

Investigation of the smart cities strategies within the United Kingdom

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Investigation of the Smart Cities strategies within the United Kingdom

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A thesis submitted in partial fulfilment of the requirements of the University of Wolverhampton for the degree of the Doctor of Philosophy (PhD)

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Abstract

The Smart City (SC) concept has emerged as an innovative response to the challenges and opportunities faced by cities around the world. However, despite many attempts to implement various strategies, many organisations within the United Kingdom still encounter difficulties embedding the smart city agenda in their systems and processes. The aim of this research is to develop a strategic framework for implementing smart city strategies in the United Kingdom to improve the quality of life for its citizens.

Exploratory qualitative research was undertaken due to the lack of strategy frameworks on the subject. This research explores the understanding of the smart city school of thought and the evaluation of the smart city concept from economic, digital, environmental, and citizen's perspectives. Additionally, this study strives to investigate the key policy challenges that help to innovate smart cities and how the governments of smart cities can use technology and smart city infrastructure such as the Internet of Things (IoT), Information and Communications Technology (ICT). Furthermore, this research develops and evaluates the strategic smart city framework.

Twenty-five key influential business CEOs in the smart city sector were chosen and through snowball sampling, the participants were interviewed. Through the literature review and the thematic analysis of the interviews, firstly, the different perspectives of smart cities were identified (citizen, environmental, digital, and economic perspectives) and the key challenges that affect the innovation of smart cities were found from the government's point of view and policy development aspect. It was found that the technology infrastructure (IT/ICT), cybersecurity, funding, stakeholders, and their collaboration with the government and citizens, as well as the knowledge and awareness of smart cities. Strategic challenges were highlighted as the main inhibitor of smart city implementation within the United Kingdom.

The framework developed provides valuable insights and serves as a roadmap for decision-makers, providing them with the tools, strategies and guidance they need to plan and implement initiatives that improve the quality of life for citizens, by leveraging data, improving citizen engagement, encouraging collaboration, and prioritising privacy and security, cities can realise the full potential of smart technologies to improve quality of life and drive economic growth. By following the framework, decision-makers can ensure that smart city projects are aligned with the city's goals and priorities and deliver tangible benefits to citizens.

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Dedication

This thesis is dedicated to:

My parents, Farideh Zakeri and Hamid Keshvaridoost.

My sister, Ayda Keshvaridoost and my partner, Judea Rosmin Raju.

Also, I would like to dedicate this thesis to my grandmother, Tooba Talebi. May her memory forever be a comfort and a blessing.

Thanks for believing in me.

Declaration

All research has been conducted by the PhD candidate and no portion of the research referred to in this thesis has been submitted in support of an application for another degree or qualification at this or any other university or institution of learning.

List of abbreviations and acronyms

Abbreviation	Acronyms
AI	Artificial Intelligence
CSF	Critical Success Factor
EIP	European Innovation Partnership
EU	European Union
HDI	Human Development Index
ICT	Information and communication technologies
IoT	Internet of Things
ISO	International Standardization Organisation
IT	Information Technology
KPI	Key Performance Indicator
M2M	Mobile to Mobile
MITM	Man in the middle
PCA	Principal Component Analysis
PPP(s)	Public Private Partnership(s)
QoL	Quality of Life
ROI	Return on Investment
SC(s)	Smart cities
SCC	Smart Cities Concept
SCD	Smart cities development
UN	United Nations
WHO	World Health Organisation

Research Output

- Keshvardoost, S., Renukappa, S., and Suresh, S., (2019) Theoretical Concepts of Smart Cities: A Critical Review, the 3rd International Conference on Smart Grid and Smart Cities (ICSGSC 2019), June 25-28, 2019, at University of California, Berkeley, USA.
- Keshvardoost, S., Renukappa, S., and Suresh, S., (2019) Investigation of the key smart cities governance issues and challenges, CIB World Building Congress 2019, Constructing Smart Cities, 17-1 June, 2019, The Hong Kong Polytechnic University, Hong Kong, China.
- Keshvardoost, S., Renukappa, S., and Suresh, S., (2018) Developments of policies related to smart cities: a critical review, IEEE/ACM International Conference on Utility and Cloud Computing Companion (UCC Companion), 17-20 December 2018, Zurich, Switzerland, 370-375.

Chapter 1. Introduction

This starting chapter presents the current problem regarding how smart governance and smart strategy developments are the key factors when considering the successful implementation of smart cities' strategies. It also presents the research aim, objectives, research questions, the limitations and scope of the research, and finally, the structure of the thesis.

1.1. The current problem

The concept of a "Smart City" has evolved as a means to achieve the aims of enhancing productivity and sustainability within urban environments. Originally, it focused on executing specific projects but has since evolved into the implementation of global strategies aimed at addressing broader urban challenges. However, the development of smart cities encounters various challenges spanning policies, funding, infrastructure, technology, cybersecurity, stakeholder engagement, and environmental concerns. While researchers emphasise the significance of smart city concepts and their development (Khan et al., 2020), Nevertheless, there have been limited studies focused on the challenges faced by the government in the development of smart cities. Mainly, smart city issues are faced by private and government organisations.

As noted by Chourabi et al. (2012) and Ibănescu (2022), the smart city is still an emerging concept as a fully successful functioning city. Smart cities need to deal with their innovation and economic competitiveness, while upgrading social cohesion, environmental sustainability and the increased personal satisfaction of their citizens. This necessitates the adoption of new technological innovations, particularly in Information and Communication Technology (ICT). The diversity in approaches to smart city policies and governance underscores numerous research opportunities essential for successful implementation. The areas requiring attention include: (1) Data Governance: Efficient resource and service management in smart cities heavily rely on data collection and analysis. However, ensuring data privacy, security, and ethical use poses significant challenges. Robust data governance policies are needed to regulate data security and privacy (Guenduez et al., 2024; Moon, 2020). (2) Collaborative Governance: Smart city initiatives involve multiple stakeholders, including government agencies, private sector organisations, and citizens. Effective collaboration and coordination among these stakeholders are vital for successful implementation. Policymakers should promote

collaborative governance models facilitating information sharing, decision-making, and resource allocation (Moir and Moon, 2021). (3) Digital Inclusion: Despite the potential benefits of smart city technologies, there's a risk of widening existing digital divides and marginalising vulnerable populations. Prioritising digital inclusion initiatives ensures that all citizens have access to and can benefit from smart city services. This may involve providing affordable internet access, digital literacy training, and accessible user interfaces (Kitchin, 2015). (4) Citizen Engagement: Citizen engagement is crucial for designing, implementing, and evaluating smart city initiatives. Traditional forms of public participation may not suffice to capture diverse perspectives and preferences. Hence, leveraging comprehensive approaches to gather various viewpoints and relate them to specific city challenges is essential (Monzon, 2015). Policymakers must utilise digital platforms and participatory mechanisms to enable meaningful citizen engagement throughout the decision-making process (Barnes et al., 2020).

Despite the global expansion of smart city initiatives, a consistent framework for an effective smart city's government strategy is lacking. This absence hinders the ability to improve citizens' quality of life and evaluate the intelligence of cities comprehensively (José and Rodrigues, 2024). Consequently, there is a lack of comprehensive framework to deal with the key challenges faced by cities and evaluating the effectiveness of smart cities governance policies in achieving their intended goals, such as sustainability, efficiency, and citizen satisfaction and quality of life.

1.2. Aim and objectives of the research

The aim of this research is to develop a strategic framework for implementing smart city strategies in the United Kingdom to improve the quality of life for its citizens.

To achieve this aim, the following objectives were developed.

1.2.1 Objectives

1. To explore the concept of smart cities.
2. To explore the policy development and challenges in the context of smart cities.
3. To investigate and analyse the government role in smart cities development.
4. To explore the key drivers for implementing smart cities projects.
5. To develop a strategic smart city governance framework.
6. To evaluate the strategic smart city governance framework.

1.3. Research questions

1. What are the smart cities’ perspectives?
2. What are the key policy challenges when developing smart cities?
3. What role does the government play when developing smart cities?
4. What solutions can be followed or implemented to guarantee the successful implementation of smart cities’ projects?

The corresponding research objectives and questions are described below in Table 1-1. This links to the table of research objectives, questions, and chapters (RO= research objective, RQ= research question).

Table 1-1. Linking table of the research objectives, questions, and chapters (RO= research objective, RQ= research question)

Chapters	Objective No.	Research Objective	Research Question No.	Research Question	Method used
Chapter 2	RO1 RO3	To investigate the existing literature on the smart city concept and analyse the government role in smart cities development.	RQ1 RQ3	What are the smart cities’ perspectives? and What role does the government play when developing smart cities?	Literature review
Chapter 3	RO2	To explore the policy development and challenges in the context of smart cities.	RQ2	What are the key policy challenges when developing smart cities?	Literature review
Chapter 5	RO1	To explore the concept of smart cities.	RQ1	What are the smart cities’ perspectives?	Semi-structured interviews

Chapter 6	RO2	To explore the policy development and challenges in the context of smart cities.	RQ2	What are the key policy challenges when developing smart cities?	Semi-structured interviews
Chapter 7	RO3	To investigate and analyse the government role in smart cities development.	RQ3	What role does the government play when developing smart cities?	Semi-structured interviews
Chapter 8	RO4	To explore the key drivers for implementing smart cities projects.	RQ4	What solutions can be followed or implemented to guarantee the successful implementation of smart cities' projects?	Semi-structured interviews
Chapter 9	RO5 RO6	To develop a strategic smart city governance framework. and To evaluate the strategic smart city governance framework.			Literature review and Semi-structured interviews

1.4. Methodology of the research

The methodology of this research is based on pragmatism as the lack of reliable smart city implementation plans/frameworks have created the need for an exploratory study. This demand has led to a qualitative approach to answer the questions and objectives proposed by the researcher (Table 1-1. Linking table of research objectives, question and chapters (RO=

research objective, RQ= research question)). Due to the nature of the challenges addressed in Chapter 4, snowball sampling was used to obtain interviews with the key influential members in the smart city sector.

To analyse the data, thematic analysis was performed to compare the different challenges presented by the interviewees and those found in the literature. Finally, they were also compared with the results, after which a framework was created for the successful implementation of smart cities' strategies within the United Kingdom (Table 1-2).

Table 1-2. Summary of the methodology of the research

RESEARCH	QUALITATIVE RESEARCH
IDEOLOGY	Pragmatism
APPROACH TO ENQUIRY	Qualitative
QUALITATIVE RESEARCH DESIGN	Grounded theory
THE MAIN PURPOSE OF THE INVESTIGATION	Exploratory research due to the complexity of the smart cities' issues and the lack of comparable research in the field.
SAMPLE TECHNIQUE	Snowball sampling
SAMPLE SIZE	25
SAMPLE DIVERSITY	Directors, CEOs, Managers
DATA COLLECTION METHOD	Semi-structured interviews
UNIT OF ANALYSIS	Cities
EMBEDDED UNIT OF ANALYSIS	Individual employees
METHOD OF ANALYSIS	Thematic analysis
OUTCOME OF ANALYSIS	Framework

1.5. Benefits of the research

The main beneficiary of this study is the smart city sector and all stakeholders, inclusive of local governments like the top management, organisations, policymakers and managers, and private and public companies within the smart cities' sector. The results of the study will:

- Improve the understanding and awareness of the concept of smart city development at the governmental level.
- Improve the understanding of the factors that push for the implementation of smart city initiatives. This will provide the governments and decision-makers with an opportunity to better understand the issues to ensure the successful implementation of smart cities in the United Kingdom.
- Help the governance of smart cities to essentially frame and build a roadmap towards adopting successful smart city strategies.
- Aid policymakers in understanding the factors that drive the need to change the development strategies towards being sustainable at the core.
- Guide organisations in effectively managing smart city projects.
- Improve the knowledge, awareness, and education regarding smart city projects.

1.6. Contribution to knowledge

- This study first provides this body of work that will be added to the reports and documents available in the study of the smart city development sector. This research can be utilised as a foundation for future research (See chapter 10.5).
- Presentation of the key challenges to the implementation of smart city projects in the United Kingdom: (1) Technology infrastructure (IT/ICT), (2) Cybersecurity, (3) Lack of funding, (4) Lack of knowledge and awareness, and (5) Stakeholders' issues.
- The extraction of the key crucial success solutions related to the implementation of smart city projects in the United Kingdom: (1) Collaboration and Partnership, (2) Government transparency, (3) Funding, and (4) Quality of life.
- The framework that will assist with successfully implementing smart city strategies in the United Kingdom.

1.7. Limitations and scope of the research

The research is investigative in nature due to the lack of reliable smart city implementation plans/frameworks. Like any research, the limitations are an important element as they recognise the scope and highlight future work. For this research, the limitations were:

- Although the study explains smart city strategies in a generalised way, the focus of the research is to develop a framework for the United Kingdom. As such, the framework created aims for use by developments in the United Kingdom where some of the components can be globally used. However, the level of development of the country will determine the challenges and benefits of the framework.
- Smart cities can be investigated in accordance with several aspects. For this research, the focus is on smart city strategies from a governmental point of view.
- The interviews were of a limited number as this is a new field and the population of smart city experts in the country is very limited.
- This research focuses on the smart city sector and experts in the region in most of the interviews, rather than having access to the knowledge of experts all over the world.

1.8. Structure of the thesis

This thesis has been written using a systematic and logical structure to allow the reader to simply follow the information flow. This also allows them to understand how the research questions were answered and how the research objectives were achieved. The thesis begins with the introductory section in Chapter 1 and ends with the conclusions and recommendations in Chapter 10.

The structure is as follows:

Chapter 1 is where the introduction sheds a light on the current problems and justification of the study. It explores the research aim, objectives, questions, and methodology. The chapter also discusses the study benefits, its scope and limitations, and provides a brief overview of each chapter.

Chapter 2 starts by reviewing the relevant literature regarding the concept of smart cities and governance.

Chapter 3 continues reviewing the relevant literature regarding smart city policy development and the relevant smart city challenges faced by governments.

Chapter 4 investigates the methodological approach chosen to achieve the research's aim and objectives. This chapter discusses the reasoning behind the use of the qualitative approach, the data collection, and the most appropriate data analysis methods.

Chapter 5 explores the smart city perspectives and the findings of the chapter are discussed across four main sections, the perspectives of citizens, environmental, digital and economic. This chapter addresses the first research objective and research questions.

Chapter 6 - This chapter discusses the key policy challenges when innovating smart cities from a governance point of view. This chapter addresses the second research objective and answers the second research questions.

Chapter 7 investigates the government's role in smart city developments. The chapter addresses the third research objective and third research question.

Chapter 8 identifies the key drivers for the successful implementation of smart cities. This chapter addresses the fourth research objective and fourth research question.

Chapter 9 describes the development of an integrated framework for implementing smart city strategies within the United Kingdom, including the evaluation of the integrated framework. This chapter addresses the fifth and sixth research objectives.

Chapter 10 summarises the key findings of this research and provides recommendations.

Finally, there are the references followed by the Appendix, representing the raw data from the interviews and its evaluation.

1.9. Summary

This chapter gives introduction to the research, followed by highlighting the pressing nature of the current problem and the imperative need for investigation. The aim of this study is to develop a strategic framework for implementing smart city strategies in the United Kingdom to improve the quality of life for its citizens, with specific objectives outlined to achieve this overarching goal. Guided by pertinent research questions and methodology (based on pragmatism approach), ensuring rigor and reliability in the findings. Beyond addressing the immediate problem, this research offers several potential benefits, highlighted in this chapter. Additionally, through its contribution to knowledge, this study seeks to improve the quality of life for the citizens of smart cities. However, it is essential to acknowledge the inherent limitations and scope of this research, which was outlined in this chapter to provide clarity. Finally, the structure of the thesis is provided, presenting a roadmap for the subsequent chapters. The next chapter (chapter 2) will focus on reviewing the relevant literature on smart

city concepts and the government role in smart cities development, followed by chapter 3, the literature review on smart city policy development and related challenges.

Chapter 2. Literature review of the smart cities' concept and governance

2.1. Introduction

This chapter focuses on reviewing the relevant literature of the first and third research objective, to explore the concept of smart cities and to investigate and analyse the government role in smart cities development. To answer the first and third research question based on the literature findings:

“What are the smart cities' perspectives?”

and

“What role does the government play when developing smart cities?”

The chapter is grouped into four main sections. The first section reviews the evolution of the smart cities concept throughout the years. The second section introduces the schools of thought on smart cities. The third section reviews the role of the government and management in smart cities. The fourth section provides a review of smart city governance. The chapter concludes with a summary.

The smart cities mission is an innovative new initiative by the government to drive economic growth and improve the quality of life of people by enabling local development and harnessing technology as a means to create smart outcomes for citizens.

Nearly 55% of the world's population now live in cities. With a yearly growth of around 2%, this will increase to roughly 70% by 2050 (World Bank, 2018; Bibri, 2020). Although urbanisation continues to be an enabler for economic growth, it has caused new challenges such as social inequality and significant environmental issues (Harvey, 2012; While and Whitehead, 2013; Vrabie, 2021).

In the approach to smart cities, the objective is to promote cities that provide a core infrastructure and provide a decent quality of life to its citizens, as well as a clean and sustainable environment, and the application of 'Smart' solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas and create a replicable framework that will act like a light house to other aspiring cities. Smart cities are meant to set

an example that can be replicated both within and outside the smart city, catalysing the creation of similar smart cities in various regions and parts of the country.

Smart governance is a key factor within the smart cities' panorama when analysing the successful implementation of smart strategies (Meijer and Bolívar, 2016). On top of their individual smart city projects, many cities take part in smart city networks where best practices are shared and promoted among their members according to various aspects, including smart governance. Despite the potential positive outcomes that local councillors can obtain from the activities carried out by these networks, their influence in the public sector has been questioned in the literature, especially when practitioners and policymakers have questions about whether these networks really do work or are counterproductive (Turrini et al., 2010). Therefore, this work aims to contribute to the literature on the councillor's governance as part of complex networks and on network performance by focusing on the existing network coordination mechanisms with a particular interest in how these can contribute to successful smart city network governance.

This research seeks to establish a theory behind the smart cities' governance policies and their impact on the innovation capacity at the local authority level, spurred by its networked method of operation and how this relates to new trends in city governance (Eisenhardt and Graebner, 2007; Yin, 2014). The scope of this work is not to provide statistical validity or reliability when establishing a successful smart city network but to analyse the literature review in a particular moment where the smart city concept is embedded in most political, economic, social and technological initiatives taken by both local and national governments.

The purpose of this literature review is to gather, analyse, and outline the measurements initiated by smart city governance by logically classifying the relevant body of literature. This chapter combines the different conceptualisations and distinguishes any possible gaps or inconsistencies. To achieve these targets, the literature review is primarily guided by four sub-regions of interest: the determining of the parts of smart city governance, the grouping of the kinds of indicators utilised to measure smart city governance, the recognising of important relevant contextual factors, and the grouping of the envisaged results of smart city governance. The primary zone of interest is the search for a set of components that make up the present comprehension of smart city governance, as well as to precisely characterise the appropriate parts of smart city governance. Conventional organisational and institutional theory applied to the smart city concept that governance represents an important building block for a functioning

smart city to develop. The second area attempts to consolidate the different measurement approaches, rather than assess appropriateness.

As a third area of interest, mentions the role of contextual factors in smart city governance. Although smart governance is assumed to be influenced by numerous variables (Bolívar and Meijer, 2016), few papers notice, theorise or examine the potential role of contextual factors in smart city governance. Subsequently, this chapter isn't planned to give the much-needed systematic analysis of the contextual phenomena related to smart city governance. Instead, it serves as an initial overview of the current state of the research. Significant efforts have been undertaken to distinguish the distinctive segments of smart city governance, as well as the differences between their results. Recently, Meijer and Bolívar (2016) picked a classification in terms of first, second and third results to describe smart city governance results (Meijer and Bolívar, 2016) including (1) improvements to the city, (2) Changes in the position of government in comparison to other urban actors, and (3) Changes to the government organisation.

