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Smart cities and their impact on economic sustainability: a contemporary view within the framework of concepts and experiences

Abstract

The importance of the research is that the technical development and progress that accompanied the twenty-first century offers many appropriate solutions to a range of problems that cities suffer, to improve the quality of human life and to contribute to intellectual and cultural development, to reach an integrated infrastructure, through the development of local areas and the harnessing of technology , especially the smart ones, using mechanisms that can be applied to support sustainable development in various areas of life to maintain the prosperity and prosperity of cities and the provision of services and smart ways of living, and the transformation from the traditional city to a pluralistic city, and access to a high quality of luxury, the problem is the lack of application of the principles of sustainability that contribute to reaching smart cities that help solve the problems that traditional cities suffer from, and the research aims to introduce the smart city and its role in the transition to sustainability and to identify its characteristics, components, objectives and their relationship to sustainability. and scientific theses and international web sites, as well as following the analytical approach of successful global experiences , with a presentation of the steps they have implemented to reach smart cities, and the extent to which they can be applied to smart cities in the United Arab Emirates.

Keywords: smart cities, sustainable smart economy, contemporary concepts

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Introduction

Recently, the concept of smart sustainable cities, at the forefront of the concerns of the international community, has become a promising response to the challenge of urban sustainability, specific to technologically advanced countries, where the United Nations estimates that by 2030 66% of the world's population will live in cities, and this requires significant challenges related to environmental and social sustainability, and includes all kinds of recreational services and various communications, electronic data, sensors and information technology for the management of commercial and industrial assets, and movement Traffic, networks and all issues related to sustainability and ecosystem, helps the people living in them to interact positively with the place where the high performance of the infrastructure occurs, and to strengthen the relationship between cities and citizens. The rapid transformation in the distribution of population between rural and urban areas, and the increasing use of communications and information technology between individuals, companies and governments, are promoting the social and economic transformation of cities around, continuously, towards the digital world. Hence the intelligent character of a city or the creation of a new city that needs two types of conditions in which a distinction can be made between what is technical and legal. And that it needs a complex and intertwined system that needs complex and conscious studies of all the elements of living for its inhabitants.

Research objective

The research aims to shed light on the definition of smart sustainable cities and clarify their characteristics and the most important elements and advantages, up to the most important Arab and global experiences of smart cities around the world. How it was able to apply these strategies to cities and the possibility of benefiting from the steps taken in them.

Research methodology

In this study the descriptive approach was chosen: by studying references, books, dissertations, international web sites, and everything related to the subject, the analytical approach: the analysis of some successful global experiences.

Definition of smart cities

The origin of this concept is due to the growth movement in the late 1980s and the roots of the idea were found earlier through what they call conservative cities via the Internet in the 1960s, in the proposal of grid cities and have been put into account for the plans since 1980.[1] The California Institute for Smart Communities has called the Smart Growth of Digital Cities the term "smart city" as they are cities that have three basic elements, technical, social, and environmental, they are three cities in one city (virtual, informatics, knowledge, and environmental).[2]

Characteristics of smart cities

The dimensions of smart cities are linked to theories of sustainable urban development, such as transport and economics, natural resources, quality of life, and participation between them.

Smart economy

An economy that encourages innovation, entrepreneurship and productivity, as well as entrepreneurship, the development of the spirit of innovation and competition for excellent production through the use of the latest technological equipment and software.

Smart environment

is the natural or built environment to represent the physical environment of the city through which all activities are conducted.

Smart/E-Government

It is the development of the system of government work using electronic means through

1) Providing information: by making available all events and information related to the residents of the city.

2) Communication: The ability to exchange information and communicate between the population and the government.

3) Electronic transactions: through the performance of electronic services.

Smart life

Water distribution network

Reducing water consumption and recycling its use is an element of sustainable cities, including monitoring in the smart water distribution network, by monitoring the content of water collection tanks, detecting leakage and monitoring water quality at specific points along the distribution system, by deploying sensors (Metaphor devices) around the pipeline to provide continuous monitoring Figure 2. By analyzing the data and information collected remotely. Treatment devices work after detecting unusual cases. Figure 2: Smart Water Distribution Network. The network performs self-repair work through triggers.

