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Administration**



**Department of Economics
and Finance**

**Effects of Smart Cities on
Changing Economic Development in Bahrain**

A Thesis Submitted in Partial Fulfilment of the Requirements for the M.Sc.
Degree in Real Estate Development and Property Management

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☐ Without making any changes to the thesis.

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المخلص

الخلفية: أصبحت العديد من البلدان الآن مدناً ذكية من خلال اتخاذ خطوات حاسمة، والتي تشمل تخصيص الموارد وتنفيذ مبادرات وسياسات المدن الذكية لدعم تحول القطاع العقاري. ومع ذلك، على الرغم من التدابير المتنوعة التي اتخذتها حكومة البحرين لتعزيز المدن الذكية وتمكين النمو الاقتصادي، لا تزال هناك ندرة في البيانات فيما يتعلق بوجهات نظر أصحاب المصلحة في قطاع العقارات حول كيفية تحقيق هذا الهدف. **أهداف البحث:** أجريت هذه الدراسة لتحقيق الأهداف التالية: (1) تحديد الآثار الاقتصادية الإيجابية والسلبية المحتملة لتنفيذ مبادرات المدينة الذكية عن طريق العقارات، (2) تحليل الفرص والتحديات المحتملة المرتبطة باستخدام تقنيات المدينة الذكية في البحرين، و (3) تقييم الإمكانيات فرص التنمية الاقتصادية التي يمكن أن تنشأ من استخدام تقنيات المدن الذكية في البحرين. **أساليب العمل:** تم إجراء مقابلة شبه منظمة بين 15 من أصحاب المصلحة من القطاع العقاري في البحرين. ركزت المقابلة في القسم الأول على البنية التحتية الحالية، والعناصر المطلوبة لإنشاء المدن الذكية، وأساليب بناء المدن الذكية، والتأكيد على الدوافع لمبادرات المدن الذكية. وفي الوقت نفسه، أكد القسم الثاني على الفوائد المتوقعة من تطوير المدن الذكية من حيث التنمية المستدامة والتحديات المرتبطة بها. وقد تم تحليل البيانات التي تم الحصول عليها من المقابلة موضوعياً. **النتائج:** كان لدى المشاركين وجهات نظر متنوعة حول الوضع الحالي للبنية التحتية في البحرين. وكانت العناصر الأساسية المطلوبة لتطوير المدن الذكية هي التعاون مع المدن الذكية الدولية ورأس المال البشري والموارد البشرية ومصادر الطاقة البديلة. واعتبرت زيادة نوعية حياة المواطنين، والنمو السكاني المتسارع، وضمان الأنشطة الصديقة للبيئة، والتصدي لتغير المناخ والاحتباس الحراري وتحقيق التنمية المستدامة، الدوافع السائدة لمبادرات المدن الذكية في البحرين. وفي الوقت نفسه، تم ذكر تحسين جودة الحياة، والاستثمار المتنوع، والاستدامة البيئية، وتحسين البنية الأمنية، وصناعة السياحة والضيافة القوية باعتبارها الفوائد المتوقعة، في حين أن التحديات المحتملة هي الأمن السيبراني، والقبول العام أو انخفاض الوعي، وارتفاع التكلفة وقبوض التمويل، وعدم كفاية الموارد البشرية، ومتطلبات البنية التحتية. **الاستنتاج:** قد يفكر صناع السياسات والسلطات المعنية المشاركة في مبادرات المدن الذكية في البحرين في تقديم حلول مبتكرة للأمن السيبراني، ومعالجة القبول العام والوعي بالمدن الذكية، وجذب الاستثمار الأجنبي لتمويل صناعة العقارات، وبناء رأس مال بشري كفؤ وفعال. إن إعطاء الأولوية لهذه المجالات وقد يسهل عملية تحويل المدن الذكية المحتملة في البحرين و يدفعها نحو تحقيق التنمية المستدامة.

Abstract

Background: Several countries are now becoming smart cities by taking decisive steps, which include allocating resources, implementing smart city initiatives and policies to support the transformation of the real estate sector. However, despite the diverse measures by the Bahrain government to promote smart cities and enable economic growth, there is still data paucity regarding stakeholders' perspectives in the real estate industry on how the goal could be achieved. **Research Objectives:** This study was conducted to achieve the following objectives; (1) identify the potential positive and negative economic impacts of the implementation of smart city initiatives by real estate, (2) analyse the potential opportunities and challenges associated with the use of Smart City technologies in Bahrain, and to (3) assess the potential economic development opportunities that could arise from the use of Smart City technologies in Bahrain. **Methods:** A semi-structured interview was conducted among 15 stakeholders from Bahrain's real estate sector. The first section interview focused on the present infrastructure, elements required for smart city establishment, approaches to building smart cities, and underlining drivers for smart city initiatives. Meanwhile, the second section emphasised the expected benefits of smart city development in terms of sustainable development and the associated challenges. Data obtained from the interview were analysed thematically. **Results:** Participants had diverse perspectives on the current state of infrastructure in Bahrain. The key elements required for smart city development were collaboration with international smart cities, human capital and human resources, and alternative energy sources. Increasing citizens' quality of life (QOL), exponential population growth, ensuring environmentally friendly activities, addressing climate change and global warming and achieving sustainable development were considered the predominant motives for smart city initiatives in Bahrain. Meanwhile, improved QOL, diversified investment, environmental sustainability, improved security architecture and robust tourism and hospitality industry were mentioned as the expected benefits, whereas the potential challenges were cybersecurity, public acceptance or low awareness, high cost and financing constraints, insufficient human resources, and infrastructural requirements. **Conclusion:** Policymakers and relevant authorities involved in Bahrain's smart city initiatives may consider providing innovative solutions to cybersecurity, addressing public acceptance and awareness about smart cities, attracting foreign investment to finance the real estate industry, and building competent and effective human capital. Prioritising these areas may facilitate the transformation of Bahrain's potential smart cities and drive towards attaining sustainable development.

Publications

A. Jreisat, M. R. Ayoob, "Smart Cities and Economic Development in Bahrain," *2023 7th IET Smart Cities Symposium*, Sakheer, Bahrain, 2023.

Dedication

The first person to whom I dedicate this work is His Majesty King Hamad bin Isa Al Khalifa, the patron of urban renaissance and sustainable development in the beloved Kingdom of Bahrain, and to His Royal Highness Prince Salman bin Hamad Al Khalifa, Crown Prince and Prime Minister, the main supporter of sustainable development in the country and the seeker of modern urban construction in various parts of the country.

It is also a pleasure to dedicate this work to all members of my honourable family, to all respected faculty members and dear friends who spared no effort in supporting and encouraging me to complete the study requirements in the best way.

I do not forget to dedicate this work also to those working in the real estate and construction sector who have worked hard to develop the sector and upgrade the practices to reach the level of advanced smart cities.

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The support provided by all my colleagues at the postgraduate level is not forgotten, working as a team and encouraging each other made this academic journey a fruitful one. I also extend my sincere thanks to all respondents in the real estate sector who participated in this study.

Author's Declaration

Mohamad Rajab Mansoor Ayoob, UOB ID#20042033 hereby states that my Master thesis entitled **Effects of Smart Cities on Changing Economic Development in Bahrain** is my work and has not been submitted previously by me or anyone else for taking any degree from University of Bahrain Or anywhere else in the country/world. At any time if my statement is found to be incorrect even after awarding the thesis, the University has the right to withdraw my Master degree.

Name of Student: Mohamad Rajab Mansoor Ayoob

Signature: _____ 

Date: _____

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List of Abbreviations

AI	Artificial Intelligence
ISA	Infrastructure System Authority
ICT	Information and Communication Technology
IOT	Internet of things
QOL	Quality of Life
TRA	Telecommunication Regulatory Authority
BDB	Bahrain Development Bank
GCC	Gulf Cooperation Council
SDG	Sustainable Development Goals
ISO	Organisation for Standardisation

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Chapter One

Introduction to the study

1.1 Overview

This chapter presents the research background, which entails the overview of smart city development in Bahrain, present economic state, and the potential link to sustainable development. Subsequently, the problem statement highlights the research gaps in the literature warranting the need to conduct this study, followed by the research objectives and research questions. The fifth sections focus on the significance of the study and the last section discusses the structure of the thesis.

1.2 Background of the study

A city refers to a human settlement with well-demarcated points, comprising infrastructures such as utility services, sewage and water treatment plants, police stations, fire departments, schools, business, houses and so on. Meanwhile, a smart city is an urban vision that enhances the engagement and technological integration of citizens with the city's infrastructure. Smart cities are built with the aim of improving quality of life (QOL) by employing technology to meet residents' needs and enhance the efficiency of services. Smart cities are also known to facilitate new “eco-friendly” job opportunities and working conditions (Kim, 2018). Technology continues to drive the interaction between city official, the community, and infrastructure of the city.

Smart city is widely described as a modern advanced urban settlement in which Information and Communication Technology (ICT) and other related technologies are used to enhance the QOL, competitiveness, and operational efficiency of services, as well as ensuring the availability of resources for the present and future generations (Bake et al., 2013). As an urban environment, smart cities employ ICT to improve the performance and efficiency of daily operations and quality of services offered by the population (Bake et al., 2013). Harrison et al. (2010) also opines that smart city connects social, physical, business, and ICT infrastructure in order to boost city intelligence.

Real-time data and information are gathered from citizens using real-time control systems and sensors (Poslad et al., 2015). The gleaned knowledge and information are the core ingredients required in addressing efficiency, thereby leading to optimisation of systems. Smart cities provide technological solutions to elucidate the current events in the city, city dynamics, and strategies to enhance QOL.

On the other hand, economic growth and economic development are interrelated (Nafziger, 2012). Economic development aims to reduce the rate of unemployment and poverty while increasing income and better QOL among the citizens of a country. These events pave way for sustainable economic development. However, the challenges to sustainable economic development and provision of basic community services are exacerbated as urban populations increase.

Urbanisation reflects the surge in populations in towns and cities. Urbanisation has grown exponentially ever since the industrial revolution, with approximately hundreds of thousands new housings being built daily. According to the United Nations (2020), there are at least one million new

people migrate into cities daily worldwide. It is expected that 6 billion people will be living in cities by 2050. Presently, America is among the most urbanised region globally as more than 80% of the population are living in urban areas (United Nations, 2020).

With increasing city urbanisation, cities officials and relevant bodies are expected to boost economic development and improve access to housing, education, job creation, healthcare, and other social and community services. Nevertheless, a lack of proper planning and rapid urbanisation rate may affect effective planning and execution of strategies to address the issues. Several countries and cities are facing diverse challenges such as low economic development, high unemployment rate, poverty, traffic congestion, poor water supply, high crime rates, environmental hazards debilitated infrastructure, and slow bureaucratic city systems.

Technology is vital aspect of smart cities, and the interplay of numerous innovations such as IOT, smartphones, mobile internet access, data analytics, and open data initiatives create rooms for collaboration between citizens in providing efficient services, irrespective of government and local bodies while opening relevant research opportunities. Despite the significance of technology in building smart cities, the success stories as evident in cities like Barcelona, Amsterdam, and New York are equally linked to appropriate blend of policy innovation, collaborations and effective leadership. Hence, defining appropriate policies and citizenry engagement are key to successful smart city initiatives and to facilitate economic growth and promote inclusive and transparent new digital citizenship.

The emergence of smart cities is projected to drive sustainable development (Viitanen and Kingston, 2014). Most European and North American countries hold this view, whereby their techno-centric smart city vision in advancing industrial-policy discourses are mainly entrepreneurial and digital. Typically, the vision encompasses digitally optimized and ultra-efficient infrastructure, increased population of highly-educated people, and affluent workers-consumers; which is expected to propel global economic growth and competitiveness.

Thus, smart cities are now seen as places where digital technologies are deployed to address previously intractable environmental and social problems, such as climate change and social exclusion (de Jong et al., 2015). As a result, “the concept of smart city has evolved rapidly to prominence within the discourse of urban development – currently becoming the leading driver of urban sustainability and regeneration initiatives” (de Jong et al., 2015: pp 12). Given the speculative estimates that the global smart cities will worth around 1.56 trillion dollars by 2020 (Frost and Sullivan, 2014), private companies and municipalities are allocating significant resources to implement smart city initiatives in order to promote citizen participation, urban growth and decarbonisation.

Nonetheless, the link between smart cities and economic growth and development is faced with diverse challenges. These constraints are experiences throughout the design, implementation and operation phases. The major challenges include high cost of designing and operating the infrastructure, heterogeneity among devices, information security, enormous data collection and analyses, and sustainability. Realistic smart city implementation requires high design and operational cost. Likewise, the presence of multiple sensors, vendors, devices and appliances contribute to the heterogeneity of smart city architectures, thus failure to

integrate all these aspects and application layers may affect the realisation of smart city notion. Other researchers have highlighted the challenge of preserving city resources and environment for future generations by efficient allocation and usage of resources and minimising carbon footprints (Fernandez and Peek, 2020).

Aligning with other countries that have successfully implemented smart cities, the smart city concept is equally seen as a key driver for economic growth in Bahrain. Bahrain, a city of around 1.3 million people, has embarked on an ambitious plan to become a smart city by 2030. Bahrain is working on an economic recovery plan, which includes the expansion of its land mass by building new cities and the creation of smart and ecologically sustainable real estate developments is encouraged by the Kingdom's National Real Estate Plan 2021–2024 (Mohamed, 2021). Specifically, the features in the Real Estate Plan include communal elevators, centralized cooling systems, and catastrophe avoidance equipment. Other vital features comprise communal commitment, economic constancy, occupational orienteers, data-drivenness, eco-friendly openness, and energy efficiency.