2.2. Smart cities concept

The concept of smart cities has emerged as a solution to the challenges posed by rapid urbanisation and technological advancements. Smart cities leverage various technologies to enhance the quality of life for citizens, promote sustainable development, and improve efficiency in resource utilisation. This section will explore the smart cities concept, its key components, and the different existing smart city concepts.

Key components of smart cities include interconnected infrastructure, data-driven decision-making, sustainable urban planning and citizen engagement (Harrison et al., 2010). (1) Smart cities require robust digital and physical infrastructure to support various technological implementations. (2) Data analytics play a crucial role in smart cities by analysing vast amounts of data collected from sensors and other sources. This data-driven approach enables cities to optimise resource allocation, predict trends, and improve decision-making processes. (3) Sustainability is a core principle of smart cities, focusing on reducing environmental impact, promoting renewable energy sources, and implementing green infrastructure. (4) Smart cities prioritise citizen engagement through digital platforms and interactive technologies. Citizens are empowered to participate in governance, provide feedback, and access public services conveniently.

Despite there being an agreement that the term smart city refers to innovations in city management, as utilisation of various technologies can enhance the efficiency of city management, its services and infrastructure (Winkowska et al., 2019). a specific definition of the term has not yet been stated. There is a wide assortment of meanings of what a smart city could be. Two patterns can be clearly recognised in connection with the primary aspects that smart cities must take into consideration. From one perspective, there is an arrangement that put accentuation on just one urban aspect like technology, ecology and so forth, leaving apart the rest of the circumstances that are involved in a city. This gathering of monotopic depictions causes the misconception that the final goal of a smart city is to provide an innovative approach to deal with urban administration and improve quality of life in which all aspects are treated with the interconnection that happens in the real life of the city. Enhancing only one player in an urban ecosystem does not imply that the issues of the entire city are being solved.

On the other hand, many researchers have emphasised the importance of smart city concepts and their development (Khan et al., 2020; Keshvaridoost et al., 2019; Gupta and Gupta, 2024). There are also a few studies that stress how the principal contrast of the smart city idea is the interconnection of all urban aspects.

The tangled issues between urbanisation are infrastructural, social, and institutional. This intertwining is reflected in the smart city idea (Cook and Karvonen, 2024). Putting into consideration the existing views on smart city concepts and key components for successful implementation of smart cities, it can be seen that infrastructures are a central piece of the smart city, and that innovation is the empowering agent that makes it conceivable. However, it is the collaboration, association, and combination of all frameworks that are important as part of a city being genuinely smart (O'Connell, 2008; Nam and Pardo, 2011; Chourabi et al., 2012; Harrison et al., 2010; Correia et al., 2011; Batty et al., 2012 and EC, 2014).

Smart cities offer immense potential for shaping the future of urban living. By leveraging technology, data, and citizen engagement, cities can become more efficient, sustainable, and inclusive. However, realising this vision requires collaborative efforts from governments, businesses, academia, and communities to overcome challenges and create cities that truly serve the needs of their citizens. Therefore, the next section discusses the school of thoughts on smart cities.

2.3. School of thought on smart cities

The meaning of 'school of thought' refers to a specific thought or set of thoughts held by a particular group, also known as a doctrine. Any thought that a group strongly believes in, be it through practicing this idea in their regular daily existence or through battling for its adoption, can be viewed as a school of thought. "Although many people today subscribe to the school of thought that everyone should have equal rights, decades ago this belief was not widely held" (Morris, 1997).

The concept of "smart cities" encompasses a diverse range of ideas and approaches, often drawing from multiple disciplines and schools of thought. To evaluate the management and governance of smart cities projects using schools of thought, smart city projects can be analysed through the lens of nine perspectives.

The following section will provide a brief description of the nine key schools in relation to smart cities projects based on a review of the literature by Morris (1997), Turner and Müller (2003), and Williams (2013).

- 1) The governance school: Assess how effectively the smart city project is governed, including the role of stakeholders, decision-making processes, and regulatory frameworks. This school considers the project to be a (legal) element and focuses on the governance of this substance and the relationships between the smart city project participants. The agreement sub-school of this school sees the project as an interface between two legal entities, as client and contractor, and describes how that interface should be managed. The temporary organisation sub-school studies the mechanisms of governance between the project as a temporary organisation and the lasting "project oriented" organisation that hosts the project (Turner and Müller, 2003).
- 2) The optimisation school: Optimising the schedule and duration of the project through mathematical optimisation (Morris, 1997) and also assess how efficiently resources are utilised in the smart city project to achieve desired outcomes, such as maximising utility or minimizing costs.
- 3) The modelling school: The modelling school uses both hard and soft systems theories to create an understanding of the different elements of the project (Williams, 2013). Utilising various models (e.g., mathematical, computational) to simulate and predict the outcomes of different strategies within the smart city project.

- 4) The behaviour school: The focus areas of this school are on leadership, squad development, communication, conflict management, human resource administration in smart cities projects and the human behaviour within the smart city project, including how residents interact with technology, respond to incentives, and adapt to changes.
- 5) The success school: This school focuses on the success and failure of projects and views a project as a business objective. whether the smart city project meets its objectives and delivers value to stakeholders.
- 6) The decision school: This school focuses on decision-making processes, who is involved, and the criteria used to evaluate options and information processing in smart city projects, and the impact that these have on the general project.
- 7) The process school: The information processing viewpoint of projects relations refers to the process school, as it views a project as a process (Morris, 1997). Focuses on the procedural aspects of managing and implementing the smart city project, including project planning, execution, and monitoring.
- 8) The contingency school: The contingency school evaluate how the smart city project adapts to sudden events or changes in the external environment, such as technological advancements or shifts in public policy.
- 9) The marketing school: This school can be viewed as a response to the watched disconnect between the developing importance of projects and undertaking the administration in associations. There is also the view that venture administration is an operational/strategic issue that is not very important or much of an incentive in reference to the organisation's strategy or performance. What's more, where venture advertising was engaged in where there was the showcasing of a contractual worker for a task, the promoting school presents the points of view of advertising the undertaking to the senior administration, basically how the smart city project is communicated to stakeholders and the public, including branding, messaging, and engagement strategies (Williams, 2013).

A combination of the nine schools of thought defined above can be used for smart cities along with the sustainability perspective. This has led to the development of a new and specific school of thought. The integration of sustainability aspects - encompassing citizens, environmental, digital, and economic perspectives - is crucial for the evaluation and development of smart cities in a holistic manner. Therefore, to apply these schools of thought effectively in smart city

projects, all ten perspectives need to be put into consideration to gain a comprehensive understanding of the management and governance of smart cities projects.

In chapter five these perspectives are discussed more in depth. The next section discusses this from the governance point of view.

2.4. The role of governance and management in a smart city

Regardless of the significant capability of the smart city concept, related organisational, strategic, and technical challenges have made it troublesome for cities and communities to reap the promising benefits. Along these lines, both researchers and professionals have contended that a large number of the difficulties for smart cities relates to ending up or being smart and exceeding the scope and capabilities of their present associations, institutional arrangements, and governance structures (Caragliu et al., 2011, Gil-Garcia et al., 2015).

Much consideration has been given to the governance implications of smart cities investments. This can be viewed as a direct consequence of “the perceived failures or lack of impact resulting from smart cities investments to date” (Barns et al., 2017).

With respect to stakeholders, processes, technology, and data have been widely discussed while the other four sub-categories of structures and organisations, roles and responsibilities, legislation and policies, and exchange arrangements have received less consideration. The number of studies that address smart city governance and its contextual factors are limited. Concerning the contextual factors, it appears that the researcher’s analysts have emphasised the ‘degree of autonomy’ previously, whereas recent studies have additionally begun to consider the local conditions. Concerning the outcomes of smart city governance, the two kinds (‘substantive outputs’ and ‘procedural changes’) are distributed equitably with respect to the literature (Ruhlandt, 2018).

2.4.1. Components of smart city governance

In the below section, the segments will be described to get a more comprehensive understanding of the new school of thought in smart city governance.

a) Stakeholders

Stakeholders are one of the most frequently mentioned segments of smart city governance. The term “stakeholders” is directly referenced (Gil-Garcia et al., 2015, Meijer and Bolivar, 2016, Kourtit et al., 2018 and Nam and Pardo, 2011) yet there are also similar terms used, for example, “key actors” (Kourtit et al., 2018) or complete generalisations, for example, “everyone's access to governance” (Hollands, 2008). Another approach describes the groups involved (Batty et al. (2012) and their cooperation in procedures and the exchange of information. In this subject, the digital government framework has been used to engage in collaboration in a smart city system (Reggi and Gil-Garcia, 2021) where the stakeholder term has been generally characterised and referred to as the individuals, groups, offices, parties, or organisations that are engaged with smart city governance in any way. In this section, the different types of stakeholder have been put into categories as public, private, academic, or civic to best capture the range of stakeholders that relate to governance issues. Initially, open stakeholders are often defined as institutions, public subjects (Battarra et al., 2016), government agencies (Castelnovo et al., 2016), political leadership and administrative proponents (Scholl and AlAwadhi, 2016), a governing body, or public administration. Private stakeholders are for the most part characterised as firms and private enterprises (Benevolo et al., 2016). On the other hand some authors describe them all broadly as industry (Lombardi et al., 2012) or even as the market (Lin et al., 2015).

Academic institutions are portrayed as scholarly organisations, for example, universities (Lombardi et al., 2012) and in addition, research bodies (Benevolo et al., 2016). In conclusion, civic stakeholders, regularly referred to as civil society (Benevolo et al., 2016 and Lombardi et al., 2012), consist of a range of diverse actors and groups including citizens (Marek et al., 2017), civic groups (Gil-Garcia et al., 2015), community sector organisations (Castelnovo et al., 2016), or communities and not-for-profit organisations (Benevolo et al., 2016). A few authors stretch the significance of stakeholder type. For instance, Lombardi et al. (2012) considers them to be one of the main key actors and citizens play the most important role.

While different cases have arisen in the literature in terms of inner versus outside stakeholders (Bifulco et al., 2016) and national versus global organisations, the author centres around the previously mentioned refinement. It ought to be noted that numerous stakeholder references in the literature address the significance of multiple or singular stakeholders (Gil-Garcia et al., 2015) without giving a comprehensive definition of the respective stakeholders and their qualities. Others maintain a vaguer depiction of the stakeholders, frequently utilising the term without giving extra detail.

b) Structures and organisations

A subset of the literature straightforwardly references structures and organisations concerning smart city governance. In this context, this is viewed as the structural or organisational developments that encourage collaboration among stakeholders or take into account certain processes. While a few authors (Battarra et al., 2016) feature the general significance of organisational and coordination structures in smart governance, others place specific emphasis on the need to enhance the existing structures (Bătăgan, 2011; Tranos and Gertner, 2012) to take into account smart governance. Scholl and AlAwadhi (2016) describe the “dismantling of these old structures as a key element of any sustainable change” while concentrating on city-wide information and communication technologies (ICT) program implementation. Gil-Garcia et al. (2015) emphasised the need for “intergovernmental, interagency, and also inter-sectoral networks” to consider the cooperation among numerous performers. Furthermore, Van Den Bergh and Viaene (2016) stated this association can reach out past a city's administrative boundary. The vast majority of the previously mentioned structural and organisational contemplations are quite general. Dameri and Benevolo (2016) detail a greater specificity in their empirical examination of the government structures implemented in smart cities. The researchers recognise three kinds of structure, political, administrative, and external, to demonstrate that a few smart cities have every one of them. Strangely, Dameri and Benevolo (2016) feature that “participation, collaboration, and partnership can be empowered through dedicated non-government organisations, such as associations, foundations, and similar groups” made from different stakeholders. In light of their research, they state that the involvement of political and administrative actors is, at least to some extent, attributable to an absence of appropriate structural and organisational formations.

c) Processes

The numerous conceptualisations for smart city governance in the literature have produced an additional diversity of interpretations regarding how stakeholders interact when utilising processes (see Table 2-1). Prior to examining the numerous processes, a conceptual delineation of the respective nomenclature seems valuable. The schools of thought in governance need more well-defined terms in smart city governance research to address some of the ambiguity.

Table 2-1. Frequently mentioned processes

Processes	Explanation	Reference
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<ul style="list-style-type: none"> • Information • Exchange • Communication 	Refers to the direct dissemination of information and the communication between stakeholders.	Marek et al. (2017) Gil-Garcia et al. (2015)
<ul style="list-style-type: none"> • Engagement • Participation • Collaboration • Co-production 	Can be defined as a process characterised by the active involvement of and collaboration between several stakeholders.	Giffinger et al. (2007) Caragliu et al. (2011)
<ul style="list-style-type: none"> • Decision making 	Encompasses the process of decision-making itself.	Dimelli (2016) Walravens (2012) Batty et al. (2012)
<ul style="list-style-type: none"> • Implementation • Management 	Can be described as the process dealing with the implementation of decisions made as well as all other managerial aspects of smart cities governance.	Pereira et al. (2017)

d) Technology, data and digital government

Technology and data have, for quite some time, been utilised in the context of smart city governance yet numerous researchers have not formally recognised them as far as technology versus data-related viewpoints go. A large portion of the general smart city governance research manages the utilisation of (new) school of thought and their technologies to support or enable particular activities, such as “enable central steering” (Granier and Kudo, 2016) and “broaden and deepen participation” (Lin et al., 2015), which centres around information related issues. For example, data collection, access, or analysis (Bakici et al., 2013), “open public data” (Angelidou, 2014), “data analysis” (Wiig, 2016), or blending the two and further related issues. Open data is made public and put to use in smart city applications and technologies. In this unique circumstance, the creator investigates this development by isolating innovation versus information-related issues to give a more exact outline of the audit test. Smart technologies drive effective governance, while attention is on the activities that can be enhanced by utilising new innovations and the extraordinary featuring of data and correspondence advances. Kourtit et al. (2017) emphasised the key part of “digital technologies,” particularly in the change procedure, while Scholl and AlAwadhi (2016) particularly feature ICTs’ part “in both the looking after and making decisions about governance.” Other advances that specialists suggest are, for instance, “geo-science tools and big data” (Kourtit et al., 2017), “data warehousing and

monitoring tools” (Meijer and Bolivar, 2016), sensors, virtualisations, geographic information technologies, and social media applications (Gil-Garcia et al., 2015). As part of creating a smart city and introducing a digital government, the following main elements are considered: digital technologies, organisational structures and processes, informational security, and a socio-economic perspective.

2.4.2. Smart city investments

Smart cities have turned out to be something beyond a trendy expression or short-term hype. It is possible to state that “all cities want to be smart.” For example, India intends to change 100 cities into smart cities and China as of now has around 500 smart cities. It is estimated that the size of the global smart cities market will grow from \$411 billion dollars in 2014 to \$3 trillion dollars by 2020 (Anthopoulos et al., 2015). Regardless of the various focuses and definitions of “smart city” (Albino et al., 2015), the centre lies in the usage of technology for the purpose of improving quality of life. Normally, intelligent systems turn into the essential application of a “smart city” with the transportation area being the “smart mobility” (smart transport) part (Lombardi et al., 2012). Intelligent transportation system (ITS) investments are starting to occur with regards to the smart city initiatives in numerous cities around the globe.

Additionally, energy efficiency and emissions reduction are getting to be the key justifications for smart city investments. Energy saving (and/or greenhouse gas emissions reduction) is viewed as one major benefit and generally it is computed in money saving advantage analyses to justify ITS investments. To be sure, the transport sector is in charge of around about one-fifth of the total energy use worldwide as per the World Economic Forum 2011 with the biggest share found in passenger road transport. Urban transport management, a large portion of which is empowered by ITS, is viewed as a major solution to mitigate climate change (Creutzig et al., 2015).

2.4.3. Mobility and intelligent systems

Smart mobility investments, or intelligent transportation system (ITS) interests in the smart cities context, are individually driven, data driven, and fuelled by bottom-up innovations; these qualities bring about both challenges and opportunities in terms of the conceptual framework (Bibri and Krogstie, 2020).

- Institutional, including the organisational, legal, and policy aspects.
- Technical, concerning technology and analytics.

- Physical: Infrastructure, equipment, and devices.

Environmental sustainability, i.e., an energy decrease and climate change mitigation, is turning into a more vital method of reasoning related to ITS interests in the smart city's context. It is critical to comprehend under what institutional and mechanical conditions the vitality investment funds advantage is acknowledged, and what the magnitude of saving is (Bibri, 2020).

As the utilisation of ICT is the main impetus of the smart cities movement and lies at the centre of these initiatives, cities focus too much on investing in technology itself and disregard the genuine objective of enhancing the quality of people's lives, bringing about the wonder of innovation arrangements "searching for an issue." One criticism that the smart city initiative usually gets is due to the emphasis on the promotion of technology (Townsend, 2013). In any case, smart mobility ought to be people-centric. Speculations made just for technology are seldom successful in achieving maximum benefits for the general population since they are not set up to do as such. Consequently, recognising an issue that people are concerned about is the key first step. Institutional conditions incorporate a channel of public participation for problem identification and design, and a community-oriented setting for all players. For example, creative thoughts and ideas through urban living labs and the community like hackathons and open-data challenges.

2.5. Review of Literature of Smart city governance

Governance networks are more or less stable examples of the social relations between commonly dependent actors which form around public issues and are shaped, maintained, and changed through interactions between the involved actors (Koppenjan and Klijn, 2004; van Meerkerk and Edelenbos, 2014).

Firstly, the literature on local governance focuses on the expanding operation of councillors in complex governing networks including public and private bodies (Copus, 2015). In these systems, councillors need to devise methodologies to impact and shape the policy decisions taken by individual players (Copus, 2015). The second part of the literature focuses on the role of mixed groups as fundamental segments of the governance structure regulating the service ecosystems in cities (Connolly, et al., 2014). There is additionally another interesting stream

of literature, studying the conditions for success in shared governance networks (Cristofoli et al., 2012).

Moreover, the stream of literature examining the conditions for success in shared governance systems makes a distinction between the three forms of network governance, specifically shared participant governance, lead organisation governance, and network administrative organisation, following the work of Provan and Kenis (2008).

In the development of the public network research literature, scholars have set aside their interests in the network structure and focused on the skills of the network manager as a way of predicting network performance. This focus on the network manager is based on the assumption that managerial skills have a direct impact on network performance (Agranoff and McGuire, 2001; Mandell, 2001).

Some authors even argue that network managers have a significantly larger influence compared to the system structure and tools in certain scenarios (Kort and Klijn, 2011). Within this framework, the management of public systems can be broadly categorised into two groups: those who maintain the system and those who guide its direction. Skills belonging to the former kind are typical of system ‘facilitators’ and ‘mediators’, while those of the last kind are associated with system leaders (Cristofoli et al., 2014).

The system facilitator-mediator is relied upon to cultivate a situation of good partner interactions in order to support the system. This is made by establishing working guidelines to administer partner participation, advance information trades between the system partners, maintain harmony, and develop approaches to adapt to the strategic and operational complexity (Agranoff and McGuire, 2001; Cristofoli et al., 2014; O'Toole and Meier, 2004). This individual is likewise expected to fabricate a commitment to the mission and the goals of the system among the system members as well as among the external stakeholders (Agranoff and McGuire, 2001; Cristofoli et al., 2014).

Following Cristofoli et al. (2014) with regards to guiding the system, the system leader is required to have the capacity to perform three tasks: action planning, activating, and re-planning. Action planning consists of establishing clear missions and creating focused strategies and measures for the system and for the organisation in which the leader works (Agranoff and McGuire, 2001).

