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Master's Thesis of Public Administration

**The Impact of Smart Cities on
Improving Quality of Life for
Egyptian Citizens**

**스마트시티가 이집트 국민의 삶의 질
향상에 미치는 영향에 관한 연구**

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The Impact of Smart Cities on Improving Quality of Life for Egyptian Citizens

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Abstract

The Impact of Smart Cities on Improving Quality of Life for Egyptian Citizens

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Governments worldwide try to adopt new smart solutions to enhance the quality of life and standards of livings for their citizens. Many countries implemented smart cities as a smart solution to provide quality services and products through dynamic and innovative solutions.

This study paper investigated how a smart city as a smart solution can enhance the quality of life, and what challenges the Egyptian government might face in developing a smart city to improve citizens' quality of life from the perception of official government officers. Furthermore, enhancing government efficiency through a data-driven and systematic approach to improve service delivery, making it more efficient and accessible to citizens.

The study used qualitative and quantitative approaches. Particularly, a questionnaire survey was distributed to collect the required data from 127 official government officers from diversified Egyptian ministries through a random sampling method. the methods used to analyze the data collected were Multiple Regression and Analytical Hierarchy Process (AHP) models.

The findings show that there is a positive relationship between the smart city and quality of life. However, the study results also showed that smart city characteristics (Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, and Smart Living) as independent variables show no significant effect on the quality of life reflecting that a smart city is based on an interconnected system and the characteristics are integrated to formulate the smart city.

Moreover, the AHP results show that from the perception of the official government officers all the dimensions that cover basic needs such as income, good housing, and education are so important to be considered to achieve a quality of life for the citizens. While the leisure and social interactions dimension which covers citizens' ability to spend leisure time outside their work time, and social activities that make them happy and satisfied came at the centre of the most important and least important dimensions.

Based on the data collected from the official government officers this study contributes to academic research and provides recommendations to the government of Egypt to consider in case of initiating a smart city national plan to improve the quality of life for Egyptian citizens.

Keywords: Smart City, Smart Cities, Sustainable Cities, Smart Cities Impediment, Smart Cities Challenges, Quality of Life, Egypt, Government.

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Chapter 1: Introduction

1.1 Study background

Our world is witnessing population growth along with all countries. As a result, it requires government intervention to facilitate and enhance the services and products provided to its citizens. With such an increase, citizens will have to migrate internally from rural to urban areas to get the required services. Therefore, governments have to find innovative and dynamic solutions to cover the needs of their citizens.

According to the data shown in table 1 below: the urban population will increase from 56.2% in 2020 to 68.6% by 2050. Also, percentages show that the urban population increases by 2.1% every five years until 2050. This increase requires the governments to plan and take the necessary actions through developing the infrastructure, establishing transportation networks that can bear this increase, and providing all the essential public services and products, such as; residence, health, education, energy, telecommunication, and clean water. Add to that, ensure the availability of adequate job opportunities.

Table 1 World Population Forecast (2020-2050)

Year (July 1)	Population	Yearly % Change	Yearly Change	Median Age	Fertility Rate	Density (P/Km ²)	Urban Pop %	Urban Population
2020	7,794,798,739	1.10 %	83,000,320	31	2.47	52	56.2 %	4,378,993,944
2025	8,184,437,460	0.98 %	77,927,744	32	2.54	55	58.3 %	4,774,646,303
2030	8,548,487,400	0.87 %	72,809,988	33	2.62	57	60.4 %	5,167,257,546
2035	8,887,524,213	0.78 %	67,807,363	34	2.70	60	62.5 %	5,555,833,477
2040	9,198,847,240	0.69 %	62,264,605	35	2.77	62	64.6 %	5,938,249,026
2045	9,481,803,274	0.61 %	56,591,207	35	2.85	64	66.6 %	6,312,544,819
2050	9,735,033,990	0.53 %	50,646,143	36	2.95	65	68.6 %	6,679,756,162

Source: worldometers.info/world-population

Based on Ortiz M., Bennett D., & Yabar D. (2017), the development of countries in economic and social areas is affected mainly by cities that consume approximately 75% of the energy and natural resources of the world. On the other hand, the forecast shows that 70 % of the world's population will be living in cities in 2050. However, this will lead to obstacles for governments to handle and manage their resources and provide a good service for their citizens. Furthermore, they will face problems in social organization and land management.

According to Unesco (2019), the Bruntland Commission Report, sustainable development is “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*”.¹

1.2 Problem Statement:

Egypt is facing a population increase that affects its capabilities to provide quality public services and products. Therefore, to what extent can the smart city solution play an essential role in improving the quality of life for Egyptian citizens?

1.3 Research Objective:

This research paper aims to examine the necessity of implementing the smart city solution by the government of Egypt to improve and enhance the quality of life and standards of living for citizens. Furthermore, how smart cities can respond to the consequences of the internal migration from rural to urban areas, which arise in the increased need for quality public services and products.

¹ Unesco. (2019). Retrieved from en.unesco.org/: <https://en.unesco.org/themes/education-sustainable-development/what-is-esd/sd>

1.4 Research Questions:

1.4.1 Major Question:

- To what extent implementing the smart city as a smart solution can enhance the quality of life for Egyptian citizens from the government official's perception?

1.4.2 Minor Questions:

- What are the challenges that Egypt might face in implementing smart cities?
- How smart cities would play an essential role in improving the quality of life for Egyptian citizens under the umbrella of Egypt vision 2030?
- How the Egyptian government can benefit from Korea's smart cities experience to improve and enhance the quality of life and standards of living for citizens?

1.5 Research Methods:

The research methodology is conducted with both qualitative and quantitative approaches, as descriptive analysis, the research includes graphs and statistical measuring and analyzing the perception of official government officers on the area of study. This methodology helps the researcher to achieve a reliable conclusion on the impact of applying a smart city as a governmental solution to improve the quality of life for Egyptian citizens and ensure its validity. The data was acquired by distributing a survey questionnaire to the official government officers, the sample is 127 from diversified Egyptian ministries through a random sampling method. Data collected were analyzed through statistical software to critically analyze the perception of official governmental officers in Egypt in the area of study.

Chapter 2: Theoretical Background and Literature Review

2.1 Smart Cities Background:

According to Zhou (2014), smart cities as a government solution appeared because of the economic crisis in 2008 to help countries enhance their operation quality and develop their policies to face such crises. Figure 1: shows us the transformational background of cities after every economic crisis, which is combined with the technological revolution. The “Smart City” concept as a result, first came to the surface by IBM as a terminology by the end of 2009 under “Smart Earth” as an initiative to help cities to operate effectively, and that initiative attracted governments, civil society, and researchers.

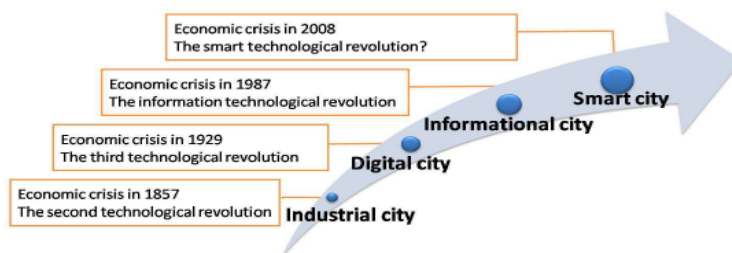


Figure 1 The Background of Smart City
Source: Zhou, (2014).

Based on Effendee, (2019) there are diversified definitions for the smart city, however, it can be categorized into three categories (Academia, Government bodies, and Industry).

The concept of smart cities varies based on the area of study, and it supports multiple approaches such as; sustainability and information and communication technology (ICT), through providing innovative products and services which are cost and quality aligned, to improve citizens' quality of life Ortiz M., Bennett D., & Yabar D., (2017).

According to the Korean Ministry of Land, Infrastructure and Transport definition of Smart City is a *“platform to improve the quality of life for citizens, enhance the sustainability of cities, and foster new industries by utilizing innovative technologies of the 4th Industrial Revolution era”*.

Azkuna, (2012) broaden the definition of the smart city, in which the city is considered smart *“when its investment in human and social capital and in communications infrastructure actively promote sustainable economic development and a high quality of life, including the wise management of natural resources through participatory government”*.

Mckinsey, (2018) analyzed different applications of smart cities and found out that adapting these applications can improve the quality of life for citizens by 10-30% in areas like predictive policing, smart traffic signals and parking, data-driven public health interventions, such improvements can improve the government's ability to understand, predict, and respond to their citizens' needs from public services.

Syalianda, (2021) mentioned that the smart city concept came to the surface to find solutions and solve the urban problems in developing countries by using information and communication technology (ICT) to improve the quality of life for citizens and the system efficiency in the urban areas to deliver quality services to citizens. Furthermore, Syalianda, (2021) gave examples of how many cities adopted the concept of the smart city such as; Busan city in South Korea, San Fransisco, Singapore cities, and Indonesian cities introduced and developed different smart city public services using ICT to improve the quality of services, enhance their citizens quality of life and achieve sustainability by better decision making, safer environment, and improved social services.

Based on Andreiou, (2021), the implementation of the smart city could increase the financial resources for governments to develop the smart city urban structures and increase the private sector's participation in developing smart systems that can play role in improving citizens' quality of life. Moreover, Andreiou, (2021), mentioned that smart cities have no specific design and that many researchers who worked in the area of governance, sustainability, and transport systems included in their designs that the construction of smart city design should include the following criteria which are; knowledge of digital technology, stakeholder involvement, projects attractive for citizens and businesses, utilization of own resources, platforms for developing applications and products, research parks, collaborative community.

According to Corcuera, (2019), "*Cities around the world are implementing smart city features to improve services and quality of life for their citizens, he also added that the transition from rural to urban is caused by two main factors: (1) the natural growth of the local population and (2) migration. The latter is motivated by the quest for better opportunities, quality of life, and higher standards that cities offer to their residents*"². Such as providing jobs with better income opportunities, improved basic coverage, a quality education system, health and public transportation services, city amenities, and so on. Furthermore, the rapid growth of cities presents governments and stakeholders with new challenges that must be addressed; For instance, high traffic jams and traffic accidents, deteriorating air quality and the environment as a result of more pollution, increased living costs, overcrowding, more diseases, crimes, and security problems.

² Corcuera, S. R. (2019). Smart Cities Survey: Technologies, Application Domains and Challenges for the Cities of the Future. *International Journal of Distributed Sensor Networks*, 1-36.

Madakam, (2019) mentioned that quality of life is the main objective for the implementation of any smart city, according to research articles on the subject. Smart cities are a new urban paradigm shift that promises to bring happiness to cities. The main goal of creating smart cities is to improve the quality of life, economic development, and environmental balance. These cities serve as hubs for civic services such as security, health care, sanitation, electric power supply, drinkable water, and adequate housing, as well as city administration in a smart technology approach. Moreover, given India's technological revolution, there has been significant economic improvement among urban citizens, who are keen to pay it to enhance their quality of life.

As a result, working people, governments, and corporations should realize the need for new urban areas and aim to invest in new cities models such as smart cities. These will contribute to ensuring a high standard of living for citizens, counting digital divisions, information, citizens' involvement and collaboration, better-quality communication, quality education, and quality of life.

Relying on the above definitions of the smart city I can come out that there is a relationship between the concept of the smart city and improving the quality of life for citizens. Implementing a smart city might look like pursuing building a utopian city where every citizen can live a quality life with no challenges or issues in acquiring his needs. The government's response using smart management of natural resources is a key challenge for implementing a smart city that can enhance citizens' lives and improve their quality of life.

2.2 Smart Cities Characteristics:

Most works of literature mentioned that smart cities have six main characteristics which are as shown in figure 2: smart economy, smart people, smart governance, smart mobility, smart environment, and smart living. In addition to that, some literature mentioned up to eight characteristics.

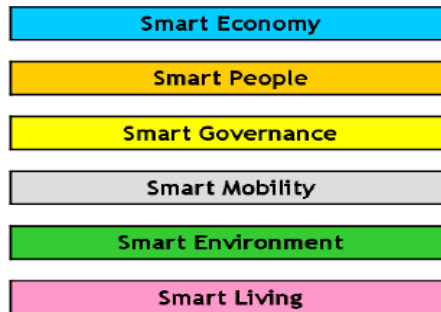


Figure 2 Characteristics of a Smart City

Source: *Smart cities Ranking of European Medium-Sized Cities, (2007)*

According to the Smart Cities Ranking of European Medium-Sized Cities, (2007), the report explained that each characteristic of a smart city contains factors that describe and define how each characteristic of smart city work in developing it.

Figure 3 shows us the six characteristics and their factors as follows;

- 1. Smart Economy:** includes eight factors which are; innovation, entrepreneurship, productivity, economic situation, participation in international markets, and labor market flexibility.
- 2. Smart People:** contains factors like creativity, flexibility, level of qualification, and social participation in public life.
- 3. Smart Governance:** consists of four factors such as; participation in decision-making, governance transparency, citizens' participation in political strategies, and providing public and social services.

4. **Smart Mobility:** focuses on transport systems and information and communication technology (ICT) which play role in providing information, and sustainable systems, enhancing the environment and reducing citizens and governmental expenses.
5. **Smart Environment:** it plans the usage of natural resources and maximizes its benefits such as; solar energy, natural water, and wastewater systems through green projects, adding to that, reduce pollution and gas emissions.
6. **Smart Living:** this focuses on the quality of life for citizens and providing them with the necessary services of high quality for example; health, education, safety, housing, and social solidarity.

