Fourth Generation Cities, an Egyptian Dream that turns into Reality

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Introduction

The concept of "sustainable development" has gradually emerged and has nowadays become the main goal of the United Nations and civil society, especially in light of the current global situation of environmental degradation that seriously threatens the survival of humankind.

The Sustainable Development Goals (SDGs) were announced through UN General Assembly Resolution 70/1 entitled " Transforming our world: the 2030 Agenda for Sustainable Development", in 2015. Accordingly, Egypt launched Vision 2030, in February 2016, as a national agenda that reflects the state's long-term strategic plan to achieve the principles and goals of sustainable development in all fields, and to localize them in various state agencies. It also reflects the three dimensions of sustainable development: the economic dimension, the social dimension, and the environmental dimension.

In early 2018, the state decided to update its sustainable development agenda, in order to keep pace with the changes in the local, regional and global context. The second edition of Egypt's Vision 2030 was concerned with becoming an inspiring vision that explains how to increase Egyptian contributions to the UN agenda.

Accordingly, Egypt has moved to establish smart cities, in order to achieve the UN's SDGs, especially SDG11 on sustainable cities and communities, in order to prove to the world that they respect and promote human rights, foremost of which is the right to life, which is the essence of these rights, and which is also one of its original pillars "the right to development". The main motive in the state's endeavor to achieve the goal is its keenness to provide a healthy and clean life for the citizen, meaning that the citizen was and still is the starting point of the state in all development projects.

Smart sustainable cities or fourth generation cities, which are one of the main solutions offered to countries of the world to deal with the increase in population density, the crisis of climate change which has recently increased in intensity, as well as the elimination of slums. It aims to reduce the economic, environmental, and social repercussions of the challenges resulting from urban expansion, such as: poverty, health care, energy, and water, by adopting an approach that mainly focuses on the citizens, with these cities providing the necessary solutions to all the problems they face.

Smart cities rely on strong infrastructure, especially in electricity and communications, to support and facilitate the operation of applications, and accelerate the provision of IT-based services.

Perhaps the most prominent feature of fourth-generation cities is their reliance mainly on modern technology in all government services provided to they are quicker, as the citizen will not need to move from one authority to another in order to finish some government procedures. It mainly aims to improve the quality of life of the citizen, by providing basic life requirements, such as: water, or energy, especially electricity, housing, education, and health, all in a clean and disease-free environment that enhances the health of the individual.

Indeed, Egypt has been able to make smart cities a reality for citizens, through the establishment of many fourth-generation cities in various governorates, where these cities will help solve problems, related to the environment, economy, and housing. At the forefront comes the new administrative capital, which will enable Egypt to become a leading economic center in the Middle East and North Africa, as well as the new city of Mansoura, which was recently opened, to be the first smart city in the Delta, to serve the people of the five governorates of the Delta.

Through this report, **we review several points related to smart cities, as follows:**

1. Definition of Smart Cities
2. Characteristics of Smart Cities
3. Benefits of Smart Cities
4. Egyptian efforts to build smart cities: New Mansoura City as a model
5. Challenges Facing Egypt
6. Recommendations

❖ First: The Nature of Smart Cities:

According to the International Telecommunication Union, a smart city is: “an innovative city that uses information and communication technology to improve the quality of life, the efficiency of urban operations and services, and the ability to compete, while meeting the needs of current and future generations with regard to economic, social, environmental and cultural aspects.”

Urban areas, through more sustainable integrated solutions, including applied innovations and better planning, a more participatory

approach, greater energy efficiency, better transport solutions and smarter use of ICTs.

Smart cities are: "ones that achieve outstanding performance in all fields, through effective partnership between the government and private sectors, regarding improving the quality of life of citizens, raising their awareness, while preserving the environment from any harmful carbon emissions that threaten the future of all humanity."

Recent developments in Internet of Things (IoT), artificial intelligence, robotics, digital twin and smart meters have all supported the development of smart sustainable cities around the world.

Internet of Things (IoT) means the speed of communication and exchange of data, and artificial intelligence allows the analysis of very large sets of data in a computational manner to detect patterns that are used to enrich and enhance decision-making in governorates. A digital twin is a virtual representation of an object or system that spans its lifecycle, is updated from real-time data, and uses simulation, machine learning and reasoning to help decision-making.

While robots, supporting service delivery, and smart grids use digital communication technology to detect and interact with local changes in usage, and help optimize energy use in cities. Smart meters transmit information on energy use by end users to the energy resource, giving end users more control over their consumption.