The Kingdom of Bahrain has adopted advanced ICTs to drive sustainability, economic viability and enhance citizens' wellbeing, moving it towards the development of Smart Cities. The Telecommunication Regulatory Authority (TRA) has implemented a variety of Smart City measures, such as the Smart Traffic Light System, which combines traditional traffic lights with the use of sensors and AI technologies to regulate vehicle and pedestrian traffic. The Electricity and Water Authority is encouraging the adoption of solar energy, offering affordable loans to install full solar energy systems. The 3rd Smart Cities Symposium held by the University of Bahrain in 2020 aimed to raise awareness of Smart City

prospects and offered a platform to exchange ideas. Additionally, Bahrain has committed to developing its national talent pool, with universities and Tamkeen providing development programs and the Bahrain Development Bank (BDB) offering a range of funding programs. A significant development in this area was the Al Waha Fund of Funds established in 2018, which seeks to invest in Venture Capital funds that have a strategic interest in the MENA region.

The development of smart cities in Bahrain is part of the country's efforts to become a leading regional hub for business, finance, and tourism. The Bahraini government has allocated over \$2 billion to develop smart infrastructure and services in the country (Al Khalifa, 2019). The goal is to transform Bahrain into a model for other Gulf Cooperation Council (GCC) countries to emulate. The government aims to achieve this goal by working with the private and academia to develop a comprehensive plan using the latest technologies and international best practices. The programme focuses on developing smart transportation, healthcare, education, energy, security, and governance systems. Recent studies also advocated for smart city development in order to improve Bahrain's economic growth and reducing urban problems (ElMotasem and Khodeir, 2021).

Despite the diverse measures taken by the Bahrain government to promote smart cities and enable economic growth, there is data paucity regarding the perspectives of key stakeholders on how the goal could be achieved. Stakeholders and policy makers are crucial players in developing appropriate smart city development plan, and their opinions may assist in addressing the challenges in implementing smart cities in Bahrain's context. Factors involving stakeholders such as policy innovation, collaborations and effective leadership were pertinent in the successful development of smart cities in European countries. Therefore, this study

aims to investigate how smart cities could facilitate sustainable economic development in Bahrain from the stakeholders' perspectives.

1.3 Problem Statement

Bahrain is experiencing a rising urbanisation rate as a high percentage of the population are now living in towns and cities. Given the deleterious impacts of urbanisation on the environment and the different technological advancement, smart and sustainable urbanism are widely discussed topics internationally.

A similar scenario is faced in the Kingdom of Bahrain as the rapid growth of population and the need for economic development has heightened the government and policymakers' efforts to improve the city's infrastructure and thread the path of smart city implementation. In this context, the smart city concept has emerged as a means to enhance the quality of life of citizens. This plan is embedded in the Kingdom's National Real Estate Plan 2021-2024 to expand its land mass by building new cities and creating smart and ecologically sustainable real estate (Al Khalifa, 2019).

Research contributions from the academia is considered a vital part of realising Bahrain's recovery plan and enabling the development of sustainable real estate and smart city. Recent studies conducted in Bahrain have highlighted the damaging effects of urbanisation on the environment such as traffic congestion, pressure on healthcare systems and city's infrastructure, thus advocating for sustainable and smart urbanism (Al Khalifa et al., 2019). Incorporating sustainable smart urbanism indicators to the Bahraini Government Plan of Action was recommended to enhance the nation's response to global SDGs, particularly by employing domain-

based indicator framework (Al Khalifa et al., 2019). Samad and Azar (2019) also presented a National Smart City Framework for Bahrain by assessing international standards and collaborating with the key stakeholders to identify the main components and aligning the framework with the national strategic plan. A recent study also looked at the factors influencing the adoption of electric vehicles in the country, which is an essential aspect of smart city transportation (AbdulRahman Shareeda et al., 2021).

Despite the extensive studies relating to smart cities and diverse measures taken by the Bahrain government to promote smart cities and enable economic growth, there is data paucity regarding the perspectives of key stakeholders on how the goal could be achieved. Stakeholders are one of the crucial players in developing appropriate smart city development plan, and their opinions may assist in addressing the challenges in implementing smart cities in Bahrain's context. Factors involving stakeholders such as policy innovation, collaborations and effective leadership were pertinent in the successful development of smart cities in European and several projects and activities in the Gulf Region such as Masdar in Abu Dhabi, "Lusail" in Qatar, and Dubai Smart City (Tok et al., 2014; Samad and Azar, 2019). In order to bridge this research gap, this study aims to investigate how smart cities could facilitate sustainable economic development in Bahrain from the stakeholders' perspectives.

1.4 Objectives of the Study

1. To investigate the impacts of Smart City initiatives on economic development in Bahrain.
2. To analyse the potential opportunities and challenges associated with the use of Smart City technologies in Bahrain.

3. To explore expansion how sustainable development challenges can be addressed through its implementation.

1.5 Research Questions

1. What is the effect of smart city initiatives on economic development in Bahrain?
2. What are the potential benefits and challenges of integrating smart buildings and technologies in smart cities into the real estate development cycle?
3. How does the implementation of real estate smart cities contribute to urban expansion and enhance the quality of life in Bahrain and address the difficulties of sustainable development in Bahrain?

1.6 Significance of the study

The significance of this study is mainly linked to three broad areas: (1) current body of knowledge on smart city development in Bahrain's context (2) policymakers and stakeholders (3) Achieving Bahrain's economic recovery plan and Real Estate Plan. First, the findings from this study will assist in addressing the research gap regarding stakeholders' perspectives on the relationship between smart city implementation and economic growth, as well as strategies to address the challenges faced in achieving sustainable smart cities. In addition, the research findings will create more opportunities for further research in future in the area of smart city initiatives. Secondly, comprehensive information and evidence-based data are required in the decision-making process and strategic planning towards building a smart city. Stakeholders and policy makers are crucial players in developing appropriate smart city development plan, and their opinions may assist in addressing the challenges in implementing smart

cities in Bahrain's context. Factors involving stakeholders such as policy innovation, collaborations and effective leadership were pertinent in the successful development of smart cities globally. The findings from this research may provide key information needed to achieve the aforementioned objectives. Thirdly, this research aligns with the Bahrain Economic Vision 2030, economic recovery plan, and Real Estate Action plan, which emphasises the development of smart cities, integration of smart cities into Real Estate development cycle, and propelling the Kingdom to sustainable economic growth and development. The findings may have a wide range of applications for crucial features in urban cities such as roads and buildings connecting people and the metropolis, provision of efficient road network, railroads, traffic signal technology, security network, power distribution scheme bridges, office buildings and so on.

1.7 Structure of the Thesis

This thesis comprises five chapters. The first chapter presents the overview of the research, problem statement, research objectives, research questions, and significance of the study. Meanwhile, the second chapter is a detailed literature review of both local and international studies relating to smart cities and sustainable development. In the third chapter, the research method which entails semi-structured interview and information on the study sites, study population, sampling, development of research instrument, and data collection process were described. The fourth chapter focuses on the findings gleaned from the thematic analysis and discussions in relation to Bahrain's context. The final chapter summarises the findings, conclusions drawn from the study, limitations and recommendations for future work.

1.8 Summary

This chapter has presented the research background, which covers smart city construction in Bahrain and steps taken by the government to enable smart city development. Nevertheless, the dearth of information, particularly from the real estate stakeholders regarding potential opportunities offered by smart city initiatives and challenges for a successful implementation require further investigation. This chapter also outlined the research objective, research questions rationale for conducting this study. The next chapter provides detailed literature review of studies relevant to the present research topic.

Chapter Two

Literature Review

2.1 Introduction

This chapter entails a detailed review of literature on smart cities and the relationship with economic growth and sustainable development. There are seventh major sections in this chapter. The first section presents the widely accepted definitions, overview and characteristics of smart cities. Next, the challenges inherent in smart cities development were discussed based on the findings reported in studies conducted in developed countries. The third section focuses on economic development and use of innovative technologies, followed by the link between smart cities with economic growth. The fifth section highlight the smart city polices. More over the sixth section discusses smart city and real estate development in Bahrain, The last section presents the overview of smart city initiatives in Bahrain and literature findings from studies conducted locally in order to identify the present research gaps.

2.2 Definitions of Smart Cities

Smart city is widely described as a modern advanced urban settlement in which ICT and other related technologies are used to enhance the QOL, competitiveness, and operational efficiency of services, as well as ensuring the availability of resources for the present and future generations (Kondepudi et al., 2014). Smart city is also defined as a provision that bridges social, business, physical and ICT infrastructure to enhance city intelligence (Harrison et al., 2010).

Despite the lack of consensus on the definition of ‘smart city’, most scholars posit that the use of ICT remains a core feature of a smart city (Komninos and Mora, 2018; Tan Yigit Canlar et al., 2018). Urban management can be more efficient and effective by using ICT-embedded urban systems comprising sensors, digital knowledge-sharing platform and real-time monitoring (Komninos and Mora, 2018). A smart city also highlights the presence of high-quality social and human capital, including the significance of smart governance (Lopes, 2017; Scholl and AlAwadhi, 2016). Overall, most scholars consider a smart city as an innovative urban development aimed at providing high QOL and sustainable development (Toppeta, 2010; Fernandez and Peek, 2020).

The term ‘smart city’ is preferred in terms of urbanism models compared to other related terms such as information city, telicity, and digital city. Smart city reflects an abstraction of all other digital urbanisation models. According to the International Organisation for Standardisation (ISO), smart city goes beyond incorporating ICT to execute the day-to-day operations of a city, by ensuring the quality, safety, and performance of inhabitants in a given advanced urban settlement (British Standards Institution, 2014).

Most smart city models comprised four broad attributes: QOL, sustainability, smartness and urbanisation (Mohanty et al., 2016). While the urbanisation attribute focuses on the infrastructural, economic, and technological aspects of converting a rural to an urban settlement, smartness describes the goal of improving social, environmental and economic standards of the city and its inhabitants.

In generic terms, smart city is an urban environment that utilizes ICT and other related technologies to enhance performance efficiency of

regular city operations and quality of services (QoS) provided to urban citizens. In formal terms, experts have defined smart city considering various aspects and perspectives. A popular definition states that a smart city connects physical, social, business, and ICT infrastructure to uplift the intelligence of the city (Harrison et al., 2010). In another comprehensive definition, smart city is defined as an advanced modern city that utilizes ICT and other technologies to improve quality of life (QoL), competitiveness, operational efficacy of urban services, while ensuring the resource availability for present and future generations in terms of social, economic, and environmental aspects (Kondepudi, 2014).

2.3 General Overview of Smart Cities

Smart cities are at the interface between technological and social dimensions. Nevertheless, the technological dimension has dominated the discussion on smart cities given the initial leading role played by corporate bodies such as CISCO, IBM, Intel and more recently Amazon, Oracle, Microsoft, and GE. Developing cloud based platforms and ways to address smart city projects are the main focus of these initiatives. Technology has played a significant role in enabling new production, distribution and governance, and the information of individual behaviours and choices (Ferro et al., 2013). These issues have been technically highlighted in several previous studies on IT initiatives and projects such as vital success factors or main challenges (Vasseur, 2010), thus creating a wide area of research and debate regarding the role of technology, its significance, benefits, and issues in an environment that is expected to be human-centric.

Technology is vital aspect of smart cities, and the interplay of numerous innovations such as IOT, smartphones, mobile internet access, data analytics, and open data initiatives create rooms for collaboration

between citizens in providing efficient services, irrespective of government and local bodies while opening relevant research opportunities.

Despite the significance of technology in building smart cities, the success stories as evident in cities like Barcelona and Amsterdam are also linked to appropriate blend of policy innovation, collaborations and effective leadership (Fernandez and Peek, 2020; Razmjoo et al., 2022). Hence, defining appropriate policies and citizenry engagement are key to successful smart city initiatives and to facilitate economic growth and promote inclusive and transparent new digital citizenship.

The main goal of initial smart cities is to improve urban citizens' QOL and reducing the gap between supply and demand in various functionalities (Zanella et al., 2014). In order to accommodate QOL demands, most modern smart cities focus on efficient and sustainable solutions for transportation, energy management, healthcare governance and so on, to meet the excess necessities of urbanisation (Ejaz et al., 2017).

2.3.1 Characteristics of a smart city

Smart cities comprise multiple attributes. Saruja et al. (2017) highlighted that four main attributes make up a smart city namely sustainability, QOL, urbanisation, and smartness (Mohanty et al., 2016). However, there are a few sub attributes under each of the aforementioned attributes. For instance, sustainability comprises infrastructure and governance, energy and climate change, waste and pollution, social issues, economics, and healthcare. Sustainability refers to the ability of a city to maintain equilibrium in the ecosystem in all the sub attributes while executing city operations. Meanwhile, improvement in QOL is reflected by emotional and financial well-being of urban citizens.

On the other hand, urbanisation attribute emphasises economical, technological, governance, and infrastructural aspects of transforming from rural to urban settlement. Smartness refers to the desire to enhance economic, social, and environmental standards of the city and its inhabitants.

The concept of sustainability has been considered as a core paradigm in urbanisation. In fact, remarkable emphasis on sustainability played a pivotal role in emerging smart cities (Wheeler and Beatly, 2014). According to the triple bottom line concept, the sub attributes of sustainability are interdependent, and natural resources are being utilized in modern smart cities to enable sustainable development. Therefore, it is pertinent to consider to scarcity of non-renewable energy sources. Researchers have also highlighted the need to safeguard natural heritages and energy sources in maintaining sustainability of smart cities (De Jong et al., 2015).

Smart cities are aimed at improving citizens' level of QOL by providing innovative solutions, thereby reducing social learning and participation barriers. Skilled citizens are recognised and employed by introducing well-defined social policies. Thus, the quality of service provided by smart cities is upgraded while enhancing skilled employees' QOL and financial state. These events are reflected in various cities such as Yokohama in Japan and Chicago in the USA (Sasaki, 2010; Oakley and Tsao, 2007).

Smart cities is perceived by the modern world as the new urban utopias (Datta, 2015). According to experts, a smart city presents the ideal solution to tackle the challenges arising from rapid urbanisation. Examples of the main problems of urbanisation are traffic congestion, ageing

infrastructure, waste management issues, air pollution, resource scarcity, and adverse human health effects.

2.3.2 Components of a smart city

Smart community, smart transportation, smart healthcare and smart energy are some of the key components of smart cities. Nevertheless, the composition of smart cities may differ from one smart city to another depending on several factors and context. For instance, a specific smart city might include a disaster management system while others may consider integrating a waste management system. A few components of smart cities are discussed in the following sub-sections.