SMART ECONOMY (Competitiveness)	SMART PEOPLE (Social and Human Capital)
<ul style="list-style-type: none"> ▪ Innovative spirit ▪ Entrepreneurship ▪ Economic image & trademarks ▪ Productivity ▪ Flexibility of labour market ▪ International embeddedness ▪ <i>Ability to transform</i> 	<ul style="list-style-type: none"> ▪ Level of qualification ▪ Affinity to life long learning ▪ Social and ethnic plurality ▪ Flexibility ▪ Creativity ▪ Cosmopolitanism/Open-mindedness ▪ Participation in public life
SMART GOVERNANCE (Participation)	SMART MOBILITY (Transport and ICT)
<ul style="list-style-type: none"> ▪ Participation in decision-making ▪ Public and social services ▪ Transparent governance ▪ <i>Political strategies & perspectives</i> 	<ul style="list-style-type: none"> ▪ Local accessibility ▪ (Inter-)national accessibility ▪ Availability of ICT-infrastructure ▪ Sustainable, innovative and safe transport systems
SMART ENVIRONMENT (Natural resources)	SMART LIVING (Quality of life)
<ul style="list-style-type: none"> ▪ Attractivity of natural conditions ▪ Pollution ▪ Environmental protection ▪ Sustainable resource management 	<ul style="list-style-type: none"> ▪ Cultural facilities ▪ Health conditions ▪ Individual safety ▪ Housing quality ▪ Education facilities ▪ Touristic attractivity ▪ Social cohesion

Figure 3 Characteristics and Factors of a Smart City.

Source: Smart cities Ranking of European Medium-Sized Cities, (2007).

Corcuera, (2019), provided an overview of applications under certain domains within the smart city paradigm classified into four clusters: “(1) *business-related domains*, (2) *citizen-related domains*, (3) *environment-related domains*, and (4) *government-related domains*”.

GOVERNMENT MANAGED	SUSTAINABILITY & ENVIRONMENTAL PROTECTION	CITIZEN RELATED DOMAINS	Education	Entertainment
			Tourism	Healthcare
			Entrepreneurship	...
		NATURAL RESOURCES RELATED DOMAINS	Agriculture	Renewable energies
			Smart grid	Waste management
			Water management	...
		INFRASTRUCTURE RELATED DOMAINS	Advertisement	Building and Housing
			City monitoring	Logistics
			Public safety	Public transport
			Traffic	...

Figure 4 Proposed City Domains.
Source: Corcuera, (2019).

As figure 4 shows us; Corcuera, (2019) provided an approach and recommended creating a domain hierarchy for “*the atomic domains would be citizen-related domains (such as entertainment, tourism, or healthcare), natural resource-related domains (such as water and waste management, food waste management, smart grids, renewable energies, and so on), and infrastructure-related domains (such as building, housing, and public spaces)*”³. These are managed by the government which is managing and responsible for them.

According to Neirotti P, (2014) many aspects can make influence the way where the government can develop smart cities, and mentioned four main contextual conditions which have a prodigious effect on the needs and resources for developing a smart city. Neirotti P, (2014) framed these four factors under the umbrella of socio-economic impact which consists of Economic Development, Structural Factors, Technology Development, and Environment.

³ Corcuera, S. R. (2019). Smart Cities Survey: Technologies, Application Domains and Challenges for the Cities of the Future. *International Journal of Distributed Sensor Networks*, 1-36.

These factors were explained by Neirotti P, (2014) as follows;

1. Structural Factors:

The size and demographic of a city can affect the initiative of developing that city into a smart city as the less the size and demographic of a city the more the governments can be able to start a pilot project. However, demographic density and size at a certain point, cause diseconomies in a variety of circumstances, including transportation, real estate, security, and energy usage. As a result, crowded cities would be identified as less smart, they also make them possibly more interested in implementing ICT-based efforts targeted at reducing the congestion problem caused by such diseconomies.

2. Economic Development:

Countries' GDP and the growth of the economy play a great role in smart cities initiatives, as the countries with high GDP growth rates can provide the budget to develop different sectors like transportation, education, and telecommunication infrastructure. Moreover, it attracts people who are looking to invest in increasing the quality of life and developing their human capital, as human capital is a key factor in endorsing smart cities initiatives.

3. Technology Development:

The countries which invested in technology development in the early stages are more able to adopt the smart cities initiatives as the ICT is one of the main characteristics of smart cities as the use of internet-based services among the population represents a key factor to countries' ability in the

development of smart cities initiatives. Furthermore, countries' investment in Research & Development (R&D) signifies the development of the technology in different sectors that enable the country to adopt the smart cities initiatives and its ability to implement them.

4. Environmental-friendly policies:

The cities which adopt environmental sustainability plans reflect their ability in providing a quality of life for the citizens, and the accessibility of green spaces is a crucial dimension to identify the smartness of this city and its ability to lower the cost of developing it into a smart city. The cost of transforming a more polluted city is higher than the city which adopts environmental sustainability plans, as the government will have to spend more budget on transportation, energy, and urban planning to develop the city into a smart city.

Other factors might affect a country to adopt a smart city initiative or develop a city into a smart one such as; political leaders, strategies, agenda, culture, the level of corruption, and the climate. All these factors next to the four main factors discussed play a great role in the ability of many countries to adopt the smart city initiative. Many cities show us how these factors played a significant role in their ability to transform and develop into smart cities such as; Seoul, Hongkong, and Singapore.

2.3 Impediment of Implementing Smart Cities:

Yiinjung, (2021) introduced four categories of impediments to smart cities in the Republic of Korea, as we can see in figure 5 which were shortly described by TIGS and they are as follows;

1. Technology:

- a. The gap between smart technologies and services; the perspective of smart technologies adopted by smart cities in the real world is not applicable because the services provided to citizens face many issues, such as security issues, which will take time to solve and cover to convince government and citizens to support smart cities.
- b. Privacy and Security; there will be many issues regarding privacy and security as smart cities will use enormous data which will cause cybersecurity and privacy issues because the data used in the smart cities contain the behavioural and personal data of citizens.
- c. Lack of data accuracy; providing quality smart services depends on accurate data which provides the decision-makers with the needs of the citizens so that they can take necessary actions and implement effective policies, and achieving that requires a large amount of precise data, which case of smart cities will be larger with high accuracy.

2. Industry:

- d. Non-innovative business ordering method; consists of three issues. Firstly, poor procedures for introducing innovative technologies, services, and products for constructing city projects. Secondly, smart cities depend on cost-efficient, while businesses adopt cost-cutting outsourcing methods which infringe on smart city methods. Thirdly; the start-ups and innovators have no chance to provide their services and products while the companies that have high capital get all the advantages.
- e. Large and/or platform companies oriented industrial structure; the big companies are having the advantage and even the monopoly to run their business in the smart city industry, and they seek only profit which reflects on the cost of the services provided to the citizens. Moreover, the start-ups lose their opportunities to participate in such an industry as they will not be able to compete with the big companies.
- f. Public-led smart service provision; in some cases, the government try to play the role of the private sector in providing smart services but that leads to issues in delivering a quality service to the citizens. Furthermore, when the government play that role it prevents the creation of more jobs by assigning private sectors to provide the services which they can't deliver with quality, as a result, the demand decline and the satisfaction of citizens.
- g. Lack of continuous supply of services; this issue is caused by the inability to maintain a budget for continuous maintenance costs, also

the start-ups, if they participated in providing such services with their financial situation, will not help them to maintain working on the market to provide this service.

3. Government:

- a. Lack of organizational system and capacity; which is represented by the strong role of the central government over the local governments and private business, and the absence of an entity that can coordinate and integrates the smart city projects between different ministries and local government.
- b. Insufficient system for promoting and spreading smart city; this occurs because technological development is faster than the response of the government on updating their policies to cope with this change and that is considered a barrier to a successful model of the smart city.
- c. The inflexibility of budgeting and business operation; is represented by insufficient budgeting from the central government for the smart cities, Moreover, the budget was approved for the construction of the smart cities which affected the development of smart services.

4. Society:

- a. Inactive citizen participation; government and citizens are the main aspects in the development of smart cities, due to the exploitation of the government to specific interest groups to participate and maximize their profits, as a result, effective citizen participation gets low and inactive.

- b. Digital divide; citizens sometimes face difficulties accessing smart services from their devices, and these difficulties and issues might increase with the spread of smart cities.
- c. Increased conflict with existing industries; with the rise of technology applications many conflicts appeared on the surface between traditional and new industries in different businesses areas, and the government all the time was trying to solve these conflicts just in the short term without implementing an essential solution on the long-term, as a result, smart cities will surge these conflicts.

<p>Technology</p> <ul style="list-style-type: none"> • The gap between smart technologies and services • Privacy and security • Lack of data accuracy 	<p>Industry</p> <ul style="list-style-type: none"> • Non-innovative business ordering method • Large and/or platform companies oriented industrial structure • Public-led smart service provision • Lack of continuous supply of services
<p>Government</p> <ul style="list-style-type: none"> • Lack of organizational system and capacity • Insufficient system for promoting and spreading smart city • Rigidity of budgeting and business operation 	<p>Society</p> <ul style="list-style-type: none"> • Inactive citizen participation • Digital divide • Increased conflict with existing industries

*Figure 5 Impediments to Driving Smart Cities in ROK.
Source: Yiinjung, (2021).*

Based on what has been discussed above it is found that implementing smart cities in ROK faces four main impediments which are; Technology, Industry, Government, and Society.

Technology and industry represent the start-ups and private sector, while society represents citizens. As a result, employing smart cities get affected by these three main pillars Start-Ups and the Private Sector, Government, and Citizens.

The government intervention over the roles of the other two pillars threatens and represents the main impediment to promoting smart cities and that is because the government seeks to maximize its benefits and strengthen its role. Furthermore, employing smart cities requires up-to-date policies that can cope with the rapid speed of technological improvements.

In this research, we will investigate the government officials' opinions about the smart city and the factors that can help Egypt implement smart cities and which factors can impede Egypt from employing smart cities. However, there are some impediments will be facing Egypt in implementing smart cities, but this research will focus on identifying these impediments and come out with findings and recommendations to be considered by the Egyptian government when implementing smart cities as a solution for improving citizens' quality of life through providing quality services by acquiring smart city characteristics.

Achieving quality of life includes many dimensions that must be taken into consideration such as; ensuring safety, quality health, job opportunities, and good governance. Hence, working on avoiding impediments to implementing smart cities will lead to achieving an improved quality of life for citizens.

2.4 Smart Cities Challenges:

According to Corcuera (2019), the smart cities' challenges are divided into two domains: *“(1) the analysis of open challenges, which conducted a literature review of the various challenges or taxonomies of challenges, and (2) the Domain-*

specific challenges, that only reviewed proposals that focused on a single domain, such as; government, transportation”⁴.

(1) The analysis of open challenges:

- 1- Managerial and organizational problems include project scale, manager attitude and behaviour, the user or organizational diversity, a lack of alignment of organizational goals and projects, multiple or competing goals, resistance to change, and turf and conflicts.
- 2- Technological obstacles include a lack of IT skills (a lack of people with integration capabilities) as well as organizational challenges (lack of sectors cooperation and inter-departmental coordination, a vision of IT management, politics and cultural challenges).
- 3- Collaboration, leadership, participation and partnership, communication, data exchange, service and application integration, accountability, and openness are all aspects of government.
- 4- Policy context: incorporating issues associated with integrating ICT with politics and institutions factors, each of which has its outline.
- 5- People and communities: counting digital divides; information; citizens participation and private partnership; better Communication; Training; Life quality; and Accessibility.
- 6- Economy: depending on factors related to economic competitiveness such as; innovation, entrepreneurship, and productivity.

⁴ Corcuera, S. R. (2019). Smart Cities Survey: Technologies, Application Domains and Challenges for the Cities of the Future. *International Journal of Distributed Sensor Networks*, 1-36.

- 7- Built infrastructure: counting IT infrastructure (internal system limitations; lack of knowledge of interoperability; availability and compatibility of software systems and applications); Security and privacy (virus, worm and Trojan threats; privacy and personal data); and operational costs (high costs for IT, IT professionals and consulting firms; costs for installation and maintenance).
- 8- Natural environment: including any challenges related to the sustainability of the deployment of the ICT.

(2) The domain-specific challenges, that only reviewed proposals that focused on a single domain included twelve areas as follows;

- 1- **Agriculture:** The sector has recently moved forward thanks to new technologies and machines but it still faces some issues when it relates to its installation in smart cities, among these problems is that cities occupy previously fertile land, so they must be responsible for producing food that could have been obtained from the land.
- 2- **Citizen:** Citizens' engagement or participation is critical to achieving the objectives of Smart cities to the fullest potential. As a result, the city can meet their needs based on their suggestions and/or engage them as active actors in the city.
- 3- **Education:** education is continually evolving and adapting to the changing needs of society. As the concept of smart cities expands, new challenges will arise regarding how to spread and link the education services provided by smart education with other contextual systems of smart cities.

Furthermore, they believe that new technologies in smart learning settings will provide new issues to the field of education, necessitating adaptation and the inclusion of issues such as;

- new pedagogical theories;
- leadership on educational technologies;
- teacher learning leadership;
- educational frameworks;
- educational ideology.

Moreover, some challenges in teaching elder people who are already dealing with the services provided by smart cities.

4- Energy: Energy efficiency is also a significant challenge; individuals must be motivated and involved in lowering energy intensity to achieve energy efficiency and, hence, sustainable growth. The integration of ICTs in the local sphere of smart cities may be energy inefficient and not available to all citizens. This emphasizes the significance of taking energy usage into account while implementing ICTs in smart cities.