Operators

They are devices that do not require human intervention, through the collection of data and information by means of sensors, then analyzed, then classified, and then made intelligent decision-making, in terms of maintenance and treatment of malfunctions by the operator T.

Electrical power distribution network

Smart grids offer many advantages such as monitoring, self-monitoring and sensing (sensor) One of the most important information applications to monitor energy transmission lines for the purpose of accurate monitoring thus ensuring better performance and increasing the efficiency of the network where smart sustainable cities are characterized by reducing the use of non-renewable energies to the lowest levels using renewable energies such as solar, wind, underground and water and raising the percentage of their use at the city level.[3]

Smart movement

It includes smart infrastructure for public transport and communications, reducing environmental pollution by reducing the energy used in manufacturing.

E-transportation

Intelligent transport is used to express the integrated applications of sensors, computers, communication technologies and electrons, and management strategy to provide individuals with the necessary information, to increase the efficiency of transport systems and to enhance traffic safety.[3] Through a set of technologies that rely on information technology, smart movement can be replaced by smart sustainable infrastructure in order to shift towards the sustainability of the basic environment which is the basis for the transition towards the sustainability of the city.[2]

Smart attitudes for vehicles and bicycles

Smart cities encourage the use of bicycles, and the creation of compatible cars and innovative bicycles, within the principles of urban design (integration, convergence, ease of access, expansion of green areas, recreational areas, where smart parking represents to create vacant spaces for parking lots, and the nearest parking for vehicles, used for new systems types of sensors (Metaphor devices) to detect vacant parking, identify occupied, reserved, as well as parking spaces for people with special needs.[1]

Smart people

Citizens represent the community in smart cities where they play the most important role in the city, they are the main source of most of the data needed to guide the smart city (www.idc,com) and they are responsible for transforming life from traditional to an innovative life based on innovative technological solutions to the problems within it, and to develop our future to be able to practice all activities and services such as government, mail, cards, books, commerce, and other electronic services.

Components of smart cities

1) Physical Civil: It is the real city with its inhabitants and infrastructure such as roads, buildings, shops, schools, hospitals, public places and each can be located in the city environment and includes infrastructure, communications and technology used, in addition to the physical components necessary to facilitate the activities of transport, education, trade, working life and others

2) Feasibility and potential of innovation: This item can be considered as a stand-alone ecosystem, as there is a cycle of sustainable activities that works to serve the development of the smart city and includes these in the basic principles of observation, apparent facts and events of life in the city, which in turn leads to the creation and innovation of the development of a strategy that culminates in appropriate use in the market.

3) Embedded applications and systems: As a result of innovation, embedded applications and systems are proposed and identified and then developed, and is generally expected, to focus on four types: intelligence, e-learning, participatory creativity, and marketing.

Smart cities objectives

The aim of building smart cities in the time of technology is to facilitate the services provided to the community, enable them to better exercise their rights and freedoms along with increasing the efficiency of local units, which entails:[4]

1) Reduce (reduce) the percentage of carbon dioxide emissions into the atmosphere.

2) Achieve the best environmental quality, in order to achieve a lifestyle suitable for the population.

3) Development and development of the advanced environmental foundation of informatics, and put it accessible to all.

4) Achieve economic growth, in parallel with the quality of lifestyle.

5) Sustainable community development.

6) Take advantage of raising the level of information and communication technologies to develop multimedia and knowledge industries.

7) Ensure social harmony between the different groups of the population.

8) Development of the city, as a living laboratory for the promotion of sustainability,[1]

9) Increasing sustainability, improving citizen life and economic growth.[5]

Smart cities mission

It is to work on the development and implementation of an accurate and successful development plan that ensures the improvement of the quality of life of citizens and encourages the plan of business enterprises to invest to provide an urban environment for sustainable living.[6]

Sustainability

It is an environmental term that describes how biological systems remain diverse and productive over time. Sustainability for humans is the ability to preserve the quality of life we live in the long run, which in turn depends on the conservation of the natural world and the responsible use of natural resources.