2.3.2.1 Smart community

Smart community aims to improve urban citizens' satisfaction and well-being. Thus, smart community aggregates several smart buildings, waste management systems and water management systems. Smart homes and business infrastructure such as schools, offices, warehouses, and factories make up smart buildings. Smart community is linked with diverse components to maximise the advantages and benefits of smart cities.

In addition, generic smart buildings include smart appliances, sensors and dedicated hardware and software. In terms of energy management, green buildings and smart building have common motive and goals. Moreover, green buildings emphasises the optimisation of energy consumption and diminishing carbon footprint (Eichholtz and Quigley, 2010). Nonetheless, a distinct strategy to improve energy efficiency is employed in energy management of smart buildings, whereby smart buildings are connected with natural energy plants and smart grids through an existing network.

Apart for energy efficiency, smart buildings are also connected to other components for security management, automated operations, surveillance and lighting control. The knowledge gained by utilising available networks also enable smart buildings to improve the quality of services provided to inhabitants. As a result, integrating smart buildings in a smart community has a significant impact on smart city operations. For instance, energy consumption lighting control, home appliances, and surveillance are controlled in a smart home, thus offering high quality services to inhabitants (Khan et al., 2017; Khan et al., 2016). Stakeholders of the community benefit from the increased productivity in supply chain management, which is facilitated by smart warehouses (Jabbar et al., 2016).

In addition, the inclusion of smart waste management in smart community is considered important in the modern world. Rapid urbanisation and industrialisation has elicited exponential increase in waste generation. Smart waste management advocates for effective management of waste generation by inhabitants, public city services, and private offices (Neirotti et al., 2014). The four major stages of waste management operation are collection, disposal, recycling and recovery. Waste management is vital for smart city sustainability as human health and environment could be severely affected if waste disposal is poorly managed (Sharholy et al., 2008).

2.3.2.2 Smart transportation

Conventional transportation systems have been revolutionised into inter-connected modern networks based on the concept and need for connecting everyday objects (Fernandez and Peek, 2020). Hence, diverse communication and navigation systems are embedded in modern

transportation mediums. Global transportation system is also facilitated by the inter-connection between disparate transport mediums.

For instance, the notion of intelligent transportation systems has contributed significant to ad hoc networks (VANET) (Naumov et al., 2006). This technology are now widely employed in managing traffic congestion via vehicle-to-vehicle and vehicle-to-infrastructure communications. As a result of real-time communication, transport systems are capable of efficient operation based on real-time data and monitoring. Smart transportation systems also provide real-time information to passengers on the level of congestion in streets, alternative transport mediums and routes (Mohanty et al., 2016). Overall, cities are enabled to achieve operational efficiency following the integration of smart transportation systems into smart cities while ensuring time, reliability, cost, and safety of city transportation are optimised.

Hwang and Seah (2008) proposed a conflict detection algorithm for next generation air transportation to predict and prevent traffic accidents via effect aircraft data exchange. Meanwhile, other researchers proposed a rail traffic management system to enhance fuel consumption and punctuality while preventing disputes by providing real-time guidelines regarding travelling speed (Mazzarello and Ottaviani, 2007). Road traffic management and safety have also been extensively studied recently. Additionally, RFID enabled toll collection, passport control at airports, parking management, tracking and renting through mobile apps are examples of novel transportation applications. Urban citizens' QOL could be improved by integrating these new transportation systems and ensuring smart city sustainability.

2.3.2.3 Smart Healthcare

The modern world is faced with exponential population growth rate, and traditional medical practices are not sufficient to cater for global healthcare demands. This situation is further exacerbated by the disproportionate number of medical practitioners relative to the increasing global population. As a result, the risk of wrong medication prescription, wrong diagnoses, administration of inappropriate therapy, and misinterpretation of infections and epidemic diseases may increase. Smart healthcare system is a paradigm shift introduced to reduce the gap between healthcare supply and demand, while preserving accuracy, efficiency and sustainability.

Smart healthcare describes the convergence between complex medical intervention approaches (i.e., wearable devices, medical equipment, sensors, ICT, and emergency services) and conventional medical practices. ICT, sensor network, fog and cloud computing, smartphone apps, and strong data-processing mechanisms are used by modern intelligent healthcare services in order to meet the demands and improve the quality of services (Catarinucci et al., 2015; Stantchev, Barnawi, Ghulam, Schubert, & Tamm, 2015).

Smart healthcare services enable the transfer and access of authorised users to sensitive patient data via secured hospital network system. This function allow doctors, laboratory technicians, and nurses to perform real-time decision in managing patients' condition. In this regard, Luca et al. (2015) proposed an IoT healthcare system capable of monitoring and tracking medical practitioners, patients and biomedical devices automatically (Catarinucci et al., 2015). Demirkan (2013) proposed a smart healthcare network, which conceptualises data-driven

mobile and smart healthcare system supported by cloud computing. A new concept of context-aware mobile healthcare in smart cities was also proposed by Solanas et al. (2014). A significant breakthrough in global realisation of smart city is expected by integrated smart healthcare into smart cities.

2.3.2.4 Smart Energy

Energy is essential to perform any form of operation. Energy sources can either be renewable such as solar, wind and geo-thermal or non-renewable like fossil fuel. Renewable energy sources are naturally regenerated, thus they are widely available and do not deplete upon consumption. The concepts of smart energy, green energy, and sustainable energy have been promoted in the last few decades (Lund et al., 2014; Chu and Majumdar, 2012) in order to increase public awareness and encourage energy consumption best practices.

Green energy aims to minimise environmental impact while consuming energy, whereas the main goal of sustainable energy is to preserve non-renewable energy sources for the present and future generations. On the other hand, smart energy concept is more widely acceptable and appealing as it encourages a holistic strategy that integrates sustainable, renewable and green energies. In other words, smart energy aims to meet energy demands by employing renewable energy sources to ensure the sustainability of non-renewable energy sources, while reducing the deleterious environmental impacts such as reduction in carbon footprint.

In line with the increasing global energy demands and awareness of renewable energies in the last decade, several studies were conducted to

integrate renewable energy sources into smart buildings. This entailed either integrating renewable energy plants with smart grids or attaching renewable energy sources to smart buildings. For instance, Kanchev et al. (2011) proposed an energy management system for a micro grid which incorporates storage units and advanced photo voltaic. Likewise, Han et al. (2014) proposed a similar architecture, which uses wind and solar energy in a home environment. A home-energy management algorithms that focuses on user comfort level was proposed by Boynuegri et al. (2013) while introducing renewable energy sources. Furthermore, numerous studies have been undertaken to attain efficient energy management in smart environments. Son et al. (2010) used power line communication to develop a home energy management system to optimise power consumption and enable intelligent control of home appliances. A demand response analysis based intelligent algorithm for home energy management system was also proposed by Pipattanasomporn et al. (2012) designed specifically for high-energy demanding household appliances.

2.4 Challenges faced in smart cities

Despite the extensive acceptance of smart city concept and its practical implementation in real world, addressing existing challenges in certain areas is crucial for further improvement. This section of the literature review presents the challenges and prospects for realistic achievement of smart cities. These problems were identified via a comprehensive review of existing literature on smart city studies. Likewise, the prospects were gleaned through stakeholders' perspectives and findings from smart city research.

The challenges faced in the actual implementation of smart cities occur during the design, implementation and operation phases. The major

challenges include high cost of designing and operating the infrastructure, heterogeneity among devices, information security, enormous data collection and analyses, and sustainability. Realistic smart city implementation requires high design and operational cost. While design cost refers to the financial capital required to deploy a smart city, operational costs are incurred due to everyday city operations and maintenance tasks. The probability of real-world implementation increases as the design cost decreases. In order to assure the sustainability of providing services without addition financial burden, minimal operational costs are highly demanded. Nevertheless, it is challenging to optimise cost all through the lifetime of a smart city.

Heterogeneity is another major concern in smart city designs and architectures. The presence of multiple sensors, vendors, devices and appliances contribute to the heterogeneity of smart city architectures, thus failure to integrate all these aspects and application layers may affect the realisation of smart city notion. Despite enabling universal access remains a challenging task, smart cities emphasis designing, identifying and procuring software and hardware to facilitate aggregation of the aforementioned heterogeneous systems. Notwithstanding the additional expenditure incurred in terms of design and maintenance, information and infrastructure security are highly enforced in smart cities.

Extensive and variety of data are collected in an urban network ranging from highly sensitive citizen data to organisation data, which could be vulnerable to various security breaches such as cross-site scripting, side channels and data leakages (Papadimitriou & Garcia-Molina, 2011; Vogt et al., 2007). Thus, data privacy is considered a crucial feature in all smart cities. Citizens interact and communicate with key smart city services using their smart phones and other smart gadgets. Therefore, the management of

privacy issues such as eavesdropping becomes pertinent. Nevertheless, ensuring the safety of citizens' data and maintaining security measures remain a highly challenging task.

Smart cities are also concerned about preserving city resources and environment for future generations by using resources efficiently and reducing carbon footprints. To achieve this, renewable energy sources is now a main focus to ensure the sustainability of daily city operations. Environmental pollution and land filling also contribute to the issues arising in smart cities, particularly in terms of waste management. According to ARUP (2016), smart waste management aims to expedite collection and separation processes. The main issues to be tackled for successful waste management systems are the scarcity of resources and population growth.

Finally, all smart city development project are concerned about failure management. Failures may stem from natural disasters such as earthquakes, floods etc., as well as system failures as seen in infrastructure breakdown and unavailability of network. In this context, sustainability entails prompt recovery approaches to address a failure and return city operations to normalcy. Nevertheless, both design and operation costs are expected to increase when identifying and implementing recovery and fault resistant strategies. Thus, the main challenge is minimise cost and increase operational efficiency while attempting to implement failure recovery mechanisms.

2.5 Economic Development and Technology

Government's incentives, dedications, leadership and vision are required for economic development (Liu et al., 2016). While economic

growth depicts an increase in gross domestic product (GDP), economic development refers to sustainable economic growth and improved standard of living among the population (Nafziger, 2012). The macroeconomic goals of economic development is to create jobs, reduce unemployment, increase income, and lower poverty and crime rate, thereby building a strong economic and enhanced QOL. On the other hand, smart economic development increases efficiency and reduces cost by leveraging technology. Likewise, the vision, leadership, and incentives of the government are strongly required. For instance, the connection between citizens and business can be achieved by using public WIFI to support business activities (Nafziger, 2012).

One of the important steps in achieving smart economic development is community planning – a strategic process of developing innovative solutions to protect and preserve the community's assets and address the community problems and challenges. Community planning aims to build a community-based sustainable food system, create conservation strategies, manage water resources, and diversify economic opportunities (Nafziger, 2012).

Historically, cities are referred to as the “centre of economic power” – local and international levels, basically given their “economics of scale” (Dillon, 2010). According to McKinsey Global Institute (2012), a whopping sum of 30 trillion USD could be injected into the global economy by growing cities by 2025. Vardy (2016) opined that rather than focusing on countries, cities should be looked into for global economic impact. Likewise, Richard Florida (2017) reported that cities contribute approximately 90% of total economic output and job opportunities in the United States. Five indicators namely financial strength, economic clout, QOL, equity and global competitiveness were used by the researchers to

develop an economic power index to measure global impact. As at 2015, the top six economically powerful cities were New York, London, Tokyo, Hong Kong, Paris, and Singapore.

2.6 Link between smart city and economic growth

Accumulated findings from the literature presents two ways in which smart cities impact economic green growth. First, the construction of smart city has specific enhancing effect on economic growth (Andrea and Chiara 2018; Shen et al. 2018). Smart cities is a concept that essentially denotes a paradigm transformation of operation, urban governance, life and production, which is guided by technological innovation (Ben Letaifa, 2015). New urban systems are characterized by intelligence, integration and synergy that can promote the diffusion and overflow of knowledge, information and technology between and within cities. Such events have a spill over effect, which may have a significant and long-term effect for sustainable economic growth (Kirwan and Fu, 2020).

Smart cities assist in integrating various innovation, ranging from technology to knowledge, and management (Capdevila and Zarlenga 2015). These smart city effects enhance the creation of platform and digital economy, which will subsequently boost economic growth. The advent of smart cities has heightened the demand for new infrastructure, such as 5G, thus facilitating the generation of more green economic growth (Deng and Zhang, 2013). Kirwan and Fu (2020) also pointed out that smart cities promote the synergy between the digital and physical world, thereby providing new opportunities for sustainable urban economic growth.

Secondly, smart city development assists in reducing energy consumption and the risk of pollutant emission (Addanki and

Venkataraman, 2017). Smart cities are highly sensitive to alterations in resource allocation, urban planning, environmental protection, and decision-making in order to diminish energy consumption, enhance energy efficiency, and reduce pollutant emission (Allam and Dhunny 2019; Ahad et al. 2020). In terms of urban planning, a study conducted in Gulbarga, India, revealed the significant contribution of smart cities to the planning of urban green infrastructure (Anguluri and Narayanan, 2017). Furthermore, the energy wastes and pollution emissions resulting from repetitive construction can be ameliorated by smart cities via smart planning and waste recovery strategies (Balaban, 2019).

Smart cities also improves the efficiency of resource allocation. A study conducted in Hefei, China, found that that urban resource consumption can be reduced by 20% following a 30% increase in the smart city scale (Sun and Zhang, 2020). Other researchers also discovered that travel modes could be optimised via smart travel and production while reducing energy consumption, and pollution emission (Zhang et al. 2018a, Pfeifer et al. 2020). For instance, Stockholm, the capital of Sweden implemented a smart transportation system to charge traffic vehicles intelligently based on the congestion levels (SCEWC, 2019). Notably, the emission of road traffic and per capita carbon dioxide emission reduced by 14% and 25%, respectively, upon installing the smart transportation system.

2.7 Smart city policies

Smart city policies have gained exceptional attention and funding in the last decade. Economic growth is considered the main driver for the increasing popularity of smart city initiatives (Caragliu and Del Bo, 2018), however, smart city policy is also important to realise the overall goal.