5- Environment: The necessity to extend the urban area has become increasingly critical since certain nations, such as China, have seen fast expansion. As a result, previous industrial sites have been converted into residential zones, posing health problems due to pollution. A key environmental problem is rehabilitating those areas so that they are safe to live in. Furthermore, new hazards are appearing, requiring the development of a comprehensive strategy to analyze their implications. Moreover, green

public spaces are difficult to build without benefiting an affluent group and causing gentrification of a neighbourhood (due to the increase in housing costs and the displacement of the residents). As a consequence, whenever green spaces are established, they must consider the conservation of social sustainability as well as ecological sustainability.

6- Government: The challenges of governments efforts in the domain of government are centred on e-government are as follows:

- accurate data;
- information technology;
- organizations management;
- legal frameworks;
- environmental and institutional.

Additionally, three IoT-based governance challenges:

mindscape, or the process of persuading entities to change, as administration systems are notoriously inflexible; ICT investment; security and privacy to securely execute smart government.

7- Healthcare: is distinguished among the following main challenges: monitoring accuracy, context awareness, human elements, heterogeneity, availability and reliability, data transfer, security and privacy, intrusiveness, and power utilization.

8- IoT: All of the essential infrastructures on which we depend on it, such as power networks, hospitals, and smart homes, are linked to a sole worldwide web. Because of this openness to the internet and the interconnectedness of

equipment, there is a danger that a single failure of infrastructure may bring the entire network down. Which as a result will affect all the services provided to the citizens.

9- Security: the main concerns are about privacy with data collected, such as location (GPS data might disclose information about the daily route or home address), contact lists, and messages. Furthermore; there are three security challenges exist as follows; crowdsensing (using sensing devices of citizens) necessitates incentivizing or motivating citizens to participate while also considering trustworthiness and their privacy; identifying false data injections; and due to the new era of big data, new policies of data privacy, availability, and management are required.

10- Sustainability: is an emerging concept that must overcome many challenges which are as follows; strategic assessment of indicators to define the priorities; mitigating the effect of the ICT in the deterioration of ecosystems and improvement of infrastructure; products, services and systems that are created by big companies may monopolise and harm the sustainability of the city; ICT knowledge in the cities is essential to be increased to equal big companies and be able to respond to ICT requests effectively.

11- Traffic: the synchronization of the data collected is a key challenge since it is difficult to connect information from various sources. Although some initiatives toward standardization have been taken, their use is still relatively restricted. Storage is another issue that arises throughout the data collection

process. Furthermore, the volume and complexity of data are growing at an exponential rate, posing a new difficulty.

12- Waste management: Waste management is still a major issue in developing countries. There is no systematic or scientifically planned waste separation at the household and community bin level; collection strategies should be enhanced, as community bins are used by households and the surrounding commercial sector; recycling is impossible because all waste goes to the same bin, even though the material could be reused to create new products; available transportation systems are insufficient to cover the entire system and are inefficient; the garbage is inappropriately disposed of, and some of it may become lost in cities before reaching the dumping site, and public-private partnerships may not always achieve both sides' aims and ambitions with their stakeholders.

2.5 Quality of Life Background:

World health organization (WHO) initiated a definition for quality of life, as there was no exact definition for it, WHO found that it is the missing measurement that affects mental health next to the health measurements and indicators. Moreover, health care in the first place depends on the patient's well-being and the quality of service delivered to him. Therefore, there was a need to define it, but on a global scale, as a result, WHO implemented a global cross-cultural method, which is the world health organization quality of life (WHOQOL), so that WHO be aware of how different cultures with different backgrounds and religions define the quality of life on a global scale. Next, researchers refined inputs on quality of life.

In 2015, the United Nations (UN) declared the 2030 agenda for sustainable development, which contains 17 sustainable development goals (SDGs). These goals were set to enhance people's lives, and a lot of countries adopted these goals in their strategies. According to the 2030 agenda UN's vision is to provide sustainable use of natural resources such as; the ability to have clean water and sanitation, affordable safe food, and energy. Add to that, allowing people to acquire quality education, health care, and social security.

In parallel, facing climate change challenges to protect the ecosystem and environment. There are three main dimensions of sustainable development, which are; economic, social, and environment. These dimensions must be balanced and integrated into the aim of reaching prosperity for all human beings and enhanced quality of life (United Nations).

The sustainable development concept has three main objectives as shown in figure 6 below:

- 1- Improving the quality of life.
- 2- Life within the limits of the environment.
- 3- Invest in technological development.

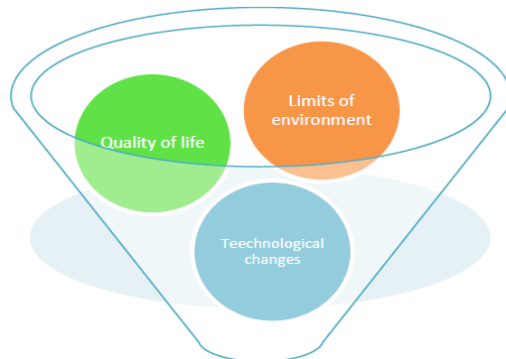


Figure 6 Sustainable Development Objectives
Source: Lorena, (2011).

According to Mckinsey, (2018), 70% of SDGs could be acquired through implementing smart cities, add to that, half of the smart city applications affect more than one of the quality-of-life dimensions.

2.6 Quality of Life Dimensions:

According to Eurostat, (2015) quality of life is affected by a multidimensional framework, which includes 9 dimensions for the quality-of-life framework, these dimensions are organized as 8+1, eight are related to people's abilities and the last one is the overall experience of life reflects individual's perception to quality of life, the multidimensions are as shown below in figure 7:



Figure 7 Quality of Life Indicators

Source: by researcher, date acquired from ec.europa.eu/eurostat/web/quality-of-life/data.

- Material living conditions: which cover financial situation or income, risk of poverty, and housing condition;

- Productive or main activity: it reflects whether the citizens are paid and employed or not, and what is the effect of working life on their quality of life;
- Health: it measures the citizens' accessibility to near healthcare, health cost, medical availability, and health behaviours;
- Education: as it measures access to quality education for all generations, also it refers to the accumulated knowledge gained through all educational institutions such as; schools and universities. Add to that, values and qualifications;
- Leisure and social interactions: the ability of citizens to spend leisure time outside their work time, plus social activities that make them happy and satisfied.
- Economic and physical safety: it includes economic and non-economic security situations, as citizens might face the feeling of insecurity because of; losing their jobs, health problems, change in their living standards, or get exposure to crimes;
- Governance and basic rights: provide the ability to participate in setting public policies and political life, also to what extent citizens trust their country institutions and the country apply good governance;
- Natural and living environment: protecting the environment;
- The overall experience of life; in this dimension concentrates on the individual point of view on life satisfaction, as it depends on personal measures and one's self-esteem.

2.7 Quality of Life Within Egypt Vision 2030:

Egypt was one of the countries that adopted the SDGs in its long-term strategic plan, which was introduced in Egypt vision 2030 and launched by the government of Egypt in February 2016.

This vision is based on the three dimensions of sustainable development, which as we mentioned before are economic, social, and environment. One of the core objectives of the Egypt 2030 vision which is the base of the eight objectives for Egypt 2030 vision is to improve the quality of life and standard of living for Egyptian citizens EgyptVision, (2020).

Based on, World Population Prospect, (2019) Egypt is one of nine countries that will contribute to more than 50% of the expected increase in global population by 2050.

Table 2 Egypt Population Forecast (2020-2050)

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km ²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Egypt Global Rank
2020	102,334,404	2.05 %	1,978,371	-38,033	24.6	3.33	103	43.0 %	44,041,052	1.31 %	7,794,798,739	14
2025	111,727,822	1.77 %	1,878,684	-40,000	25.1	3.33	112	43.3 %	48,427,431	1.37 %	8,184,437,460	14
2030	120,831,557	1.58 %	1,820,747	-40,000	25.6	3.33	121	44.4 %	53,613,464	1.41 %	8,548,487,400	14
2035	130,340,364	1.53 %	1,901,761	-30,000	26.2	3.33	131	46.0 %	59,988,198	1.47 %	8,887,524,213	14
2040	140,350,381	1.49 %	2,002,003	-30,000	27.3	3.33	141	48.3 %	67,730,752	1.53 %	9,198,847,240	13
2045	150,355,053	1.39 %	2,000,934	-30,000	28.5	3.33	151	50.8 %	76,439,477	1.59 %	9,481,803,274	12
2050	159,956,808	1.25 %	1,920,351		29.7	3.33	161	53.3 %	85,320,777	1.64 %	9,735,033,990	11

Source: worldometers.info/world-population/egypt-population/

As presented above in table 2 the researcher found that Egypt population global rank in 2020 is 14th among all world countries population, with an urban population estimated at 44 million citizens, and it is predicted that Egypt's global rank in 2050 will jump to the 11th with an urban population projected to reach around 85 million citizens, which equals a double increase in population. Hence, the Egyptian government must take into consideration that this increase in population is considered a challenge that must be faced by smart solutions that improve the governmental performance in providing public services and the needs of the Egyptian citizens.

As reported by Kandil A., (2020), Egyptian President Abdel Fattah El-Sisi mentioned more than once in his speeches that the growth in population rate represents a threat to the country. In the same line, Egyptian prime minister Mostafa Madboly said that the Egyptian government is already facing a lot of challenges in the areas of social, economic, and environment because of the increase in population. As a result, Egypt insufficiently provides the main public services like quality education, healthcare, transportation, clean energy, and sanitation networks that could cover all governorates Kandil A., (2020).

As the World Bank, (2021) stated in its Egypt's Economic update publication, Egypt has some key challenges which include a low budget allocation for the education and health sectors, furthermore, improving the social protection system, and promoting private sector participation in providing job opportunities and increasing income for young and large Egyptian population.

Based on Urbanet, (2021) Egypt's population growth is 2% is settled only in 6% of the total Egypt area and this percentage should be expanded to 12% by building new cities that could bear the population increase.

2.8 Egypt New Administrative Capital:

Based on El Sakty, (2021) Egypt's administration has begun to transform Cairo, the country's capital, into a major political, cultural, and economic hub for the Middle East and North Africa. The government has constructed the administrative capital east of Cairo to attain the previous goal. The major goal of building the administrative capital is to create a successful economic environment that is supported by a diverse range of economic activities, as well as to achieve long-term development. Moreover, During the first phase, the projected population is around 0.5 million people, including 40 to 50 thousand government employees who will be transferred to the new headquarters, with attempts to increase the employees' capacity during the first three years. The administrative capital city has a total area of 700 Km², a population of nearly 6.5 million people with the completion of the city's growth, and about 2 million job opportunities. Many ministries, embassies, and government institutions will be relocated to the New Administrative Capital City.

2.9 South Korea National Smart City Plan:

South Korea is one of the countries that adopted smart cities as a national plan for implementing smart cities such as; Sejong, Busan, and Seoul. According to Jeong J, (2019) in the master plan of the Sejong National Pilot Smart City white paper, Sejong as a pilot administrative smart city goal is to enhance the quality of life for citizens and develop a sustainable city to be a Korean Future City Project. This pilot national smart city plan is established depending on the South Korea's smart 4th industrial revolution technologies to provide creative and innovative opportunities through data-driven AI. Moreover, it consists of Seven Innovative Factors entrenched by the citizens' participation.

2.10 Egypt Smart Cities Challenges:

According to Mubarak L.M., Bakeer L.M. & Rashed A. Y., (2018), Egypt will face challenges in adopting and implementing smart urban cities presented in six characteristics which are shown below in figure 8, and they are consistent with the six characteristics of a smart city mentioned above in figure 2.

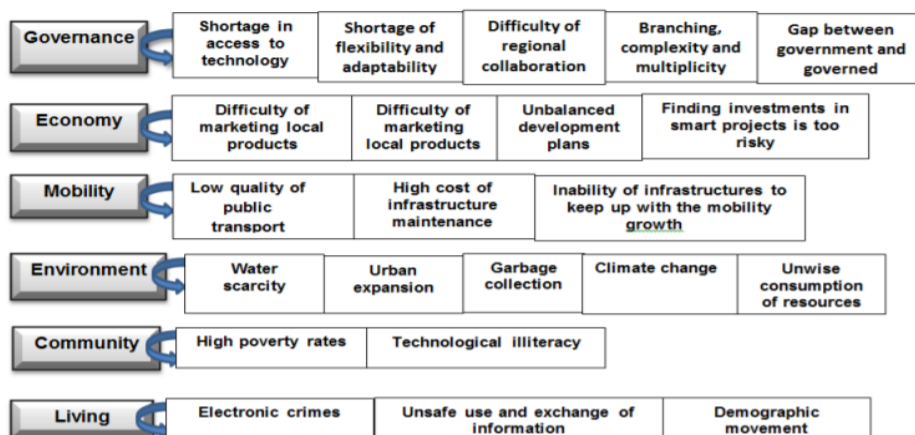


Figure 8 Challenges and Obstacles Facing Smart Urban Design in Egypt
Source: Mubarak L.M., Bakeer L.M. & Rashed A. Y., (2018).

These challenges are described and analyzed as follows;

1. Smart governance:

The current Egyptian administrative system confronts insufficient in its performance as it is not a flexible and adaptable system, because of the absence of cooperation and communication between the governmental institutions. Moreover, a trust gap between the citizens and the governmental institutions because of not adopting good governance as a tool used to achieve the best performance and results. In addition, the shortage of access to technology, a weakness in the human capital qualifications, and the absence of transparency and accountability.

2. Smart economy:

There is a shortage in using ICT and infrastructure maintenance, which leads to Egypt's inability to attract investors, create new job opportunities, and increase incomes. As a result, there will be an increase in the unemployment rate and poverty. Moreover, the absence of encouragement for Small and Medium Enterprises (SMEs) and entrepreneurs they are the base for any stable and smart economy, as they provide jobs and creative ideas to establish new investments and projects that reinforce the economy.