The sustainable city

The Sustainable City is a relatively recent concept that has received increasing attention in the past decades through the international community, a city that provides for the needs of its inhabitants nowadays without affecting the needs of future residents.

Smart sustainable cities

It is an innovative city that uses information and communication technologies, and other means to improve the quality of life, operational efficiency, urban services and competitiveness, while ensuring that it meets the needs of present and future generations in relation to economic, social, environmental, and cultural aspects. It is based on the following elements.

Electronic city

It is a digital and virtual city, where information and communication technologies are equipped with wireless networks, from sensors, so that they form essential elements of the built environment, as a system for the operation of the smart society, and smart urban management.[4]

An eco-city:(city) :is a city that uses new and renewable energy resources.

City informatics

It is a city focused on the cognitive and creative activities of individuals, knowledge institutions, and the digital infrastructure environment for communication and knowledge management.[7] Finally, a smart sustainable city is a city that:" meets the needs of its current inhabitants without compromising the ability of others or future generations to meet their needs and, therefore, does not go beyond local or planetary environmental constraints, as this is supported by information and communication technologies.

Smart cities and sustainable economic development

Objective and subjective requirements and necessities

There are a set of objective and subjective requirements to make a qualitative shift towards sustainable smart cities, the most important of which is a stable, secure, reliable and interoperable communication infrastructure to support a huge volume of applications and services based on information and communication technology. The main principles of these requirements are:

1) The recent developments in the internet - artificial intelligence - smart grids and smart meters are all driving and supporting the development of sustainable smart cities all over the world.

2) The importance of a rapidly growing network of computing devices to communicate with each other and exchange data and includes sensors and software - enables billions of devices and objects equipped with smart sensors to communicate with each other, gather information in real time, and send this data, via communications Wireless, to central control systems. These, in turn, manage traffic, reduce energy use, and improve a wide range of urban operations and services.

3) Artificial intelligence also allows the analysis of very large sets of data computationally to reveal patterns that are used to enrich and enhance the decision-making process in municipalities.

4) The importance of smart grids - in reference to the electricity supply networks that use digital communication technology to detect and interact with local changes in use - that help to optimize energy use in cities. Smart meters, smart sensors with IP addresses, can transmit information about energy use by end users to the energy supplier, giving end users more control over their consumption.

5) Just as the third and fourth generation networks used by mobile phones today pose a number of problems in supporting a set of services required for sustainable smart city applications, the development of fifth generation technology, and refers to the fifth generation of mobile communication technologies, provides the ability to connect devices reliably It uses the Internet and other devices, transfers data more quickly, and processes large amounts of data with the least amount of delay.

Objectives of smart cities towards integration towards sustainable development

Several experiences of countries have been able in recent years to transform into smart cities, by developing means of controlling traffic and parking, rehabilitating waste collection methods and managing landfills, and reducing energy consumption. Several countries have also created completely new smart cities that provide from the beginning all friendly standards. Building environment, relying on clean energy, and introducing modern technologies in all aspects of life.

How did the idea of these smart cities come about? Will the experiment also work in developing countries? What are the justifications for building these cities despite their high cost? Does it actually achieve its desired goals and contribute to rapid sustainable growth?

There is no dispute that the problem of environmental degradation is the greatest challenge facing the planet at the present time and in the coming years. It is an existential challenge for humanity, and urgent action must be taken to stop the bleeding. Thus, interest in smart cities as one of the sustainable solutions to the problem of climate change is no longer a luxury or just an improvement. For the quality of life, it is an imperative, especially if we recall that more than half of the world's population currently lives in urban areas. These smart, digital or ecological cities also provide services that depend mainly on the infrastructure of information and communication technology, and this advanced structure helps in managing services The city has public lighting, water and sewage networks, safety and security, and the fight against crime. Residents of these cities can easily access most of the services through the Internet, which enables them to contact the

various institutions and bodies in their city, and spend their interests electronically.