A recent study conducted in Singapore reflected the significant effects of legislation and policy transfers in driving smart city development (Li et al., 2022). Specifically, the presence of a policy entrepreneur, cities' drive for policy learning, explicit regulatory mechanisms were identified as critical success factors for the construction of smart cities. Besides advanced technologies, smart city development require urban governance and policies to guide the selection and adoption of technologies (Lim et al., 2019). Nonetheless, several studies posited that less attention is given to smart city governance and policies as most cities are more technology-centric (Lim et al., 2019; Yigit Canlar et al., 2019).

Despite the emphasis on smart city policies, their micro effects on urban economic growth still remain unclear. Although previous studies suggest a positive relationship between urban economic performance and implementation of smart city policies (Caragliu and Del Bo, 2018a), the underlining mechanisms are not fully understood.

2.8 Smart city and Real Estate Development in Bahrain

Bahrain, generally known as the Kingdom of Bahrain, is among the Gulf Cooperation Council countries, which comprises Oman, Qatar, Kuwait, the United Arab Emirates, and Saudi Arabia. With a population of approximately 1.3 million people, Bahrain's GDP was estimated as BD 10,206.7 million in 2012 while a 3.4% year-on-year growth was recorded in its real GDP (Bahrain Census, 2020). Meanwhile, unemployment rate and public sector debt relative to GDP were 4.2% and 36.7%, respectively (Bahrain Department of Statistics, 2015).

Bahrain experienced a boom in its real estate, which was followed by a rise in non-nations, representing about two-third of the country's

population (Al Khalifa, 2019). A high population of western expatriates migrated to Bahrain to work in new service sectors and the construction industry, thereby creating a demand for housing and residential properties. These events led to a dramatic increase in the prices of land, with low-income groups in Bahrain finding it difficult to afford a house. In the long run, such events may culminate in sense of exclusion and trigger social unrest.

Apart from western expatriates, most of the labour required in the construction industry is provided by migrants from the Indian and Asian sub-continent (Al Khalifa, 2019). These sub-population also increase the demand on infrastructure and potential challenges associated with exponential population growth and urbanisation. Nevertheless, these migrants may also experience social exclusion similar to the challenges faced by some Bahraini citizens since they are away from their families and being accommodated temporarily on sites characterised by lack of support and enabling services.

In a nutshell, the case of Bahrain reflects the challenges faced by a developing country in ensuring sustainability criteria while constructing its real estate and working towards becoming a smart city. Given the aforementioned issues, Bahrain's leadership has intensified efforts to improve the city's infrastructure and thread the path of smart city implementation. Accordingly, the smart city concept has emerged as a means to address the problems associated with increasing population and urbanisation, while improving the citizen's quality of life. This plan is embedded in the Kingdom's National Real Estate Plan 2021-2024 to expand its land mass by building new cities and developing smart and ecologically sustainable real estate (Al Khalifa, 2019).

2.8.1 Impact of COVID-19 and smart post-pandemic urbanism in Bahrain

The global impact of COVID-19 has presented a new perspective on the need for smart cities. Several technological trends triggered by COVID-19 will remain even as activities return to their normalcy (Shana'ah and Khalifa, 2021). The pandemic had a devastating effects on Bahrain's economy given the structure of the sectors, which comprise both local and foreign human resources, as well as reliance on the oil market. A local survey conducted by Bahrain chamber (2020) revealed that 32% of business owners expected complete closure of their companies. Most of the businesses surveyed were associated with hospitality, tourism, education, and commercial markets. During the pandemic, numerous businesses devised online means of operation coupled with government support to maintain economic growth (BNA, 2020). In addition, 50% of Bahrain citizens reduced cash transactions by diverting to online payment methods. This change was linked to people's concern of safety and hygiene. As a result, a study suggested that Bahrain future jobs will depend on artificial intelligence, which will only be enabled by constructing smart cities (Derasat, 2020).

2.8.2 Smart Cities of Bahrain for economic recovery

Bahrain is currently working on an economic recovery plan, which includes the expansion of its land mass by building five new cities, namely, Fasht Al Jardim, Suhaila Island, Fast Al Adham, Bahrain Bay and Hawar Islands. This ambitious project is expected to create new job opportunities and attract foreign investments to help Bahrain recover from the economic downturn. According to the plan, each new city will be equipped with world-class infrastructure, services, and amenities to facilitate living

standards for residents. As stated by the Minister, the initiative will have a multiplier effects by boosting the tourism, banking, financial services, retail, real estate sectors. The development of these cities is essential in fulfilling the vision of a diversified economy. A recent review by ElMotasem and Khodeir (2021) elucidated the role of Bahrain's smart cities initiatives in achieving the Sustainable Development Goals (SDGs), especially the SDG 11 which focuses on self-sustaining consumption and production. The creation of smart and ecologically sustainable real estate developments is encouraged by the Kingdom's National Real Estate Plan 2021–2024 (Mohamed 2021), with smart cities features such as communal elevators, centralised cooling systems, and catastrophe avoidance equipment study originated the communal commitment, economic constancy, occupational orienteers, data drivenness, eco-friendly openness, and energy efficiency.

2.8.3 Literature findings on smart city and real estate development in Bahrain

A few studies on smart city initiatives have been conducted recently in Bahrain. Al Khalifa et al. (2019) recommended that incorporating sustainable smart urbanism indicators to the Bahraini Government Plan of Action to enhance the nation's response to global SDGs, particularly by employing domain-based indicator framework. Similarly, Samad and Azar (2019) presented a National Smart City Framework for Bahrain by investigating the international standards and collaborating with key stakeholders to identify the critical components and aligning the framework with the national strategic plan. Meanwhile, a more recent study assessed the factors influencing the adoption of electric vehicles in

the country, which is an essential aspect of smart city transportation (AbdulRahman Shareeda et al., 2021; Aljawder and Al-Karaghoul 2022).

A literature review by Hamdan et al. (2020) elucidated the effects of smart cities on changing economic development in Bahrain discovered that technology-based services, access to diverse data and infrastructure enable citizens to make well-informed decisions. Smart cities also facilitate partnerships between the public, private, and civil society sectors, thereby promoting investment, innovation, and development. Another important aspect of smart cities is enabling efficient use of resources by optimising human capital reducing time spent on manual labour. Overall, the provision for integrating innovative technologies in smart cities assists to attract new businesses, investment and stimulate economic growth. Thus, increasing the utilisation of smart city initiatives could aid in driving economic development in Bahrain (Hamdan et al. 2020).

Most of the reviewed studies in this section advocated for effective policy innovation, collaborations and leadership to transform and develop smart cities in Bahrain, aligning with the critical success factors employed in the development of smart cities in European and several projects in the Gulf Region such as Masdar in Abu Dhabi, “Lusail” in Qatar, and Dubai Smart City (Tok et al., 2014; Samad and Azar, 2019).

Despite research on smart cities and steps taken by the Bahrain government to promote smart cities and enable economic growth, there is still a dearth of information on the perspectives of key stakeholders regarding the benefits, elements required, and challenges in the design, implementation and uptake of smart cities in the country. Given the active role played by stakeholders and policy makers in smart city construction,

their views may assist in addressing the challenges associated with building smart cities in Bahrain's context.

2.9 Chapter Summary

This chapter has provided detailed literature review of studies relating to smart cities and their contribution to real estate and economic development. Studies conducted in Bahrain and the current smart city initiatives were also elaborated in order to identify the present research gaps. The research methodology is discussed in the next chapter.

Chapter Three

Research Methodology

3.1 Introduction

This chapter presents the methodology applied in this study. There are nine main sections in the chapter. The first two sections presents the research design and philosophical choice, philosophical paradigm and approach, whereas the third section focused on the research strategies study site, population and unit of analysis, sampling procedure and inclusion criteria. In the sixth section, focused on the research instrument and contents of the semi-structured interview, as well as data collection process and analysis were succinctly presented. The concluding section discusses the data analysis and a brief summary of the chapter.

3.2 Research Design

This research entails a qualitative research approach to assess stakeholders' perspectives in Bahrain real estate on the impact of smart cities on changing economic development in Bahrain. The research will consist of two phases. The first phase will involve a qualitative analysis of the existing literature on smart cities and economic development, as well relevant local studies in the context of Bahrain.

This study attempts to use qualitative methods to answer the research questions raised in the first chapter of this thesis since the data will be gleaned on stakeholders' experience, meaning and perspectives regarding the research topic. Such data are not measurable or countable and entails collecting important information from either small-group discussions or

semi-structured interviews, in-depth interviews, and analyses of documents or texts such as media articles, websites, or government reports. A semi-structured interview was selected as the preferred qualitative research method in this study since the field of smart city has not been extensively explored in the Kingdom of Bahrain. Moreover, stakeholders in Bahrain's real estate are still in the process of acclimatising with smart city initiatives and the concept is relatively new compared to other developed countries. Thus, respondents will need to be guided in providing the required data and information in this study.

3.3 Philosophical choice

Smart cities can have a positive effect on economic development in Bahrain. Smart cities make use of technology to improve public services and infrastructure, such as transportation, healthcare, and education. This can lead to an increase in economic growth, as a better-connected and more efficient infrastructure will allow businesses to operate more effectively and efficiently. Additionally, smart cities can provide access to new markets and opportunities, allowing businesses to expand and create jobs. Finally, smart cities can provide a platform for entrepreneurs to start new businesses, creating a new wave of economic growth. Smart cities can thus help Bahrain to become more competitive on the global stage, by providing the necessary infrastructure to attract businesses and investors.

3.4 Philosophical paradigm and approach

The term 'paradigm' in a research context refers to the researcher's view of the world (Kivunja & Kuyini, 2017). Research paradigms form the bedrock of research problems and emphasise on how they are worthy of exploration, and generate organised criteria and principles to select

appropriate research tools (Kivunja & Kuyini, 2017). The research method and analytic techniques to be employed are determined by research paradigm, as well providing definite pathways for the intended research conclusions.

The choice of research paradigm was determined in this study based on the research questions and objectives, which is to uncover real estate stakeholders' perspectives on the role of smart city initiatives in achieving sustainable development in Bahrain. Thus, the study is driven by the interpretivism pragmatic stance to elucidate stakeholders' experiences and perspectives with smart city initiatives, which could then be used to extrapolate the researching findings. In terms of ontological basis, the study also adopts an interpretative approach, thus allowing the results to be specific to the experiences of real estate stakeholders in Bahrain.

3.5 Research strategies

This study employed 2 main research strategies, namely, narrative literature review and qualitative research approach. The narrative literature review was conducted by reviewing recent studies on smart cities and their relationship with economic development. As a result, studies conducted in countries that have successfully implemented smart cities or in the implementation process were succinctly reviewed. Likewise, studies conducted locally in Bahrain relevant to the research topic were assessed. This review was achieved by assessing various academic databases, such as EBSCO, JSTOR, and Google Scholar, as well as online sources, documents and reports from government bodies, NGOs and industry experts.

Meanwhile, for the qualitative research design, this study utilised semi-structured interviews with stakeholders in the smart city development process in Bahrain, such as government officials, business owners, and citizens. Findings from the narrative literature review were used to develop the interview guide and specific questions that would assist the researcher in documenting stakeholders' experiences and perspectives on the effects of smart cities on economic development in Bahrain.

3.6 Study Site

Bahrain is officially known as the Kingdom of Bahrain – an island nation in Western part of Asia located on the Persian Gulf (Figure 3.1). Approximately 83% of the country's landmass comprises a small archipelago consisting 50 and 33 natural and artificial islands, respectively. The Kingdom of Bahrain is location between the North-eastern coast of Saudi Arabia and Qatar. The recent population census found that the nation's population is 1,501,653 people of whom 712,362 are citizens of Bahrain (Bahrain 2020 Census). In terms of land mass, Bahrain is about 760 square kilometres (Bahrain, World Fact Book), and the third-smallest nation in Asia after the Maldives and Singapore. Manama, the capital city, is also the largest city in Bahrain.



Figure (3.1). Map of the Kingdom of Bahrain showing Manama, the central city and core of smart city initiatives (Source: worldmapatlas.com)

Given the high concentration of population, urbanisation, and availability of real estate and smart city initiatives in Manama, the city was selected for the present research. Moreover, since this study aims to use semi-structured interviews, available evidence suggests that real estate stakeholders with ample experience on smart cities can be easily reached in Manama. Thus focusing on the aforementioned study site will enable the researcher to gather the required data to execute the research objectives.

3.7 Population and Unit of Analysis

Population in research is also considered the population of interest, which comprises the overall group of individuals serving as the source of data and information required for research. The first step in data analysis is to define the unit of analysis (Trochim, 2006), and this could be individuals, groups, organisations, and social artefacts. However, individuals are the most widely used unit of analysis in qualitative research (Kumar, 2018). The study population and unit of analysis in this study encompasses stakeholders in Bahrain's real estate.

3.7.1 Sampling method

Since this research entails a qualitative design, probability sampling is not necessary in selecting stakeholders that will serve as respondents to the semi-structured interview. Hence, a non-probability sampling method known as convenience sampling was used in identifying and recruiting stakeholders in Bahrain's real estate sector. Convenience sampling entails data collection from population members who are available to provide data and information required in research (Sekaran and Bougie, 2016). This sampling technique is appropriate for the qualitative phase as the respondents will include stakeholders in real estate sector who are conversant with the national plan of implementing smart cities in Bahrain.

3.7.2 Sample size

Sample sizes are pertinent in research designs. Although sample sizes are not definite in qualitative research, they are still required in selecting the study units or participants (Leedy and Ormrod, 2010). The recommended sample size in phenomenological or qualitative research

should range from five to 25 (Leedy and Ormrod, 2010). Meanwhile, other researchers posited that a sample size of 10-15 participants is sufficient for qualitative research (Hair et al., 2017). A sample size of 15 respondents was considered in this study to accommodate a variety of stakeholders in Bahrain's real estate sector. This sample size is sufficient to gather the required information to achieve the research objective. Moreover, qualitative research emphasises depth rather than achieving a representative sample of individuals as expected in quantitative research (Morrow, 2007).