3. Smart mobility:

It focuses on providing a smart transportation system, which reduces congestion, pollution, and commutes time, as a result, it provides smart parking spaces, enhances the environment, and decreases the usage of natural resources like gas and petrol, which is positively reflected in reducing citizens and governmental expenses. Egypt is working on developing and enlarging its roads, but it is still facing

challenges in implementing a smart mobility system, because of the weakness of its public transportation system and insufficient infrastructure. Add to that, the increasing demand for buying new private cars, which makes the load on the infrastructure and negatively affects the environment.

4. Smart environment:

Egypt is facing a water shortage challenge, desertification, high pollution emissions, and high demand and consumption of natural resources such as; petrol, gas, and coal for producing energy, all of that occurs because of the absence of a real smart system that could monitor the usage of natural resources and allow citizens to be rational in their consumption.

5. Smart community (people):

Adopting a smart city requires citizens to be well-educated and qualified enough to deal with the new technologies which are being innovated rapidly all over the world. Unfortunately, Egypt is facing a lot of challenges such as; technology illiteracy, high unemployment and poverty rate, unsatisfactory education and health system, and lack of awareness. Regarding this, some will find that solving such challenges and problems have the priority of adopting a smart city with a smart system that will improve their standards of living and that the resistance of the citizens will be the crucial challenge Egypt will face.

6. Smart living (quality of life):

Providing a quality of life for citizens is a real challenge for every government around the world. Egyptian government faces different challenges in providing Egyptian citizens with high-quality, and affordable cost public services, using ICT which facilitates delivering the required services, add to that, granting appropriate living conditions like good homes, health care system, quality education, suitable work hours, safety, and entertainment places for their leisure time. In addition, the pressure on the services, products, and infrastructure is due to the internal migration from rural areas to urban areas.

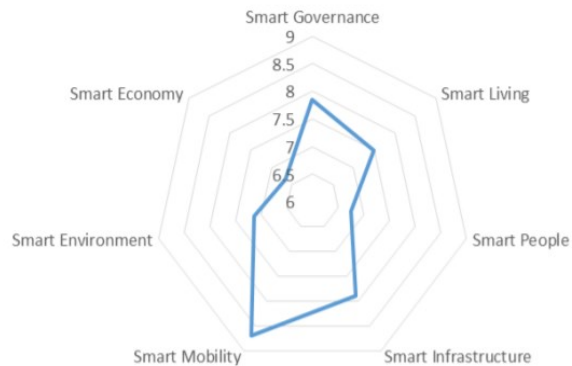
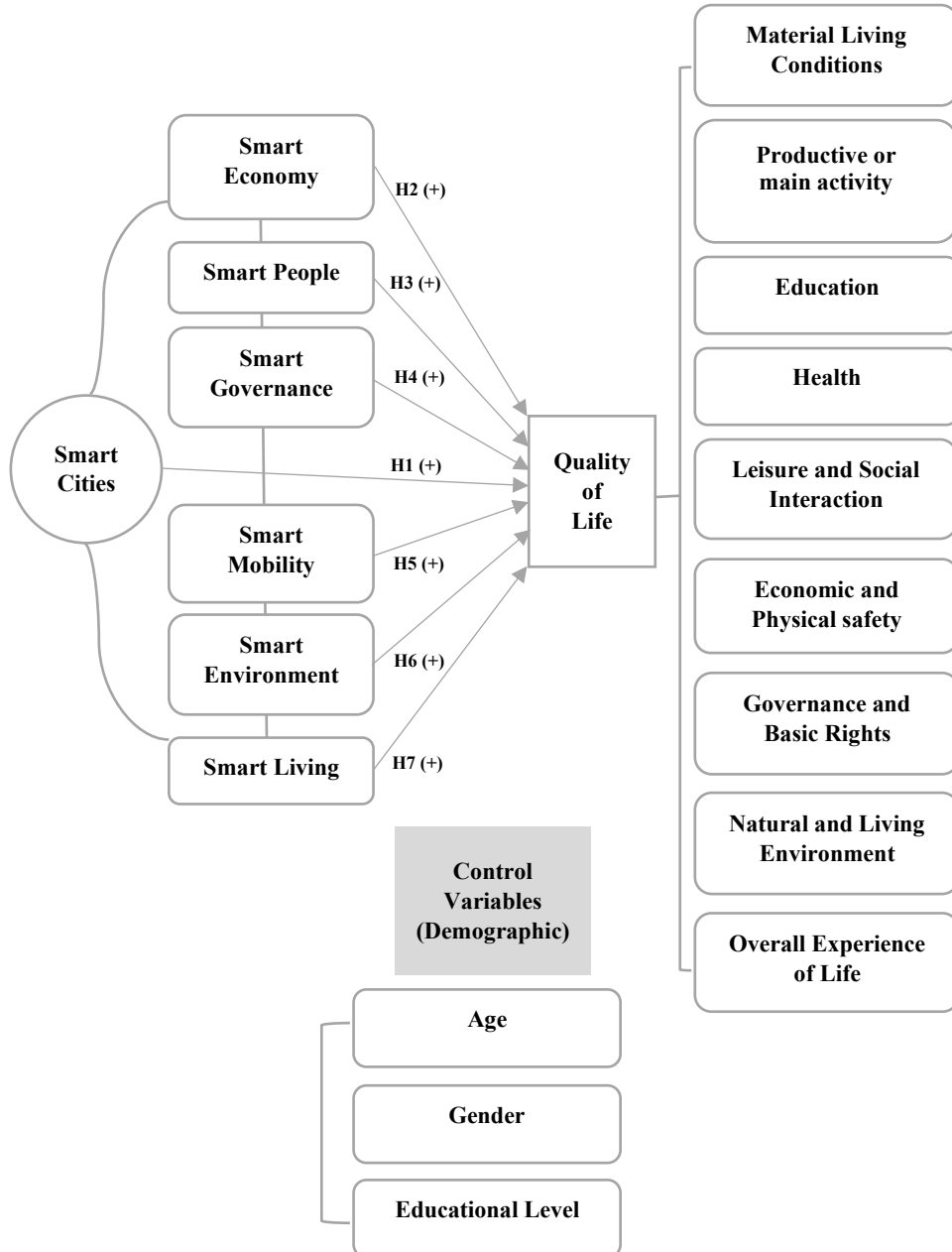


Figure 9 Smart City Initiatives of the Egyptian Environment
Source: Abou El Seoud T., (2019).

As seen above in figure 9 Egypt is facing its challenges and focusing mainly on improving smart mobility, smart infrastructure, and smart governance, which are considered a good base for implementing smart cities.

Chapter 3: Research Methodology

3.1. Diagram. Analytical Framework:



Source: Designed by the researcher

The analytical framework for this study (shown in the diagram) shows the relationship between the defined variables, including Smart Cities as an independent variable and Quality of Life as a dependent variable, based on the theoretical foundation and literature review. According to Yeh, (2017) smart city services are meant to improve citizens' quality of life when they utilize the services consistently depending on Rogers, (1962) theory of the Diffusion of Innovation (DOI) which is based on one concept of the social and technological aspects and is widely used in technologies area as a tool to compare different scenarios.

As a result, this research indicates that smart cities may have an impact on the quality of life as the main hypothesis, followed by six sub-hypotheses for the smart city characteristics as independent variables to measure the effect of each of the smart city characteristics based on their importance on improving the quality of life based on their importance from the perception of the official government officers, which will help the government to focus and consider it as a priority for developing the smart city. Moreover, as a smart city consists of these six characteristics the researcher believes that none of them must be excluded, they are combined to shape the smart city.

Hypothesis (1):

- There is a positive relationship between constructing a smart city and improving citizens' quality of life.

Hypothesis (2):

- There is a positive relationship between a smart economy and improving citizens' quality of life.

Hypothesis (3):

- There is a positive relationship between smart people and improving citizens' quality of life.

Hypothesis (4):

- There is a positive relationship between smart governance and improving citizens' quality of life.

Hypothesis (5):

- There is a positive relationship between smart mobility and improving citizens' quality of life.

Hypothesis (6):

- There is a positive relationship between a smart environment and improving citizens' quality of life.

Hypothesis (7):

- There is a positive relationship between smart living and improving citizens' quality of life.

3.2 Variables Definitions:

- **The dependent variable:** is quality of life dimensions. According to Owczarek (2010), the concept of quality of life first appeared in the United States of America after World War II, to reflect how people's lives are good like if a person owns a house or car, it reflects that the person could have a good life. Nowadays, the concept turned to measuring internal and external factors that have an impact on the person. Consequently, to improve the quality of life for people, there was a need to set dimensions that are measured statistically to indicate what humans value in their lives, World Health Organization (WHO) defined quality of life as “individuals’ perception of their position in life in the context of the culture and

value systems in which they live and in relation to their goals, expectations, standards, and concerns” WHO, (1998).

- **The Independent variable:** is smart city, as mentioned before there is no actual definition for smart cities based on the literature reviews, but there are different definitions for smart cities that could avail my research which are;

- *According to Allahar, (2020) “A smart city places people at the center of development, invests in human and social capital, manages resources wisely, incorporates ICT into urban management, and emphasizes collaborative planning and citizen participation. The aim of a smart city is geared towards promoting sustainable development and improvements in the quality of life of its citizens through ongoing initiatives that support innovation, competitiveness, attractiveness, and resilience of the city”⁵.*
- *“Smart Cities are ‘systems of people interacting with and using flows of energy. Materials, services, and financing to catalyze sustainable economic development resilience, and high quality of life; these flows and interactions become smart through making strategic use of information and communications infrastructure and services in a process of transparent urban planning and management that is responsive to the social and economic needs of society” Kumar, (2017)⁶.*
- *“When investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic*

⁵ Allahar, H. (2020). What are the Challenges of Building a Smart City. *Technology Innovation Management Review*, 11.

⁶ Kumar, T. V. (2017). In T. V. Kumar, *Smart Economy in Smart Cities* (pp. 37-38).

growth and a high quality of life, with a wise management of natural resources, through participatory governance” Deakin, (2014)⁷.

As mentioned above, we can figure out that enhancing the quality of life for citizens depends on different external and internal factors in the context of the culture and surrounding environment. On the other hand, a smart city’s role is to develop, enhance and promote the encompassing aspects affecting citizens' needs of society to enrich their quality of life through sensible and smart management of natural resources.

3.3 Research Design:

The study is investigating the impact of applying a smart city solution as an independent variable on improving the quality of life for Egyptian citizens as the dependent variable, by examining the case of the New Administrative Capital city as a potential smart city. According to Huang, Luo, Zhang, & Li, (2021) the government of china plays a great role in the decision-making process, designing policies, and constructing smart cities, so the population of this research is the government of Egypt, and the data was acquired by distributing a survey questionnaire to the official government officers who are working for the Egyptian government ministries representing the sample frame of this research, and the sample size is 127 respondents from the diversified Egyptian ministries.

⁷ Deakin, M. (2014). Smart Cities: state-of-the-art and governance challenge. *Triple Helix*, p. 1:7.

3.4 Research Methodology:

The research methodology is conducted with both qualitative and quantitative approaches, as descriptive analysis, the research includes graphs and statistical measuring and analyzing the perception of official government officers on the area of study. This methodology helps the researcher to achieve a reliable conclusion on the research topic and ensure its validity.

3.5 Data collection:

The data is collected through different primary and secondary resources which are as follows;

- Primary data through a survey questionnaire randomly distributed to official government officers from various ministries in the government of Egypt.
- Secondary data through a literature review of books, theses, journal articles, websites, and reports.

3.6 Survey Instrument:

The survey questionnaire is designed into five sections divided and includes a total of 81 questions.

The first section is regarding the overall perception of the official government officers about the independent variable smart city and its characteristics; the second section is regarding the dependent variable the quality of life and its dimensions; the third section general questions about the perception of the official government officers about the effect of smart city on improving the quality of life and the challenges that might face the government of Egypt to construct it; the fourth section is AHP analysis question to give a weight for the quality of life dimensions and measure the priority for each dimension from the perspective of the official

government officers to consider it for decision making; the fifth section is regarding the sample demographic data.

The survey includes qualitative and quantitative approaches; the qualitative data is obtained by open-ended questions, while the quantitative data is obtained by the scale and multiple questions.

3.7 Criteria of Measurement:

To measure the perception of the official government officers about the effect of a smart city on improving the quality of life and the challenges that might face the government of Egypt to construct it. A single survey questionnaire was developed as a self-administrated questionnaire by integrating questions from the relevant and important literature to serve the purpose of this study. The WHOQOL-100 which is included in the WHOQOL manual was used to accumulate the perceptions on the quality of life. Moreover, the Quality of Life Scale (QOLS) according to Burckhardt, (2003) was developed by American psychologist John Flanagan in the '70s to measure the quality of life within cultures.

All measurements for the dependent and independent variables used a five-point Likert scale ranging from one to five. According to Kim Y, (2015), the AHP survey questionnaire was used to measure the relative importance of several dimensions related to the quality of life and life satisfaction from the perspective of public officials. AHP section was included to measure the relative importance of the dependent variable quality of life using a scale from 1 to 9, and scales 2,4,6,8 was excluded and considered as an expression of intermediate values.

3.8 Data Analysis:

The data collected was analyzed through SAS statistical software, this software is used to facilitate the data analysis process to critically analyze the perception of official governmental officers in Egypt on the area of study. Based on Saaty, (1988) local and national governments face problems that require making decisions such as; building a bridge or a hospital in our daily life.