The relationship between sustainable cities and smart cities

The relationship between smart cities and sustainable development is a close and particularly important one, so that smart cities can contribute to achieving the principles of sustainability in design and operation and there is a correlation between smart cities and sustainability and the extent to which sustainability affects smart cities Table 1 shows the axes of correlation between smart cities and sustainable cities.

Table 1 The axes of correlation between smart cities and sustainable cities

The relationship of sustainability with smart cities	Characteristics
The smart economy is based on the exchange of data and information through different communication networks, where it offers many applications that contribute to the development of various economic activities, which helps to reach the most appropriate ways to preserve and develop basic resources in ways that maintain their continuity and then sustain them for future generations in what is known as the green economy.	Economy
It is an educated and supportive society that innovates and technology and that will come up with innovations that benefit society and save its current energies for the future in an effort to maintain the sustainability of available resources.	Society
The main goal of the Green City is to reach a clean and sustainable energy that contributes to the development of the city and ensures its sustainability, which has resulted from the applications of information technology in the field of energy and access to new sustainable resources, and these applications are one of the most important components of sustainable cities.	Infrastructure
Good urban governance and community participation are among the most important requirements of sustainable urban planning, so the information city is the appropriate proposal through the application of e-management methods.	Government & Administration
The smart city is the right offering through the capabilities it provides to its administrative and planning devices such as remote sensing, geographic information systems and other programs and tools that help to plan well and make the right decision at the right time, which contributes to its preservation and development in accordance with the concepts of environmental sustainability.	Planning and Environment
Smart living is the result of all previous characteristics and it is life in smart ways to preserve the natural environment and ensure its continuity for future generations	Living (Life)

Some International and Arab experiences to establish smart cities or transform to them

Global experiences of smart cities can be classified into two categories:

1) They are new smart cities that have been established,
2) the transformation of existing cities into smart cities (www.jdc) where smart city projects differ among themselves but they depend on three main features, namely the ICT infrastructure, the specific integrated administrative framework, and smart users, and for the success of these many systems in smart cities and to be integrated between them users must have the required technical skills that allow them to interact with technologies Smart services, sustainability and required utilization.

Experience of Singapore

It is a small island that shows great interest in the environment and in 1992 the idea of a smart island was started among government officials with the goal of improving the quality of life for all and achieving economic growth.

It was ranked first among smart cities in 2009 based on the evaluation of Forbes, and in 2011, 2012 it was ranked first in the ease of business activities by the World Bank Group.

Experience of the United Arab Emirates

The UAE government launched the Smart Government Initiative, and then launched the Artificial Intelligence (AI) strategy, on which all future services, halls and infrastructure will depend in 2071, to be the best in the future. Abu Dhabi (Masdar City): Masdar

City is located in the desert of the Emirate of Abu Dhabi The idea was established in 2008, to accommodate 40,000 residents and 50,000 visitors, with an area of six thousand kilometers, in order to be the most sustainable city in the world.[8]

Below will be summarized the steps that were presented for the two experiments and the most important elements that were applied as in Table 2.

Results

i. The smart city is an innovative and innovative system, it represents a combination of digital technology with the tools necessary to solve the problems of modern life for such a kind of sophisticated aphids.

ii. In order for the life of the population to be happy, easy and sophisticated, it is necessary to use means and techniques that ensure the protection of human rights and personal freedoms.

iii. The smart city meets all the concepts of sustainability and therefore the transformation to smart cities is an implicit transformation of green sustainable cities.[9–11]

iv. The process of transforming smart cities requires the development of smart goals, vision and strategy that translate into projects, and the development of communication infrastructure, whether it is (networks or data) to build a set of applications that emphasize

the intelligence of the city) smart economy, smart infrastructure, smart environment, smart life.

v. Recent advances in artificial intelligence (AI), smart grids, and smart sensors all support the development of smart sustainable cities.[12–14]