3.7.3 Inclusion criteria

Certain inclusion criteria were also considered in this study for respondents' recruitment. The target participants were stakeholders in the country's real estate sector, who are conversant and actively involved in the country's plan of developing smart cities. On that note, participants are expected to be 18 years and above, experienced and involved in any activity relating to real estate and smart city development in Bahrain, ability to communicate in English, and willing to provide oral and written consent to participate in the study. These points are essential to elucidate stakeholders' perspectives regarding the research topic.

3.8 Research Instrument

This study employed a semi-structured interview. The semi-structured interviews were conducted to document stakeholders' views and perspectives on the prospects and challenges of implementing smart city, and the role in achieving sustainable development in Bahrain. The following subsection presents the procedures in developing the research

instrument and specific questions to glean the required data and information.

3.8.1 Development of Research Instrument

The development of research instrument, interview guide in the present context, entails designing, directing, and compiling the items for assessing the key information required in research (Cooper and Schindler, 2011). In this study, a multi-dimensional approach was applied to develop the semi-structured interview guide based on findings from previous related research, modification of instruments utilised in prior studies, and discussion among the researchers.

The semi-structured interview guide was designed in two broad sections; section A and B. Section A comprises the respondents' demographic details such as age, gender, occupation, education level, and their role in Bahrain's real estate and smart city initiatives. These socio-demographic factors were selected in this study based on previous research demonstrating their relevance in terms of participants' perspectives and views on smart cities and sustainable development (Fernandez and Peek, 2020; De Jong et al., 2015).

Section B encompasses 2 main subsections: (1) Conditions and ingredients required for successful smart cities initiatives and (2) Expected benefits and challenges. The first and second subsection comprises 4 questions each. All the questions that were designed to collect vital information on stakeholders' perspectives on the research topic.

For the first subsection (conditions and ingredients required for successful smart cities initiatives), the first question focuses on the present state of Bahrain's infrastructure to enable the transformation towards smart

cities. As such, the researcher aims to gather vital information on the readiness of the technical infrastructure and state of communication network. The second question focuses on the required elements in terms of human resources, smart mobility, smart effective communications, and smart economy to facilitate Bahrain's transformation towards smart cities. These questions aim to elucidate how the aforementioned events could preserve the health and safety of Bahrain's population. Third, stakeholders were asked to state the best approach in building conducive real estate communities for the emergence and sustainability of smart cities. The last question focuses on the motives and reasons for the paradigm shift towards smart cities in Bahrain.

For the second subsection on expected benefits and challenges, the first question entails respondents' perspectives on the benefits and advantages of smart cities, particularly in terms of QOL, investments, and citizens' participation. Meanwhile, the second question relates to the contribution of smart cities in achieving sustainable urban development. The third question focuses on the problems that may arise in building smart cities, whereas the last question emphasises the role of smart cities in preserving the environment, heritage, historical sites, and antiquities through effective systems. The specific questions asked in the interview are summarised in Table 3.1.

Table (3.1): Specific questions asked in the semi-structured interview
with 15 stakeholders from Bahrain’s real estate industry

	SECTION A
	Kindly provide information about your age, position held in the real estate, gender, and year of experience.
	SECTION B1: Conditions and ingredients required for successful smart cities initiatives
1.	Do you find that the current infrastructure in Bahrain conducive to the transformation towards smart cities?
2.	What is your assessment of the elements required for Bahrain to transform towards smart cities?
3.	What are the best ways to build real estate communities conducive to the emergence and sustainability of smart cities?
4.	What are the most prominent motives and reasons that promote the shift towards smart cities in Bahrain?
	SECTION B2: Expected benefits and challenges.
1.	What are the most prominent benefits and advantages of smart cities?
2.	To what extent can real estate development related to smart cities contribute to leading sustainable urban development in Bahrain?
3.	What are the problems that might arise in building smart cities in Bahrain?
4.	What roles can smart cities play in preserving the environment, heritage, historical sites, and antiquities through effective systems?

3.8.2 Recruitment of Stakeholders and Administration of Interview

The stakeholders were identified from the list of companies, firms, and governmental parastatals in the Bahrain’s real estate industry. The document containing stakeholders’ contacts such as phone numbers and email address were obtained from the organisation’s website and officers in the records section. All the eligible real estate developers and organisations were initially contacted to brief them about the research aim and procedures, and seek for their consent to participate in the study. Those willing to participate for further screen according to the inclusion criteria

presented earlier in this chapter. Upon fulfilling the eligibility criteria, the research and potential respondent agreed on the preferred method of performing the semi-structured interview, either face-to-face or online. Overall, the interviews were either conducted in the respondent's office or any preferred location on a scheduled date or via online platform such as Google meet or Zoom.

During the interview, the researcher briefed the respondents once more about the research objectives and confidentiality of all information provided. Then, the respondents were informed to introduce themselves before proceeding to the main questions as presented in the interview guide. Since the research topic is relatively new in the context of Bahrain, respondents were guided during the interview to ensure their responses aligned with the research question and objectives. For instance, upon asking respondents the first question on the integration of digital technology into various infrastructure in Bahrain, the examples of such smart city innovations such as airports, hospitals and parks were highlighted. Likewise, the second question was elucidated by stating points such as the readiness of technical infrastructure and communication network. For the third question on strategies to build conducive and sustainable real estate communities, the practical approaches which include expanding the use of smart solutions or imposing a specific pattern for building smart cities were suggested. Finally, regarding the motives and reasons for the paradigm shift towards smart cities in Bahrain, possible factors such as population growth, increasing city budgets and requirements, and technological development were highlighted.

Despite using a semi-structured interview, respondents were allowed to provide robust information until data saturation was achieved. Data saturation is a vital aspect in ensuring pertinent information are gathered in qualitative research, and aligning such information with the research objectives. In this study, data saturation was considered when no new information could be gleaned from participants' responses. All the interviews were conducted in English between January 2, 2023 to April, 2, 2023.

3.9 Data analysis procedure

The study data were analysed thematically using NVIVO 12, a software capable of analysing qualitative data, generating themes and coding vital information. Aligning with the present research questions, thematic analysis is a vital qualitative research method that is utilised to reflect the values and meanings in dataset patterns (Braun & Clarke, 2012). The emphasis on the dataset would depict stakeholders' perspectives and experiences with smart city initiatives and sustainable development in Bahrain's context. The emerging patterns were classified into themes that would be derived from multiple and analyses of interview transcripts. Similarities among recurrent themes were drawn to sustain continual re-categorisation (Lichtman, 2012). The meaning of the themes were also filtered through inductive strategies for descriptive outcomes (Merriam & Grenier, 2019). The overall process is summarised below based on the six steps proposed by Lichtman (2012):

Step 1 - Initial coding: The responses were first organised into a summary of response ideas.

Step 2 - Revisiting coding: Code modification process based on examining previously collected and new data

Step 3 - Developing a list of categories: The codes were then organised into categories with some codes becoming major topics while others were considered as subsets.

Step 4 - Modifying categorical list based on additional data review: The iterative process proceeded with categorical adjustments

Step 5 - Revisiting categories: Possible redundancies were either omitted or integrated.

Step 6 - Deriving themes or concepts from categories: The key concepts reflecting the meaning attached to the collected data were determined.

3.10 Chapter Summary

This chapter has discussed the methods applied in executing the research objectives. The rationale for selecting qualitative research design was presented, as well as the steps taken to recruit stakeholders from the real estate industry, development of the semi-structured interview guide, data collection process, and analysis. The next chapter entails the results obtained upon analysing the data.

Chapter Four

Analysis and Discussion

4.1 Introduction

This chapter presents the findings obtained from the semi-structured interview among 15 participants from real estate and smart-city related field in Bahrain. There are five various sections in this chapter. The first section presents the descriptive results based on the participants' demographic information, specifically the positions held, years of experience, age, and gender. Meanwhile, the second section focused on the findings from the thematic analysis of questions regarding present state of infrastructure, elements required for smart city development and motives for smart city initiatives in Bahrain. The next section presents the discussion of the research finding regarding the relationship between smart city development and sustainable development, and the expected benefits and challenges in implementing smart cities.

4.2 Descriptive Results

As shown in Table 4.1, a total of 15 stakeholders from various real estate firms and smart city-related organisations participated in this study. All the participants were males, currently holding top positions such as general manager and chief executive officer (CEO), project evaluator, and engineering professionals. Participants' age ranged from 36 to 55 years old while years of working experience ranged from 6 to 22 years, respectively. All the participants provided oral and informed consent before proceeding with the interview.

Table 4.1: Participants' demographic characteristics

	Participants														
Variables	1 (P1)	2 (P2)	3 (P3)	4 (P4)	5 (P5)	6 (P6)	7 (P7)	8 (P8)	9 (P9)	10 (P10)	11 (P11)	12 (P12)	13	14	15
Gender	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male
Position held	CEO	CEO	Property evaluator	CEO	Property manager	General Manager	CEO	Property consultant	Head of evaluation	CEO	CEO	CEO	CEO	CEO	CEO
Age	39	42	45	39	53	50	42	36	55	47	54	38	52	44	47
Years of Experience	6	8	10	8	6	18	15	11	22	7	20	6	16	21	14

4.3 Thematic Analysis

As shown in Tables 4.2A and 4.2B, codes were generated from the initial thematic analysis, followed by specific themes that represent the information provided by participants for each question (Table 4.3A and 4.3B). The first section focused on the current state of infrastructure, required elements to establish a smart city, best approaches to build real estate communities, and main motives driving smart city initiatives in Bahrain.

4.3.1 Current state of Bahrain's infrastructure

For the first question on current state of infrastructure, 3 broad themes were obtained from the thematic analysis: Availability of adequate infrastructure, partially readiness of infrastructure, and below the required standard. These findings reflect that participants had diverse views on the present infrastructure in Bahrain to facilitate the establishment of smart cities.

"I believe that Bahrain has made great strides in these matters, and the thing that helps Bahrain is the small geographical area. In the extended countries with a vast area, the issue is more difficult and the cost is greater, and I see that the introduction of smart building techniques to approach smart cities is possible because the general trend in real estate construction is currently towards small spaces as well"

(Participant 1, CEO of a real estate firm)

"I see that the infrastructure is conducive to partial transformation, not total, as there are several projects that have introduced advanced electronic technologies, such as Diyar Al Muharraq and Dilmunia."

(Participant 6, General Manager of a real estate firm)

“The infrastructure is adequate, and companies have invested in advanced networks, and STC Bahrain recently announced its intention to establish a land network with large investments, but the trend towards smart cities undoubtedly requires additional needs.” (Participant 8, CEO of a real estate firm)

Table (4.2a): Coding of participants’ responses to questions regarding the condition and ingredients required for successful smart cities initiatives in Bahrain

	Items	Current state of infrastructure	Required elements to become a smart city	Best approaches to build real estate communities	Prominent motives and reasons driving smart city initiatives
1	Participant 1	Partially ready for transformation/testing and evaluation needed	Physical infrastructure	Combination of smart solutions expansion and implementing a specific pattern	To improve QOL
			Human resources are required		Sustainable development
			Collaboration with smart cities abroad		
2	Participant 2	Adequate infrastructure	Linking technical infrastructure with e-government system	Combination of both methods	Population growth and increasing demands
3	Participant 3	Adequate infrastructure	Human resources	Combination of both methods	Economic growth
4	Participant 4	Below the required standard	Infrastructure and human resources	Combination of both methods	Economic growth and addressing problems
5	Participant 5	Partially ready for transformation/testing and evaluation needed	Human resources	Incentives to encourage smart city initiatives	Technological development
			Alternative energy sources		Addressing climate change
6	Participant 6	Partially ready for transformation/	Human resources	Standardised systems	Following the global trend
			Support systems like smart transportation		Addressing climate change

7	Participant 7	Partially ready for transformation/	Alternative energy sources and communication and transportation network		
8	Participant 8	Still below expectations	Human resources are adequate but more development required in smart transportation	Incentives to encourage smart city initiatives	Global trend and economic growth
9	Participant 9	Still below expectations	Support systems and integration for more automated services	Impose a system of smart applications	Addressing climate change and global warming
10	Participant 10	Partially ready for transformation	Human capital	Combination of both methods	Improved QOL, economic growth
11	Participant 11	Adequate infrastructure	More awareness and education	Impose a system of smart applications	Increasing population growth
12	Participant 12	Adequate infrastructure	Human capital and resources	Combination of both methods	Economic growth
13	Participant 13	Adequate infrastructure	Implementing the idea into existing infrastructure	Combination of both methods	Population growth
			Human capital		Global trend and economic growth
14	Participant 14	Still below expectations	Human resources need to be developed	Combination of both methods	Population growth, increasing city requirements, and technological development
15	Participant 15	Partially ready for smart city	Human capital and resources	Incentives to encourage technological solutions and adopting smart solutions	Bahrain's vision of transformation towards smart cities
					Population growth

Table (4.2b): Coding of participants' responses to questions regarding the expected benefits and challenges in establishing smart cities in Bahrain.