Saaty, (1988) introduced the Analytical Hierarchy Process (AHP) which is one of the most comprehensive systems for making decisions with various criteria since it allows you to frame the problem in a hierarchical form through a combination of quantitative and qualitative factors. The first step is to identify and organize the decision into a hierarchy; The second step is to assign a nominal value to each level of the hierarchy and construct a pairwise comparison judgment matrix; Finally, the algorithm result gives the relative priority of different factors. As a result, the AHP method will be used to give relative importance to the dimensions of the dependent variable quality of life.

According to Babbie E, (2013), Multiple Regression is a statistical analysis model used to prove that a single definite dependent variable is affected by numerous independent variables. Therefore, the Multiple Regression model will be used to measure the impact of smart city characteristics on quality of life.

Based on the above-mentioned analyzing criteria, the methods which will be used to analyze the data collected will be AHP and Multiple Regression models.

Chapter 4 Analysis and Discussion of the Results

This study was conducted to determine if developing a smart city can improve the quality of life for Egyptian citizens from the perception of official government officers of Egypt. The hypothesis of this research is to test if there is no relationship between developing a smart city and the quality of life. Multiple regression analysis was used to measure if there is a relationship between the research variables and the AHP method will be used to give relative importance to the dimensions of the dependent variable quality of life. Moreover, Pearson's correlation test was constructed and multiple regression was run to test the research hypothesis.

4.1 Descriptive statistics

4.1.1 Descriptive statistics of survey respondents

Table 3 Descriptive Statistics of Dependent & Independent Variables

Variable	N	Mean	SD	Min	Max
<i>Smart Cities</i>	127	4.139	0.905	1	5
<i>Smart Economy</i>	127	3.992	1.042	1	5
<i>Smart People</i>	127	3.866	1.079	1	5
<i>Smart Governance</i>	127	4.228	1.009	1	5
<i>Smart Mobility</i>	127	4.252	1.054	1	5
<i>Smart Environment</i>	127	4.220	1.031	1	5
<i>Smart Living</i>	127	4.276	1.013	1	5
<i>Quality of Life</i>	127	3.266	0.646	1.542	5

Source: by the researcher

Table 3 above shows us the descriptive statistics consisting of the number of observations, mean score, standard deviation, minimum, and Maximum of the dependent and independent variables.

Regarding the independent variables smart cities' mean score is 4.139 with SD = 0.905, the smart economy mean score is 3.992 with SD = 1.042, the smart people mean score is 3.866 with SD = 1.079, smart governance mean score is 4.228 with SD = 1.009, smart mobility mean score is 4.252 with SD = 1.054, smart environment mean score is 4.220 with SD = 1.031, smart living mean score is 4.276 with SD = 1.013, and the dependent variable quality of life mean score is 3.266 with SD = 0646.

Table 4 Descriptive Statistics of Survey Respondents

Variable	Category	Frequency	Percent	Cumulative Frequency	Cumulative Percent
<u>Gender</u>	Male	63	49.61	63	49.61%
	Female	64	50.39	127	100%
<u>Age</u>	24-35	27	21.26	27	21.26%
	35-45	75	59.06	102	80.31%
	45+	25	19.69	127	100%
<u>Education</u>	Bachelor's degree	38	29.92	38	29.92%
	Master's degree	74	58.27	112	88.19%
	Ph.D.	15	11.81	127	100%

Source: by the researcher

According to the data shown above in table 4, the total responses analyzed are 127 out of 172 responses received, as from the 172 responses 153 were a relative population sample and 27 out of the 153 responses were removed as they consisted of missing values.

As shown below in figure 10; the sample population by gender consists of 63 males (49.61%), and 64 females (50.39%)

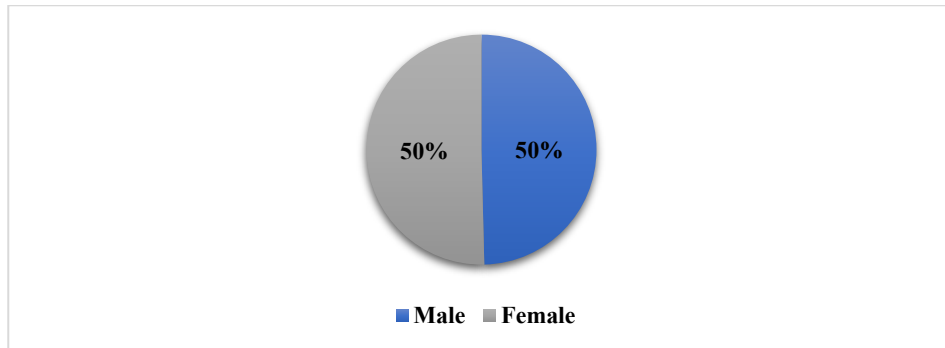


Figure 10 Descriptive Statistics by Gender
Source: by the researcher

The following figure 12 shows that the sample age includes 75 respondents aged 35-45 representing (59%) of the total sample population, 27 respondents aged 24-35 representing (21%), and the last 25 respondents representing (20%) of the total population.

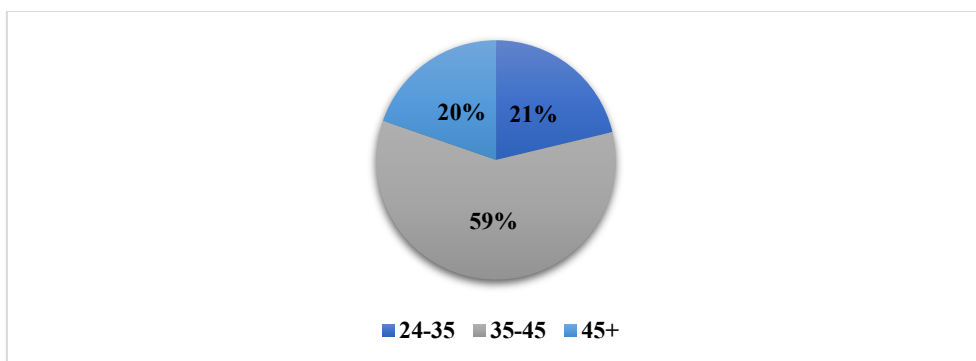


Figure 11 Descriptive Statistics by Age
Source: by the researcher

Based on figure 12 below; the Education level show 74 respondents hold a Master's degree representing (58%), whereas 38 hold a Bachelor's degree representing (30%), and 15 hold a PhD degree representing (12%) of the respondents.

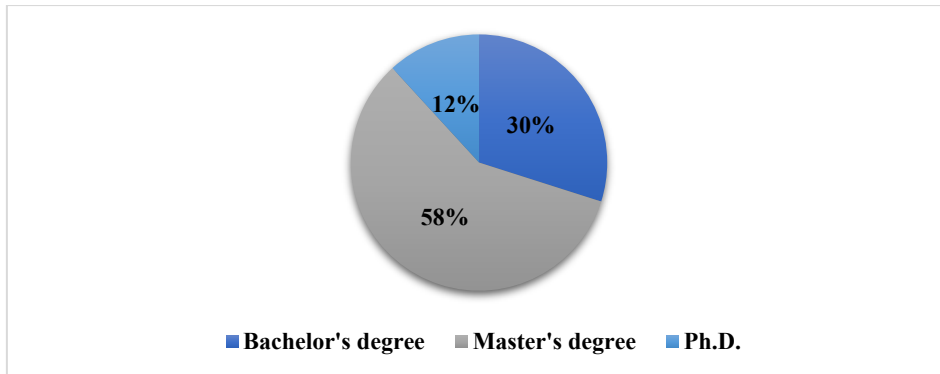


Figure 12 Descriptive Statistics by Education Level
Source: by the researcher

4.1.2 Demographic statistics of key variables by gender

Table 5 Demographic Category Comparisons of Key Variables by Gender

<i>Gender</i>	<i>Variable</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
<i>Male</i>	Smart City	63	4.008	1.020	1	5
	Quality of Life	63	3.288	0.638	2	5
<i>Female</i>	Smart City	64	4.268	0.762	1.333	5
	Quality of Life	64	3.243	0.658	1.542	4.75

Source: by the researcher

The above table 5 shows us the demographic category assessments by gender for the key variables of the smart city and the quality of life. For the independent variable smart city, the mean score for males is 4.008 less than the mean score for females 4.268 in the smart city variable. Regarding the mean score for the dependent variable male score is 3.288 while the female's mean score is 3.243, which is less than the mean for the male score.

Table 6 *Demographic Category Comparisons of Key Variables by Age*

<i>Age</i>	<i>Variable</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
24-35	Smart City	27	4.025	1.051	1	5
	Quality of Life	27	3.265	0.602	1.542	4.542
35-45	Smart City	75	4.131	0.904	1	5
	Quality of Life	75	3.203	0.632	2	5
45+	Smart City	25	4.287	0.740	2	5
	Quality of Life	25	3.453	0.719	2.125	5

Source: by the researcher

As shown in above table 6 the demographic category assessments by age for the key variables smart city and quality of life. For the independent variable smart city the mean score for ages between (24-35) is 4.025, while the mean score for ages between (35-45) is higher with a mean score of 4.131, and for the ages, more than 45 the mean score is 4.287 which is much higher. Regarding the mean scores for the dependent variable quality of life, the mean score for ages between (24-35) is 3.265, while the mean score for ages between (35-45) is less with a mean score of 3.203, and for the ages, more than 45 the mean score is 3.453 which is much higher.

Table 7 Demographic Category Comparisons of Key Variables by Education Level

<i>Education</i>	<i>Variable</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
<i>Bachelor Degree</i>	Smart City	38	3.974	1.020	1	5
	Quality of Life	38	3.302	0.623	1.542	5
<i>Master's Degree</i>	Smart City	74	4.259	0.787	1	5
	Quality of Life	74	3.198	0.594	2	4.667
<i>Ph.D. Degree</i>	Smart City	15	3.967	1.101	2	5
	Quality of Life	15	3.508	0.893	2.083	5

Source: by the researcher

As shown in above table 7 the demographic category assessments by education level for the key variables smart city and quality of life. For the independent variable smart city, the mean score for the bachelor's degree is 3.974, while the mean score for the master's degree is higher with a mean score of 4.259, and for the Ph.D. degree, the mean score is 3.967 which is much lower. Regarding the mean scores for the dependent variable quality of life, the mean score for the bachelor's degree is 3.302, while the mean score for the master's degree is less with a mean score of 3.198, and for the Ph.D. degree, the mean score is 3.508 which is much higher.

4.1.3 AHP Model Analysis

Table 8 Overall Rank Order and Relative Priority of Quality of Life Dimensions

DOMAIN	DIMENSION	TOTAL WEIGHT	OVERALL RANK ORDER
QUALITY OF LIFE	Material living and Condition	0.233	1
	Productive or Main activity	0.186	2
	Education	0.144	3
	Health	0.116	4
	Leisure and Social Interaction	0.074	5
	Economic and Physical safety	0.068	6
	Governance and Basic rights	0.065	7
	Natural and Living Environment	0.062	8
	Overall Experience of Life	0.061	9

Source: by the researcher

Table 8 represents the rank order and the relative priority of the quality of life dimensions based on the data acquired from the research sample of the official government officers of Egypt with a total of 127 responses.

Based on the above results shown in table 11, the most important dimension is the material living and conditions with a total weight score of (0.233), which cover financial situation or income, risk of poverty, and housing condition. Comes in second place the productive or main activity with a total weight score of (0.186), which cover whether the citizens are paid and employed or not, and what is the effect of working life on their quality of life. In third place is Education with a total score of (0.144) which measures access to quality education for all generations, and also refers to the accumulated knowledge gained through all educational institutions, followed by health with a total score of (0.116).

Regarding the least important quality of life dimensions, comes the overall experience of life with the least score of (0.061), this dimension concentrates on the individual point of view on life satisfaction, as it depends on personal measures and one's self-esteem. The second least dimension comes to the Natural and Living Environment with a score of (0.062), followed by Governance and Basic rights the third least with a score of (0.065), and Economic and Physical safety with a score of (0.068).

All these results show us that from the perception of the official government officers all the dimensions that cover basic needs such as income, good housing, and education are so important to be considered to achieve the quality of life for the citizens. While Leisure and social interactions dimension which covers the ability of citizens to spend leisure time outside their work time, plus social activities that make them happy and satisfied came at the 5th rank at the centre of the most important dimensions and least important dimensions with total weight score of (0.074).

Figure 13 below reflects the above-mentioned scores by descending the dimensions.

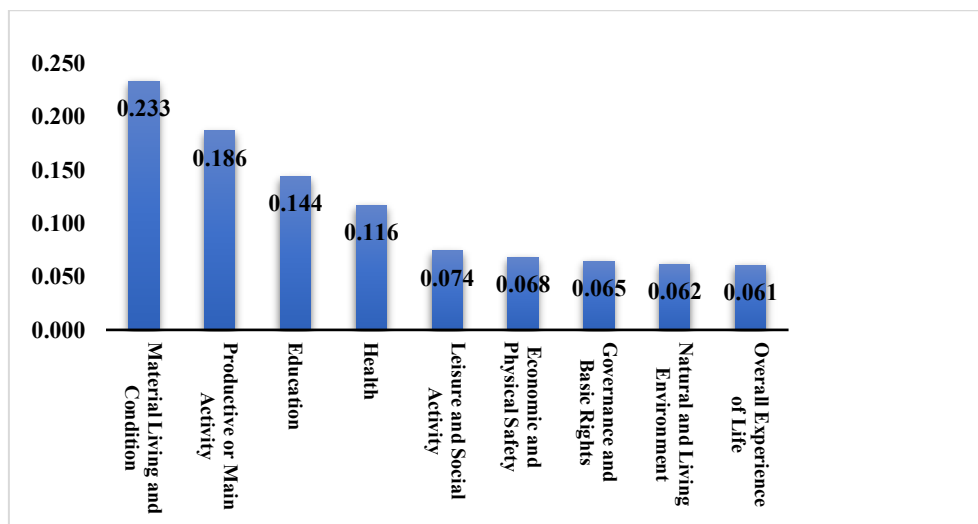


Figure 13 Rank order for Quality of Life factors
Source: by the researcher

As figure 14 below show us; that smart living which focuses on the quality of life for citizens and providing them with the necessary services of high quality for example; health, education, safety, housing, and social solidarity, got the highest responses as extremely important, 75 out of 153 responses representing (49.02%) said it is extremely important.