Activating consists of choosing the proper players and resources for the system, tapping into the skills, knowledge, and resources of others, picking up trust and building agreement (Agranoff and McGuire, 2001). In the end, re-arranging consists of altering and repositioning the system objectives when imperative changes happen in the system environment (Shortell et al., 2002). Integrating the previous streams of literature in a system governance environment, the components for the coordination of the system partners and the ability of the network manager to run the network are reliable predictors of a network governance performance. Kern and Bulkeley (2009) propose three governance mechanisms available to city-systems:

- Information and communication
- Project funding and coordination
- Recognition, benchmarking, and certification.

All three aim to encourage cities to convert their commitments into actions.

The work of authors mentioned in Table 2-2 advocates establishing smart city governance as a more distinct smart city research area. Furthermore, considering it is difficult to offer a conclusive number in terms of the present number of smart cities or smart city projects, the significant gap between smart cities and smart city governance studies highlights both the lagging of and gaps in the academic literature in comprehension and informing the practice of smart cities governance.

Table 2-2. Reviewed studies on smart city governance

Study	Statements and findings on smart city governance
Giffinger et al. (2007)	<ul style="list-style-type: none"> - Defines the ‘smart city’ concept and rates European cities accordingly, considering factors and pointers. - Delineates the smart city as political participation, services for citizens, and the workability of the administration.
Bătăgan (2011)	<ul style="list-style-type: none"> - Analyses the importance of smart networks on quality of life and sustainability. Identifies the key factors of future smart cities. - General need to improve the collaboration across departments as well as with communities. Describes the potential results of a smarter government.

Caragliu et al. (2011)	<ul style="list-style-type: none"> - Defines the operational smart city concept and uses statistical methods to analyse and state factors like education and ICT when defining smart city performance. - Points participatory aspect of smart city governance.
Chourabi et al. (2012)	<ul style="list-style-type: none"> - Suggests a framework to understand the smart cities concept. Identifies the critical factors of smart city initiatives like management, organisations, technology, and governance. - Defines smart city ICT governance as communicating a collection of technology, people, policies, practices, resources, and information.
Gil-Garcia (2012)	<ul style="list-style-type: none"> - Argues about the challenges of organisational collaboration and information technologies in smart governance. - Highlights smart governance's technology usage to interconnect information, processes, institutions, and infrastructure.
Angelidou (2014)	<ul style="list-style-type: none"> - Identifies four strategic choices of policy with a spatial reference to the development of smart cities. - Describes the participatory aspects of SG with regards to citizens
Bolívar (2016)	<ul style="list-style-type: none"> - Studies the role of governments in cities. Highlights the importance of engagement for governments and citizens. - Describes the unsatisfactory status quo of smart city governance in most cities.
Bolívar (2016)	<ul style="list-style-type: none"> - Analyses the relevance of the main dimensions of smart city governance frameworks. The results show that the dimensions are mainly drawn from empirical experience rather than theory. - Stresses the managerial feature of organising collaborations among the stakeholders, network characteristics, and the special role of the government with regards to smart governance.
Bolívar and Meijer (2016)	<ul style="list-style-type: none"> - Develops a research smart city governance framework consisting of elements, outcomes, and implementation strategies. Emphasises importance of additional innovation capacity.

	<ul style="list-style-type: none"> - Conceptualises framework of smart governance including strategies (ideas, actions), arrangements, and outcomes.
Castelnovo et al. (2016)	<ul style="list-style-type: none"> - Discusses importance of a holistic approach to the assessment of smart city governance when developing a performance valuation framework consisting of five dimensions. - Provides guidance on how to assess the smart city governance scopes.
Meijer (2016)	<ul style="list-style-type: none"> - Discusses the cooperative knowledge potential and the nature of the problem as key contextual factors. Develops a framework to assess smart city governance in context. - Argues that the efficiency of techno-governance arrangements depends on situational factors.
Meijer and Bolivar (2016)	<ul style="list-style-type: none"> - Analyses smart city governance publications and finds that different emphases are placed on technology, people, and collaboration perspectives in reference to smart city governance changes, and the results. - Discusses, from a comprehensive smart city governance perspective, where smart city governance crafts new forms of human collaboration through the use of ICT to obtain better outcomes.
Meijer et al. (2016)	<ul style="list-style-type: none"> - Argues on the contextual conditions, governance frameworks, and assessment of public value in the smart city context. Highlights the importance of modified smart city approaches. - Mentions various smart city governance components and raises questions regarding the multilevel public value aspects of smart city governance.
Kourtit et al. (2017)	<ul style="list-style-type: none"> - Highlights the information needs in the strategic planning of smart cities. - Shows the governance aspects of big digital data management. Stresses the importance of citizen participation and the role of city governments within a cities' network.

Marek et al. (2017)	<ul style="list-style-type: none"> - Defines the implementation experiences of new technologies in a post-disaster environment. Examines the problems arising from top-down technocratic solutions. - Defines smart cities as urban centres where smart technologies drive effective governance through the engagement of citizens.
Yigitcanlar et al. (2018)	<ul style="list-style-type: none"> - A perfect framework to build smart cities of the century. For the situation, its training includes a system of systems approach and a sustainable and adjusted view of the financial, societal, environmental, and institutional development spaces.
Tan and Taeihagh (2020)	<ul style="list-style-type: none"> - Technology-enabled smart cities can only be realised when the concurrent socioeconomic, human, and legal aspects are embedded in the long-term developmental trajectories of developing countries. - Social development, economic policy, and financial endowment; the technological literacy and participation of citizens are the keys to partaking in smart city development. - Unique cultural factors are important for smart city development.
Fonseca et al., (2021)	<ul style="list-style-type: none"> - Smart cities studies need the contribution of citizens. - The use of sensors is essential for proper data collection in smart cities.
Wirtz and Müller (2022)	<ul style="list-style-type: none"> - Multi-layered smart city ecosystem comprising of a scheme for the collaboration of the involved actors. - A framework for creating knowledge and human capital, economic value, and social sustainability. - An infrastructure for processing data for real-world operations. - A governance framework that can achieve a robust and productive environment with a variety of potential for specialisation.

The authors work mentioned in table 2-2 proposes the following research directions.

1. Multiple identified components stand to gain from additional data collection. One route forward for this explicit research initiative might be to engage in more case study research. This research method has the potential to look at currently marginalised themes and is particularly suitable for theory building.

2. Research should explicitly look at the connections between smart city governance components and their envisaged outcomes, which remain largely vague. Potential insights should be tested against their causal connections. The few components and sub-components that show predominant similitudes with respect to their generated insights can be additionally analysed by utilising confirmatory statistical research.

3. Future research should investigate empirically the role of contextual factors and their potential influence on smart city governance components and outcomes. Further research should concentrate not just on the contextual factors addressed within this review but also broaden the analysis to include a variety of other potential factors.

4. Finally, longitudinal investigations can provide valuable insights to sharpen the causal models of the components, interrelationships, and dynamics related to the field of smart city governance. Moreover, longitudinal research could offer further insights into the development stages of smart city governance where certain connections may not be explainable or recognisable through other research designs.

5. In research concerning urban planning, it is important to clarify the structure of governance, the various levels within the system, and how different actors relate to one another and eventually what services are provided by different institutions (Alawadhi and Scholl, 2016). The objective here is to identify the issues that the governance is facing and how they can contribute to the citizens, businesses, employees, and the government. frameworks of smart governance that can help with governance issues.

Government to Citizen Model: Under this approach, the government directly interacts with its citizens through various communication channels like newspapers, web portals, forums, radios and applications. The aim is to reach out to citizens and allow them to speak for themselves, to listen to their problems, complaints, and advice, and to make them applicable.

Government to Business Model: Entrepreneurs play a crucial role in taking the economy ahead. The business model is aimed towards the direct interaction between the central and state government with the business sector and the bottlenecks faced by entrepreneurs, traders, and

start-ups. Companies can get direct knowledge about the latest policies, regulations, taxes, schemes, and credit facilities to improve and expand their businesses.

The business model also encourages online business transactions to save time, costs, and provide real-time data which can further be used in the planning and forecasting of the economy. Business houses can benefit from government-collected surveys, reports, and data to initiate new ventures.

Also, sustainable development is integral for good governance. The government can inform companies about environmental regulations, the guidelines and protocols to follow when setting up of manufacturing units, product specifications and factory waste disposal.

Government to Government: The model is targeted towards the direct interactions between government-to-government organisations, departments, and agencies. The aim is to integrate all channels of governance for a simpler, holistic system. This will lead to more transparency, accountability, and the smooth delivery of administrative duties.

With the use of ICT, a paperless digital model of services will come into place. This will reduce any unnecessary clutter and corruption in public offices. A proper two-way communication will be set up between officials and citizens, especially at the municipal and regional levels, bringing more accountability and efficiency into government proceedings.

Government to Employee: This aims to provide an online software system and tools to create a channel of interaction between employees, the government, and companies. The idea is to maintain a personal account for each employee using their social security number, bank account number, and personal information. Many employee-related tasks such as payroll, medical compensation, provident funds, pension schemes, and bank loans can be carried out online.

Analysing the Table 2-2 further the following recommendations are drawn:

- Multiple recognised components stand to improve from additional information collection. Deploy more case study research.
- Research should specifically inspect the connections of smart city governance and their future outcomes.
- Future research should empirically investigate the role of contextual factors and their potential influence on smart city governance outcomes.

- Future studies can provide valuable insights to sharpen the fundamental models involving the components, interrelationships, and dynamics related to the field of smart city governance.
- Wide varieties among the alleged building blocks of smart city governance exist and different researchers centre around various individual building blocks or sub-sets of them. Certain specialists claim to have at least identified certain dimensions or components that give the impression of being instrumental for smart city governance. Empirical proof is deficient or totally missing. Claims about certain smart city governance components are meagre; this incorporates, for instance, ‘structures and organisations’ and ‘legislation and policies’.
- When researching the components more deeply, the authors saw that specific statements on components are particularly ambiguous. For example, the design of the ‘processes’ segment seems complex, and it is, in this manner, frequently utilised in rather vague ways. A similar condition can be seen with the ‘exchange arrangements’ part concerning the different components of exchange that are possible. The respective nomenclature in such cases needs to be clarified, especially for analytical purposes. Additionally, research to create a consensus regarding the terms that shape the building blocks of smart city governance and the causal models of their effects on smart city governance and smart city results would benefit the field greatly.
- The integration of the sustainability school of thought into smart cities should also be reflected in the methodologies of study on the topic. These research methodologies should be capable of taking various results and outcomes. Sustainability is too important for the future of smart cities projects to be addressed in generalisations.

Overall, this section provides a comprehensive understanding of governance roles, dynamics, mechanisms, and recommendations that can help with understanding and improving the government's contributions to smart city initiatives.

2.6. Summary

This chapter has addressed the literature related to smart city concept and reviewed the existing literature on smart cities governance (Research objective one and three) and answers the first

and third research question: “*What are the smart cities’ perspectives?*” and “*What role does the government play when developing smart cities?*”.

The chapter explore the concept of smart cities, which have emerged as a response to the challenges posed by rapid urbanisation and technological advancements. Smart cities integrate various technologies to enhance citizens' quality of life, promote sustainable development, and optimise resource utilisation. Key components include interconnected infrastructure, data-driven decision-making, sustainable urban planning, and citizen engagement. Moreover, the chapter explores different schools of thought from smart city viewpoint, encompassing nine perspectives such as governance, optimisation, modelling, and behaviour. These perspectives, along with sustainability considerations, shape the development of smart city concepts.

Further examination delves into the role of governance and management in smart cities, highlighting challenges related to organisational, strategic, and technical aspects. Stakeholders, structures, processes, and technology play crucial roles in smart city governance. However, there's a need for more comprehensive research to understand the dynamics and outcomes of smart city governance fully.

The chapter concludes with recommendations for future research, including the need for more empirical studies, consideration of relative factors, and integration of sustainability principles into smart city methodologies. Overall, the chapter provides a comprehensive overview of the complexities and potentials of smart city concepts and governance, emphasising the importance of interdisciplinary approaches and collaborative efforts in shaping the future of urban living.

The next chapter (Chapter 3) explores the smart cities challenges and policy development.

Chapter 3. Literature review on smart city policy development

3.1. Introduction

In this chapter, an in-depth review of existing literature concerning the second research objective and question: “*To explore the policy development and challenges in the context of smart cities.*” And question: “*What are the key policy challenges when developing smart cities?*” With a particular focus on the United Kingdom and the EU. The chapter is divided into four main sections: (1) smart city development of policies, (2) smart city challenges, (3) smart city governance challenges, and (4) critically reviewing the existing literature on smart cities governance challenges.

The accelerating pace of urbanisation in both developing and developed countries shows new chances to apply emerging technologies to the difficulties of city management. The coordination of urban governance and technology, for the most part referred to as "smart cities," is driven by both global private enterprises and local and national governments seeking to strengthen their economic competitiveness and improve quality of life. Regardless of these trends, smart city development (SCD) in developing countries is not as firmly considered as it has been in developed countries (Vu and Hartley, 2018).

This chapter commences by reviewing the factors that differentiate the policies involved in the development of smart cities. Four strategic choices with a spatial reference are recognised: national versus local strategies, strategies for new versus existing cities, hard versus soft infrastructure-oriented strategies, and sector-based versus geographically-based strategies. This includes policies related to mobility, energy, governance, waste, water, and education which are discussed including the advantages and disadvantages of each strategic choice. Secondly, this section examines the strategies adopted globally by smart cities. The third part incorporates suggestions for the development of smart cities (De Guimarães et al., 2020). Also, an increasing number of studies concentrate on the security, privacy, and risks in smart cities, highlighting the threats concerning data security and the challenges to the smart city infrastructure in the management and processing of personal data (Ismagilova et al., 2022).

This chapter also adds to the smart city discourse by clarifying the confusion about strategic choices regarding smart city development, stating the advantages and disadvantages of these strategic choices. A serious examination has been made to draw material together exclusively from the smart city literature. Moreover, the chapter provides a starting point for the design of smart city strategies, separating the factors using examples of applied strategies in each category which keeps the smart city conversation ongoing by instigating further research.

3.2. Smart city development of policies

This review demonstrates a concise examination of the literature about smart city development policies. Cities require a satisfactory arrangement of framework conditions in the field of policy and regulations, keeping in mind that the end goal is to have the capacity to become smart. The requirement for activity in the field of policy and regulations is highlighted by the following (Strzelecka et al., 2017).

3.2.1. Regulations that repress smart city roll-out

Regulations, extending from local grants for industry to lawful orders and acts that represent expansive arranging, through to struggling with national benchmarks, would all be able to obstruct the execution of smart city systems.

Uncertainty

Private organisations are reluctant to put resources into innovative technologies and infrastructure where there is policy uncertainty and restricted technology integration. Technological uncertainties and differences in the technical standards between different nations frequently prevent an expansive scale which relates to the European-wide deployment of smart city ideas (Scoones and Stirling, 2020).

Ambitions

A strategic vision backed up by all stakeholders and supported by long-term policies, directions, and systems is the reason for a powerful and productive change process. Arrangements, both on a level plane (different policy fields) and vertically (local, regional, national, and EU), utilising a participatory approach guarantees a holistic view and responsibility regarding the smart city process.

Recommended approach

Innovative forms of governance are expected to enable the combination of stakeholders within the procedure. Stages and forums (both formal and ad-hoc) are expected to unite producers and specialists to chip away at the recognisable proof and mapping of conflicts, gaps, hurdles, and enhancements to the regulatory framework (improve, abolish, consolidate, and simplify). This is as well as having procedures for the preparation and training of city partners (sharing of knowledge and best practices).

Activities required at the policy level are European Innovation Partnership on Smart Cities and the Communities Strategic Implementation Plan (Glasmeier and Nebiolo, 2016).

- 1) Encourage cities to build up a Smart City Strategy and implementation plan to provide motivation and implement more prominent acknowledgments across the policy domain thinking.
- 2) Challenge the policy and control to enable the application of innovative funding frameworks that join the existing public and private funding sources with new kinds of subsidising which, in the meantime, enable urban areas to acquire desired effects without the funds of other policymakers.
- 3) Implement "innovation zones" in cities to test and assess the impact of overhauled policies and regulations and, in addition, consider extraordinary or decreased type of control in particular fields (Strzelecka et al., 2017).

To develop smart cities policies, there is a need to investigate the priority areas as shown in Figure 3-1 detailing the priority areas in smart city development and policy. It indicates how the governments of smart cities have been impacted by their decision-making process and also how citizen participation and knowledge sharing, and most importantly funding, can have an impact on the priority areas in the development of smart cities.



Figure 3-1. Priority areas in smart city development and policy

Source: *The European Innovation Partnership on Smart Cities and Communities, 2017*

3.2.2. City deals to empower city authorities

The Cameron–Clegg coalition government in the United Kingdom in December 2011 committed to unlocking the maximum capacity of the cities, seeing intense and imaginative spots that can shape their predeterminations and satisfy their potential (Maer and Gay, 2015). The government distributed unlocking growth in cities, propelling a program of city deals. Each arrangement is bespoke, mirroring the distinctive needs of individual places. Each arrangement intends to:

- 1) Give cities the freedom to develop the apparatuses they need to drive development.
- 2) Opens the door to projects or initiatives that will support nearby economies.
- 3) Deliver a step-change in governance.

The Cities Policy Unit leads on this work. To date, there are eight cities in England outside London, and new and imaginative methods for doing things that will open up development. In February 2013, the government welcomed a further 20 cities and their wider areas to negotiate

for the devolution of the specific powers, assets, and obligations required to convey their locally determined economic priorities (Public data group, 2018).

3.2.3. Participating in EU programmes

The European Commission has signalled its commitment to building up a European wide capacity to create smart cities by setting up the European Innovation Partnership (EIP) focused on smart cities and communities. The Commission is being supported by a High-Level Group with the power to develop imaginative methods to make cities smarter. This is upheld by a group of specialists drawn from businesses. Representatives from the UK are currently shaping this activity. Possible areas of work in this EU context include:

- 1) Sustainable mobility.
- 2) Sustainable digital infrastructures.
- 3) Low energy connected buildings and districts.
- 4) Smarter decision-making in urban planning and daily life. (Russo and Rindone, 2023)

3.3. Smart city challenges

Cities are the main poles of human and economic activity. They hold the possibility of creating synergies, allowing great development opportunities for their inhabitants. Nonetheless, they also create an extensive variety of issues that can be difficult to handle as they grow in size and complexity. Cities are also spots where inequalities are stronger and, if they are not legitimately dealt with, their negative impacts can outperform the positive ones.

Urban regions need to deal with their advancement, supporting economic competitiveness while upgrading social cohesion, environmental sustainability, and the increased personal satisfaction of their citizens. This includes the advancement of new technological innovations, primarily ICT. The concept of the "smart city" emerges as a way to accomplish more productive and sustainable cities. Since its origination, the smart city idea has developed from the execution of specific projects to the implementation of global strategies to handle more extensive city challenges. In this way, it is important to obtain a comprehensive overview of the accessible possibilities and relate them to the particular city challenges (Monzon, 2015).

As cities continue booming tirelessly, their challenges need to be carefully thought through so then population growth, economic development, and social advances progress in a similar way.

Although most of the global GDP is delivered in urban communities, not all activities happen inside these agglomerations, implying positive externalities. Cities are additionally the spots where inequalities are stronger. In the event that they are not appropriately dealt with, the negative impacts can outperform the positive ones. The smart city framework can prompt a superior city arranging and administration and along these lines, the accomplishment of a reasonable framework of urban growth. In this research, the challenges have been recognised and put in groups in various measurements with a specific end goal to encourage the subsequent stages of the venture. By dissecting the urban condition, research works to deal with a different number of fields to frame the city (Giffinger, et al., 2007).

The study has identified, in the explored literature, that they would all be able to be allotted inside six main city dimensions: (1) Governance, (2) Economy, (3) Mobility, (4) Environment, (5) People, and (6) Living.