	Benefits and advantages	Contribution to sustainable urban development	Expected Challenges		Role in preserving the environment
				High cost	
Participant 1	Facilitating life		Cyber security	Aligning with modern smart city systems, designs	Green technologies
			Cost	Combating security and privacy attacks (vulnerability of electronic and digital methods)	Control processes and smart systems to reduce accidents and crises
Participant 2	Catalyst for economic development		Enhancing public awareness	Acceptance of the technology	Environmental preservation
	Real-time information		Budget allocation	Vulnerability to piracy and cyber attacks	
	Efficient communication processes			Lack of supportive legislation to encourage investors	
				Land acquisition	
Participant 3	Increased investment	Supporting systems	Limited resources	Ensuring environmentally friendly smart city development	Imposing smart city initiatives
	Inbound tourism stimulation		High costs	Appropriate policies	Reducing air pollution
	Improved QOL		Poor infrastructure	Automated operations (non-usage of paper)	Smart transport network
Participant 4	Reliance on renewable energy sources	Attracting capital	Human resources	Lack of government support	Reliance on environmentally-friendly methods
				High cost	Less pressure on conventional operational methods
Participant 5	Improved QOL	Significant contribution to Bahrain's GDP	Financing/high cost	Accessible infrastructure and services	Environmentally-friendly methods

	Environmental sustainability	Increased investment		Support systems	
Table 4.2b (contd)					
	Real-time information	Digital transactions	Lack of infrastructure	Capital and budget	
Participant 6	Facilitate smart transportation	Efficient operations	Inconsistent network connectivity	Capital and budget	
	Improved QOL	More investment	Data privacy and security	optimal utilization of energy sources	
	Diversified investment		Financing	Electronic services in key sectors	
	Addressing crimes and enabling safer environments		Organisational and management issues	High cost	
Participant 7	Improved QOL	Providing services to meet citizens' demands	High cost	Integrating advanced technologies in key smart city sectors	Improved transportation systems
	Strong security		Poor infrastructure	Societal acceptance and awareness	Preserving historical and archaeological sites
	Smooth operations in public institutions			Infrastructure	
				Cyber security	
Participant 8	Catalyst for fast and efficient operations		Cultural change and Acceptance		Effective solutions and smart transportation systems
Participant 9	Improved QOL	Appropriate placement for smart city advancement	Financial		Establishing environmentally friendly communities
	More investments	Legislation	Awareness		Efficient waste disposal
	Citizens' participation	Necessary incentives and facilities	Technical and security issues		

Participant 10	Economic development	Integrating real estate tech in real estate reports	Job loss/unemployment		Establishing environmentally friendly communities
	Abundant information				
Participant 11	Increased productivity	Integrating advanced technologies	Data security and confidentiality		Usage of renewable energy sources
	Increased investment				Sustainable environment
	Lower environmental pollution				Crime reduction
Participant 12	Cyber security	Integrating real estate tech in real estate reports	Public acceptance		Establishing environmentally friendly communities
					Effective solutions and smart transportation systems
Participant 13	Boost tourism	Integrating advanced technologies	Transportation: difficult to incorporate WIFI in bus systems	Lack of competition in smart technology market	Prioritising infrastructure in the sector
	Advanced solutions in waste management		Low awareness	High cost of implementation	
Participant 14	Save time and increases efficiency	Extending connectivity		High cost of implementation	
	Reduce construction cost during inflation	Allocation of resources: advanced waste management			
Participant 15	Improved quality of life	Supporting national strategies	Lack of collaboration and partnerships	Lack of a unified framework	Developing a unified framework
				High operational cost	

Table (4.3a): Emerging themes from the thematic analysis of stakeholders' responses to questions regarding the condition and ingredients required for successful smart cities initiatives in Bahrain

Questions and emerging themes			
Current state of infrastructure	Required elements to become a smart city	Best approaches to build real estate communities	Prominent motives and reasons driving smart city initiatives
Partially ready for transformation/testing and evaluation needed	Improved infrastructure	Combination of smart solutions expansion and implementing a specific pattern	To improve QOL
Adequate infrastructure	Collaboration with smart cities	Incentives to encourage smart city initiatives	Sustainable development
Below the required standard	Human resources	Impose a system of smart applications	
	Legislation and policies		Addressing climate change
	Integration of advanced technologies		Population growth and increasing demands
	More awareness and education		
	Alternative energy sources		

Table (4.3b): Emerging themes from the thematic analysis of stakeholders' responses to questions regarding expected benefits and challenges in smart city development

	Emerging themes			
	Benefits and advantages of smart cities	Contribution of smart cities to sustainable urban development	Expected Challenges	Role of smart cities in preserving the environment
1	Real-time information	Supporting systems	Cyber security	Green technologies
2	Efficient communication processes	Attracting capital	Financing	Control processes and smart systems to reduce accidents and crises
3	Increased investment	Increased investment	Public awareness/ Cultural change and Acceptance	Environmental preservation
4	Inbound tourism stimulation	Digital transactions	Poor infrastructure	
5	Addressing crimes/security	Efficient operations	Human resources	
6	Environmental sustainability		Organizational and management issues	

4.3.2 Elements required to establish smart cities

Thematic analyses for the second question yielded five main themes: collaboration with international countries, improved infrastructure, integration of advanced technologies, human resources, and alternative energy sources.

4.3.2.1 Collaboration

Some participants considered collaboration with other international smart cities is the best approach towards establishing smart cities in Bahrain. Participants used examples of Middle east countries that have successfully implemented smart cities to elaborate this point. Accordingly, the main point emphasised is that no country can solely implement smart cities without assistance from the international community. Examples of the support needed via the collaboration include training of Bahrain's nationals, as well as human and financial capital. Some of the participants' verbatim responses are presented below;

“You see, what we need to establish smart cities in Bahrain is to collaborate and work together with other countries such as Saudi Arabia and Qatar, that are currently using smart systems in virtually all public institutions. We might have the infrastructure but we learning from our neighbouring and European countries will assist us tremendously to achieve sustainable development” (Participant 12)

“Some countries have exceptional template that we can learn from and see how to improve our infrastructure. Smart cities is not a day job but a long-term plan, thus it is important to work in hand with some developed

countries, especially in terms of human training and advanced technologies” (Participant 6)

4.3.2.2 Human Resources

Participants shared diverse perspectives on human capital and resources as elements required to establish smart cities in Bahrain. While a few participants felt the country is sufficient in terms of human resources and manpower, others had a contrary opinion by insisting the country must obtain support from developed countries for experts trained in various smart city fields such as cyber security, Internet of Things, Cloud computing, Artificial Intelligence and so on. This theme is depicted by the following statements;

“We have well-trained experts in advanced technologies than will assist us in achieving our smart city plan, what we need is the strong support and leadership to make it a reality” (Participant 11)

“Human resources remain a top priority for Bahrain’s smart city development, focusing too much on technology without looking at the human side is a big mistake. We need to look outside, especially developed countries, to train our citizens who are ready to contribute to this real estate sector” (Participant 8)

4.3.2.3 Infrastructure

In terms of present infrastructure, most participants highlighted that Bahrain’s infrastructure is yet to attain the level needed for successful smart city operation and sustainable development. This point was buttressed by citing examples of transportation, network, communication systems that are still far from operating smartly as found in other developed

countries. Another point raised by participants was the gap between technical infrastructure and e-government systems/institutions. The use of paper and lack of automated systems in public institutions were also highlighted. The findings are reflected in the following verbatim responses;

“Our infrastructure is not yet at the required level to become a smart city. We must integrate our infrastructure and enable digitised solutions as seen in Abu Dhabi and other neighbouring countries driving towards becoming smart cities” (Participant 5)

4.3.2.4 Alternative Energy sources

Participants shared different views on Bahrain’s energy sources and how this vital sector may contribute to implementing smart cities. While some participants stated the wide usage of renewable energy sources, others felt their usage in various private and public institutions must be improved. Ensuring that such renewable energy sources are readily available, cost-effective, and accessible were the points raised by participants to expand their usage in the population. Examples of the responses are presented as follows;

“For us to become a smart city, all the infrastructure and service sectors must engage the usage of renewable energy sources. The use of conventional energy sources is not sustainable. Most smart cities are already using renewable energy sources in all vital areas to encourage environmentally friendly activities” (Participant 2)

Alternative energy sources have to be accessible and affordable in order to encourage the usage among Bahrain citizens. It is only when renewable

energies are utilised in virtually all industries that we can start discussing about becoming a smart city” (Participant 13)

4.3.3 Approaches to Build Real Estate Communities

As mentioned earlier in the methodology, participants were guided when answering this question by presenting possible strategies of building real estate communities; imposing a system of smart applications or implementing a specific pattern of real estate buildings. Participants shared different views on Bahrain’s energy sources and how this vital sector may contribute to implementing smart cities. Resultantly, the responses were broadly categorised into those who opined for (1) combining both methods (2) Imposing a system of smart applications, and (3) Incentives to encourage smart city initiatives.

4.3.4 Motives and Reasons Driving smart city initiatives

The final question in this section focused on participants’ views on the main reasons driving smart city initiatives in Bahrain. Results showed that 4 broad themes were gleaned from the thematic analysis; Improved QOL, Population Growth, Sustainable/Technological Development, and Addressing Climate Change.

4.3.4.1 Improved Quality of Life (QOL)

Most participants mentioned the need to enhance citizens’ QOL was among the main motives for smart city initiatives in Bahrain. This point was emphasised by highlighting the expected benefits and advantages of smart cities such as smart transportation, healthcare, transactions, job opportunities, housing and so on. In fact, some participants used examples

from other developed and smart cities to convey their argument. The following statements are verbatim quotes from some of the participants;

“As an experienced person in real estate, smart city is an effective approach to improve citizen’s quality of life since it enables optimal delivery of services and access to adequate infrastructure” (Participant 9)

“the driving factor for smart city initiatives in Bahrain is to diversify the economy and create more job opportunities to enhance the quality of life. Smart city will improve the transportation, healthcare, housing sectors, thus contributing to higher standard of living among Bahrain’s citizens.” (Participant 11)

4.3.4.2 Population Growth

The rapidly increasing population, particularly in Bahrain’s major cities, were highlighted as the main driver for smart city initiatives. Participants posited that the exponential population growth necessitate smart city systems to meet the daily increasing demand and ensure smooth operation of public services. Although real estate CEOs in this study opined that Bahrain’s population is still low relative to other developed countries, the vast desert land and small land mass for real estate development reflects the need for smart city systems. Thus, participants emphasised faster pace of implementing smart city strategies to align with the increasing population growth. These findings are depicted in the following comments;

“I believe the government has realised the increasing population and the need to improve existing infrastructure and basic amenities in the country. On a personal note, I think meeting the demand of Bahrain’s increasing population is a major drive to become a smart city” (Participant 14)

“The increasing rate of urbanisation and population growth is occurring globally and the Kingdom of Bahrain is not an exception. In line with the global trend, smart city development is a key strategy to address the issue of population growth” (Participant 15)

4.3.4.3 Sustainable Growth and Development

Another theme synthesised from the thematic analysis was “sustainable growth and development” as a vital driver for Bahrain’s smart city initiatives. These participants perceived that smart cities are the best approaches to achieve sustainable growth and development. In contrast to conventional operating systems and infrastructure, a smart city was described as an effective system of integrating advanced technologies into various aspects of public and private services such as healthcare, housing, security, banking and business, transportation, communication, and energy sectors. The theme is reflected in the following participants’ verbatim quotes;

“As stated in the Real Estate Plan, smart city initiatives is key to achieve sustainable development in all facets of our economy. So I see it as the main motive for all the discussion and recent desire towards developing smart cities” (Participant 8)

“I think the end result is what we should be focusing on, which is achieving sustainable growth and development. I believe smart cities will have

positive impact on the country's infrastructure and citizen's quality of life, but in the end, ensuring that the economic development remains sustainable is more important. Let us not forget that it is a long journey."
(Participant 13)

4.3.4.4 Addressing Climate Change

In line with the global trend of ensuring environmentally friendly activities, participants relayed that addressing climate change and global warming is a major drive for smart city initiatives in Bahrain. Climate change and global warming were identified as a major threat to human existence, and participants mentioned the government's will to address this challenge by encouraging smart cities in Bahrain. The points used to convey this theme include alternative energy sources, ensuring prudent use of available resources and preserving for future generations.

"As an oil-producing country and location in the Middle East, we have a great opportunity to develop smart cities and contribute significantly in addressing the issue of climate change and global warming."
(Participant 9)

4.3.5 Benefits and advantages of smart city initiatives

The second section focused on the expected benefits of smart cities, particularly in relation to sustainable development, and the challenges that may affect realising the goal. Four questions were asked in this section and thematic analyses were also employed to identify the emerging themes according to participants' responses.

For the first question on the advantages of establishing smart cities in Bahrain, six broad themes were gleaned from the analysis; Improved QOL, Diversified Investment, Tourism stimulation, Environmental sustainability, Addressing Crimes and Improved Security.

4.3.5.1 Improved QOL

Most participants mentioned better citizens' QOL as the top benefits of implementing smart city in Bahrain. To drive this point, participants posited that smart cities will improve the efficiency of services delivered by the transportation, healthcare, communication, and housing sectors to mention a few. Some participants also used examples from other developed and smart cities to convey their argument based on the increment in GDP per capital and low poverty rate experienced in other countries upon transforming to modernised smart cities. This theme is highlighted in the following verbatim statements;

“Smart city will contribute to increased GDP and minimise the poverty rate, the multiplier effects will lead to better quality of life” (Participant 14).

“We can see how developed countries like Singapore, Canada and Switzerland are currently enjoying the lowest poverty rate and higher quality of life among their citizens. This rapid development were made possible upon successfully implementing smart city initiatives.” (Partipant 13).

4.3.5.2 Diversified Investment

Facilitating diversified and expanded investment opportunities were highlighted by most participants as a prior benefit of smart cities. Smart

cities encourage foreign investment given that investors from different facets can contribute to array of services offered in such an advanced environment. Participants mentioned that the strong security network in smart cities will trigger foreign investment as investors will be assured of the safety of their money. The following statements are verbatim quotes from the participants;

“As mentioned earlier, smart cities come with a lot of advantages and foreign investment is one of them. By building smart transportation, communication, housing and healthcare systems, foreign investors will be encouraged to invest in Bahrain, and this is what we need to achieve sustainable development” (Participant 4).

4.3.5.3 Tourism stimulation

The service sector, particularly tourism and hospitality industry, is expected to benefit immensely from smart city initiatives. Given the diverse areas in which smart systems operate in terms of transportation, housing, and communication, participants were of the view that the provision of digitised smart solutions in these areas will boost the tourism and hospitality sector. The location of Bahrain in the Middle East and preservation of archaeological and historical sites with the use of smart and innovative solutions were also used to convey this theme. Examples of the statements reflecting this theme are presented below;

"As someone from the real estate industry, I strongly believe that the tourism sector will gain substantially from smart city development. This is because smart cities encourage people to visit in order to enjoy the services offered by various sectors of the economy. The long-run impact will also pave way for sustainable development” (Participant 10)

“Our tourism sector can use smart technologies to preserve our archaeological and historical avenues. Imagine the revenue that could be generated from such initiatives” (Participant 12)

4.3.5.4 Environmental sustainability

Participants shared their views on how Bahrain could achieve environmental sustainability by implementing smart cities and ensuring real estate development. Factors such as reliance on renewable energy sources and smart transportation were conveyed as prior approaches of achieving environmental sustainability. Furthermore, participants mentioned the present global trend of implementing green technologies and environmentally friendly activities to address climate change and global warming. Smart cities are expected to promote prudent use of available resources and preserving for future generations.