❖ **Second: Characteristics of Smart Cities:**

Sustainable cities are characterized by 6 characteristics, which are:

1. **Smart living**: Living in smart cities is characterized by high quality and efficiency, as it ensures the comfort of citizens, in order to achieve social cohesion and preserve the community culture.
2. **Smart government:** Government transactions are carried out through electronic means and applications. The government uses the means of communication to exchange information with the population, so that citizens participate in the decision-making process, and the government can develop policies and strategies that include different points of view.
3. **Smart Society:** Any society capable of using and developing various technological means to conduct all transactions, and to keep pace with global developments.
4. **Smart movement (Smart transportation):** the creation of a smart infrastructure for sustainable, innovative and safe transportation

systems. For example, smart cities contain smart means of transportation and traffic lights.

5. **Smart environment:** the use of technology to reduce environmental pollution, as well as reducing the use of non-renewable energy and waste recycling, in addition to managing resources optimally and sustainably
6. **Smart economy:** i.e., increasing productivity and entrepreneurship, and using smart technologies to ensure local and global connectivity and increase competitiveness. This achieves effective participation in the global economy.

❖ **Third: Benefits of Smart Cities:**

Sustainable cities have many benefits that affects all aspects of life. The most prominent of these are:

1. **Preserving environmental resources** by reducing environmental pollution, production of unrecyclable waste, and water consumption, as well as using tools such as smart meters and smart transportation, which contributes to reducing greenhouse gas emissions.
2. **Improve citizens' quality of life.** According to the McKinsey Global Institute report on smart cities, smart city applications help save the lives of 30 to 300 people every year in cities with a population of five million. These applications help reduce crime and disease, as well as contribute to the speed and ease of access to services, especially government services.
3. **Increasing the productivity of the retail and industrial sectors and increasing the volume of investments,** by relying on artificial intelligence in manufacturing and packaging. Smart cities attract investments, especially in infrastructure and clean energy.
4. **Enhancing traffic safety,** through the use of smart applications and devices that collect traffic data to manage and reduce traffic congestion. This is done by providing the necessary data to drivers on the slowest and fastest roads, as well as the speed used.
5. **Empowering women**. These cities can contribute to gender equality by facilitating women and girls' access to different resources, including information, capacity building initiatives and services. It can help combat violence against women by enhancing their security and allowing them to campaign to make their voices heard around the world, not just by governments.

6. **The possibility of predicting and preventing terrorist operations,** through the adoption of technologies that detect bullets that can be used in such operations, while collecting the necessary data in combating crime and terrorism in general. It can also allocate platforms for drawing maps showing the places most vulnerable to terrorism, as well as quick smart tools, to deal with urgent terrorist threats, until specialists arrive at the scene.

❖ **Fourth: Egyptian Efforts on Smart Sustainable Cities:**

The development of new cities in Egypt has gone through 3 main stages, namely:

1) First Generation Cities (1977-1982):

During that period, new cities were established in the back of Cairo and Alexandria, with the aim of expanding economic activities and housing, as well as establishing a group of cities in the desert as buffers for internal migrations to Cairo and Alexandria, such as the Tenth of Ramadan, Salhiya, and Nubaria. As for Sadat City, it was meant to be the Administrative Capital, by transferring some ministries to it, the first of which is the Ministry of Housing.

2) The Second and Third Generation (1995-2010):

It is a group of cities that were established around the new cities of the first generation, such as; Obour City, Badr City, and Sheikh Zayed City, where these cities were called at that time "twin cities of the provincial capitals", especially Upper Egypt. The aim of establishing these cities at that time was to overcome the problem of limited land for expansion in the immediate hinterland of the Nile Valley.

3) Fourth Generation Cities (2014-):

These cities have witnessed a diverse boom in terms of the composition of their establishment and implementation. They became more compatible with the changes in the global technology environment. These cities are an advanced model of cities, in their network systems, activities supporting the knowledge economy from universities, and advanced global and private research centers. The principles of green and smart cities are included in their planning and design. Competitive economic activities are added to their functions such as global tourism (El Alamein and Ras El Hikma), as well as international trade, business centers and services (East Port Said, and the New Administrative Capital). The New Capital provides a new form of central activities for the state, and business services that attract

international institutions, and is considered as the central urban artery of the Suez Canal Economic Region, with its pivotal economic zones for Egypt.

This means that smart cities represent a key element in Egypt's infrastructure development strategy. One of the most prominent steps taken by the state is the allocation of EGP 7.8 billion in the 2019/2020 budget to modernize the information infrastructure and digital content. Moreover, EGP 12.7 billion was allocated in the budget in the period from 2021-2030 to the digitalization system in Egypt.

The Ministry of Housing, Utilities and Urban Development have established the "Sustainable Cities and Renewable Energy" unit. It aims to develop and propose strategies and plans to ensure the availability of sustainable green urban standards in new cities, especially with regard to energy uses. It provides technical support, consultations and studies, both at the level of existing new cities and cities to be established.