They speak to the particular parts of a city whereupon smart initiatives attempt to accomplish the normal objectives of a smart city technique; sustainability, efficiency, and a high quality of life. Technology itself is not considered an action field yet it is an empowering influence that enhances the productivity of tasks. Inside European cities, challenges have been identified (Giffinger, et al., 2007).

3.3.1. City challenges in the United Kingdom and European cities

The main challenges that cities face in the smart governance action field are related to the urgent need for a change of governance frameworks. This will face the challenge of making themselves more flexible, allowing for the possibly of combining their top-down policies with bottom-up initiatives and also informality. Demographic changes and territorial cohesion are the other two main challenges to face (Cohen, 2006). In general, the issues that smart cities face relate to the categories in six different areas that can be seen in Figure 3-2.

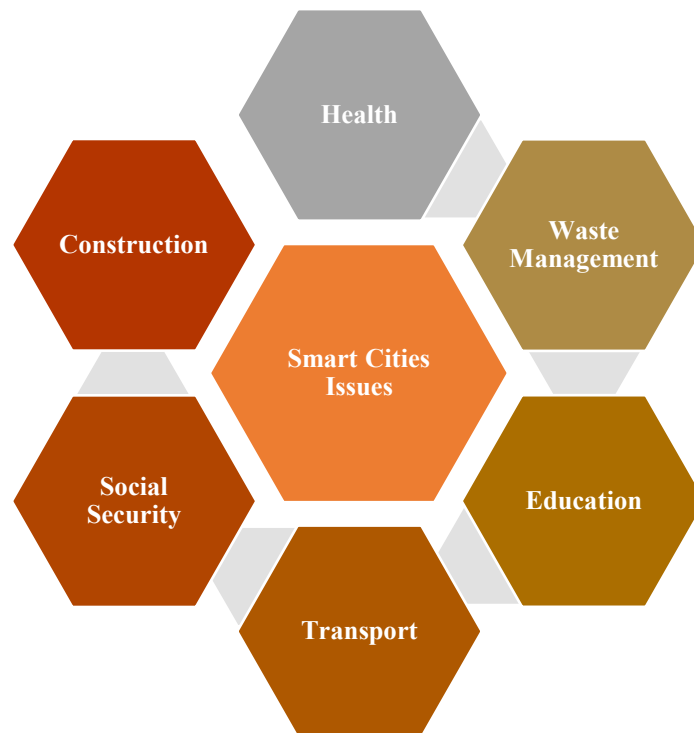


Figure 3-2. Smart cities issues

(Source: Giffinger et al., 2007)

These days, cities have a wide range of fields where improvements can be made with the goal that they can turn out to be better places for living. Demographic changes and the financial crisis have revealed the desperation of confronting these city challenges. In any case, it isn't just a matter of the difficulties that smart cities must face today; the future issues of cities must be considered in a coordinated path as proposed in the record of the European Commission "Cities of tomorrow" (Cities of tomorrow EU, 2011). Choices in urban arranging and administration have long haul outcomes. Following this comprehensive approach, every one of these difficulties can be ordered in connection to the smart city activity fields as shown in Table 3-1.

United Kingdom

Smart city agendas emerged during the post-2008 era after the economic recession crisis. Most cities are now more unevenly divided between people who are rich and people in poverty than during recent years, even with there being a level of wealth generation that has not been seen in the past (UN-Habitat, 2016). New sensor technologies contact social systems, and they can describe the well-documented social and environmental inequalities (Safransky, 2020).

Table 3-1. Challenges within European cities

(Source: Monzon, 2015)

GOVERNANCE	ECONOMY	MOBILITY	ENVIRONMENT	PEOPLE	LIVING
Flexible governance	Unemployment	Sustainable mobility	Energy saving	Unemployment	Affordable housing
Shrinking cities	Shrinking cities	Inclusive mobility	Shrinking cities	Social cohesion	Social cohesion
Territorial cohesion	Economic decline	Multimodal transport system	Holistic approach to environmental and energy issues	Poverty	Health problems
Combination of formal and informal government	Territorial cohesion	Urban ecosystems under pressure	Urban ecosystems under pressure	Ageing population	Emergency management
	Mono-sectoral economy	Traffic congestion	Climate change effects	S.diversity as source of innovation	Urban sprawl
	Sust. local economies	Non-car mobility	Urban sprawl	Cyber Security	Safety and Security
	Social diversity as source of innovation	ICT infrastructure deficit			Cyber Security
	ICT infrast.deficit				

Challenges in the smart economy action field are related to the productive structure of the city. After the economic crisis, urban regions have understood the convenience of not focusing their productive model on just one economic sector. Enhancing the creation of a multispectral economy would make the cities more resilient to economic downturns, exploiting the unique conditions of each urban agglomeration within a certain region and interconnecting their productive networks which can improve their resistance. Achieving a sustainable, inclusive, and efficient mobility system for goods and people is the overall challenge to be dealt with in the smart mobility action field. Implementing a multimodal public transport system, fostering alternatives to car-based mobility, and making public transport reachable and available to all citizens are the three main axes that will allow a reduction in congestion and pollution in cities, improving connectivity (Bibri and Krogstieb, 2017). In the smart environment action field, different challenges related to the built and natural environment can be found. On one hand, there is a need for reducing the land consumption used for the extension of cities. A mix of uses can help to concentrate the population and ultimately reduce the use of cars. On the other hand, the reduction of energy consumption, pollution, and CO₂ emissions is a growing ecological demand as part of achieving sustainable development. Improving social cohesion and quality of life are the main challenges faced in the smart people action field. An enriching community life is the final goal and to achieve this, it is necessary to take the initiative to solve

the high levels of unemployment in cities. This is as well as using the demographic movements and mix of populations as an opportunity for innovation, taking into consideration all citizens independently of their age, gender, culture, and social condition. The main challenges in this field are related to the supply of housing, health conditions, and crime rate situation. These three aspects, together with the social cohesion of the population, are the main issues that establish the differences enabling a city to be able to talk about having a good quality of life (Monzon, 2015).

3.3.2. Infrastructure security

Several vulnerabilities and risks face the cyber-physical infrastructure used in city smartening. However, while these modern cyber-physical infrastructure systems are massively used, there is no satisfying insight into their vulnerabilities and threats. Generally, intentional and accidental threats to smart city infrastructure-related security cause different serious consequences according to the city's maturity and smartness. Thus, this study presents the main encountered infrastructure security-related threats and challenges. Urban infrastructure such as electricity supply, water distribution, streets, buildings, and others face several security threats in their specific cyber-physical components and systems (AlDairi et al., 2017) such as:

Cameras: Cities are full of private and public cameras that are protected variably using encryption protection and username/password protection. Reaching private or public cameras and having access to them can cause the violation of an individuals' privacy and the ability to spy on governmental concerns.

Communication networks: Cyber-physical objects are connected together in the smart city using several communication technologies such as Wi-Fi, 4G, RFID, GSM, and others. Each of which has specific security concerns that must be perceived during deployment and the use of communication technologies.

Building management systems: The designers and developers of such systems usually concentrate on the service provided and disregard cybersecurity-related issues (Elmaghraby and Losavio, 2014). Thus, the manufacturers of such systems do not implement in these systems notification options to notify users about security violations and they do not respond to vulnerabilities. This results in building management systems that are insecure and weakly protected.

Transport management systems: Such systems face the most critical hacks as they cause catastrophes, especially when they happen to air traffic systems or train control systems. Moreover, they cause huge traffic jams that may last for hours by hacking the control systems of traffic lights and their sequencing, as well as road signs and speed limit signs.

3.3.3. Security challenges in smart cities

Throughout this research, expectations of security and privacy will centre around the following ideas. Security as a concept is not absolute but it is a dynamic and genuine attempt to prevent harm to the smart city and its inhabitants, both directly and indirectly, through digital and physical connections. The security challenges discussed in this section will mostly involve the abundant opportunities for security corruption within a smart city framework. When it comes to privacy, Elmaghraby and Losavio's (2014) first two general principles concerning data privacy and cybersecurity are beneficial. They state that first “activities within the home have the greatest level of protection” and second, that “activities that extend outside of the home depend on reasonable expectations of privacy” (Elmaghraby and Losavio, 2014). The identified smart city privacy challenges will mostly revolve around what constitutes ‘reasonable expectations of privacy’ and the appropriate level of privacy protection necessary for inhabitant participation in the smart city. This segment will focus on the following five questions regarding potential privacy and security challenges in a smart city.

To solve the aforementioned privacy and security challenges facing smart cities, stakeholders must address issues holistically in order to make sure that the challenges will not continue plaguing the rest of the smart network. To do so, security professionals and smart city planners should utilize projects and current cities that simulate a smart network. An example of an IoT infrastructure project can be seen in Santander, which in Spain is called Smart Santander. Smart Santander is made up of over two thousand IoT devices mimicking an urban environment with the intention of developing a smart network with experimentation support and service provisions in place (Ijaz et al., 2016). Experimentation support allows researchers to put their theories to the test in a real-life scenario and the service provision allows Smart Santander to provide services to the people described in the form of user cases (Ijaz et al., 2016). Thus, projects such as Smart Santander are a useful resource for testing solutions and corroborating theories surrounding smart city security and privacy challenges.

3.3.4. Smart city management

The grouping of people, companies, and associations in cities promotes creativity, development, assorted variety, and financial development (Harrison and Donnelly, 2011). The collaboration between the distinctive parts likewise builds increased economies of scale and is crucial to a country's sustainable development (AMETIC, 2012).

An effective open transport framework can take care of clogging issues, albeit smart mobility expects to go one step further by looking for inventive and feasible approaches to give portability to individuals in cities such as by growing environmentally-friendly public transport fuels and propulsion systems supported by technology, as well as the proactive behaviour of citizens (Chourabi et al. 2012). The environment and sustainable lifestyles are the key highlights of smart cities.

1) Smart environment

Cities transform and shape the natural environment through physical components to accomplish a permanent human settlement. This change is accomplished through extensive and invasive infrastructures and buildings which make a critical effect in response to the environment (Güell and Lara, 2014). The change in the environment due to urban development creates effects, for example, the utilization of natural resources and energy, atmospheric emissions, and waste discharge. It has been evaluated that urban areas at present expend around 75% of the world's energy and produce 70% of the worldwide CO₂ emanations (UN-HABITAT 2012). These figures are relied upon as urban areas become considerably bigger. The expanding force of urban metabolism and its effects on climate change are some of the most important sustainability challenges facing cities today.

The sustainability of the urban environment can be examined using two methodologies: one from the perspective of energy and the prevention of consumption involving renewable energy, mechanical frameworks, pollution control and administration, green structures, green urban management, effectiveness, reutilization et cetera, and the other connected to the urban matrix and the administration of assets like waste, street lighting, waste management, drainage systems, monitoring water resources, reducing contamination, and improving water quality (Manville et al. 2014). It ought to likewise be noted that the smart mobility hub is firmly identified with environmental sustainability. Smart mobility incorporates various activities intended to enhance the earth, for example, diminishing the utilization of private vehicles and coordinating transport modes which, for the most part, deliver an abatement in emanations.

The commence of the smart environment is the utilization of technology to enhance the learning of environmental conditions and services, for example, power, water, and gas, with a specific end goal to change people's habits, avoid waste, benefit the environment, and improve the efficient use of resources. Chourabi stressed that in the ecological elements, these activities affect the city liveability and manageability and ought to be considered while considering smart activities (Chourabi et al. 2012).

2) Smart mobility

As a rule, the vast majority of the references to mobility are closely related to improving traffic. While this is a vital issue, portability angles in a smart city do not concern traffic alone as smart mobility is comprised of the progression of activities to encourage the mobility of users either by walking, cycling, or using public or private transport, which all seek to meet a shared objective: to reduce the economic, environmental, and time costs. In the area of mobility, planning must prevail over technology and any actions should be aimed at organising different modes of transport including transport on foot, as far as their significance and importance is concerned (Bustamante, 2015). The concept of mobility is to shift from a mobility mainly based on ownership to services based on access. This shift could be specified as socio-technical as technology has had a main role in enabling this development innovation, making it more able to be integrated with other conventional transportation solutions (Arcidiacono and Pais, 2018).

Sharing mobility requires the combined use of vehicles, bicycles, electric scooters, and other types of travel. Sharing mobility is one of the highly innovative transportation approaches that allows citizens to have access to transportation based on their needs (Sharifi et al., 2024). Sharing mobility can involve one-way services that may be restored to another location, round-trip services that will be sent back by the user to the location of departure or returned anywhere within the designated area (Scalingi et al., 2018). Sharing mobility is clearly motivated by urban design, economic growth, housing, alternative transport systems, and development management.

As per the holistic concept of a smart city, citizens should be the cornerstone of all actions relating to quality of life and health in the case of mobility solutions. The need ought to be to make measures to energise strolling, followed by methods of transport that bring down emissions and noise pollution. (Bustamante, 2015). Figure 3-3 demonstrates the four components chosen and the assessment in the region of mobility.


 MOBILITY	Factors Evaluated
	Sustainable Mobility Urban Plans
	Payment Integrated in Multimodal transport system
	Deployment of alternative modes
	ICT in traffic control

Figure 3-3. Factors assessed in smart mobility

(Source: Tahmasseby, 2022)

3) Smart water management

Water is one of the crucial assets for human life. The emotional change in atmosphere and incremental increase in the population has made the water supply insufficient compared to the demand. As the utilization of water is expanding, water management turns into a major test for both the government and water companies. The challenge likewise incorporates giving quality water at a minimum cost with a low energy use. Water management intersects in numerous ways within human lives like water consumption, farming, food production and the environment. Water is required for creating vitality and energy, while energy is needed to provide water. Existing frameworks invest more energy in social occasion information and focus less on the insights that can be drawn from the data. The water level in tanks must be gathered physically. In a conveyance framework, perusing the stream and weight meters is done physically. Water quality is checked by taking samples which is then tried in labs. This will take a few days to get the outcome. Smart water investigation can bring about a change in this by acquiring ongoing information so then the investigator can invest energy in the water's examination and activities for a brief time and at a low cost. Shrewd water administration frameworks incorporate the ongoing checking of water levels, distinguishing spills in distribution systems, observing, and maintaining the water quality (Strzelecka, 2017).

4) Energy management systems for smart cities

The exponential increase in urban development results in increased human needs with respect of health, transportation, and energy conservation. The existing physical infrastructure has to bear the responsibility to deliver these services on time, while ensuring that these needs are not met through the unscrupulous exploitation of resources (Mishra and Singh, 2023).

5) Smart street light system for smart cities

This section highlights important examples of this reality in the case of connected street lighting. Being ubiquitous throughout a city, street lighting is ideal for accommodating the small cell and IoT technology necessary to bring about a smart city change. On the other hand, sensor technology can be utilized in lighting to guarantee that they self-dim when pedestrians are not using them, saving energy. The functionality of the smart infrastructure goes far beyond its energy efficiency as these sensors also turn into a hub to gather useful data, providing insights for the governments of smart cities. For example, cities around the globe have already had success installing environmental sensors in street lighting in order to monitor air pollution, temperature, and data gathering during the Covid-19 pandemic, among others. In this manner, the connected infrastructure develops the ‘nervous system’ of the smart city. Income streams for smart street lighting therefore go further than energy efficiency on its own and centre around the economic value of data which can help with city management functions. Increasingly, it is starting to look like a combination of public and private sector investments are the most common method of smart city funding going forward. Pay-for-performance choices are at present being trialled where private sectors might fund the development of existing digital infrastructure areas or enhance their own access to data and services. Thus, they will see an immediate improvement in profit resulting from the investment they have successfully made in the city infrastructure (Gagliardi et al., 2020).

As for the suggestion based on the literature findings, this study suggests the technology that can help with economic growth such as smart street lighting systems (Figure 3-4) in large urban areas as they help to bring down the energy use and efficiently manage the demand side response, particularly in combination with renewable energy sources (Dizon and Pranggono, 2021).



Figure 3-4. Smart streetlights (Generating data)

These systems can reduce the natural energy used and they are equipped with motion and lighting sensors.

3.3.5. Smart city objectives

The smart cities projects are aimed at building up a comprehensive framework for assessing mobility and urban services projects to advance the knowledge of this field and define methods for making informed decisions on smart investment strategies in the smart cities setting. This framework is able to open up private bodies as an apparatus for organising, creating, and executing techniques.

The distinction between mobility and smart mobility portability is public accessibility related to real-time data. This enhances the benefits by saving time, enhancing the journey, saving money, and reducing CO2 emissions (Manville et al., 2014). Smart mobility is critical to the smart transformation of cities (Van Audenhove et al., 2013).

Therefore, the procedure towards what are known as smart cities is a reality and, as can be seen, there is no single framework for smart cities (Alonso, 2016). There are a wide range of smart cities: heterogeneous demographics, urban areas noted for their social or innovative responsibility, and even urban areas with advantaged contexts for certain businesses. Cities evolve quickly, the same as technology and society. The impact of cities on the lives of city tenants requires the effective management of the axes described. Spanish smart cities have great outcomes for mobility and quality-of-life which individuals see as key viewpoints in a city. Nonetheless, conditions that come about require change. The map described in this study is a tool for the representation and dynamic inquiry of the status of the smart initiative showing the features of the cities. It is intended to serve as the basis for a Spanish smart cities observatory. The motivation behind this tool is to provide a realistic help to advise clients about the advances in the procedure of urban transformation in the smart city concept. Later on, this examination ought to incorporate more cities in the analysis and more highlights that uncover their effect on the concept of smart cities. The summit of this project is a National Monitoring Centre for Spanish smart cities to use to prioritise, develop, and implement smart city strategies.

3.3.6. Future research and developments

A future development might include a vast number of smart indicators in the evaluation framework, making it updated and accurate. This is as well as increasing the number of territorial indicators and growth of the shape under study, for example, adding all capital

provinces or all cities with over 50,000 inhabitants. Another improvement should be an evaluation model in a European framework. An additional development might be a Weighted Model Evaluation, introducing a weight to each factor depending on the impact on citizens or the experts' opinion (Delphi method). Finally, a cluster analysis framework needs to be undertaken to identify different types of smart city in Spain.

3.4. Challenges of smart city governance

In order to follow the systematic literature review standards, the author follows the guidelines through the creation of a reproducible research record. Moreover, the author embraces the systematic research method. Overall, the systematic review methodology appears fundamentally to not be the same as the narrative approach as it clearly determines its “criterion-based selection” process. In this way, it looks to stay away from any possibility of partiality or prejudice that may potentially develop if unrevealed criteria are utilised in the selection of the literature.

While some authors indicate the potential outcomes at a broad level such as public value, others establish the outcomes based on their potential economic, environmental, and social impacts (Bolívar and Meijer, 2016).

The next step to improve the outcomes is to

- provide changes to the government organisation.
- provide changes regarding the position of the government with regards to other urban actors.
- apply improvements to the smart city infrastructure. (Bolívar and Meijer, 2016; Lin et al., 2015).

3.4.1. European smart city government policies

There is an extensive variety of government policies and programs that are relevant to developing the UK's capability. They can be assembled according to three main areas (Brown et al., 2023):

- Empowering and engaging city authorities to build up the vision and leadership to provide solutions to their own problems.

- Advancing open information and the limit of associations to enhance the access to open data and to share and utilize it including the development of open standards; projects to create supporting innovations and exhibit their efficacy.
- Departmental projects to empower the reception of new approaches and technologies to change both the service systems and consumer behaviour, taking an interest actively in EU programs.

These key government policies enable access to the gathered smart cities knowledge, which helps keeping the overview of which solutions and best practices have already been successfully implemented and establishing ideas for smart cities projects.

3.4.2. Challenges faced by governments

Citizen-centric challenges, effectiveness, efficiency, and sustainability services are responsibilities that governments need to face. To reach this goal, people and governments need to realise that everything is connected in new cities all over the world these days. Concepts, actors and organisations, systems, environments, infrastructures, information, citizens, policy, and technology are the components that are interconnected within a governmental system which needs to adopt to the governance efficiently. The literature suggests priority areas within the current Information and knowledge in cities. These priority areas are listed and explained in this section.