Table 2 The steps that were presented for the two experiments and the most important elements

T	Experiment	Singapore	
I	The strategy used	Transformation into a regional center for the development of computer programs 1980-1990	
		Transformation into a global center for electronic services between 1995 and 2010	
		Obtaining a grant for having a strategic plan that has an impact on the lives of citizens 2012	
	Domain	Smart Economy	Trapping the public, private and people sectors
			Use technology as a means to achieve an end to enable improved living, working and playing together
			Communicate with the private sector in order to enable computing
			Improved services helped attract intensive activities
			Integrating environmental and development goals
			Formation of a regional and global financial center to improve customer services, efficiency in trade finance and strengthening oversight
		Smart Government	Clarity of the basic objectives in guiding information and communication technologies to enhance competitiveness.
			Launched 6 national ICT master plans
		Smart Society	Raising the level of skills of citizens, especially the workforce
			Use wearable devices or smartphones to monitor their health and activity.
			Use smart sensors and systems to save energy and ensure sustainable use of resources
			Implementing the e-learning system to strengthen the relationship between students, teachers and parents
		(Smart Infrastructure) Smart Grid	Equipping the physical infrastructure to create a suitable environment for education
			Improved services helped attract intensive activities
			Establishment of a landscape project in 2009 with the aim of designing a green mane, while providing green and regular common areas.
			Land use planning for optimal ease of use.
			Establishing the Marina Bay project as a combination of environment and waterfront design to live, play and learn.
			It launched a program to experiment with the smart grid to monitor and manage the smart city consisting of the latest elements that allow control and monitoring in 2009.
			Installation of intelligent transmission system. Use public transport to reduce private mobility. And the rain between land and water.
			Installation of a network of smart water.

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Recommendations

Here are some recommendations that help implement the smart sustainable city system at the level

1) Raising awareness and publicizing the importance of applying the principles of sustainability and intelligence in the new city.
2) Preparing for the establishment of scientific conferences to discuss sustainable intelligence in its various fields of sustainability.
3) Organizing scientific and international exhibitions, publishing scientific journals and encouraging the establishment of scientific research and specialized studies.
4) Benefit from international and Arab experiences in various fields of intelligence.
5) Develop laws and legislation to ensure the application of smart sustainability principles
6) Apply the principles of sustainability to all buildings to equip them to be smart later .
7) Equipping the infrastructure that is able to apply sustainability and intelligence together, through the assimilation of modern and digital information loggia.
8) Encourage the private sector to invest in smart and sustainable projects and provide them with all equipment.
9) Develop a long-term plan within the state projects that adopt and ensure the application of smart and sustainable projects to include all state institutions.
10) Coordination between the different sectors of the state such as education, scientific research, utilities, housing, roads, transportation... etc. to exchange information and experiences in the field of

Raising awareness of the importance of this specialized field in science and modern learning

1) Establishing specialized departments and colleges such as sustainable building technology and smart energy, such as departments of architecture, sustainable planning, civil engineering, departments interested in clean energy, mechanical and electrical engineering.
2) Conducting training programs for students in universities and higher institutes to raise awareness of this modern specialization in our beloved society.
3) Modifying and equipping curricula to keep pace with modern and international universities in the field of smart and sustainable architecture.
4) Encourage cooperation with universities and colleges that are interested in this field through conferences, workshops and scientific research, and encourage e-learning in this field.
5) Establishing scientific sites for the information network in Libyan universities and linking them to the latest scientific research.
6) Encourage and support young researchers in the field of sustainability and smart architecture, which bring benefits at different levels of the economic and social city, and the environment.

Conclusion

From the above, a harmonious smart sustainable city is a model for a sustainable future, designed to be the best place to live, work, learn and visit. Its sustainable development model incorporates the most valuable concepts and practitioners in the rise of digital/smart cities around the world, environmental communities, smart cities, knowledge groups and regional systems of innovation.[9–11]

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Conflicts of interest

There are no conflicting interests declared by the authors.

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