Followed in second place by smart mobility which focuses on transport systems and information and communication technology (ICT) which play role in providing information, and sustainable systems, enhancing the environment and reducing citizens and governmental expenses, it got 73 out of 153 responses as extremely important representing (47.71%).

In third place comes smart governance which considers participation in decision-making, governance transparency, citizens' participation in political strategies, and providing public and social services, it got 71 out of 153 responses as extremely important representing (46.41%).

Regarding the very important scale smart people which considers factors like creativity, flexibility, level of qualification, and social participation in public life, it got the highest responses as very important, 69 out of 153 responses representing (45.10%) said it is very important. Followed by the smart economy which includes eight factors which are; innovation, entrepreneurship, productivity, economic situation, participation in international markets, and labor market flexibility, got 64 out of 153 responses as very important representing (41.83%).

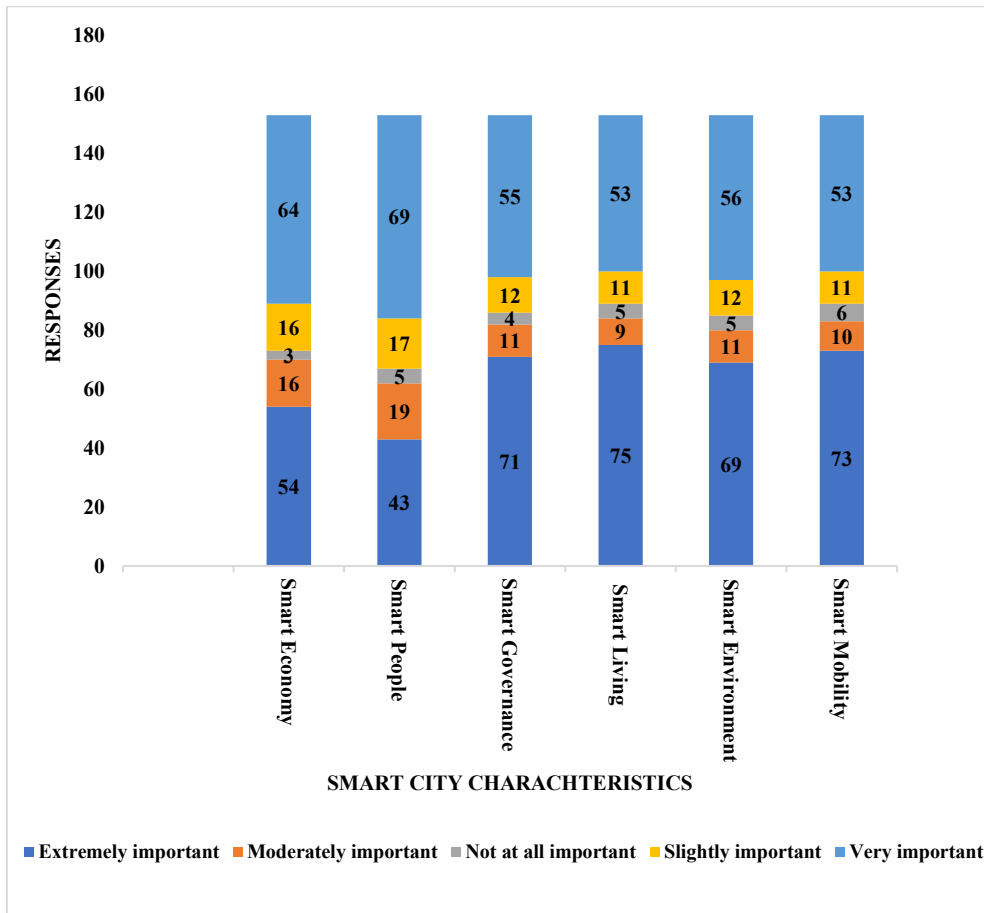


Figure 14 Smart City Characteristics Importance Weight
 Source: by the researcher

The following figure 15 shows us in descending order the challenges that might face the Egyptian government to develop a smart city from the perception of the official public officers.

Lack of smart technologies and services obstacles come as the main challenge that will face the Egyptian government to develop a smart city with 76 responses out of 153 representing (49.67%). Followed by Budgeting & Operation Inflexibility and Lack of Data Accuracy in second place as the challenges the Egyptian government need to consider while developing a smart city with 71 responses out of 153 representing (46.41%).

In third place comes the challenges of Corruption & Lack of City Management which the Egyptian government have to deal with it with responses 68 out of 153 representing (44.44%), followed by the Lack of Communication between Government entities with 65 responses out of 153 representing (42.5%).

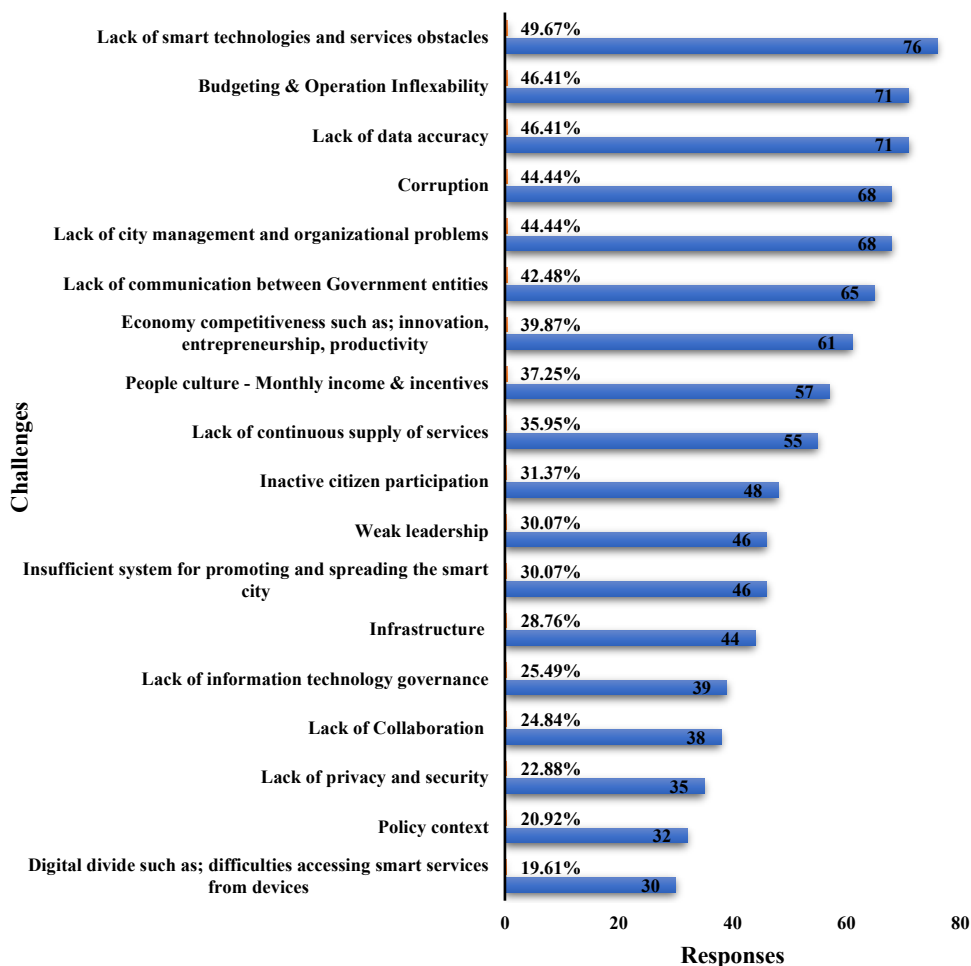


Figure 15 Egypt's Challenges for Developing a Smart City
Source: by the researcher

4.2 Pearson Correlation Analysis

Table 9 *Pearson's Correlation Coefficient Test Results*

Pearson correlation coefficient, N = 127

		<i>under H0: Rho=0, Prob > r </i>	
	Smart Cities	Quality of Life	
<i>Smart Cities</i>	1	0.171	Correlation Coefficient
		0.055	P-Value
<i>Quality of Life</i>	0.171	1	Correlation Coefficient
	0.055		P-Value

Source: by the researcher

Table 9 shows us Pearson's correlation, according to Babbie E, (2013) Pearson's correlation is a proper analysis to measure the linear relationship between two variables, which in this research are smart cities and quality of life. The size of the correlation coefficient reflects the size of the correlation which is 0.171 and it reflects a positive relationship but a weak correlation. Moreover, the p-value reflects whether the correlation coefficient is statistically significant at 1%, 5%, or 10%, so since the results shown in above table 7 for the p-value is smaller than 0.1 and larger than 0.05 with a result of 0.055, then the correlation between smart cities and quality of life is statistically significant in the 10% significance level.

4.3 Regression Model Analysis

Table 10 *Regression Model (2) Control Variables & Independent Variable (Smart City).*

<i>Dependent variable: Quality of Life</i>			
<i>Variables</i>	Model 2		
	Estimate	St.E	Pr > t
<i>Intercept</i>	2.800	0.283	<.0001
<i>Gender (female)</i>	-0.154	0.117	0.191
<i>Age (35-45)</i>	-0.112	0.143	0.435
<i>Age (45+)</i>	0.194	0.178	0.276
<i>Edu (Masters)</i>	-0.105	0.128	0.413
<i>Edu (PhD)</i>	0.317	0.199	0.113
<i>Smart Cities</i>	0.144	0.064	0.025
<i>N. of obs</i>		127	
<i>R-square</i>		0.098	
<i>Adj R-square</i>		0.053	
<i>F-value</i>		2.17	
<i>Pr>F</i>		0.051	

Note: values reported in the table represent OLS regression coefficients. Standard errors are in parentheses. P < 0.001 '***' 0.01 '**' 0.05 '*'

Source: by the researcher

Based on the results shown in the above table 10 regression model, the regression model shows (F = 2.17, P-value = 0.025), using alpha = 5% (or at a 5% significance level), its statistically significant and reflect that a smart city has a positive relationship with quality of life, which means that as the other variables are constant 1 point increase in smart cities is reflected in 0.144 increase in quality of life.

Table 11 Regression Model (3) Control Variables, and Smart City Characteristics.

<i>Dependent variable: Quality of Life</i>			
<i>Variables</i>	Model 3		
	Estimate	St.E	Pr > t
<i>Intercept</i>	2.772	0.286	<.0001
<i>Gender (female)</i>	-0.201	0.121	0.100
<i>Age (35-45)</i>	-0.096	0.146	0.514
<i>Age (45+)</i>	0.213	0.182	0.244
<i>Edu (Masters)</i>	-0.098	0.131	0.456
<i>Edu (PhD)</i>	0.342	0.201	0.092
<i>Smart Economy</i>	0.096	0.086	0.266
<i>Smart People</i>	-0.016	0.082	0.846
<i>Smart Governance</i>	-0.043	0.115	0.711
<i>Smart Mobility</i>	0.096	0.115	0.404
<i>Smart Environment</i>	-0.132	0.115	0.256
<i>Smart Living</i>	0.148	0.120	0.218
<i>N. of obs</i>		127	
<i>R-square</i>		0.126	
<i>Adj R-square</i>		0.043	
<i>F-value</i>		1.51	
<i>Pr>F</i>		0.136	

Note: values reported in the table represent OLS regression coefficients. Standard errors are in parentheses. P< 0.001 ‘***’ 0.01 ‘**’ 0.05 ‘*’

Source: by the researcher

Based on the results shown in the above table 11 regression model, using alpha = 5% (or at a 5% significance level), it statistically shows no significance. Moreover, it reflects that smart city characteristics (Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, and Smart Living) as independent variables show no significant effect on the quality of life.

Table 12 Regression Model: Control Variables, Independent Variable (Smart City), and Smart City Characteristics.

Dependent variable: quality of life

<i>Variables</i>	Model 1			Model 2			Model 3		
	Estimate	St.E	Pr > t 	Estimate	St.E	Pr > t 	Estimate	St.E	Pr > t
<i>Intercept</i>	3.340	0.156	<.0001	2.800	0.283	<.0001	2.772	0.286	<.0001
<i>Gender (female)</i>	-0.120	0.118	0.314	-0.154	0.117	0.191	-0.201	0.121	0.100
<i>Age (35-45)</i>	-0.094	0.145	0.517	-0.112	0.143	0.435	-0.096	0.146	0.514
<i>Age (45+)</i>	0.225	0.180	0.215	0.194	0.178	0.276	0.213	0.182	0.244
<i>Edu (Master)</i>	-0.067	0.129	0.606	-0.105	0.128	0.413	-0.098	0.131	0.456
<i>Edu (PhD)</i>	0.309	0.202	0.129	0.317	0.199	0.113	0.342	0.201	0.092
<i>Smart Cities</i>				0.144	0.064	0.025			
<i>Smart Economy</i>							0.096	0.086	0.266
<i>Smart People</i>							-0.016	0.082	0.846
<i>Smart Governance</i>							-0.043	0.115	0.711
<i>Smart Mobility</i>							0.096	0.115	0.404
<i>Smart Environment</i>							-0.132	0.115	0.256
<i>Smart Living</i>							0.148	0.120	0.218
<i>N. of obs</i>		127			127			127	
<i>R-square</i>		0.098			0.098			0.126	
<i>Adj R-square</i>		0.053			0.053			0.043	
<i>F-value</i>		1.53			2.17			1.51	
<i>Pr>F</i>		0.187			0.051			0.136	

Source: by the researcher

4.4 Hypothesis Testing:

To confirm the hypotheses based on the models used in this research, the statistical significance of the regression coefficient of the independent variables was tested. The intercept of model 1 that was used to test (H1) is ($\beta_0 = 2.80$, $P < .0001$) which means it is statistically significant at 0.05%, while the intercept of model 2 that was used to test (H2, H3, H4, H5, H6, and H7) is ($\beta_0 = 2.77$, $P < .0001$) which means it is statistically significant at 0.05%.