Funding: In order to create a digital infrastructure and link everything online, the government needs a lot of funding and investment. Developing countries are already facing a money crunch due to other developmental activities, low tax collection, heavy international loans, trade deficits, and other social problems (Hamilton and Zhu, 2017).

Lack of interest: Even though good governance implies more people's participation, government departments do not wish to engage the public in every activity that they do. Sometimes, due to security and political reasons, they try to maintain a distance with the public (van Twist and Meijer, 2023).

Illiteracy: Not everyone is e-literate. To reap the benefits of e-governance, basic knowledge of computers and the internet is a must. People residing in rural areas, tribal regions, poor households, and marginalized communities do not have easy access to the internet or digital systems. In order to make effective use of ICT, the government must initiate public programs and training activities to make e-learning accessible to all sections of society. Only then can

people from various walks of life benefit from these services, resulting in the cross-sectional development of society as a whole (Chatterjee and Kar, (2015).

Political impacts: Innovative smart city strategies and regulations are expected to empower and enable large scale project implementation and roll-out (Angelidou, 2015). Smart cities require an adequate set of framework conditions in the field of policy and regulations so as to have the capacity to smarten up. To accomplish this objective, smart cities can collectively learn from one another to yield general lessons for the circumstances in which specific strategies are appropriate, and the types of localisation that can best contribute to success. This is especially true when more information about their true results, more extensive impacts, and long-term consequences become accessible. This work aligns the smart city strategies from the local to the national level. On the one hand, knowledge sharing is a positive mechanism for policymakers who have to make faster decisions than in the past due to the rapidly evolving socio-political context. Then again, another constructive outcome is the response to forward thinking in policymaking practices (Accordino, 2013). In the end, an extra positive effect has to do with the way that access to contacts and information may leverage the differences among cities of bigger and smaller sizes.

Economic impacts: The beneficial political impact that good smart city governance produces for the city governments also gets translated into a positive economic impact where, first, smart cities can reduce their costs and second, they can get funds to create innovative projects (Stamopoulos et al., 2024).

Overall, the economic impact on the smart cities can be considered according to three different aspects:

- Cost reduction based on shared knowledge and staff training.
- Stimulation of the national investment in smart city projects.
- Participation in funded projects.

Social impacts: For the most part, there is a tendency to associate the term smart cities with only new technologies, overlooking the different perspectives linked to human, social, relational and environmental capital which are viewed as key factors in urban development (Angelidou, 2015; Caragliu, Del Bo, and Nijkamp, 2011). In a smart city, incorporated actions that promote the relationships between citizens and the different institutional, urban, and technological elements are crucial to ensure both urban growth and that of the knowledge and innovation economy. Caragliu et al. (2011) demonstrated steady evidence of a positive

relationship between urban wealth and the presence of a vast number of creative professionals, a high score in a multimodal accessibility indicator, the quality of urban transportation networks, the diffusion of ICT (most noticeably in the e-government industry), and finally, the quality of human capital.

Overall, an integrated smart city framework should work towards the following four goals (Angelidou, 2015):

1. Progression of human capital: Citizen empowerment (informed, educated, and participatory citizen), intellectual capital, and knowledge creation.
2. Progression of social capital: Social sustainability and digital inclusion.
3. Behavioural change: Sense of agency and meaning or the feeling that citizens are all owners and equally responsible for the city.
4. Humane approach: Innovation receptive to the needs, skills, and interests of users, respecting diversity and individuality. In alignment with the importance of building a smart society integrated within a smart city, the main objective is identifying the needs of a smart city society, so then the smart city solutions adopted are not disconnected from its social context and fail to solve the city challenges.

Technological impact: In the current digital society, ICT has shown up as the main supportive component of the development of society, cities, and countries. While a few studies accentuate the impact of new technologies on economic development and others centre around the analysis of the key factors related to ICT use and capability, all studies agree that new technologies play an essential role in the development of cities (Alfaro Navarro et al., 2017).

Intelligent Waste Management: The outlook for waste management in smart cities is rapidly changing. They are responding to the situation according to more of an innovative aspect after years of resistance in previous decades. Today, the waste industry and start-ups are making big strides when it comes to integrating innovations in robotics, machine learning, and smart city technology into waste management. The pioneering role of such industries and start-ups has given way to smart waste management. Though the real-world implementation comes with its own share of challenges, the benefits are outperforming (Kumar et al., 2020).

The intelligent waste management significance and the trending stories discussed here will compel people to believe “smart waste management is something worth more than gold itself.”

The literature findings above regarding the priority areas in challenges faced by governments raises a concern when it comes to its implementation. Table 3-2 explains the key areas and the actions necessary to improve the services through the development of smart cities for its citizens.

Table 3-2: Areas of improvement for smart city services and staff development.

Areas of improvement in relation to developing services	Areas of improvement in relation to staff development
<ul style="list-style-type: none"> - Waste management. - Parking and mobility management. - Smart city platform. - Energy management of public-private partnerships (PPP) in sensor-related projects. - Open data, e-government, transparency, and citizen participation. - Define the expected quality of service by contractors. 	<ul style="list-style-type: none"> - Training. - Discounts and free passes to conferences, workshops, and fairs. - Travel to common interest topics. - Best practices and lessons learned by others.

Overall, the suggestions address one main desire: the effective execution of projects and initiatives in relation to smart cities. This efficiency is seen from three different angles: economic expenditure, best practise maximisation, and time constrains. From the economic side, some members would like to see initiatives covering common interests in several cities. This would allow for a reduction in economic costs by sharing technical specifications and contracting the administrative processes.

Smart governance across all regions

Developed countries have been creating their infrastructure on the basis of smart governance and sustainable development for more than a decade now. The developing world is not far behind either. As cities are developing, based on smart city frameworks, governments across all regions are using e-governance to strengthen democracy, citizen participation, and public welfare.

The aim of smart or e-governance is to make the system more transparent and citizens more informed. Governmental information will no longer be a repository for only a few public officials or servants but accessible by all sections of society (Griffith, 2000).

Features of smart governance

E-governance and the involvement of the public in the decision-making process is the most important aspect of smart governance. The tools used to achieve them are the following:

Use of Information and Communication Technology (ICT): This implies the use of computers, the internet, telecommunications, and digital equipment for collecting, processing, sharing, and retrieving data as well as the better penetration of telecommunications channels such as cable, radio, telephones, and satellite systems for transmitting information. This is in addition to the use of Geographical Information Systems (GIS) for travel and transport, video conferencing, instant messaging in banking, healthcare, energy, and security services (United Nations, 2019).

E-Consultation: People's participation is the main feature of smart governance. There must be a proper channel of interaction between the government and its citizens. They must be empowered to voice their opinions and views, ideas about government programs and schemes. Their feedback should directly reach out to leaders, counsellors, city managers, and local heads (Bernardo, 2019).

E-Data: Easy access to government funds, expenditure and investment data, and public information must be available online. Except for critical information pertaining to security and the safety of citizens, data must be provided freely and openly. This will make the government more accountable and citizens participative in the government's functioning (Bernardo, 2019).

3.5. Critical review of Smart City Challenges

This section critically reviews the challenges found in this chapter related to the development of smart city policies from (1) Government policies, (2) Smart city innovation, (3) Infrastructure, (4) Environmental standards, (5) Social responsibility, (6) Cost reduction and funding, points of view.

Table 3-3 provides a breakdown of the authors' viewpoints regarding the challenges that impact the effective development of smart city policies.

Table 3-3. Critical review of smart city challenges

Challenges	Authors	Descriptions
Government policies	<p>Bolívar and Meijer (2016)</p> <p>Lin et al. (2015)</p>	<p>While some authors indicate potential outcomes at a broad level such as public value, others establish outcomes based on their potential economic, environmental, and social impact. However, the next step to improve the outcomes is to</p> <ul style="list-style-type: none"> - provide changes to the government organisation. - provide changes regarding the position of the government regarding other urban actors. - apply improvements to the smart city infrastructure.
Urban innovation	Caragliu and DelBo (2018)	<p>Smart city plans worldwide show how they focus mainly on ICT as a factor that can improve urban frameworks and ultimately foster urban innovation. However, the downside is the lack of bottom-up approaches and stakeholder involvement and a general disregard for local conditions. This is in clear contrast with the theoretical tenets of smart city policies and practices.</p>
Infrastructure	Ahvenniemi et al. (2017)	<p>Some smart cities focus on hard infrastructure, for example, the deployment of networks and different kinds of fast internet, the establishment of sensors in the built environment, the exploitation of open information, and the Internet-of-Things. However, they need to pivot more toward the soft infrastructure such as human and social capital and the quality of governance.</p>
Environmental standards	Chourabi et al. (2012)	<p>The commence of the smart environment refers to the utilization of technology to enhance the learning of environmental conditions and services such as power, water, and gas with the specific end goal of changing people’s habits, avoiding waste, benefiting the environment, and improving the efficient use of resources. Chourabi stressed the ecological elements; these</p>

		activities affect the city liveability and manageability and ought to be considered while considering smart activities in turn.
Social responsibility	Glasmeier et al. (2016)	The prime requirement for achieving the successful implementation of sustainability practices in any organisation involves better-quality training and education for employees. This will help implement sustainability culture and create an awareness about sustainability practices.
Cost reduction and funding	Mirzaee and Sardroud (2022) Cohen (2006)	Keeping in mind that the end goal is to create a digital infrastructure and link everything online, smart cities need a great deal of funding and investment. Developing countries nowadays confront the money crunch due to other developmental activities, low tax collection, heavy international loans, trade deficits, and other social issues.

3.5.1. Policy recommendations for the smart city framework

The discussions provide insights related to developing a framework to guide smart city development (SCD) initiatives. The accompanying framework envelops five measurements: strategy, monitoring, accountability, rethinking, and transformation. These five can be blended and marked as a smart model (Lytras et al., 2021). This segment quickly plots each of these measurements. A clear strategy is essential for the following three reasons:

- 1) It establishes an objective that guides the efforts of individuals, government agencies, and businesses.
- 2) It improves benchmarking by encouraging stakeholders, especially governments and businesses, to survey cases for insights while leveraging strengths and managing weaknesses.
- 3) When formulating strategies, governments ideally work with multiple stakeholders including the private sector, experts, and academics; a collaborative buy-in can make implementation more effective and efficient.

Second, the checking progress in SCD through key execution markers, which are Key Performance Indicators (KPIs), can enable urban communities to target ceaseless enhancements. KPIs incorporate both process (efficiency) and results measures (quality of life, policy efficacy, equality, and sustainability) with reflections and experiences drawn from every estimation period. KPIs ought to be agreed on and composed into SCD ventures at the soonest point, as should frameworks for gathering, breaking down, and revealing information. Furthermore, observing endeavours are squandered without an arrangement to cycle experiences into the basic leadership process. This requires governments and SCD venture directors to receive a nonstop change mentality and it further requires SCD activities to be adaptable when incorporating new discoveries including informative advancement and usage. Checking is a key capacity of government and intelligent regarding both ability and effectiveness, both of which have associated issues recognized as regions of worry among the overview respondents (Grossi and Trunova, 2021).

Finally, as discussed, SCD tends to support operational improvements over governance reforms. Fundamental change is important to limit this predisposition. Governments might be inclined to focus on marginal or insignificant items that only signal progress. For instance, a reduction in wait times at road toll booths signals the improvement of traffic bottlenecks.

However, this does not affect the travel demand designs that underlie congestion. Another example, the monitoring of tax payments, may signal a more operationally efficient fiscal system. However, there is no certification stating that the assessment strategy is accomplishing its social and financial objectives (Albino et al., 2015).

These outcomes can be viewed as a first step in clarifying the channels through which investing in policy initiatives based on the smart city framework can have a positive impact on urban performance as defined in terms of economic growth, quality of life, sustainability, and overall wellbeing. More research is needed to comprehend the overall effect of smart city strategies and how this translates into long-term objectives along with a more exact definition of what smart city policies really are.

3.6. Summary

This chapter has addressed the literature findings on the second research objective: *“To explore the policy development and challenges in the context of smart cities.”* With a particular focus on the United Kingdom and the EU city developments and answers the second research question: *“What are the key policy challenges when developing smart cities?”*.

The chapter begins with an overview of the literature relating to the development and challenges of smart city policies. It highlights the importance of establishing a conducive policy framework for smart city initiatives to thrive, emphasising the role of governments and governance structures. Additionally, it underscores the need for innovative forms of governance to facilitate stakeholder collaboration.

A significant portion of the chapter is dedicated to exploring the challenges faced by smart cities, encompassing dimensions such as governance, economy, mobility, environment, people, and living standards. These challenges range from demographic shifts to infrastructure security concerns, reflecting the complications inherent in urban development. It also examines the challenges encountered by governments in implementing smart city strategies, including funding constraints, political considerations, and the need for citizen engagement. The discussion extends to the social, economic, and technological impacts of smart city governance, emphasising the importance of holistic approaches that integrate human capital development, environmental sustainability, and technological innovation. Additionally, the chapter outlines

policy recommendations for advancing smart city frameworks, advocating for clear strategies, robust monitoring mechanisms, and transformative governance reforms.

Overall, the chapter provides a comprehensive review of the literature on smart city policy development and challenges, offering insights into the complexities of urban governance in an increasingly digital and interconnected world. It calls for further research to deepen the understanding of the long-term impacts of smart city initiatives and the efficacy of policy interventions in shaping urban development trajectories.

Chapter 4. Research methodology

4.1. Introduction

This chapter describes the research methodology undertaken in the present study. The identification of the research ideology that directed the research has been explored. In the literature review chapter, the investigation of smart cities development in the scope of this research was identified. Also, the implementation of smart governance factors in the context of smart cities was drawn up and the research model were developed. This chapter explains the reasoning behind the individual strategic planning utilised in this research. Some of the methodological considerations including the sampling techniques, the sample size of the research and of the data, along with the design and implementation of the interviews, are further detailed.

Considering the description of these areas, which will constitute most of the chapter, additional sections will illustrate the post-compilation stage of the data analysis and the research ethics. These segments will help relate the theory to strategic design while also revealing the possible limitations of the analysis and outcomes. This chapter also reviews the details of the research and analysis methodology which was picked as quantitative. This is followed by the framework adopted for tackling the research questions. The research direction is outlined in detail and the significance of the research is highlighted with a focus on the relationships to the literature review characteristics. The data sources are shown, and an overview of the research approach, method, strategy, and techniques is discussed.

4.2. Overview of the research process

This research was aimed at developing an objective and systematic approach to the implementation of smart cities strategies in the United Kingdom. The research concentrated on a qualitative exploration of the smart city's development strategies. This qualitative exploration was based on a pragmatic approach to an unexplored and relatively new area of study.

To achieve this approach, an in-depth systematic and critical literature review was conducted looking into the smart city development strategies from a governmental point of view (Chapters 2 and 3) so as to be able to understand the situation of smart city development and evaluate the

existing strategies available to smart cities. From the literature review, a series of factors, challenges, and critical success methods were identified and detailed. This identification assisted in the creation of the semi-structured interviews as it underlined what areas need to be developed in the smart cities sector.

After the questions were created, it was clear that CEOs and influential professionals need to be interviewed in the smart cities field, therefore snowball sampling method was selected. Based on the knowledge demand of this research, the following profile was created.

Senior experts' representatives:

- Experience in the smart cities sector (technological, invention, governance, financial, and the public and private sectors).
- Minimum of five years' experience in the smart city field.
- Knowledge of smart cities projects.

Based on the profile, 25 participants were identified ranging from the directors of businesses, through to including the directors of projects, CEOs of companies, and managers. Due to the lack of a successful plan in the smart cities sector, a further sampling technique needed to be implemented, therefore snowball sampling was added. The interviewees found it hard to agree to the interview since part of the data collection was during the Covid-19 pandemic. Nevertheless, it was quickly discovered that sample saturation was able to be achieved. Once the data was gathered, the transcripts were created. With the transcripts properly written, the next step was the analysis of the data using the grounded theory strategy according to Glaser and Strauss work. The analysis identified new challenges, critical success factors, and solutions related to the smart city's development. To merge the findings from the literature with the ones from the interview, thematic analysis was performed. With all of the results aligned, Chapters 5 to 8 present a detailed explanation of the findings obtained through the data collection and analysis. An integrated strategic framework was developed from the findings.

4.3. Research design

All research is led by the researchers' ideology in combination with the selected strategy as can be seen in Figure 4-1, as in the research design typology conceptual overview. Ideology is an evidence-driven continuous line from the left through positivism and pragmatism in the centre towards constructivism on the right (Kothari et al., 2014). The determination of what

ideology to use depends on the purpose of the research. For positivism, the data is an undisputable fact; for pragmatism, the interpretations of the researcher are the objectives of the study; for constructivism, the views and ideas of the research participants are the important factors.

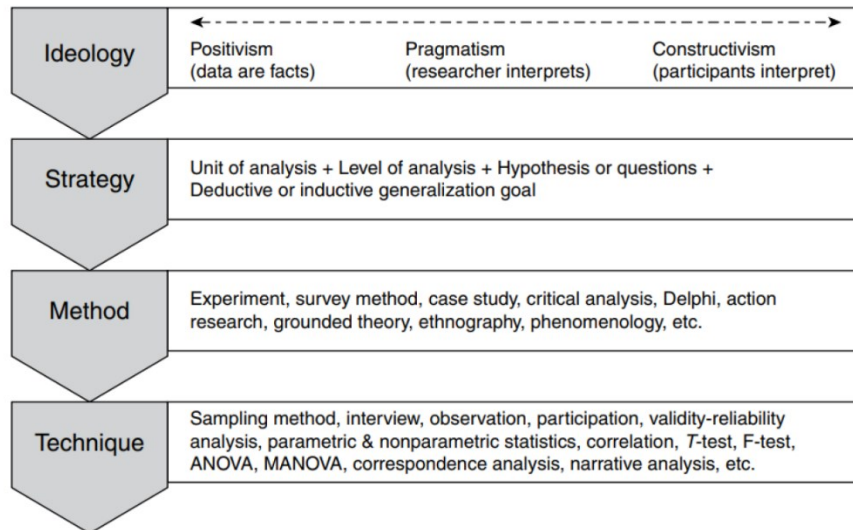


Figure 4-1. Research design typology conceptual overview

(Source: Strang, 2015)

This research follows the pragmatism ideology for several reasons, such as its flexibility compared to other ideologies (Strang, 2015). It permits the usage of a wide range of research methods to collect and analyse the data. Effective decisions based on the best working answers for the questions under investigation allows the researcher to conduct the research in an innovative way to find solutions to the research problem. Additionally, in pragmatism, great importance is given to the research problem where the research question is a crucial element of the ideology. This implies that attention is paid to practical solutions and useful results instead of abstract differences. This falls in line with the current study since the research problem refers to the successful implementation of strategies in smart cities. More sensible outcomes are preferred by the researcher and they are also more useful to the industry.