4.3.5.5 Addressing crimes and improved security

The last theme synthesised in terms of benefits of smart cities was reducing the rate of crimes and improving the security architecture of the country. Smart cities are characterised by digitized smart solutions, real-time information/monitoring, and artificial intelligence for world of art security network. The presence of cyber security experts and smart systems in various services ranging from banking to daily business transactions are also expected to address internet fraud and cyber attacks.

“smart cities offer us the opportunities to reduce crimes, cyber attacks and the general security network of the country via digitised solutions and advanced technologies such as Artificial intelligence and real-time monitoring” (Participant 7)

“similar to the multiplier effects on quality of life and present infrastructure, better job opportunities and improved standard of living will reduce the rate of crimes and risk of cyber threats” (Participant 4)

4.3.6 Contributions to Urban Sustainable Development

This question is pertinent in the present research objective, especially to elucidate the link between smart cities and sustainable development. Four broad themes were obtained from the thematic analysis of participants’ responses regarding the contributions of smart cities to urban sustainable development. The themes were as follows; Supporting systems, Attracting Capital and Investment, Efficient Operations.

4.3.6.1 Supporting systems

Participants posited that smart cities provide the structural framework and foundation to support urbanisation. According to participants, urbanisation is centred on providing facilities and services to cater for the increasing population while ensuring improved QOL and efficient service delivery, thus smart cities were described as the most effective approach to achieve the aforementioned objectives.

4.3.6.2 Attracting capital and investment

Most participants mentioned the more investment opportunities enabled by smart cities as a drive for sustainable development. Smart cities encourage foreign investment from various areas, and when harnessed, will ultimately improve Bahrain’s GDP. The support from strong security network in smart cities was also mentioned by participants to trigger

foreign investment as investors will be assured of prudent usage and return on their investment.

4.3.6.3 Efficient Operations

Based on the characteristics of smart cities, participants highlighted how such an environment can facilitate smooth and efficient operations to meet citizens' demands. The provision of digitised smart solutions are considered appropriate placement for smart city advancement and delivering public services efficiently with less chance of error.

4.3.7 Expected Challenges

The last question in this section focused on the expected challenges in smart city development. Resultantly, the identified themes were cyber security, financing, infrastructure and human resources, and acceptance and awareness level by the public (citizen's participation).

4.3.7.1 Cyber security

Despite the numerous advantages and benefits relayed by participants in the previous section, they raised pertinent issues, especially cyber security as a major threat to smart city initiatives. In fact, cyber security and vulnerability to data breaches and privacy issues were commonly reflected in participants' responses. Some participants provided examples to elucidate their concern about this challenge as presented below;

One of the most prominent problems that may arise in the event of a move to smart cities is the issue of electronic or cyber security, as well as the cost. (Participant 12, CEO Real Estate)

“Smart cities have their pros and cons such as low privacy and exposure to electronic attacks. Imagine, for example, that hackers are in faraway China or Russia from It is possible to stop a train network here or there by hacking its electronic system”. (Participant 11, Real Estate Manager)

4.3.7.2 Financing

Only a few participants did not mention financing or high cost of smart city development when asked about the potential challenges. In fact, most participants viewed financing as the most critical issue in transforming Bahrain’s cities to smart cities. This theme can be gleaned from the following verbatim statements;

“I think the biggest problem is the need for a big investment in technology, and that will be financing as one of the most important problems in the case of moving towards smart cities. (Participant 4, Property Manager).

“One of the most prominent problems that may arise in the event of a move to smart cities is the issue of electronic or cyber security, as well as the cost. (Participant 1, CEO Real Estate)

4.3.7.3 Acceptance/Public Awareness/Cultural Change

Acceptance by the public and present low awareness level were presented by participants as prominent challenges for successful implementation and development of smart cities in Bahrain. The culture of

deploying conventional approaches in areas of healthcare, transportation, housing and so on might be difficult to change, especially among certain subpopulation in the country. In addition, public perception of smart cities was highlighted as another issue to be addressed as evident in the following quotes;

“Perhaps the two most prominent problems are related to culture and the need to change the negativity of some people towards new things, in addition to improving the infrastructure to rise to the level and standards of smart cities” (Participant 5, Property Consultant in Real Estate).

“If we want to impose new city technologies, this requires awareness first and then imposing this method on people to accept it, in addition to the economic challenge related to the budget, as well as the economic challenge of abundance or scarcity of money. (Participant 11, CEO of a Real Estate Agency).

4.3.7.4 Infrastructure and Human Resources

As gleaned from the first interview questions, infrastructure and human resources were highlighted as bottlenecks that may affect the implementation of smart cities in Bahrain. These themes are reflected in the verbatim quotes presented below;

“The infrastructure need to be developed, such as laying very large pipes and wires to speed up the pace of communication, in addition to introducing expensive systems and technologies. (Participant 6, CEO of a Real Estate Agency).

The challenges and problems are many because our resources are limited, while the costs seem very high. (Participant 3, Property Evaluator).

*“Smart cities need integrated service complexes and highly qualified personnel, provided that these complexes are comprehensive”.
(Participant 8, CEO of a Real Estate Agency).*

4.4 Discussion of the Research Findings

The participants in this study were all males holding important positions and well-experienced in Bahrain’s Real Estate Industry. Specifically, the positions held included general managers, CEOs, real estate evaluator, architectural and construction engineering. These descriptive findings revealed that appropriate respondents that could provide vital information required to answer the present research questions were recruited in this study. The participants’ characteristics and position held also align with the demographic information of active stakeholders in the country’s real estate industry (Bahrain 2020 Census).

In this study, the semi-structured interview was mainly divided into two sections, whereby the first section focused on the present infrastructure, elements required for smart city establishment, approaches to build smart cities, and underlining drivers for smart city initiatives. Regarding the first question, participants demonstrated diverse views regarding the readiness of current infrastructure to enable smart city implementation. While some stakeholders felt the present infrastructure were adequate, others opined that significant improvement is required because the amenities are below the required standard. Previous studies conducted in the Kingdom of Bahrain have also emphasised the need to provide adequate infrastructure, which is considered an enabler for other related real estate and smart city initiatives (Mouzughi et al., 2014; Monk et al., 2013). Likewise, land use and planning systems in developed

countries identified the significance of infrastructural readiness as the first factor in the transformation of real estate (Monk et al., 2013). Thus, Bahrain government needs to initiate adequate infrastructural development to attract private sector investment – a key aspect in sustainability criteria.

4.4.1 Element Required for Smart City Development

In terms of the elements required for smart city establishment, the factors identified in this study were appropriate smart city policies, collaboration with international smart cities, human capital and human resources, and alternative energy sources. The implementation of legislation and policy transfers were highlighted as crucial elements to facilitate smart city initiatives in Bahrain. Apart from the availability of infrastructure, participants viewed decision-making among the relevant authorities and policy makers as crucial factors for a successful implementation. These results are consistent with a recent study conducted in Singapore on the role of policy transfers in driving smart city development (Li et al., 2022). In the latter study, the presence of a policy entrepreneur, cities' drive for policy learning, explicit regulatory mechanisms were identified as vital factors.

Overall, apart from advanced technologies, smart city development require urban governance and policies to guide the selection and adoption of technologies (Lim et al., 2019). However, most studies revealed that less attention is given to smart city governance and policies (Lim et al., 2019; Yigit Canlar et al., 2019), and this seems to be the case with Bahrain. The present finding depict that government may consider analytical, and operational aspects of ensuring policy capacity and legislation to promote smart city development in Bahrain.

Another theme documented in this study was collaboration with other international smart cities. Assistance from the international community in various aspects such as human and financial capital, capacity building, and infrastructure will go a long way in catalysing smart city development (Lim et al., 2019; Fernandez and Peek, 2020). Likewise, Li et al. (2022) recommended formalising collaborative mechanisms and joint partnerships between cities and international or regional networks of smart cities as crucial elements for smart city development in Singapore.

Human capital and resources were also highlighted as vital elements to establish smart cities in Bahrain. Although a few stakeholders opined that the country's human resources and manpower, most had a contrary opinion by emphasising the need for experts trained in various smart city fields. Similarly, previous studies revealed the importance of utilising human and material resources for effective mobilisation of real estate industry to enable smart city actualisation and meeting economic and sustainability criteria (Avdeeva et al., 2019). A recent study conducted in China by Hu et al. (2023) equally conveyed that human capital should be prioritised in smart city creation in developed nations while those at various stages of smart city development may benefit more from context-specific interpretations of technology-centricity. Thus, Bahrain may consider its current developmental stage and phase of smart city development in their policymaking, particularly in balancing technology vs human-centric approaches. Nevertheless, the present findings suggest that human capital remain a fuel for implementing and sustaining smart cities in Bahrain's context.

Regarding the present infrastructure, most participants perceived that Bahrain's infrastructure is yet to attain the required level for smart city operation and sustainable development. For instance, compared to other countries at higher stages of smart city development, there is still gap to be bridged in linking transportation, network, communication systems. A term "city infrastructure" is used in the IT industry which refers "the interconnected structures that enable people to get the resources they need in the city, and also the interconnected structures to people to get the resources they need in the city, and also the interconnected structures provide public services for social and economic activities in the city" (Abutabenjeh et al., 2022). As summarised in the smart city literature, the infrastructure that makes up a smart city comprises energy, transportation, communication, water supply and drainage, disaster risk-reduction, educational, healthcare, sports, and social welfare (Abutabenjeh et al., 2022). The requirement is to use ICT in managing all the infrastructures at the city level, while sensing data are gathered by sensors distributed within the infrastructures. Unfortunately, as gleaned from this study, Bahrain is yet to achieve this level of infrastructural integration.

In this subsection, the last theme that emerged from the thematic analysis focused on renewable energy sources. Despite a few participants hinted on the expanding usage of renewable energy sources, most stakeholders argued that diversified energy sources are required for smart cities to be materialised. Industries, especially those in developed countries, have successfully harnessed technological advancement to extract energy from renewable energy sources (RES) (Fernandez and Peek, 2020). This approach reduces environmental pollution, and facilitates the diversification of energy sources, particularly in regions with

underdeveloped infrastructure and scarce natural resources (Vukovic and Nekhorosheva, 2022).

Despite Bahrain does not fall in any of these contexts, it needs to align with the global trend towards minimum and rational usage of resources and energy-efficient systems. For instance, smart cities in Russia, Canada, United States, Denmark and Australia generate their energy requirement using RES, providing about 40% to 100% of their energy supplies (Vukovic and Nekhorosheva, 2022).

4.4.2 Motives and Reasons Driving smart city initiatives

The most predominant point stated by participants regarding the motives for smart city initiatives was to enhance citizens' QOL. Participants in this study stressed that smart city systems such as smart transportation, healthcare, transactions, job opportunities, and housing offer better opportunities for people to improve their livelihood. This finding is not surprising given that QOL remains the ultimate goal of smart city development (Mouzughi et al., 2014; Fernandez and Peek, 2020). Moreover, the smart city concept has emerged as a means to enhance the quality of life of citizens as embedded in the Kingdom's National Real Estate Plan 2021-2024 to expand its land mass by building new cities and creating smart and ecologically sustainable real estate (Al Khalifa, 2019). In addition, smart city initiatives were described in several studies as proven catalysts to improve citizen's standard of living and QOL.

Meanwhile, the exponential population growth was highlighted by some stakeholders as the main driver for smart city initiatives. Given the increasing population growth, smart city systems are necessary to meet the daily increasing demand and ensure smooth operation of private and public

services. Recent data depicted that Bahrain is experiencing a rising urbanisation rate, with a high percentage of the population living now in towns and cities (Bahrain Census, 2020). Smart cities are thus seen as the main approach to address the potential adverse impacts of urbanisation on the environment. It is not surprising as Bahrain's government and policymakers have garnered efforts to improve the city's infrastructure and thread the path of smart city implementation (Al Khalifa, 2019). These findings also relate to participants' views regarding sustainable growth and development as the ultimate goal for initiating smart city initiatives in the country.

Aligning with the global trend of ensuring environmentally friendly activities, addressing climate change and global warming was identified as a major drive for smart city initiatives in Bahrain. Alternative energy sources, prudent use of available resources and preserving for future generations were highlighted as various means of achieving this goal. Promoting the integration of climate strategies and encouraging citizen participation as obtained in a smart city approach were reported to enhance the interaction between nature and technology – an important event for early adaptation and safeguarding smart infrastructure from climate impacts (Fernandez and Peek, 2020).

4.4.3 Expected Benefits and challenges

The second section focused on the expected benefits of smart cities, specifically in terms of sustainable development, and the challenges that may be faced in the process. Resultantly, stakeholders held the view that the main benefits of smart city development are improved QOL, diversified investment, environmental sustainability, improved security architecture and robust tourism and hospitality industry.

Enhanced QOL among Bahrain's citizens was the most predominant benefit mentioned by participants in this study. This point was elucidated by highlighting the positive impact of smart cities on the services delivered by the transportation, healthcare, communication, and housing sectors. This result is expected since the main goal of initiating smart cities is to improve urban citizens' QOL and bridge the gap between supply and demand in various functionalities (Zanella et al., 2014; Kim et al., 2015). The majority of modern smart cities emphasise efficient and sustainable solutions for transportation, energy management, healthcare governance and other sectors in order to accommodate QoL demands and meet the increasing demand urbanisation (Ejaz et al., 2017).