Hypothesis (1):

- There is a positive relationship between constructing a smart city and improving citizens' quality of life.
 - Based on the results of the regression model which shows ($F = 2.17$, $P\text{-value} = 0.025$), using $\alpha = 5\%$ (or at a 5% significance level), its statistically significant and reflects that a smart city has a positive relationship with quality of life.
 - The relationship is statistically significant and reflects that smart city has a positive relationship with quality of life. As a result, (H1) is accepted, in other words, the researcher rejects the null hypothesis.

Hypothesis (2):

- There is a positive relationship between a smart economy and improving citizens' quality of life.
 - Based on the results of the regression model which shows ($F = 1.51$, $P\text{-value} = 0.266$), using $\alpha = 5\%$ (or at a 5% significance level), the relationship statistically shows that the smart economy as an independent variable has no significant effect on the quality of life. As a result, (H2) is rejected, in other words, the researcher accepts the null hypothesis.

Hypothesis (3):

- There is a positive relationship between smart people and improving citizens' quality of life.
 - Based on the results of the regression model which shows ($F = 1.51$, $P\text{-value} = 0.846$), using $\alpha = 5\%$ (or at a 5% significance level), the relationship statistically shows that the smart people as an independent variable has no significant effect on the quality of life. As a result, (H3) is rejected, in other words, the researcher accepts the null hypothesis.

Hypothesis (4):

- There is a positive relationship between smart governance and improving citizens' quality of life.
 - Based on the results of the regression model which shows ($F = 1.51$, $P\text{-value} = 0.711$), using $\alpha = 5\%$ (or at a 5% significance level), the relationship statistically shows that the smart governance as an independent variable has no significant effect on the quality of life. As a result, (H4) is rejected, in other words, the researcher accepts the null hypothesis.

Hypothesis (5):

- There is a positive relationship between smart mobility and improving citizens' quality of life.
 - Based on the results of the regression model which shows ($F = 1.51$, $P\text{-value} = 0.404$), using $\alpha = 5\%$ (or at a 5% significance level), the relationship statistically shows that the smart mobility as an independent variable has no significant effect on the quality of life. As a result, (H5) is rejected, in other words, the researcher accepts the null hypothesis.

Hypothesis (6):

- There is a positive relationship between a smart environment and improving citizens' quality of life.
 - Based on the results of the regression model which shows ($F = 1.51$, $P\text{-value} = 0.256$), using $\alpha = 5\%$ (or at a 5% significance level), the relationship statistically shows that the smart environment as an independent variable has no significant effect on the quality of life. As a result, (H6) is rejected, in other words, the researcher accepts the null hypothesis.

Hypothesis (7):

- There is a positive relationship between smart living and improving citizens' quality of life.
 - Based on the results of the regression model which shows ($F = 1.51$, $P\text{-value} = 0.218$), using $\alpha = 5\%$ (or at a 5% significance level), the relationship statistically shows that the smart living as an independent variable has no significant effect on the quality of life. As a result, (H7) is rejected, in other words, the researcher accepts the null hypothesis.

4.5 Discussion of the major findings

The results show us that the average for the mean results of the smart city characteristics is (4.14) which reflects that the perception of the official government officers of Egypt is that each of the characteristics combined is extremely important.

For the independent variable smart city, the mean score for males is 4.008 less than the mean score for females 4.268, while the mean score for ages between (24-35) is 4.025, while the mean score for ages between (35-45) is higher with a mean score of 4.131, and for the ages, more than 45 the mean score is 4.287 which is much higher, and the mean score for the bachelor's degree is 3.974, while the mean score for the master's degree is higher with a mean score of 4.259, and for the Ph.D. degree, the mean score is 3.967 which is much lower.

Regarding the AHP model analysis which was used to give relative importance and rank order of the dependent variable dimensions, all the results show us that from the perception of the official government officers all the dimensions that cover basic needs such as income, good housing, and education are so important to be considered to achieve the quality of life for the citizens. While Leisure and social interactions dimension which covers the ability of citizens to spend leisure time outside their work time, plus social activities that make them happy and satisfied came as the least important dimensions.

The most important dimension is the material living and conditions with a total weight score of (0.233), comes in second place the productive or main activity with a total weight score of (0.186), In third place is education with a total score of (0.144), followed by health with a total score of (0.116) in the fourth place.

Regarding the least important quality of life dimensions, comes the overall experience of life with the least score of (0.061), the second least dimension comes to the natural and living environment with a score of (0.062), followed by governance and basic rights the third least with a score of (0.065), and economic and physical safety with a score of (0.068).

Smart city characteristics importance weight showed us that smart living got the highest responses as extremely important, with responses representing (49.02%) said it is extremely important, followed in second place by smart mobility with responses as extremely important representing (47.71%), in third place comes smart governance with responses as extremely important representing (46.41%). Those results reflect what was presented above in (figure 9) that Egypt is facing its challenges and focusing mainly on improving smart mobility, smart infrastructure, and smart governance, which are considered a good base for implementing smart cities from the government's perception.

Regarding the very important scale, smart people got the highest responses as very important with responses representing (45.10%) saying it is very important, followed by the smart economy with responses of very important representing (41.83%).

Pearson's correlation showed us that the size of the correlation coefficient which is 0.171 reflects a positive relationship but a weak correlation and that the p-value is smaller than 0.1 and larger than 0.05 with a result of 0.055, which reflects that the correlation between smart cities and quality of life is statistically significant in the 10% significance level.

The results of the regression analysis using model 1 to test the smart city as an independent variable show us that the findings of (H1) reflect that the relationship between the smart city and the quality of life is statistically significant and smart city has a positive relationship with quality of life, as ($F = 2.17$, $P\text{-value} = 0.025$), using $\alpha = 5\%$ (or at a 5% significance level).

While the results of the regression analysis using model 2 show us that the characteristics of the smart city (smart economy, smart people, smart governance, smart mobility, smart environment, and smart living) which were tested by (H2, H3, H4, H5, H6, and H7) as independent variables showed no significant effect on the quality of life. However, it proves the idea of the researcher that smart city characteristics must be measured on a combined basis to show the effect of a smart city on quality of life.

Consequently, it gives evidence that the above works of literature and with a concentration on the definition of Allahar, (2020), the independent variable smart city represents that *“the aim of a smart city is geared towards promoting sustainable development and improvements in the quality of life of its citizens through ongoing initiatives that support innovation, competitiveness, attractiveness, and resilience of the city”*⁸.

Furthermore, according to Lom M, (2021), based on the Smart Cities Evaluation Framework (SMACEF) they introduced Multi-Agent Systems which is a combination of Systems Theory and Cyber-Physical theory as a constructing block for modelling smart cities, and it presents that cities are dynamic and nonlinear-systems.

⁸ Allahar, H. (2020). What are the Challenges of Building a Smart City.

The results of Lom M, (2021) show that based on the system theory smart city can be seen from an environmental view, while the Cyber-Physical Systems can see as particular systems from a mobility view, however, it was mentioned that the difference between traditional cities and smart cities is that in traditional cities *“systems interact only with their environment It means that systems are mostly stand-alone and not interoperable with other systems. In smart cities, systems are interconnected by energy or information relations, and information management becomes more and more important”*⁹.

Consequently, the results reflect that a smart city is based on an interconnected system and the characteristics are integrated to achieve the goal of improving the quality of life.

⁹ Lom M, P. O. (2021). smart city model based on systems theory.

Chapter 5 Conclusion and Recommendations

5.1 Conclusion:

Undoubtedly, the world is having an increase in population despite the particularities of each country, but some countries especially developing countries with a high growth rate in population face a lot of challenges in providing appropriate quality services and products which affect the quality of life and standards of living for their citizens. Hence, these countries must define their challenges and face them with data-driven decision-making, and a systematic approach, where smart cities appear as innovative, dynamic, and efficient solutions to solve their problems. As this research showed us smart city has a positive relationship with improving citizens' quality of life and their standards of living, as a result, it could be a prodigious solution for governments to implement smart cities to improve their citizens' quality of life.

In this regard, the Egyptian government set an objective to enhance people's quality of life and standards of living through its Vision 2030, and based on Morsy A., (2020), Egypt took a step in this regard by investing in building fourteen 4th-generation cities, such as; the New Administrative Capital, and New Alamein City. Therefore, the Egyptian government based on the results of this research needs to adopt smart cities as a smart solution, by developing a smart city national pilot plan to respond to Egyptian citizens' needs considering covering basic needs such as income, good housing, and education. Moreover, the government should consider constructing new integrated smart cities within every Egyptian governorate to reduce internal migration which will be positively reflected in improving citizens' quality of life, maximizing the benefits of the current and next generations and achieving the goals of Egypt's vision 2030.

5.2. Policy Recommendations:

According to what was presented in this research, this section will provide some recommendations for the government of Egypt's policy-makers in case the government decided to initiate a smart city national plan to improve the quality of life for Egyptian citizens, which requires up-to-date policies that can cope with the rapid speed of technological improvements and big data era that can help the government to improve the services, and increase the efficiency, as follow;

1. Legal Framework:

Regarding privacy and security, smart cities will use enormous data which will cause cybersecurity and privacy issues because the data used in the smart cities contain the behavioural and personal data of citizens, as a result, the government should reform and develop a strong legal framework which consists of strong law that will guarantee citizens data privacy and security, and increase the trust for citizens to the idea of developing a smart city.

2. International Cooperation:

The researcher recommends that the government of Egypt should acquire financial and technical assistance through cooperation with international institutions such as; the WB and IMF or signing bilateral, and multilateral agreements with other developed countries which implemented smart cities to improve the quality of life and standards of livings for their citizens. For example, South Korea is one of the countries that adopted smart cities as a national plan for implementing smart cities such as; Sejong, Busan, and Seoul. Certainly, such experience and cooperation with South Korea which is one of the leading and top countries in the area of technology, innovation,

and artificial intelligence will maximize the advantages of implementing and adopting smart cities as a smart solution for improving the Egyptian citizen's quality of life.

3. Citizens participation:

Since the smart city initiative's goal is to improve the quality of life for citizens and change their daily lives by providing quality services, the participation of citizens using the bottom-up approach in developing a smart city is crucial from the design phase until the implementation and evaluation phases. Consequently, the city can meet their needs based on their suggestions and/or engagement as active actors in the city to reach the required impact of improving their quality of life.

4. Business Environment:

Government should design & implement policies that can encourage start-ups and SMEs, especially in the area of the ICT industry to face the risks of big companies' monopolies which can take all the advantages because of their high capital and consequently the start-ups lose their opportunities to participate in such industry to provide their services and products and increase innovative and creative services and projects that drive business environment. Moreover, the government must boost the environment for the private sector to participate in such an initiative to create more job opportunities and avoid making crowds out in the market which will lead to a decrease in private investments.

5. Capacity Building:

No doubt that the government of Egypt is taking good steps in enhancing the capacity building for the official government officers, but implementing a smart city requires qualified and skilled employees, which requires providing adequate training programs in the area of ICT & city management. As a result, the government needs to cooperate with international organizations and international training centres to provide training programs for government officials to be qualified to deal with and adapt to the new technologies required to run a smart city.

6. Collaboration between government entities:

Based on the results of the data, most of the responses showed that lack of communication between the government entities might be a big challenge for developing a smart city in Egypt. Consequently, building a collaboration between government entities is essentially next to introducing a unified platform that can help to have integrated data and facilitate collaboration between the government entities.

5.3. Future Recommendation for the Study:

This study was focusing only on the perception of the official government officers, the upcoming research should enlarge the scope to include the experts and citizens. Moreover, the sample size of the research should be increased to ensure and enlarge the research's reliability.

5.4. Study Limitation:

To achieve the final results of this study the researcher confronted several challenges during the execution of the research as shown below;

Firstly, the research target was to examine 300 responses from official government officers, but the total responses analyzed were 127 out of 153 from the relative population sample, and 27 out of the 153 responses were removed as they consisted of missing values. Responses were from diversified ministries with a total of 27 ministries out of 33 Egyptian ministries. Consequently, that might affect the validity of the research.

Secondly, there were time, budget, and distance constraints as the questionnaire was sent only by using internet channels such as; social media groups, as the researcher is studying outside of his country and is not able to provide incentives to collect more responses.

Moreover, the results of the regression analysis show inconsistency, and the R² is too low and the F-test results on the model is not significant.

Finally, as per the above-mentioned limitations, the focus of this study was to examine only the perception of the official government officers of Egypt excluding the perception of experts and citizens.

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Appendix

SURVEY QUESTIONNAIRE for Writing the Thesis:

The Impact of Smart Cities on Improving Quality of Life for Egyptian Citizens

Dear respondent,

This survey questionnaire instrument will be used in the thesis entitled, “The Impact of Smart Cities on Improving Quality of Life for Egyptian Citizens” for the partial fulfilment of the requirement for the degree of Master in Public Administration at Seoul National University, South Korea.