4.3.1. Research ideology

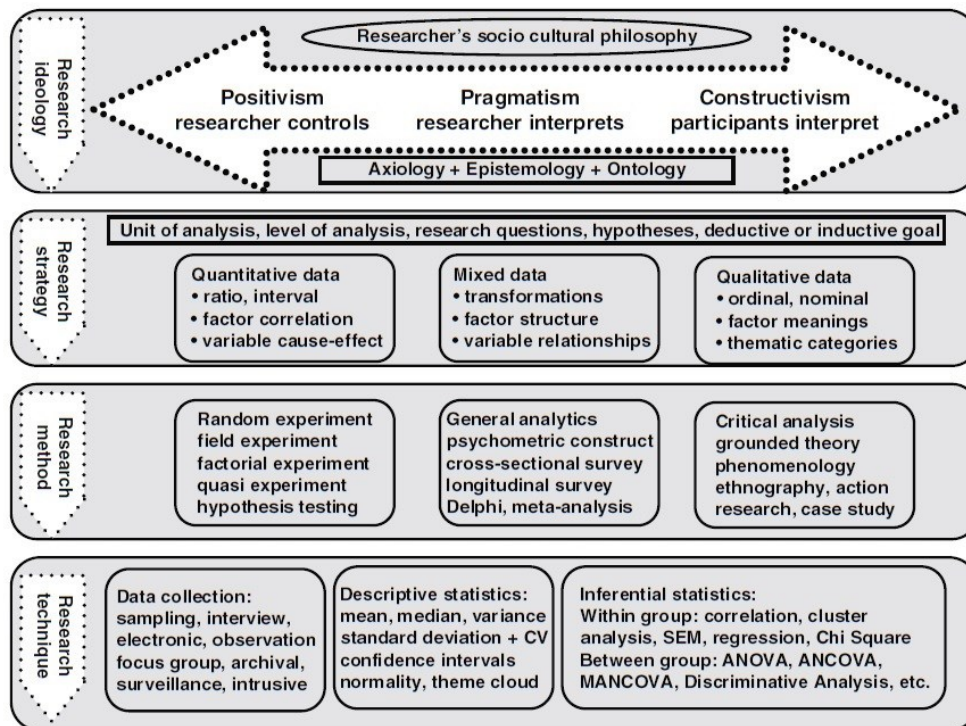


Figure 4-2. Full model of the research design typology

(Source: Strang, 2015)

This research follows the pragmatism ideology. According to the pragmatism research ideology, the research question is the most crucial factor of the research viewpoint. Pragmatism can combine both positivist and interpretivism positions within the scope of a single research study according to the type of research question (Figure 4-2).

As opposed to the positivism and interpretivism research philosophies, the pragmatism philosophy can combine more than one research method and research strategy within the same analysis. Furthermore, studies using the pragmatism research philosophy can combine the use of multiple research methods such as qualitative, quantitative, and mixed methods.

Once an ideology is chosen, a method of application of the ideology must also be implemented. Positivism usually links to the quantitative method and constructivism links to the qualitative method. In the case of pragmatism, both qualitative and quantitative methods can be implemented.

4.3.2. Research method selection

The next sensible step was to decide which method would help to address the research aims and objectives more accurately.

4.3.2.1. Qualitative, quantitative, and mixed methodology

The literature on the research methodology offers various tactics and methods for use in the research design. However, it is not always clear as to how to merge these methods when conducting certain types of research, or how to analyse the data. The research design is a general guide for the gathering and evaluation of information for use in a particular study (Chih-Pei and Chang, 2017). Any empirical study starts with a literature review and contains data collection of some sort, without which there would be no academic research (Strang, 2015; Creswell, 2018; Leavy, 2022). However, the data collection needs to be done using an appropriate method and technique to achieve the intended aim and objective. The research design facilitates the search for answers to the questions that are being studied for a research project. Furthermore, it is undertaken to support the research structure through the clear identification of limits and ethical matters that will need to be considered (Cardano, 2020). Three main research methodologies are the most frequently used: quantitative, qualitative, and mixed.

The quantitative methodology is applied when the aim of the research is to quantify a situation, occurrence, problem or event and where the data collection method and analysis is designed to determine the magnitude of the variation. This is contrary to qualitative studies which aim to describe and investigate a situation, problem, or event through a qualitative measurement scale to analyse the variations of the issue without quantifying it (Strijker et al., 2020).

A mixed method, as the name implies, uses both quantitative and qualitative methods to fulfil the aim. Even though the research process is the same in all methods, they distinguish between the terms of the underpinned ideology, the method of data collection, the analysis, and the research finding communication style.

Due to the underpinning ideology chosen for this research, the qualitative methodology was chosen to better fulfil this aim. A quantitative and mixed method could not have been used due to the lack of quantifiable parameters.

4.3.2.2. Qualitative Research

Qualitative research methodologies attempt to construct meaning or knowledge. The qualitative research method follows a developing flow as the different steps evolve as the research matures. The aim of the qualitative method is complicated and broad, centred around finding, describing, understanding, and shared interpretations mainly based on open-ended interview questions and an analysis that permits patterns to form and aid in the formation of a theory.

The basic characteristics of qualitative methods explain the aim of this study as it is an exploration into the development of smart city strategies, therefore making the choice of the method qualitative.

4.3.3. Qualitative research design

A research design is the set of plans put together to achieve a certain goal. In the context of this research, it is the plan that the researcher follows to answer the research questions. It is the connection between the research ideology and the selected data collection and analysis methods (Saunders et al., 2015).

Qualitative research involves various methodologies tailored to understand human behaviour, perceptions, and experiences in depth. Four major types of qualitative research design are the most commonly used. They are: (1) phenomenology, which seeks to explore individuals lived experiences to unveil common patterns and essences. (2) Ethnography involves immersing researchers in a cultural setting to comprehend societal norms, rituals, and behaviours within their natural context. (3) Grounded theory aims to construct theories grounded in empirical data, allowing themes and concepts to emerge from the data rather than being predetermined. Finally, (4) Case study methodology delves deeply into specific cases to explore complexities and intricacies, often aiming to understand unique phenomena or experiences (Astalin, 2013). The choice of the research design depends on various factors, depending on the research problem, that is, the research questions and objectives. This is in addition to its coherence with the research ideology, approach, the amount of time and resources available, together with the ability to access the participants and any other sources of data. Considering all the factor's, grounded theory is the most suitable and matches this research criteria.

4.3.4. Grounded theory

Grounded theory was established in 1960s by Glaser and Strauss (Suddaby, 2006) to help better understand social research. The research design refers to the qualitative methodological approaches that it uses to establish a theory. Saunders et al. (2015) stated the key factors of grounded theory that should be taken into consideration when adopting this approach includes:

- Early start of data collection.
- Simultaneous collection and analysis of the data
- Developing categories and coding from the data as they are collected and analysed.
- Use of frequent comparison and the writing of self-memos to develop conceptualisation and to formulate a theory.
- Use of theoretical sampling and theoretical saturation aimed at building theory rather than achieving population representativeness.
- Use of the literature as a complimentary source regarding the categories and concepts emerging from the data.
- Development of a theory that is grounded in the data.

Astalin (2013) stated that grounded theory is among the strategies that can help the researcher in getting a better understanding of the phenomenon, as well as linking between the categories and formulating a relationship between them. Glaser advocates for theoretical sampling (Glaser and Strauss, 2017). wherein data collection is guided by emerging theoretical insights rather than predefined sampling criteria (Howard-Payne, 2016). This allows researchers to select participants and sources of data that will best contribute to theory development. Therefore, Glaser's Theoretical Sampling variation of grounded theory was selected for this research.

4.4. Data collection and data analysis

The data collection and analysis methods used for this research were (1) semi-structured interviews and (2) thematic analysis. Semi-structured interviews were adopted for the collection of the primary data. Thematic analysis was selected as the qualitative analysis technique and grounded theory was selected for the qualitative research design. The reasoning behind the choosing of the methods has been explained in this section.

4.4.1. Semi-structured interviews

Interviews are among the most important techniques used for collecting qualitative data in which the interviewees respond to a number of questions asked by the researcher about a particular subject, event, or situation (Griffiee, 2005; Adeoye-Olatunde, and Olenik, 2021). Interviews can be done through the use of three categories: (1) structured, (2) semi-structured, and (3) unstructured (Barr et al., 2017). Structured interviews are defined by their fixed and inflexible nature where the questions asked are pre-determined. This will not allow for any type of variation in the interviewees' answer. This kind of interview needs very little administrative effort and it is quick to carry out. Unstructured interviews, unlike structured ones, lack any type of organisation. They are made mainly of open-ended questions and present the interviewees with the freedom to direct the interview. These types of interviews represent a high difficulty level for the researcher when it comes to analysing the interview and it is time consuming to complete them (Gill et al., 2008). Semi-structured interviews were chosen as the best fit for this research. They have some of the qualities of structured interviews but offer the interviewees the freedom to explore the characteristics of the topics in more detail if they wish. Two-way communication between the researcher and interviewees is encouraged which allows the interviewee to be more comfortable and engaged within the scope of the interview questions. This might help the researcher find aspects that were not contemplated before the interview.

All the interviews were recorded using note-taking. This was alongside with voice recordings in some of the interviews using the researchers phone, which worked as a back-up. The transcribed interviews were analysed following the grounded theory approach according to Glaser and Strauss.

4.4.2. Thematic analysis

The purpose of the interviews and data collection is to gather data in order to answer the research question. However, it is not that the data we have collected has any intrinsic value. Therefore, a systematic approach must be implemented to help extract useful information from the data. Thematic analysis is a broadly and frequently used methodology in qualitative research (Guest et al., 2011; Braun and Clarke, 2022). This study followed the grounded theory approach according to Glaser, meaning that the researcher analysed the data as he collected it. The transcription of the interviews accomplished by the researcher enabled him to acquire a sense of familiarity with the data since the transcription process takes a lot of effort and time. This provided an opportunity for the researcher to familiarise himself with the data as he read

and re-read the developed transcripts. This step was crucial as it enabled the researcher to start identifying the reoccurring themes within the data.

In smart cities, there are concepts that represent themselves and create distinct frameworks of smart sustainable cities. This research utilises a qualitative approach to discover the concepts and underlying governance strategies and developments to identify the theories behind them. In relation to the thematic analysis, the aim of qualitative research is to define and clarify the relationships between a process that entails a set of conceptual categories and the role of related applications in the development of smart cities. Following a set of qualitative tactics suggested by Lester et al. (2020) that can help create meanings from diverse material, the thematic analysis has been designed and adopted with two goals in mind. First, to identify the most innovative framework for policy development for use in smart cities and the related concepts and technologies. Second, to conceptualise the theoretical base behind the framework of smart governance with the underlying technological components linked with the successful implementation of smart cities by answering the question on what the needs are when developing and evaluating a framework for use in governance frameworks in smart cities.

Thematic analysis can be used to address the various types of questions presented by the researcher to create a conceptual framework and systematic questioning of the underlying meanings in qualitative data. This can be done through discovering patterns, themes, relationships, and concepts in the qualitative data. Therefore, thematic analysis is a suitable method through which to analyse and synthesise the interview data in the manner of conceptual frameworks, critical reviews, and descriptive research. This can be applied to generate theory-driven analyses (Kiger and Varpio, 2020).

The main steps of this research thematic analysis approach were as follows:

- 1) In the review of the smart city, sustainable city, smart governance, smart technology, and other literature themes that are related to the smart cities policy developments, the aim is to analyse the data gathered through the conduction of interviews related to the framework of smart cities governance that puts an emphasis on the methods used to solve the challenges faced by the governments of smart cities and to improve the quality of life for people.
- 2) The outcomes of this process consist of several themes, the “components of smart city governance, policy recommendations and developments for smart cities, smart cities

perspectives and smart cities frameworks” which in this case are related to the respective framework of smart governance.

- 3) Pattern recognition requires the skill to see patterns in seemingly random information. The objective is to identify the main themes and concepts within the data and then to, in the second step, look for relationships or sub-themes within the sample and study the results using perspectives (e.g., citizens’, digital, environmental, and economic perspectives).
- 4) Identifying a framework involves recognising a particular and unique framework of smart governance for cities of the future.
- 5) Conceptualisation is about discovering the theoretical relationships between the identified concepts and smart cities.

The outcomes of the thematic analysis have been reviewed and explained in detail in the next chapter. Through the thematic analysis, there were some key themes and perspectives that emerged from the interview data that highlight knowledge creation while also revealing the evolutionary process of the smart city concept.

4.4.3. Literature review process

The narrative literature review method was followed for the data collection within this study. The steps for this have been explored in this section of the study, and different stages of the study were used to create a successful framework for the implementation of the smart cities strategies.

The research stages have been investigated and are shown in Figure 4-3. Stage (1) is the literature review, (2) is the data collection, (3) contains the data analysis, and the final stage (4) is the strategic framework for the implementation of the smart cities strategy within the United Kingdom.

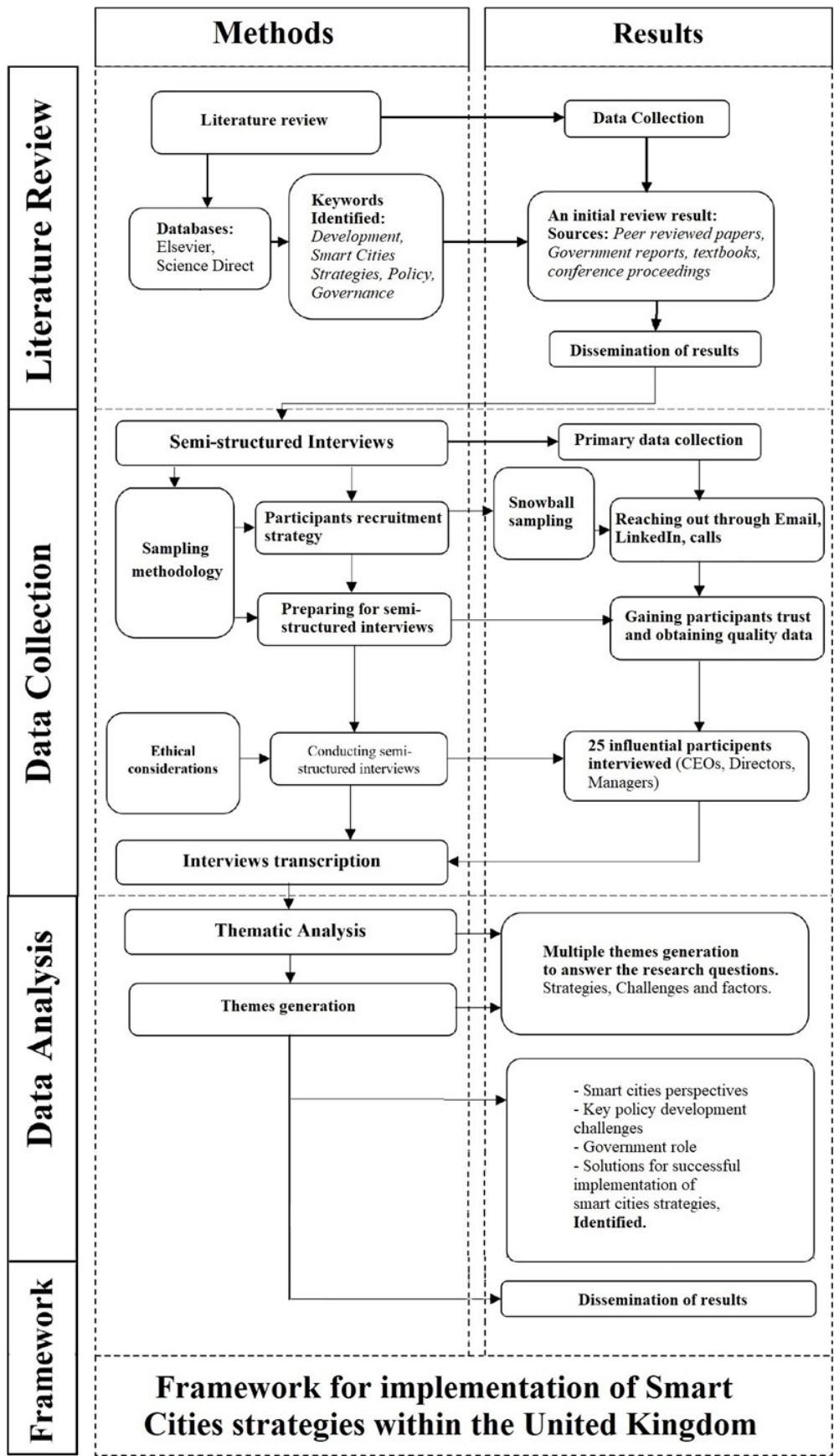


Figure 4-3. Research process

4.4.4. Data collection

To respond to the research aims and objectives, semi-structured interviews were adopted as the data collection technique. The actions taken in order to collect the qualitative data have been detailed within this section. The interviews were completed over a period of one year. The interviews took around twenty and thirty minutes, usually. The interviewees were among the top management which included CEOs, directors, and managers (business/company owners, directors, project directors, project managers, local government, engineers, and academia) alongside others with a minimum of five years experience within the smart city industry, as shown in Table 4.1.

Table 4-1: Classification of the interviewees

INTERVIEW NO.	PARTICIPANT	ROLE	EXPERIENCE
1	P1	CEO and Founder	>9
2	P2	Director	>10
3	P3	Director	>20
4	P4	Chief executive officer	>5
5	P5	Manager/Product developer	>5
6	P6	CEO/Mentor	>13
7	P7	Manager	>7
8	P8	Chief executive officer	>5
9	P9	Chief executive officer	>5
10	P10	Director	>6
11	P11	Manager	>5
12	P12	Project Manager	>7
13	P13	Chief executive officer	>8
14	P14	CEO and Founder	>11
15	P15	Director	>20
16	P16	Director	>10
17	P17	Project Manager	>6
18	P18	Director	>6

19	P19	Chief executive officer	>6
20	P20	CEO	>8
21	P21	CEO	>6
22	P22	Director	>12
23	P23	CEO	>22
24	P24	Manager/Product developer	>8
25	P25	CEO	>9

4.4.4.1. Sample strategy: snowball sampling

The method selected for the questions is clear and enables the easy answering of the questions (Bhattacharjee, 2012). Following the same theme, some of the research questions were designed in a way to enable the participant to explain their strategy in detail. Snowball sampling was used to collect the data. The research participants were asked to help recruit the participants for this study. Firstly, potential subjects were identified, and the existing participants were asked to recommend colleagues or any other potential candidates in the field of smart cities with top-level management experience.

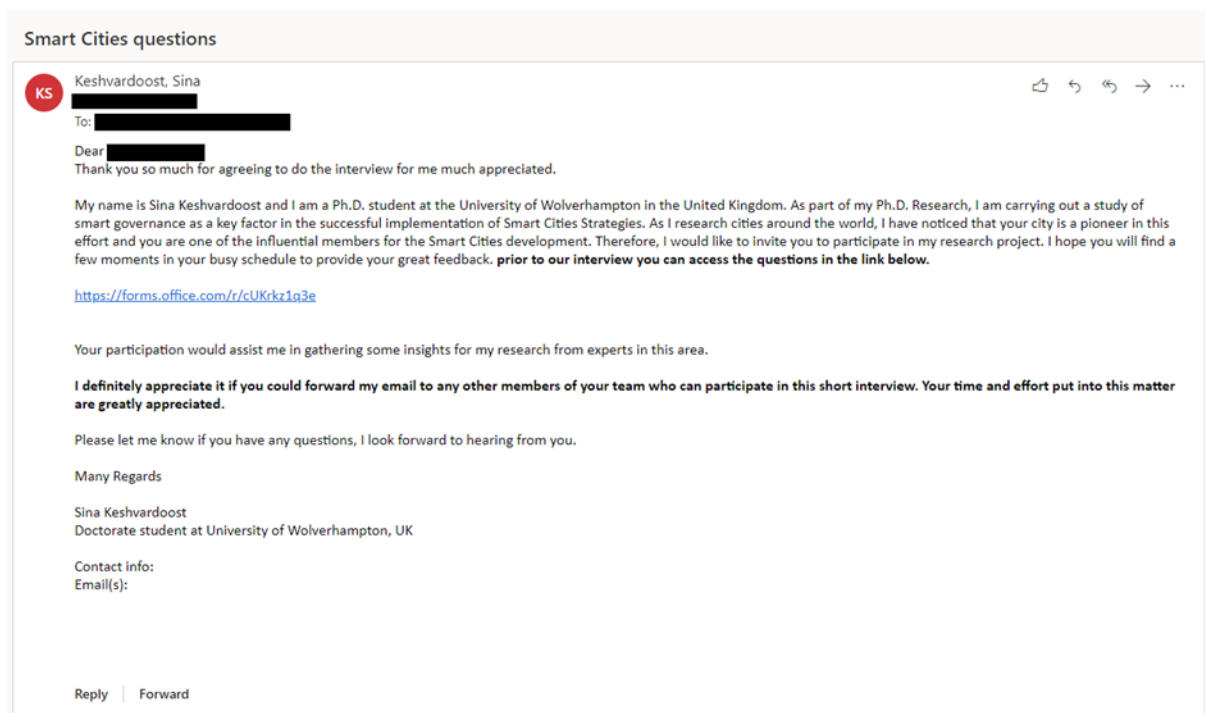


Figure 4-4. Email sample sent to the interviewees using the snowball sampling method

As shown in Figure 4-4 above, an online link for the interview questions was provided to the participants to help with the interview. significantly benefiting the snowball sampling technique, Also, the participants were notified that the gathered data would only be used for this research and that it would be kept confidential. Utilising online technologies for qualitative data collection has become commonplace within academia in recent years (Baltar and Brunet, 2012 and Opara et al., 2021).