Based on the semi-structured interview, smart cities were described to provide the structural framework and foundation to support urbanisation. Urbanisation entails providing facilities and services to cater for the increasing population while ensuring improved QOL and efficient service delivery (Wang et al., 2022). Therefore, smart cities are considered the modern and effective approach to achieve sustainable development. In addition, smart cities environment facilitate smooth and efficient operations to meet citizens' demands. The provision of digitised smart solutions are critical for smart city advancement and delivering efficient private and public services, thus presenting the framework for sustainable development.

The provisions in smart cities contributes positively to the tourism and hospitality industry, given the diverse areas in which smart systems operate such as transportation, housing, and communication (Mouzughi et al., 2014). Thus, it was surprising as stakeholders in this study highlighted tourism and hospitality industry to gain substantially from digitised smart solutions. Bahrain's location in the Middle East and the culture of

deploying smart and innovative solutions in preserving archaeological and historical sites are expected to boost the tourism sector. Likewise, recent studies depicted the importance of the tourism sector to sustainable development based on the multiplier effect of high tourist spending on the economy (Handayani, 2022). According to the Prime Minister, examples of the event is the Formula One development, which has put the country on the tourism map, thereby contributing positively on other sectors of Bahrain's economy (Mouzughi et al., 2014).

Another way in which the tourism sector impacts positively in achieving sustainable development is by encouraging foreign investment (Handayani, 2022). In this study, participants also opined that smart city initiatives will bring about diversified investment – which is prerequisite for sustainable development in any country. Nevertheless, there is usually a challenge in balancing economic and social sustainability criteria. From an economic perspective, the influx of foreign investment and tourists are desirable, but may elicit unintended consequences, such as shortage in housing, particularly those belonging to the low-income group (La Rocca, 2014). This point was raised by a few participants in the present study, who recommended that available infrastructure must be improved to cater for Bahrain's citizens, irrespective of their income groups while attempting to boost the tourism sector and influx of people. This suggestion aligns with the terms “sustainable tourism” and “sustainable livelihood approach”, whereby policymakers should ensure that existing activities are not displaced when introducing tourism to communities (Tao and Wall, 2009). In other words, the introduction of the latter should be complementary to present activities, rather than replacement (Yakob et al., 2012).

In this study, participants posited that smart city development will contribute significantly in reducing the rate of crimes and improving the country's security architecture. This finding is consistent with previous studies regarding expected benefits of implementing smart cities among various stakeholders in real estate and smart city initiatives (Mouzughi et al., 2014; Fernandez and Peek, 2020). The presence of digitized smart solutions, real-time information/monitoring, and artificial intelligence for world of art security network are some of the ingredients to fight cybercrime and other forms of crimes in the society (Baig et al., 2017). Meanwhile, some stakeholders in this study believed that smart cities will helping in addressing crimes by increasing job opportunities and improved citizen's QOL. Given the improved standard of living among the population brought about by smart cities, the rate of crimes are expected to reduce significantly. Nevertheless, identifying the challenges associated with smart city development and providing appropriate solutions remain pertinent to address issues such as cyber security, data confidentiality, privacy and security as discussed in the subsequent section.

In terms of the expected challenges in becoming a smart city, the main issues raised by participants were cyber security, public acceptance or low awareness, high cost and financing constraints, insufficient human resources, and infrastructural requirement. Regardless of the advantages of developing smart cities, the advanced environment are vulnerable to several cyber security threats, thereby making it difficult to ensure strong security (Baig et al., 2017). The participants recognised the potential cyber security threats since they are experienced and currently holding top positions in Bahrain's real estate and related smart-city related projects. For instance, a participant highlighted the risk of hijacking the control of a smart train by someone in another country following unauthorised access

and invasion of smart control systems. Likewise, Zhou et al. (2021) highlighted that an individual's unintentional or intentional vulnerable action may put the whole smart city at risk. Moreover, countries that have successfully implemented smart cities are still faced with the challenge of cyber security (Sengan et al., 2020), thus Bahrain is not an exception to this big threat. Stakeholders in Bahrain's real estate and smart city initiatives need to identify the threats to citizens' privacy and cyber security challenges, which is considered the first step in providing proper solutions, as well as successful smart city design, implementation and development (Kashef et al., 2021).

Another challenge mentioned by most participants was financing and high cost of smart city development. Given the array of advanced technologies and state-of-art infrastructure required for the design, implementation and development of smart cities, finance and high cost are widely recognised as pressing issues that need to be addressed (Razmjoo et al., 2022). Nevertheless, the transformation to smart cities is a long-term plan and financial or budget allocation may prioritise specific sectors that are more likely to have multiplier effects on the economy to facilitate sustainable development.

Acceptance of smart cities by the public and improving awareness level of the benefits were reported as hurdles to be crossed for successful implementation and development of smart cities in Bahrain. Citizens and inhabitants need to be encouraged and educated on the positive impact and expected benefits of smart cities. A recent study by Hartely et al. (2023) revealed that respondents were more optimistic about the impact of smart cities on QOL than on governance, but the results differed according to respondent's educational and income level. Participation and acceptance by citizens was also reflected as crucial for the implementation of policy

initiatives, including a smart city (Cardullo and Kitchin, 2019). Our present findings are consistent with the reports from a survey conducted in Japan and Australia whereby respondents' willingness to live in smart city was influenced by their perceptions about smart city characteristics, particularly those affecting the daily QOL (Shibuya and Suzuki, 2022; Yigit Canlar, 2022). Likewise, awareness about smart cities differed among various groups of respondents in Indonesia (Novita and Suryani, 2019). Respondents in the latter study also felt that the government's communication and information efforts concerning smart initiatives were inadequate. A similar finding was observed in the present study as respondents posited that Bahrain's government appears to focus on technology-centric approaches while neglecting the role of citizen participation and the public buying into smart city initiatives. Other challenges such as human resources and present state of infrastructure have been discussed earlier in the section.

4.5 Chapter Summary

This chapter has presented the research findings based on the thematic analyses of participants' responses to each question in the two broad sections of the semi-structured interview. The findings were discussed in relation to Bahrain's context and studies conducted in other countries. The next chapter presents the conclusions, limitations and recommendations for future work relating to smart cities and sustainable development.

Chapter Five

Conclusion and Recommendations

5.1 Introduction

This chapter summarizes the research and present the conclusions drawn from the study. The summary provides a recap on the study background, problem statement, research objectives, methodology, and the summary of the research findings. The limitations of the study are highlighted in this chapter, followed by recommendations for future research on smart cities and real estate development.

5.2 Summary of Research Findings

Based on the research gaps presented earlier in the introductory chapter of this thesis, this qualitative study was conducted to achieve the following objectives; identify the potential positive and negative economic impacts of the implementation of smart city initiatives by real estates, analyse the potential opportunities and challenges associated with the use of Smart City technologies in Bahrain, and to assess the potential economic development opportunities that could arise from the use of Smart City technologies in Bahrain.

To achieve the research objectives, the first section of the interview focused on the present infrastructure, elements required for smart city establishment, approaches to build smart cities, and underlining drivers for smart city initiatives. Meanwhile, the second section emphasised the expected benefits of smart city development, especially in terms of sustainable development, and the associated challenges.

Resultantly, participants demonstrated diverse perspectives on the current state of infrastructure in Bahrain, whereby some stakeholders opined that significant improvement is required while others felt the present infrastructure is adequate. Regarding the required elements for smart city establishment, the factors identified in this study were appropriate legislation or policies, collaboration with international smart cities, human capital and human resources, and alternative energy sources. The findings from this study revealed that increasing citizen's QOL, exponential population growth, ensuring environmentally friendly activities, addressing climate change and global warming and achieving sustainable development were the predominant motives for smart city initiatives in Bahrain.

For the semi-interview on expected benefits of smart city development, the themes that emerged from the thematic analyses were improved QOL, diversified investment, environmental sustainability, improved security architecture and robust tourism and hospitality industry. Notably, these expected benefits and advantages align with Bahrain's Real Estate Plan 2021-2024, National Recovery Plan, and Sustainable Development Goals. On the other hand, the expected challenges raised by participants were cyber security, public acceptance or low awareness, high cost and financing constraints, insufficient human resources, and infrastructural requirement. Overall, stakeholders from the real estate industry provided important information that may assist in ascertaining the benefits of smart city initiatives, tackling the issues that may arise, and pave the way for sustainable growth and development.

This study revealed pertinent information regarding the potential economic impacts of implementing smart city initiative by real estates in Bahrain, ranging from better QOL among the citizens, diversified

investment, environmental sustainability, improved security architecture and robust tourism and hospitality industry. These expected benefits of smart city initiatives might propel Bahrain towards attaining sustainable development in the long run. Nevertheless, the present infrastructure needs to develop to facilitate the implementation and realisation of the aforementioned macro-economic goal. Apart from infrastructure, the essential elements required for smart city construction in Bahrain's context include strong appropriate legislation and policies, international collaboration, human capital and resources, and exploring alternative energy sources. Thus, real estate stakeholders in this study elucidated the opportunities to transform the Bahrain and join the league of smart cities.

Notwithstanding, identifying the potential challenges is equally important for smart city dream to become a reality. Policymakers and relevant authorities involved in Bahrain's smart city initiatives may consider providing innovative solutions to cyber security, addressing public acceptance and awareness about smart cities, attracting foreign investment to finance the real estate industry, and building competent and effective human capital. These areas need to be prioritised to enable the transformation of Bahrain's potential smart cities and drive towards attaining sustainable development.

5.3 Limitations of the study

Despite the vital information gleaned from this qualitative study, a few limitations in the research need to be highlighted. This study entailed a semi-structure interview, which was conducted among top stakeholders in Bahrain's real estate industry. Thus, verbal responses were subjected to thematic analysis without collecting any empirical data. The findings are therefore immeasurable and restricted to qualitative interpretation.

In terms of study population, the participants in this study comprised stakeholders currently holding top positions in the real estate industry, ranging from CEO to project evaluators and general managers. However, policymakers and top leadership officers from the public sector were not recruited for the interview. These personnel might offer crucial information relating to the research topic if enrolled. The main reason for recruiting those from the private sector was the less bureaucracy and protocols in reaching them and obtaining their consent to participate in this study.

Since smart city is a relatively recent initiative in Bahrain, the participants were guided during the interview by highlighting certain points to trigger their response. Such procedures might introduce bias in the information provided by the participants. Nonetheless, participants were only guided when the question asked was not well-understood.

5.4 Recommendations for future research

Based on the limitations highlighted in the previous section, the following recommendations may be considered for future research on smart cities and sustainable development in Bahrain;

- Given the data paucity on the research topic in Bahrain's context, empirical and mixed study designs may be considered in future works to obtain more robust data that will assist in elucidating the relationship between smart cities and sustainable development. In addition, such comprehensive approach will facilitate data triangulation and provision of evidence-based data in answering the research questions.

- Participants from various fields relating to smart city initiatives from the private and public sector may be recruited in future studies for better and more diverse insight, particularly on how smart cities could trigger sustainable development in the long run.
- Rather than looking at the whole real estate industry and service sectors, the contribution of specific sectors to smart city implementation and sustainable growth requires further investigation. Such information will definitely assist policymakers and those involved in smart city decision-making process to identify areas to focus on and addressing the challenges inherent in a given sector or industry.

5.5 Chapter Summary

This chapter has successfully summarised the research findings and conclusions drawn from the qualitative study. Notably, this thesis presented pertinent information that may assist policymakers and relevant authorities in identifying the potential benefits of smart city initiatives, addressing the challenges that may be faced, and position the country on the trajectory of sustainable growth and development. This chapter also highlighted the limitations of the research and recommendations on how such weaknesses could be ameliorated in future studies.

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APPENDIX 1: Interview guide

Dear respondent,

My name is Mohammed Ayoob, I am currently studying for *M.Sc. in Real Estate Development and Property Management* my research topic is “Effects of Smart Cities on Changing Economic Development in Bahrain”. I need your assistance to conduct my research project. This exercise seeks to establish the element required for smart city initiatives and challenges facing smart city initiatives, present changing business environment and the strategies adopted to remain competitive and address the issues. Recorded data will be aggregated when reporting findings. The researcher understand that you are busy and thus the survey may consume some part of your time, however the results and recommendations of this study will and should benefit the organisation and yourself in return.

How old are you?

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What is your highest level of qualification?

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How long have you worked in the real estate?

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.....

What is your position in this company?

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What are the challenges of smart cities in Bahrain, especially if we know that smart cities are those cities that integrate digital technology into the various infrastructure and provide services in an innovative digital way that helps improve the quality of life?

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To what extent do you find that the current infrastructure in Bahrain is conducive to the transformation towards smart cities, such as the readiness of the technical infrastructure and the abundance of information?

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What is your assessment of the elements that Bahrain has to transform towards smart cities, such as human capabilities, smart mobility, effective smart communications, and so on?

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What are the best ways to build real estate communities conducive to the emergence and sustainability of smart cities, is this through expanding the uses of smart solutions to facilitate life, or by imposing a specific pattern for building cities in a smart way?

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What are the most prominent motives and reasons that promote the shift towards smart cities in Bahrain, and do you think that among these reasons are: population growth, increasing city requirements and budgets, and technological development?

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What are the most prominent benefits and advantages of smart cities, especially with regard to improving the quality of life, attracting investments, and the ability of citizens to participate and communicate their opinions and orientations?

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To what extent can real estate development related to smart cities contribute to leading sustainable urban development in Bahrain?

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What are the problems that might arise in the case of building smart cities in Bahrain?

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What roles can smart cities play in preserving the environment, heritage, historical sites, and antiquities through effective systems, for example, for managing waste or reducing the occurrence of disasters, and the like?

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جامعة البحرين

كلية إدارة الأعمال



قسم الاقتصاد والتمويل

تأثير المدن الذكية على تغيير التنمية الاقتصادية في البحرين

أطروحة مقدمة كجزء من متطلبات الحصول على درجة الماجستير

إعداد

محمد رجب منصور أيوب

٢٠٠٤٢٠٣٣

إشراف

الدكتور عمار برهم جريسات

(استاذ مساعد)

جامعة البحرين

مملكة البحرين

يناير، ٢٠٢٤