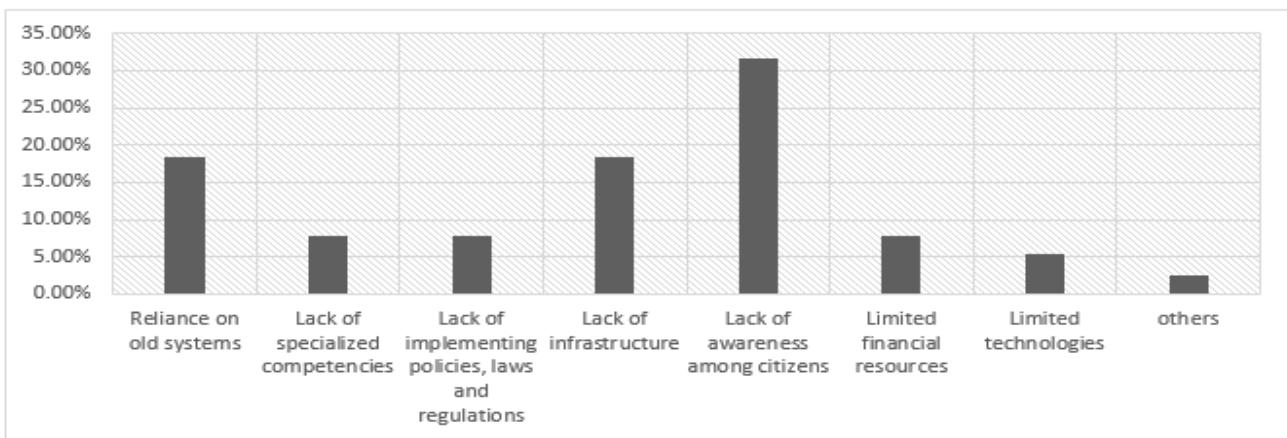


Figure 6: Barriers to implementing smart city services

Figure (6) shows the obstacles to implementing smart city technologies, which are represented in lack of awareness among citizens 31.6%, lack of infrastructure, and relying on old systems are equal at 18.4%, followed by the lack of specialized competencies, limited financial resources, and the absence of implementing policies, laws and regulations in equal proportions 7.9%. Finally, limited technologies 5.3%.

3.5 Results

Regarding the local community's awareness of the smart city's concept, the results indicated that 84.2% had previously heard of smart cities also results showed that 63.2% are aware of the existence of smart cities in Egypt. Moreover, the results confirmed that 68.4% believe that smart cities are technologically equipped cities, while only 15.8% believe that smart cities mean by sustainability. These results confirm that the local community is aware of the existence of

and health by 52.6 % and transport by 47.4 % by utilizing successful smart city experiences and technical expertise.

Concerning the importance of smart cities for the local community, the results indicated that electronic services, 26.3% and a decrease in pollution 21.1%, followed by transportation and communications 21.1% are the most important services that will benefit the local community when implementing smart city services. The results also showed that economic growth 31.6%, enhance services for citizens 26.3%, Health, and education, 21.1% are the most important benefits that will stimulate the local government to implement smart city services. Moreover, the results clarified a number of the shortcomings of smart cities from the point of view of the local community, namely: The high standard of living 42.1% and the difficulty of dealing with technological services 23.7%.

Finally, Regarding Barriers to implementing smart city services, the results emphasized that

lack of awareness among citizens, lack of infrastructure, and relying on old systems are the most important obstacles to implementing smart city technologies.

4. Recommendation

To implement the smart city concept, we need several basic points, such as developing the government electronically and raising the level of their technical training in all departments of government organisations specialising in serving the people, using examples from successful smart cities and consulting experts in several sectors.

In addition to raise the level of awareness of local communities by developing education and thus raising the level of awareness of new generations as well as Transforming educational and medical institutions from financial capital to social institutions aiming at optimal service to society.

As well Developing workers' skills and old competencies in all types of establishments through the provision of accurate technical courses required to raise technical awareness. Additionally, smart cities ought to run ongoing educational and electronic awareness campaigns for the general public and the elderly in all forms of social media and other media, including newspapers, magazines, radio, and television.

5. Conclusion

The research indicates that the smart city concept may be an opportunity for the Egyptian government to manage the effects of rapid urbanisation and its consequences on the economic and environmental situation and the deterioration of quality of life. The smart city concept is based on the use of rapid development in the field of information and communication technology to improve the quality of life and achieve sustainability.

Moreover, the whole environmental restructuring caused by ICT, which has provided huge amounts of data, has also changed patterns of the tourism industry, which led to the emergence of smart tourism. In this context, a smart tourism city is an innovative

tourist destination that ensures sustainable development, which facilitates and enhances the interaction of visitors with experiences in the destination. Thus, it improves the quality of life of the residents. The concept of the smart tourism city is based on the exchange of data between the public and private sectors; In addition, visitors and residents are play an important role in providing and receiving that information. Most importantly, a smart tourism city provides intelligent services to visitors in terms of transportation, gastronomy, accommodation, ancillary services and attractions throughout three phases: the pre-travel (planning) phase, the travel (onsite) phase and the post-travel phase (evaluation). All those services are realized on the basis of the main domains of the smart city infrastructure: service, land and infrastructure. This study relied on a quantitative approach in order to measure the awareness of Egyptian local community about the concept of smart city the applicability of smart city services. This study also aimed to identify the importance of smart cities for the Egyptian local community and explore challenges that hinder the implementation of the smart city concept. The results indicated that the Egyptian local community is aware of the existence of smart cities, but a large proportion of the local community believes that smart cities are technologically equipped cities, while a small percentage realizes that smart cities are sustainable cities. Concerning the possibility of applying smart city services, the results illustrated that the local community want their city to become a smart city and the local community doesn't find it difficult to deal with the electronic services that will characterize the smart city in the future. The results also emphasized that lack of awareness among citizens, lack of infrastructure, and relying on old systems are the most important obstacles to implementing smart city technologies in Egypt.

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