4.4.4.2. Ethical considerations

The data for this research was collected from human beings, therefore ethical approval was necessary before proceeding with the data collection. The objective was to ensure that the research data was collected in an ethical manner that protects participant information. The submitted form contained a description of the intended research aim and objectives, and the information sheet and methods which the data collection will use in the interactions with the participants. Additionally, the researcher explained how the participants' data would be collected, used, and later removed when the research was completed. Ethical approval was requested from the University of Wolverhampton research ethics committee, and it was submitted and approved on 19 November 2019. See the Appendix for the full details on the submitted form and the University of Wolverhampton's research ethics approval.

4.5. Development and evaluation of the strategic framework

A strategic framework used for the implementation of smart cities development was developed from the findings of the different stages of this research, in addition to some aspects of the literature. The framework was developed as an answer to the interviewees highlighting, during the interviews, that there was a need for a strategic framework when implementing smart cities successfully, ultimately improving the quality of life of the citizens. The framework (available in Chapter 10) was developed to provide support to decision-makers to help them properly understand, manage, and implement smart city initiatives.

The developed framework was evaluated by five professionals in the smart cities sector. The professionals selected have experience over 6 years in the smart city sector. The professionals were emailed the framework in advance to allow them some time to explore the framework in-

depth. The interview questions are available in Appendix B, and each interview lasted between ten to fifteen minutes.

4.6. Challenges and difficulties

This study faced some challenges and difficulties in its different phases.

- In the data collection stage, one of the challenges in this research, which can be considered the biggest, was getting the participants to agree to the interviews. Due to their busy schedules, there was a lack of response from many organisations. Many of the selected participants refused to engage with the interviews and in some cases, follow through with the interview once it was scheduled. This was countered by the snowball sampling method since the early participant contacts came from the smart cities sector. They referred other participants that met the criteria set by the researcher. The snowball sampling method worked perfectly and was more efficient than trying to find more qualified participants through traditional channels.
- Due to the lack of experience of the researcher, the interviews tended to take longer than necessary and they had to refocus the interviewee back on the subject which took more time than planned. Also, due to the data collection methodologies and additionally due to this research being the first experience, it added to the difficulty of the research. To help gain a better understanding, the researcher engaged in discussions with their colleagues who had conducted similar research. Additionally, the University of Wolverhampton's workshops related to the selection of methodology for research were very useful.
- Choosing a method of analysis was a challenge for this research in the beginning as there was confusion between thematic analysis and content analysis.
- The raw data from the interviews was complex but the themes were easy to identify. However, many of the participants tended to answer multiple questions in one go, making the themes and categorisation more difficult to analyse.
- The challenges mentioned above were addressed most of the time through extensive study, discussions with colleagues, conference presentations of the research, the undertaking of university activities, and continuous discussions and support with and from the supervisory team.

4.7. Summary

This chapter provides information on the methodology and the methods for conducting this research. It started by clarifying the research design and the methods used for analysing the data. The research structure was then explained and the steps that needed to be followed to achieve the research objectives were listed. A qualitative approach was selected. Grounded theory approach was selected as the qualitative research design. Also, the sampling format, size, and techniques were defined. The next chapter presents the data analysis protocols and findings.

Chapter 5. Evaluation of the smart cities' concept

5.1. Introduction

This chapter focuses on the analysis of the first research question and the first objective:

“What are the smart cities perspectives?”

and

“To explore the concept of smart cities.”

Semi-structured interviews (from 25 participants) were used to collect the industry perceptions which were then analysed using thematic analysis to determine the inferences and conclusion. The analysis of the data revealed four key perspectives, namely the citizens' perspective, digital perspective, environmental perspective, and economic perspective. Smart cities have developed as a potential answer to city problems deriving from rapid growth. Smart cities are considered to be essential as part of a sustainable future. However, the literature reveals there is a lack of conceptual transparency around the term 'smart city' due to the plethora of existing definitions. In this chapter from the data analysis, we identified four smart city perspectives. Therefore, this chapter focuses in order to recommend frameworks to help the governments of smart cities implement smart city strategies considering the four key smart city perspectives, namely the citizens' perspective, digital perspective, environmental perspective, and economic perspective.

The aim of this chapter is to capture the general insights into the smart cities sector on the concept of smart cities using a qualitative approach. Four perspectives, from the citizens' perspective, digital perspective, environmental perspective, and economic perspective, were considered based on their impact on the UK smart city sector.

Several key findings have developed from the analysis of this research question. More data-driven cities and the use of technology are required for cities along with interconnectivity, resulting in less energy loss and less use of resources. Overall, the effects that come from improvements in quality of life along with the effect of information and communication technology (ICT) allows governments to optimise their resource usage and eventually create a better city for their citizens. In addition, this analysis of the data identified several emerging themes in the smart city perspectives. Each of the perspectives individually have an impact on

the implementation of smart city strategies in cities, although this analysis indicates that they can also work closely with each other as well.

This chapter provides a rich insight into the understanding and awareness of the impact of the key perspectives of the UK smart cities sector and the changes that the infrastructure sector needs to undertake in order to improve the quality of life of citizens. Furthermore, frameworks are offered to demonstrate the relationships necessary between the key perspectives for improvement.

Table 5-1. Overview of the interviews conducted (Focus perspective)

INTERVIEW NO.	PARTICIPANT	FOCUS OF THE INTERVIEW	ROLE	YEARS OF EXPERIENCE
1	P1	Citizen	CEO and Founder	>9
2	P2	Digital	Dean of School Faculty	>10
3	P3	Citizen	Course leader/Design Engineer	>20
4	P4	Digital	Chief executive officer	>5
5	P5	Digital	Manager/Product developer	>5
6	P6	Economic	CEO/Mentor	>13
7	P7	Digital	Manager	>7
8	P8	Economic	Chief executive officer	>5
9	P9	Digital	Chief executive officer	>5
10	P10	Economic	Director	>6
11	P11	Economic	Manager	>5
12	P12	Environmental	Project Manager	>7
13	P13	Environmental	Chief executive officer	>8

14	P14	Digital	CEO and Founder	>11
15	P15	Digital	Director	>20
16	P16	Digital	Director	>10
17	P17	Digital	Project Manager	>6
18	P18	Environmental	Director	>6
19	P19	Environmental	Chief executive officer	>6
20	P20	Citizen	CEO	>8
21	P21	Citizen	CEO	>6
22	P22	Digital	Director	>12
23	P23	Citizen	CEO	>22
24	P24	Digital	Manager/Product developer	>8
25	P25	Economic	CEO	>9

As stated in Table 5-1, considering the participant's role and organisational sector, the focus of the interviews was determined.

5.2. Citizen's perspective

The information and communication technologies allowed for the democratisation of the citizens' inclusion capacity, which has enabled citizens to participate in the innovation of smart cities, is where a strong governance-oriented approach is necessary for smart cities which stresses the role of social capital and relations in urban development, as mentioned by Albino (2015).

Over the past decade, many countries have adopted and invested in businesses and their innovation capabilities to create a beneficial service that involves the public to create an environment that encourages and supports citizens and ultimately increases quality of life. The quality of life associated with living and working in a public environment can have a positive impact on competitiveness because it attracts new businesses who strengthen economics, as well as the political and cultural life of the citizens, leading to positive developmental changes (Annibal et al., 2013).

Most of the interviewees described quality of life as one of the key smart city goals. Also, they agreed with the importance of the citizens' perspective and the importance of their involvement in the decision-making for the city by the governance of smart cities. As stated by another interviewee (Participant P9):

“Smart cities provide solutions with technology and urban development for cities composed of ICT and data to provide a better future and better quality of life for citizens.”

which underlines the importance of citizen involvement.

Similarly, P3 also mentioned that a smart city as:

“An intelligent entity providing real time information on aspects of life in City for the public to improve their quality of life.”

Supporting the citizens' perspective demands carefully designed, facilitated, and managed processes in which the originators have an active engagement and in which the aspects of engagement are openly and repeatedly, systematically, and structurally studied and addressed, even though citizens are supposedly the recipients of smart city missions. Traditionally however, they are rarely asked about what they want and their ability to contribute (Cardullo and Kitchin, 2019). From the literature review chapter, it was understood that some of the already-existing methods could play an important role. However, time, lack of funding, and the technology methods used as well as the established and imbalanced relationships between the government and citizens, as well as the conflicting views, concerns, and objectives among the stakeholders can lead to less sustainable instances of addressing the issues.

Based on the interviews, this research indicates that the development of a new framework is crucial to improve the quality of life of citizens by developing a framework of collaboration for smart cities. In this discourse, it is emphasised that a city's residents should be in a position to actively articulate and effectuate their concerns, views, and objectives. Moreover, they should have plenty and equal opportunities to create value for themselves and their communities. This research also concludes that in order to truly support the citizens of smart city, not only are motivated citizens willing to participate in developments but furthermore, the open, flexible, and clear forms of governance can potentially positively impact that (Sennett, 2018). To support such forms of governance, organisations are required where citizens are respected equally and reliable members in the public sector. This research advocates for new roles and responsibilities for both the government and its citizens. In smart city development

processes, collaboration is key, although, at the same time, there is a need for governance where participation is key, and citizens are included in a decision-making capacity.

5.3. Environmental perspective

There are many initiatives focused on making the city more environmentally-friendly, such as the use of ICT to improve quality of life, the effectiveness of urban operations, services and competitiveness, while making sure that it meets the needs of both present and future generations with respect to the economic, social, and environmental aspects. Every government strategy has an impact on the environment. Organisations are now integrating environmental concerns into their business strategies.

The discourse surrounding smart cities often emphasises the potential benefits, particularly in terms of efficiency, sustainability, and quality of life. However, it's crucial to critically examine the environmental perspective of smart city initiatives. One significant concern is the increased demand for certain resources, such as silicon, cobalt, lithium and rare metals, which are essential for the energy transition and subsequently the development and operation of smart city infrastructure. These materials form the backbone of many smart city technologies (David and Koch, 2019). As the deployment of these technologies expands, so does the demand for silicon. Similarly, rare metals are critical for the production of batteries, sensors, and other components used in smart city applications. The extraction and processing of these resources often come with significant environmental costs, including habitat destruction, pollution, and ecosystem degradation (Bridges and Kucharski, 2018; Roy, 2018).

It can be inferred, while smart city initiatives aim to optimise resource utilisation and enhance sustainability, the reality is more nuanced. The transition towards smart cities may inadvertently exacerbate resource consumption rather than reducing it.

For instance, Interviewee P13 noted that:

“Smart cities mean all utilities interconnected resulting in less energy consumption, less resources required, more efficient, less crimes, quick reactions in case of emergencies and less costly to live.”

Therefore, while smart cities hold promise for addressing urban challenges, it's imperative to recognise and mitigate their environmental impacts. This requires a comprehensive approach that considers the entire lifecycle of smart city technologies. Without careful consideration, the

transition towards smart cities risks perpetuating unsustainable resource consumption and exacerbating environmental injustices, both locally and globally.

The concept of smart cities from an environmental perspective concerns the management of physical resources that are necessary for the future (Kirimtat et al., 2020). The physical limits of our planet have been established in various theories and concepts. These limits are the factors that determine the sustainable use of our natural resources.

The concept of sustainability pertains to an environmental dimension. However, the concept of sustainable smart cities is more than just an environmental issue (Dyllick and Hockerts, 2002).

The interviewees also described the various terms that are used to refer to sustainability. For instance, P19 mentioned that:

“Smart city is a sustainable city which issues strategies to solve daily life tasks in a more environmentally friendly way. some of the environmental issues that we face are becoming more critical to our survival.”

Overall, the intention is to gain a competitive advantage by reducing its carbon footprint.

Although the perceptions of the concept of sustainability vary widely across different industry sectors, most interviewees noted that this is in line with the environmental aspect.

The engineering sector is perceived as being more environmentally focused than other sectors.

In this research, more than half of the respondents agreed with the importance of environmental strategies.

In order to work effectively within smart cities, the governance of these cities and the public effort should create an infrastructure to stop energy reduction and loss. Data-based smart cities are where technology can eventually improve quality of life, security, and protect the environment of smart cities.

As city developments, economic developments, and consumption grow, the environmental pressures increase. Products such as building automation systems, energy efficient electricity, and some mobility applications could combine to cut emissions by 10 to 15% as mentioned in the literature review chapter. Waste and water management, which pairs advanced metering with digital feedback messages, can push citizens toward conservation and reduce the consumption in cities where the residential water usage is high. In many segments of the

developing world, the largest source of water waste is leakage from pipelines, which can be monitored using smart sensors and analytics.

Generally, cities can lessen the wastage of water per person each day and decrease waste overall. By using air quality sensors, it can pinpoint the causes and provide a foundation for further action. Sharing real-time information with the public via smartphone apps allows people to take protective measures. This can decrease the harmful health impacts depending on the current pollution levels. As mentioned above, three solutions are recommended.

- Air quality monitoring.
- Energy use optimisation.
- Electricity, water, and waste management.

5.4. Digital perspective

It has been suggested that ICT can be used to develop and manage cities more energy-efficiently (Narimatsu et al., 2012). However, the high usage of information and communication technology (ICT) does not automatically lead to a small environmental footprint as discussed in the environmental perspective.

To become more energy-efficient and sustainable, cities are looking for ways to improve their efficiency and adopt ICT solutions. Understanding the various types of investment that are most beneficial to their city will help them formulate their plans and implement them.

There have been three key trends highlighted by the interviewees in the smart city technology perspective. More data-driven cities relate to the use of technology as an intelligent entity providing real time information for people. The use of smart devices is because they are capable of capturing and transmitting data that is then analysed in order to obtain information and make decisions (automated connections between smart devices). The use of digital and telecommunication technology is connected to the use of information and communication technology (ICT) that allows governments to optimise their resource usage. From the digital perspective, the interviewees stated that they consider the use of technology as the main key factor in the smart city projects.

For instance, interviewee P14 highlighted that:

“Smart technology allows city planners and governments to optimise resource usage, improve quality of life, and automate certain routine processes. Smart cities solutions may include unique hardware or assets that are specially designed for use in these areas. In some cases, these IoT solutions sync with other connected devices that are preconfigured for IoT.”

Also at the sector level, all of the respondents, in some way, mentioned the use of ICT.

For example, P7 underlines:

“A smart city is a city that uses information and communication technologies (ICT) to improve quality of life of its citizen and increase operational efficiency, share information with them and improve the quality of government services within the city.”

In conclusion, smart cities use data and technology to establish efficiency, better sustainability, and also to encourage economic developments to ameliorate the quality of life of the citizens who live and work in the smart cities (Lai et al., 2020). Technology organisations and a number of other institutions in collaboration with city officials are among the key actors able to help promote the development of smart cities worldwide. However, this study shows that the majority of organisations are private entities looking for a profit. Consequently, precise management and monitoring should be formed and engaged in order to make them deliver public goods.

Smart cities need dozens and in some cases hundreds of small and large-scale initiatives at different levels to be able to emerge in a responsive framework. The use of smart devices will enable quick and reliable connectivity and usher in a new era in smart city development.

As participant P4 stated:

“Using automated connections with everyone about everyday activities such as smart traffic light, automatic parking, monitoring air pollutants, etc.”

The participants mentioned the effectiveness of the digital perspective in their businesses. In the software and development sector, digital security is mentioned as a key factor by P14:

“Software development provides assistance with configuring, managing, and monitoring internet of things (IoT) technologies used in a city infrastructure.”

From the government sector, organisations find digital connectivity important in their approach as stated by interviewee P15:

“Above all else, a smart city is a learning city. It means that smart cities learn through data, make data driven decisions, and continually iterate to improve.”

On the other hand, it's important that all of the above is supported by a powerful technological solution including secure networks allowing for stable and fast data transfers. Currently, there is a big discussion on using 5G technology, which is the fifth-generation technology standard, for improving the productivity and energy efficiency in smart cities. However, the standards for 5G are still uncertain and the implementation of the technology has been hindered for numerous economic and political reasons. Furthermore, there is a need for combining the standards for smart grids and ICT before moving forward.

ICT is a key driver of smart city initiatives (Hollands, 2020). The combination of ICT with development projects can significantly improve city life (Ianuale et al. 2015) and offer several potential opportunities. They can improve the management and implementation of smart cities (Odendaal, 2003). Regardless of the advantages and benefits of ICT usage in smart cities, the influence is still unclear (Odendaal, 2003). In fact, it can improve the quality of life for citizens but also raise inequality and promote a digital divide (Odendaal, 2003). Therefore, smart city governments should take into consideration certain factors when implementing ICT with respect of resource accessibility, capacity, inequality, the digital divide, and changing society and behaviours (Odendaal, 2003). Ebrahim and Irani (2005) defined some of the challenges when utilising technologies in smart cities. The challenges can be identified according to two different components, ICT and organisational. To meet the digital challenges, smart cities need IT training programs. The lack of employees with integration skills, the lack of cross-sectoral collaboration, the unclear vision of ICT management, politics, and culture issues need to be considered for improvement by the government (Ebrahim and Irani, 2005).

In conclusion, smart cities can create a new type of digital city commons and improve social collaboration. The analysis recommends that utilising these types of application can increase the share of residents who feel connected to the local community and also upsurge the share who feel connected to the local government. Developing routes for two-way communication between the public and local organisations could make smart city governments more responsive. Smart cities depend on a set of smart computing technologies applied to important infrastructure components and services. The digital perspective of smart cities refers to a “new generation of integrated devices, software and applications, and network technologies that offers ICT systems with real-time data in the real world and innovative analytics to help citizens

make more intelligent decisions about alternatives and actions that will be more beneficial for them and the environment” (Washburn et al., 2009).

5.5. Economic perspective

From an economic point of view, sustainability refers to the management of resources that maximize the benefits of economic development and clean technologies, boosting the smart cities’ development in terms of energy, transportation, and health (Pearce and Turner, 1990; Lai et al., 2020).

In this research, interviewee P6 stated that they believe:

“Optimisation of resources (time, effort, natural resources) and also opportunity to a better communication and inclusivity (social inclusion in broad terms) as part of the economic dimension”

Although the concept of smart cities is associated with the environment and society, it is equally important for corporations to maximize their profitability, cost savings, and shareholder value. For instance, one of the interviewees, P11, stated that:

“Services linked by technology and leading the cities to provide better administration, safer public spaces and promote sustainable practices in general”.

Sustainability is a guiding principle when developing a sustainable business. This means not only staying focused on the core business but also looking after the non-financial bits of the operation. The main goal of economic success is to maximize profits by producing new products and services that are desired by customers. As one of the interviewees, P1, said:

“In my view smart cities is the managing the journeys of every citizen within the city. For me and my company, it’s about looking at every single person and being supportive of their needs and requirements – health, finance, happiness, well-being, personal development etc.”

There is a huge amount of economic growth potential to be utilized through the Smart City concept. But whether or not a city can be successful doing so will depend on the prior implementation of an effective strategy which takes into account the economic growth perspective, helping to shape the direction of the development. Integrated connectivity, data,

and ICT for such cities provides a safe digital infrastructure upon which a customised strategy for economic growth can be based.