The ministry also said in a statement that it aims to establish about 38 smart cities, to accommodate more than 30 million people. They are also to become attractive cities for investments, as they will be built on 530,000 acres in various governorates, and will provide 7 million jobs. It is expected that the total investments of smart cities will reach 700 billion pounds, in partnership between the government and the private sector.

In the following, we will review asmart cities that are being built in Egypt at the present time:

1. **The New Administrative Capital:**
   It has been developed with international specifications to become one of the largest capitals in the world. It is likely to receive 40 million people by 2050. Its total cost was estimated at $ 45 billion. Its construction takes from 5 to 7 years. It includes a presidential palace, and the buildings of ministries, governmental bodies, embassies and consulates. The project is also considered a global capital, with 1.1 million housing units, 40,000 hotel rooms, with a capacity of 5 million people.
2. **Al-Galala City:**
   It is the second most important national project after the Administrative Capital. The project includes both the city of Galala, a tourist resort overlooking the Gulf of Suez, and the Sokhna-Zafarana road that cuts through Mount Galala. The city also

includes King Salman University and Galala University of Science and Technology, which have advanced faculties aimed at achieving the state's plan towards digital transformation. It is estimated to be 17 thousand acres.

3. **New City of Alamein:**
   It is one of the most important smart cities in Egypt, due to its location on the northern coast. It is located on the international road between Alexandria and Marsa Matrouh with a length of 48 km, and extends on the Mediterranean coast with a distance of 14 km. It is supposed to accommodate more than 3 million people.
4. **New Ismailia City:**
   It is an extension of the current city of Ismailia due to its proximity to the Suez Canal axis. It achieves full accessibility for people with special needs, as it has equipped roads, recreational places, and even doors and elevators to allow them to practice daily life without the need for assistance. It is the first city in which solar energy is depended on for electricity. Its area is estimated at 2828 acres. It opened in May 2019.
5. **New 6th of October City:**
   It is the latest fourth-generation city, and the largest urban expansion carried out by the state in this region. It was established on an area of 90,000 acres, to be an extension of the old 6th of October City. It is meant to accommodate the largest number of residents in residential projects.
6. **New Mansoura City:**
   It is the first smart city in the Delta region. The city is unique as it includes distinctive designs and strong infrastructure. It will also include tourist and treatment services, serving visitors to the city. The first phase was opened on December 1, 2022, which targeted 2063 acres, out of 7200 acres.
7. **Salam City Egypt (New Port Said City):**
   It is the first smart city in Egypt located in the Sinai region. It is planned to become Egypt's new economic capital. The city is located in the East Port Said area on the borders of North Sinai Governorate, with a length of 35 km on the Mediterranean Sea. It is located west of the development project of the new Suez Canal area. South of the city there is an agricultural area of 50 thousand acres, and the Salam Canal passes through it.
8. **New Obour City:**

The Urban Communities Authority is building it to become a new urban community in a privileged location. It will contain high-level services. The city is characterized by its presence near an important road network, as it is linked to major roads, such as: the regional ring road, and the middle ring road. It is also located on the Cairo-Belbeis desert road from kilo 15 to kilo 25, and from kilo 26 to kilo 48 of Cairo-Ismailia Road. It is estimated at 58,914 acres.

9. **New Rafah City:**
   It is a new city on the land of Sinai to be established by the armed forces, in cooperation with the Ministry of Housing, as part of the comprehensive operation **"Sinai 2018". I**t is located at the village of Al-Wefaq in North Sinai on an area of **1.5 * 1.5 km**, and 2 km from the border with the Gaza Strip. It was established with the aim of accommodating all residents of the old city of Rafah, on a total area of 535 acres. The first phase was completed at the beginning of 2019**.**
10. **New Toshka City:**
    It is located about 55 km from the High Dam, and 90 km from the city of Abu Simbel. It is a new city near Aswan that integrates with the rural villages surrounding the Toshka project, accommodating 80,000 people, and providing 30,000 job opportunities, with an area of 3000 acres. The first phase was implemented at a cost of 500 million pounds to accommodate 17,000 people.

✓ **New Mansoura City (the newest city)**

It is one of the fourth-generation cities that was established by a presidential decree in 2018. It is characterized by a varying geographical nature, by combining desert areas towards the beach, and agricultural areas towards the Delta and Dakahlia Governorate. This made it compete with coastal cities located on the Mediterranean Sea, such as: Alexandria, and the North Coast.

New Mansoura is located directly on the international coastal road, covering a distance of 14 km, extending from the city of Gamasa to reach the road of Kafr El-Sheikh Governorate. It is under the management of the New Urban Communities Authority. It accommodates 650,000 people.

The New Mansoura City project consists of four consecutive phases, with each phase to be fully completed before moving to another phase. Work began on the first phase in January 2017,

which targeted 2063 acres out of 7200 acres. It was opened on December 1, 2022.