The instrument is intended to collect data about the perception of the Egyptian official government officers of smart cities and quality of life. The data collected through this survey will be used in a master’s degree dissertation.

The findings of this research will help understand the impact of constructing a smart city as a governmental solution to enhance the quality of life for Egyptian citizens. Moreover, it will help to predict the challenges that the government of Egypt faces in developing the new administrative capital city as a potential administrative smart city for a long-term initiative governmental plan. You will be asked to complete four sections regarding;

(Smart City - Quality of Life - General - AHP - Demographic)

Your perceptions and beliefs are fully confidential and anonymous.

Your participation should take approximately 30-40 minutes.

Kindly read all the survey sections carefully and respond to all of the questions.

Thanks in advance.

Student Researcher,

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– **Section (1) questions regarding the Smart City:**

Are you working as an official government officer?

A. Yes

B. No

1. Have you heard about the “smart city” term before?

Yes No

2. On a scale from 1 to 5, how would you rate your knowledge of what a smart city is?

(1) Very bad (2) Bad (3) Neutral (4) Good (5) Very good

3. On a scale from 1 to 5, how satisfied are you with the management in the following aspects of your current city?

	Very dissatisfied (1)	Dissatisfied (2)	Neither satisfied nor dissatisfied (3)	Satisfied (4)	Strongly satisfied (5)
Security	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
health services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
public transport	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
parks and public spaces	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
public services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
traffic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
management for governorates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
promotion of physical and mental health care.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. On a scale from 1 to 5, how would you describe the importance of each of the smart city characteristics?

	Not at all important (1)	Slightly important (2)	Moderately important (3)	Very important (4)	Extremely important (5)
Smart Economy includes factors of “innovation, entrepreneurship, productivity, economic situation, participation in international markets, and labor market flexibility”.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Smart People includes factors of “creativity, flexibility, level of qualification, and social participation in public life”.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Smart Governance includes; “participation in decision making, governance transparency, citizens' participation in political strategies, and providing public and social services”.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Smart Mobility includes; “transport systems and information and communication technology (ICT) which play role in providing information, sustainable systems, enhancing the environment”.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Smart Environment includes; “usage of natural resources and maximizes its benefits such as; solar energy, natural water, and	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

wastewater systems through green projects, adding to that, reduce pollution and gas emissions”.					
Smart Living includes; “quality of life for citizens and providing them with the necessary services with high quality for example; health, education, safety, housing, and social solidarity”.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Upon your selections for the above table please specify your priorities for establishing a smart city (choose more than one if necessary).

- Economy Education Energy
- Environment Recreation Safety
- Shelter Solid Waste Urban Planning
- Finance Fire and Emergency Response Governance
- Health Transportation Telecommunications and Innovation
- Wastewater Water and Sanitation
- other, please specify _____

6. On a scale from 1 to 5, can the current construction of the New Administrative Capital allow the government to transform it into a smart city holistically?

- (1) Strongly disagree (2) Disagree (3) Neither agree nor disagree
- (4) Agree (5) Strongly agree

– **Section (2) questions regarding the Quality of Life:**

1. On a scale from 1 to 5 “in general, how satisfied are you with your life”?¹⁰
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
2. On a scale from 1 to 5 “in general, how satisfied are you with the quality of your life”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
3. On a scale from 1 to 5 “in general, how satisfied are you with your health”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
4. On a scale from 1 to 5 “in general, how satisfied are you with the conditions of your living place”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
5. On a scale from 1 to 5 “in general, how satisfied are you with your financial situation”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
6. On a scale from 1 to 5 “in general, how satisfied are you with your ability to perform your daily living activities”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied

¹⁰ WHO, W. H. (1998). *Programme on Mental Health_ WHOQOL User Manual*.

7. On a scale from 1 to 5 “in general, how satisfied are you with your access to health services”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
8. On a scale from 1 to 5 “in general, how satisfied are you with your ability to learn new information”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
9. On a scale from 1 to 5 “in general, how satisfied are you with your opportunities for acquiring new skills”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
10. On a scale from 1 to 5 “in general, how satisfied are you with the way you spend your spare time”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
11. On a scale from 1 to 5 “in general, how satisfied are you with your ability to perform social activities”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied
12. On a scale from 1 to 5 “in general, how satisfied are you with your ability to provide for or support others”?
 - (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
 - (4) Satisfied (5) Strongly satisfied

13. On a scale from 1 to 5 “in general, how satisfied are you with the support you get from friends”?
- (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
(4) Satisfied (5) Strongly satisfied
14. On a scale from 1 to 5 “in general, how satisfied are you with your physical safety and security”?
- (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
(4) Satisfied (5) Strongly satisfied
15. On a scale from 1 to 5 “in general, how satisfied are you with your ability to make decisions”?
- (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
(4) Satisfied (5) Strongly satisfied
16. On a scale from 1 to 5 “in general, how satisfied are you with the climate of the place where you live”?
- (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
(4) Satisfied (5) Strongly satisfied
17. On a scale from 1 to 5 “in general, how satisfied are you with your physical environment (ex. climate, noise, traffic, pollution)”?
- (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
(4) Satisfied (5) Strongly satisfied
18. On a scale from 1 to 5 “in general, how satisfied are you with your transport”?
- (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
(4) Satisfied (5) Strongly satisfied

19. On a scale from 1 to 5 “in general, how satisfied are you with your overall experience of life”?
- (1) Very dissatisfied (2) Dissatisfied (3) Neither satisfied nor dissatisfied
(4) Satisfied (5) Strongly satisfied
20. On a scale from 1 to 5, how would you describe your relationships with others: such as; parents, spouse, children, siblings, other relatives, or friends are:
- (1) Very bad (2) Bad (3) Neutral (4) Good (5) Very good
21. On a scale from 1 to 5 how would you describe your social, community and civic activities related to helping or encouraging others are:
- (1) Very bad (2) Bad (3) Neutral (4) Good (5) Very good
22. On a scale from 1 to 5, how would you describe your personal development and fulfilment: intellectual development, occupational role, creativity, and personal expressions are:
- (1) Very bad (2) Bad (3) Neutral (4) Good (5) Very good
23. On a scale from 1 to 5, how would you describe your recreation: socializing, active, and participatory recreational activities are:
- (1) Very bad (2) Bad (3) Neutral (4) Good (5) Very good
24. On a scale from 1 to 5, how would you describe your independence: the ability to take care of yourself is:
- (1) Very bad (2) Bad (3) Neutral (4) Good (5) Very good

– **Section (3) general questions:**

1. On a scale from 1 to 5, how would you describe that constructing smart cities can play an essential role in improving the citizens' quality of life?

(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree

(4) Agree (5) Strongly agree
2. On a scale from 1 to 5, how would you describe the importance that Egypt should adopt in constructing a smart city?

(1) Not at all important (2) Slightly important (3) Moderately important

(4) Very important (5) Extremely important
3. Which challenges would face Egypt upon developing a smart city?
(choose more than one if necessary).
 - Lack of smart technologies and services obstacles
 - Lack of privacy and security
 - Lack of city management and organizational problems
 - Lack of data accuracy
 - Lack of continuous supply of services
 - Lack of organizational system and capacity
 - Insufficient system for promoting and spreading the smart city
 - The inflexibility of budgeting and business operation
 - Inactive citizen participation
 - Digital divide such as; difficulties accessing smart services from devices
 - Lack of Collaboration

- Weak leadership
 - Lack of communication between Government entities
 - Policy context
 - Economy competitiveness such as; innovation, entrepreneurship, productivity
 - Infrastructure
 - Other please specify _____
4. How can we make the city a better place for citizens' quality of life?
 5. What are the challenges the government would face in developing the new administrative capital city as a potential administrative smart city?
 6. What do you think the government of Egypt should do to develop the new administrative capital city as a potential administrative smart city?

– **Section (4) AHP questions:**

This section aims to assess the degree of importance that government public officials like yourself place on several criteria related to quality of life. Kindly look over each matched item and indicate how significant a single dimension is in contrast to its associated item. The description and examples of each item may be viewed on the right-hand side of the answer box. I hope that these explanations will help you to react to this section.

The following actions will be required for your response:

1. Rate the relevance of the left-hand item in relation to the right-hand item using the left-hand item as a reference.
2. Indicate the degree of importance on the more important side (left or right).

For example; compare the importance of Material living and conditions versus Productive or main activity. If Material living and condition is more significant, mark the box on the **left-hand** side of the scale from 1-9 that corresponds to the level of priority allocated to Material living and condition.

	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Material living and condition			√															Productive or main

Analytic Hierarchy Process (AHP)

Quality of Life dimensions

* Please mark only one box

	9	7	5	3	1	3	5	7	9	
Material living and condition										Productive or main activity
Material living and condition										Education
Material living and condition										Health
Material living and condition										Leisure and social
Material living and condition										Economic and physical safety
Material living and condition										Governance and basic rights
Material living and condition										Natural and living environment
Material living and condition										Overall experience of life
Productive or main activity										Education
Productive or main activity										Health
Productive or main activity										Leisure and social
Productive or main activity										Economic and physical safety
Productive or main activity										Governance and basic rights
Productive or main activity										Natural and living environment
Productive or main activity										Overall experience of life
Education										Health

Education										Leisure and social
Education										Economic and physical safety
Education										Governance and basic rights
Education										Natural and living environment
Education										Overall experience of life
Health										Leisure and social
Health										Economic and physical safety
Health										Governance and basic rights
Health										Natural and living environment
Health										Overall experience of life
Leisure and social										Economic and physical safety
Leisure and social										Governance and basic rights
Leisure and social										Natural and living environment
Leisure and social										Overall experience of life
Economic and physical safety										Governance and basic rights
Economic and physical safety										Natural and living environment
Economic and physical safety										Overall experience of life
Governance and basic rights										Natural and living environment
Governance and basic rights										Overall experience of life
Natural and living environment										Overall experience of life

– **Section (5) Demographic questions:**

1. What is your gender?
 - A. Male
 - B. Female
2. What is your age?
 - A. 24 - 35 years old
 - B. 35 - 45 years old
 - C. 45+
3. What is the highest degree or level of education you have completed?
 - A. Bachelor's Degree
 - B. Master's Degree
 - C. PhD or higher
4. What is your marital status?
 - A. Single
 - B. Married
 - C. Divorced
 - D. Widowed
5. What is your current employment status?
 - A. Employed Full-Time
 - B. Employed Part-Time
 - C. Retired

6. What is your current employer's ministry?

Ministry of _____ (List of Ministries)

7. What is your current position?

List of positions _____

8. How many years of experience do you have?

- A. Less than 1 year
- B. 1-3 years
- C. 4-5 years
- D. 6-10 years
- E. More than 10 years

9. What is your current email address?

국문초록

스마트 시티가 이집트 시민들의 삶의 질 향상에 미치는 영향

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글로벌행정전공

전 세계 정부는 시민들의 삶의 질과 삶의 수준을 향상시키기 위해 새로운 스마트 솔루션을 채택하려고 노력하고 있다. 많은 국가들이 역동적이고 혁신적인 솔루션을 통해 양질의 서비스와 제품을 제공하는 스마트 해결책으로 스마트 시티를 구현했다.

본 연구 논문은 공무원의 인식에서 스마트 솔루션으로서의 스마트시티가 삶의 질을 향상시킬 수 있는 방법과 이집트 정부가 시민의 삶의 질을 향상시킬 수 있는 스마트시티를 개발하기 위해 직면할 수 있는 과제가 무엇인지를 조사하였다. 또한 데이터 중심의 체계적인 접근 방식을 통해 정부의 효율성을 높여 서비스 제공을 개선함으로써 시민들이 보다 효율적이고 쉽게 접근할 수 있도록 한다.

이 연구는 질적 및 양적 접근법을 사용했습니다. 특히 다양한 이집트 부처 공무원 127 명을 대상으로 무작위 표본추출 방식으로 필요한 자료를 수집하기 위한 설문조사를 실시했다. 수집된 데이터를 분석하는 데 사용된 방법은 다중 회귀 분석 및 분석 계층 프로세스(AHP) 모형이었다.

연구 결과는 스마트 시티와 삶의 질 사이에 긍정적인 관계가 있다는 것을 보여준다. 그러나 독립변수로서의 스마트 도시 특성(스마트경제, 스마트피플, 스마트거버넌스, 스마트 모빌리티, 스마트 환경, 스마트 리빙)은 상호 연계된 시스템을 기반으로 하고 스마트 시티를 표현하는 특성이 통합되어 있음을 반영하여 삶의 질에 유의미한 영향을 미치지 않는 것으로 연구결과가 나타났다.

게다가, AHP 결과는 공무원들의 인식에서 소득, 좋은 주택, 교육과 같은 기본적인 필요를 다루는 모든 차원이 시민들의 삶의 질을 달성하기 위해

고려될 만큼 매우 중요하다는 것을 보여준다. 시민들이 업무 시간 외에 여가 시간을 보낼 수 있는 능력을 다루는 여가 및 사회적 상호 작용 차원과 그들을 행복하고 만족스럽게 만드는 사회적 활동이 가장 중요하고 덜 중요한 차원의 중심에 있었다.

공무원들로부터 수집된 자료를 바탕으로 본 연구는 학술 연구에 기여하고 이집트 정부가 이집트 시민들의 삶의 질을 향상시키기 위한 스마트 시티 국가 계획을 시작할 때 고려해야 할 권장 사항을 제안한다.

키워드: 스마트 시티, 지속 가능한 도시, 스마트 시티 장애물, 스마트 시티 과제, 삶의 질, 이집트, 정부

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