According to the Ministry of Housing, a vision has been developed for the new city of Mansoura as a sustainable city, a tourist and service capital, and a center of attraction for the region's residents, regional services and economic activities. The reason for its inclusion among the sustainable cities, is that it is compatible with the national strategy for climate change in achieving sustainable economic growth that is low in emissions. It has the ability to adapt to climate change. It is also one of the sustainable cities that formed Egypt's vision in launching the Global Sustainable Cities Initiative in cooperation with the UNDP at the Conference of the Parties (COP27).

Perhaps the most important element of the sustainability of the new city of Mansoura is to achieve social justice for all residents. The first phase included 19 thousand housing units that include all housing types, namely for the "Sakan Misr" project. It includes 196 buildings with a total of 4704 units. Social housing includes 58 buildings with a total of 1392 units. The Jannah project includes 462 buildings with a total of 11232 units. There also 2100 villas, making the total 17 thousand housing units.

It also includes (8) commercial markets, in addition to schools for all academic levels, and the new Mansoura University, which was built on an area of 127 acres. The university includes (8) faculties operating since the last academic year. There are also private universities, a medical center and a police station. It also has the fourth-generation control building, which reaches the main control room. It also includes (5) mosques and (3) churches, as well as (3) banks.

Complementing the elements of sustainability, New Mansoura is a green city friendly to pedestrian and bicycle traffic, as well as its support for mass and sustainable transportation. It also supports water reuse. The city includes 1800 acres of green spaces, and an electrical transformer station. The city's water sources have been diversified, including a groundwater

desalination plant with a capacity of 1000 cubic meters/day, and a seawater desalination plant with a capacity of 1600 cubic meters/day, which is the first seawater desalination plant in the Delta. There are also two irrigation water treatment plants. Thus, the new city of Mansoura is a smart city that adapts to climate changes, especially related to rising sea levels. Mansoura Beach is low. Therefore, it had to be protected and developed so that it does not become exposed to potential risks in the event of a rise in sea level.

❖ **Fifth: Challenges Facing Egypt:**

1. The absence of a legislative framework that controls smart city applications, and the problems of privacy violations.
2. The cost of these projects is high. The lack of funding, the foreign currency crisis, as well as high inflation rates, all represent a major obstacle to political will in the implementation of projects. This prompted the state to seek ways to attract investments, while providing all available facilities, and overcoming obstacles facing investors.
3. Poor infrastructure, as well as the lack of qualified human resources to develop and invest in information and communication technology This prompted the leadership to develop the national network of roads, and the Decent Life Initiative specialized in developing villages and their infrastructure, and provides training, according to the economic activity that characterizes each governorate.
4. The high cost of relying on technology in finding alternative solutions to save water. There is a strategy of rationalizing consumption, and recycling water, in light of the possibility of future exposure to a water deficit due to climate change or the receding waters of the Nile River.
5. Some infrastructure networks (energy, water, wastewater) need technological systems to manage them to increase their efficiency, reduce losses and optimize their use.
6. The main challenge is how to operate those cities and the level of governance that will be implemented, with the ability to integrate digital technologies into daily life, and educate citizens about them.
7. Implementing services in cities without having sufficient funding to operate them. Sometimes there is a lack of proper coordination between the different authorities in regards to the services operation.

8. The spread of some commercial services that appear randomly in residential areas, especially in the ground floor of buildings. They serve the needs of those areas giving the residents no reason to move to service centers.

❖ **Sixth: Recommendations:**

1. Providing research and development centers in every smart city to work on the optimal utilization of the city's data, resources and capabilities.
2. Finding a digital way for smart city residents to participate in any urban development process for the city; such as simulating the new projects to be established in the city, which contributes to enhancing its sustainability.
3. Extending the period for granting the golden license to investors, so that they are encouraged to invest in Egypt.
4. Drawing up an investment map showing the type of investments required and the sectors that need them.
5. Addressing problems that are a priority for investors, not only the problems the state sees, in addition to discussing with them before taking any decision that would affect their interests.
6. Dividing the private sector companies according to the areas and sectors that need investments, while concluding alliances with each other. For example, the companies responsible for construction and contracting must cooperate to eliminate the black market and the possibility of conflict in prices and policies.
7. Opening the way for long-term investment in smart city projects, which will help provide the necessary funding and train specialized manpower.
8. Launching awareness campaigns for citizens, so that they understand the importance of digital transformation in improving their quality of life.
9. Prioritizing smart transportation projects for the development of new cities, especially with regard to linking existing and new communities to achieve ease of movement between them. Laying out the infrastructure for smart transportation in new cities is crucial, so that in the future it will be available when there is need for it considering the growth and enlargement of new cities