At the sector level, the majority of the respondents from the smart city background/CEO sector identified the concept of the economic perspective being a top priority. This is mainly due to the combination of higher energy prices and the UK's target of reducing greenhouse gas emissions. Although many organisations are looking to reduce their carbon emissions and energy consumption, few of them are willing to commit to the concept of sustainability in their business models.

The economy is a major driver of smart city initiatives and a city with a higher level of economic competitiveness is considered to be one of the components of a smart city. In addition, one of the key indicators to evaluate developing city competition is the capability of the city as an economic engine (Smart cities ranking of European medium-sized cities, 2018). Giffinger et al. (2010) suggested a smart city framework containing six main components, specifically a smart economy, smart people, smart environment, smart governance, smart mobility, and smart living (link to LR). The operational definition of a smart economy consists of all factors related to economic competitiveness, specifically the innovation, development, trademarks, productivity, and flexibility of the people as well as integration in the national and worldwide markets.

The smart city initiatives are intended to develop information technology capacities and create an outline for change through the use of industry actions and business development (Cairney and Speak, 2000). Building an environment for business development is crucial to a smart city (Bronstein, 2009). The economic results of the smart city initiatives are business innovation, job creation, workforce development, and an increase in productivity.

In conclusion, it appears that although local governments are the key actor in smart cities, there is an urgent need for strong groups of managers and leaders to push the smart city policies and investments which could become a leading element of economic sustainability.

However, there were some areas not mentioned by the participants. These standards are an indispensable element when addressing the economic challenges in an efficient and successful manner by focusing on specific areas of energy management, road safety, intelligent transport, health and wellbeing, and connectivity.

5.6. Summary

This chapter addresses the first research objective and question:

“To explore the concept of smart cities.”

“What are the smart city perspectives?”

The chapter provided an in-depth view of the smart city perspectives on the success of smart city implementation.

Data collection and analysis was carried out and by utilising the literature findings and research framework, a series of interview questions was developed to address the main research questions. The goal is to identify and highlight the crucial organisational factors involved in smart governance strategies in smart cities. The literature sources of the questions and the defined questions for outlining by the participants and the identification of their thoughts around the smart city’s strategy factors follow. The interview questions also contained the participants’ profiling data which required the participants to non-anonymously answer more complex questions on their organisations’ strategy and professional information (organisation type, organisation sector, role category, job description, and industry type).

This research concludes that although there are considerable smart city dossiers in the literature, the governance framework and structural variation development across different regions is lacking. Future work will focus on collecting data from smart city projects and organisations through semi-structured interviews and questionnaires within the United Kingdom and a more in-depth exploration of governance issues and the challenges of smart cities.

The discussions provide insights for the purpose of developing a framework (See chapter 9 for more information) to guide smart city development initiatives. Table 5-2 summarises the four perspectives revealed from data collection and analysis.

Table 5-2. Smart cities’ perspectives

Themes	Sub-themes
Citizens	1) Being supportive of people’s needs and requirements (health, finance, happiness, technology, wellbeing, personal development). 2) Mainly concentrates on the needs of citizens and requirements to improve quality of life and reduce costs.

	<p>3) Sharing information with citizens to improve the quality of the government services within the city.</p>
Digital	<p>1) Smart city/factory is a place where traditional services and manufacturing are made more efficient with the use of digital and telecommunication technologies for the benefit of the business/organisation.</p> <p>2) A smart city is a learning city. This means that smart cities learn through data, make data-driven decisions, and continually iterate to improve.</p> <p>3) Leveraging the power of technology to more equitably deliver essential public services to the residents.</p> <p>4) More data-driven cities and the use of technology as an intelligent entity providing real time information for the people.</p> <p>5) The use of smart devices capable of capturing and transmitting data which is then analysed in order to obtain information and make decisions (automated connections between smart devices).</p> <p>6) The use of digital and telecommunication technologies and the use of information and communication technologies (ICT) which allows governments to optimise resource usage.</p> <p>7) An intelligent entity providing real time information on aspects of life in the city for the public to improve their quality of life.</p> <p>8) Using automated connections with everyone about everyday activities such as smart traffic lights, automatic parking and monitoring air pollutants.</p> <p>9) This means a smarter way of delivering and receiving sales orders.</p> <p>10) By using technology, smart cities can gather data that is intended to improve planning and development, and potentially improve people's lives.</p>
Economics	<p>1) Optimisation of resources (time, effort, and natural resources).</p> <p>2) Services linked by technology, leading the cities to provide better administration, safer public spaces, and sustainable practices in general.</p>
Environmental	<p>1) Smart cities mean that all utilities are interconnected, resulting in less energy consumption, less resource requirements, more efficiency, less crimes, quick reactions in case of emergencies, and it being less costly to live.</p>

	<p>2) A sustainable city that issues strategies to solve daily life tasks in a more environmentally-friendly way.</p> <p>3) Energy consumption and less use of resources, resulting in a more efficient city and increased cost efficiency.</p>
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The development of a new framework is crucial as part of improving the quality of life of citizens by developing a framework of collaboration between the digital (the methods of collaboration and engagement), environmental (the governments of smart cities), citizens (the core of smart city developments), and economic (businesses, stakeholders, and organisations who help city improvements) perspectives of smart cities. Businesses, smart city governance, and every citizen so then they are working together in various ways to confront the problem of smart cities. With the goal of learning at the centre, a framework is offered to demonstrate the relationships necessary for improvement.

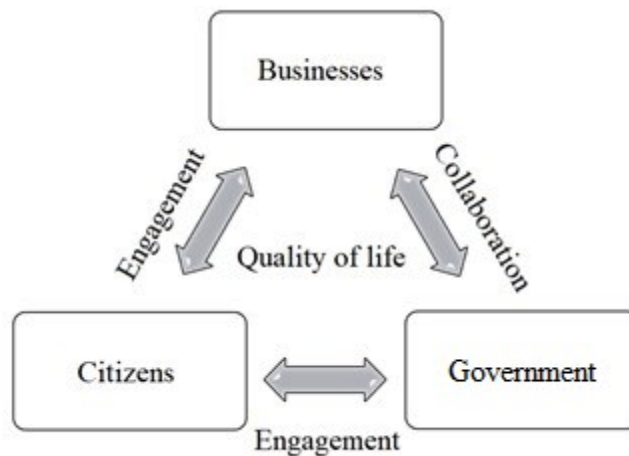


Figure 5-1. Managing smart cities: A framework for improvement

As mentioned by El Hilali and Azougagh (2021), the connection between technology, citizens, and the collaboration between them leads to the smart cities' success as Figure 5-1 demonstrates above. This shows the importance of the engagement of citizens and businesses and their collaboration with the government to implement a successful smart city. As this research indicates, one of the main goals of smart city initiatives is the improvement of quality of life yet no definition has explained what this means and at what cost this improvement will come for citizens and the environment. Future efforts to identify smart cities should take place to improve quality of life through the use of advanced technology and consider whether all perspectives of smart cities are equally represented.

There is a need for a framework to resolve the issues found in each perspective and to allow them to work closely together to create a better city.

Chapter 6. Key policy challenges to innovating smart cities: governance point of view

6.1. Introduction

This chapter focuses on the analysis of the second question and the second research objective.

“What are the key policy challenges when developing smart cities?”

Objectives:

“To explore the policy development and challenges in the context of smart cities.”

To identify the key challenges that organisations are facing when implementing smart city strategies and to quantify the adverse impact of these challenges in relation to implementing smart city strategies, the objective is to promote cities that provide a core infrastructure and give a decent quality of life to its citizens, as well as a clean and sustainable environment where there is the application of smart solutions. The focus is on smart and inclusive development and the idea is to look at small areas and create a replicable framework that will act like a lighthouse to other aspiring cities. Smart cities are meant to set examples that can be replicated both within and outside the smart city, catalysing the creation of similar smart cities in various regions and parts of the country.

Smart city projects, geographies, and levels of development face significant governance challenges, for instance, the failure to designate a framework for cybersecurity or to assess the privacy risks when obtaining new technology methods. This encourages governments to close these gaps and protect their cities' long-term interests by solving the issue for the time being.

In accordance with the literature and the findings from the interviews, other important issues that are impacting smart cities growth are knowledge and awareness, stakeholder issues and most importantly lack of funding which is discussed more in details in section 6.4, detailing where there is a lack of funding.

6.2. Smart city technology infrastructure (IT/ICT) issues

Technology and data have for quite some time been utilised in the context of smart city governance, yet numerous researchers have not formally recognised them as far as technology

versus data-related perspectives go. A large part of the general smart city governance research manages the utilisation of this (new) school of thought and use technology to support or enable particular activities, thus becoming able to “enable central steering” (Granier and Kudo, 2016) and to “broaden and deepen participation” (Lin et al., 2015), centred around information-related issues, for example, data collection, access, and analysis (Bakici et al., 2013). This is as well as “open public data” (Angelidou, 2014), “data analysis” (Wiig, 2016), blending the two, and related issues. Open data is made public and put to use in smart city applications and technologies. In this instance, the creator investigates this development by isolating innovation versus information-related issues to give a more exact outline of the audit test. Smart technologies drive effective governance while the attention is on the activities that can be enhanced by using new innovations and the extraordinary featuring of data and correspondence advances.

As interviewee P5 explains:

“Key policy challenges for smart cities includes, digital innovation, digital transformation of local public services, open data and data sharing, city performance and local growth, future infrastructure, and export.”

Supporting the interviewees argument, Kourtit et al., (2017) emphasised the key part of “digital technologies,” particularly in the changing part while Scholl and AlAwadhi (2016) mainly feature ICTs’ part “in both the looking after and making decisions about governance.”

Interviewee P17 mentions the importance of the use of technology in smart cities:

“By using technology, smart cities can gather data that is intended to improve planning and development for cities, and potentially improve people’s life.”

Other advances that specialists suggest are, for instance, “geo-science tools and big data” (Kourtit et al., 2017); “data warehousing and monitoring tools” (Meijer and Bolivar, 2016), sensors, virtualizations, geographic information technologies, and social media applications (Gil-Garcia et al., 2015).

The smart wide use of various ICT and digital technologies such as IoT, data analytics, Big Data, AI, image processing and Cloud computing, have addressed various real-life challenges and the issues of smart cities. They have also enriched smart city services with enhanced capabilities and effective utilisation. Such smart services, with the aid of the digital environment, are directly contributing to providing better services to its users, the smart city

residents, and stakeholders. Now smart city digital services have become an important factor in the city economy and a prime important element in the overall growth of smart cities.

This section covered in detail the challenges faced by smart cities and how these challenges and issues are addressed with the help of the latest tools and technologies. The information and results obtained through this research are very promising. Many solutions discussed in this section are still at the proof-of-concept or conceptual level. In future, it is planned to undertake the full-fledged implementation of some of these solutions which are found to be very effective at the proof-of-concept stage to address known the limitations of such solutions while carrying out said implementation. With the complete implementation of selected solutions, smart cities can take full advantage of using and deploying such solutions to mitigate certain challenges and the issues faced by them.

6.3. Cybersecurity: safety and privacy issues

As mentioned earlier in the literature (Chapter 3), smart cities face several key challenges (Chapter 3 section 3.3). Not only do they need to manage with a data overload but they also need to discover ways to collaborate more efficiently, while keeping any cybersecurity threats under control. A smart city presents with a number of solutions to the various problems faced by the city development and city management. Nevertheless, the smart delivery of services relies on information and communication technology (ICT) as an important component. There are risks and challenges invoked by introducing ICT to the infrastructure of a smart city. People gradually use unsafe Wi-Fi/internet networks to access their important emails, banking information, and so on, subjecting themselves to numerous types of cyberattack such as man in the middle (MITM) and others. On the other hand, new important infrastructures of cities are likely to be subjected to attacks that can cause a serious denial of service to cities and hinder the delivery of other essential services. security and privacy play an important role in businesses, the government, and for citizens. In business, security relies on cybersecurity, passwords, hacking, malware, transparency, and confidentiality. Security and privacy issues affect not only the smart city but also its smart components including buildings, health, education, and mobility, that will be explored further in Chapter 7. Cybersecurity is one of the major distinguishing characteristics that can be utilised to classify safe cities around the globe (Andrade et al., 2021).

Several weaknesses and risks face a cities' cybersecurity infrastructure used in city smartening. Particularly in the smart industry, the Internet of Things (IoT) and cyber-physical systems at present lack sufficient access control and anti-malware, as well as operating 24/7. They are vulnerable to various cyberattacks such as artificial intelligent threats and they are lacking data security, data privacy, and Cloud security. Regarding personal data protection in a smart context, data confidentiality is essential for privacy law agreements such as General Data Protection Regulation (GDPR, 2018) in the EU and personal data protection acts in several other countries. Therefore, security with privacy is an important topic for ICT users with an emphasis on smart cities. However, these modern cyber-physical infrastructure systems are massively used and there is no satisfying insight into their vulnerabilities and threats. Generally, intentional and accidental threats to smart city infrastructure-related security cause different serious consequences according to the city's maturity and smartness. Thus, this study presents the main encountered infrastructure security-related threats and challenges. Urban infrastructure such as the electricity supply, water distribution, streets, buildings, and others face several security threats to their specific cyber-physical components and systems (AlDairi et al., 2017) such as cameras, communication and data security networks, building management systems, and transport management systems.

For instance, Interviewee P14 highlighted that:

“The Information and communication technologies (ICT) community must overcome current technological and scientific challenges before smart city platforms can be widely adopted, Smart City IT infrastructure must be agile and flexible to scale.”

Also, Interviewee P11 mentioned that:

“The main challenge I would say is political as to implement this successfully the involvement of highly placed political leaders is required to gain the engagement from the public and many other stakeholders. Another one is the uncertainty on how the data is going to be protected from hacking attacks and ensure that all the interfaces are to be used appropriately.

In some cases, we also find problems with an unbalance geographical development within big cities as this caught some users in a shortage in access to the required technology.”

From these findings it can be inferred, there is a need for governments political support, flexible infrastructure, and equitable access to technology to overcome the cybersecurity issues.

Elmaghraby and Losavio (2014) offer a framework and deal with the cybersecurity challenges presented. They discussed the main challenges relating to privacy and security. The main components of smart cities and the collaborations among them were the presented frameworks that were also found to be vulnerable. The major cybersecurity challenges concerning smart cities are debated in this section. These challenges are the categories corresponding to the governance perspective, economic perspective, and digital perspective.

Cybersecurity concerns from an economic point of view are wellbeing issues related to the health and privacy of patient data on the Cloud and their database (Khatoun and Zeadally, 2016). Therefore, when the health providers infer the patient's record in an authorised way via the Cloud, the citizen may be hesitant to share the health-related records. Advanced security measures and mechanisms should be adopted to secure patient data.

Cybersecurity concerns in the governance perspective of smart cities firstly rely on the transparency of the government and how collaborative they are. The systems relating to governance are constantly at risk of disturbance as they can cause disasters, particularly when they arise or lead to management and transportation systems. These systems are often exposed to attacks. Some of the examples discussed in the available literature show that they can trigger big issues in smart city infrastructure and interrupt the everyday life of citizens. Secondly, other cybersecurity concerns are in management. The developers of these techniques usually concentrate on the tools required and ignore cybersecurity issues which results in an absence of cybersecurity. Lastly, from the digital perspective use of RFID technology, RFID technologies are exposed to theft and illegal access to sensitive information and are likely to create data privacy issues (Rebollo-Monedero et al., 2014). Similar to smartphones, the weaknesses of smartphones can affect the security of smart cities including smart applications, shared GPS locations, as well as threats from online shared networks (Park et al., 2018).

Safety and privacy are main factors and are considered to be the open threats in smart cities. The subject of cybersecurity needs to be studied further by providing a framework to address the security issues and offer solutions.

One of the solutions regarding finance and cyber security is to try shifting the mindset of cyber security from being a cost centre to cybersecurity as an investment.

In smart cities, the main concern is offering a unique quality service for citizens to use to make their quality of life better. Therefore, it is important for the governments of smart cities to consider privacy, safety actions, and challenges to guarantee the privacy of its citizens and to protect their information from cyberattacks. This section compared the literature findings with what the participants mentioned in the interviews. This was as well as examining the smart city's security and privacy challenges according to three different perspectives - economic, governance, and digital -, and also discussing security and privacy threats.

6.3.1. Data security and data privacy

According to the norm of smart city interconnectivity, data will be transferred and used in smart city activities with several organisations sharing and gaining access to data. From the manufacturers of the smart sensors to the city's transport organisation and to people gaining access to the smart city through their mobile phones, each organisation providing data to the smart city will individually use and manage data in ways that may compromise personal privacy. Moreover, because every single smart city stakeholder will have a different concern, there will be gaps among the various stakeholders' privacy standards.

There are already gaps in the privacy standards among private and public sectors centred on the unique principles that these two sectors provide. Private organisations get risk and benefit evaluations when choosing how strong their privacy protection is (Basi, 2016). The goal is to gain value and income by presenting goods or services, so companies will offer only enough privacy security to guarantee that their product is not tarnished, so then their consumers remain and buy their goods (Basi, 2016). Alternatively, public sector organisations, for instance, health care providers or city transport systems, run crucial services for the benefit of society (Haque et al., 2022).

Backing the literature review findings, interviewee P7 expressed:

“Cities lack technology related skills and capacity; some cities find it difficult to involve all its departments in it. A huge concern about data privacy and security.”

This shows how smart city organisations are concerned about the lack of data privacy and security. However, smart cities cannot depend on conventional privacy techniques while adjusting or participating in the process of integrating business and application data. Additionally, when expecting privacy attacks, the assumptions of an opponent's experience can

be damaging for privacy security. Therefore, when considering frameworks for protecting individual privacy in smart city data settings, the concept of differential privacy can be considered. Differential privacy has been considered one of the toughest privacy frameworks since it, through empirical observation, ensures privacy regardless of an invader's background knowledge and ability (Rizi and Seno, 2022).

Alternatively, to deal with the privacy problem of important data, analysis should be performed on fewer attributes, suggesting that a pre-processing stage is necessary. The problem is that the feature selection process issues may affect privacy risks. Hence, there are multiple findings in the literature suggesting solutions (Pattu et al., 2015 and Zhanget al., 2017) and concentrating on reducing the selection of a set of relevant attributes in a privacy-preserving manner.

Privacy maintaining solutions were mentioned by some of the participants. For instance, P15 stated:

“Security and privacy must both be imbedded within any smart city policy, strategy, process, and technology being deployed.”

This statement brings us to the next factor which helps governments to apply security and privacy in smart cities using privacy-enhancing technology with the aim of appropriately addressing the challenges of maintaining personal privacy in the smart city environment. The degree of privacy must be measured and mapped (Rebollo-Monedero et al., 2014). Therefore, researchers and engineers can understand where some technologies and processes stand in terms of privacy and security. This can be accomplished by employing processes of uncertainty, data, and the attacker's mistakes and diversity (Rebollo-Monedero et al., 2014). The latest privacy-preserving techniques must fulfil the requirement of differential privacy to appropriately keep smart city residents secure. Public sector organisations require cyber security and cyber privacy experts with excellent communication abilities, understanding, and industry assessment abilities (Lum, 2016). With such specialists, public sector organisations will be capable of successfully collaborating with private sector companies on privacy concerns that are in the public interest.

It is valuable to fight broad privacy challenges with privacy frameworks. For instance, data privacy experts can decide between collaborative and non-collaborative privacy frameworks when designing privacy techniques. Collaborative frameworks allow data miners to secretly gain access to records where the data owner publishes custom relevant data, while non-collaborative frameworks anonymise the data settings and allow private or public access

accordingly (Mohammed et al., 2014). Data as a service provider may use data management models to incorporate various database owners by applying non-collaborative frameworks (Khokhar et al., 2016).

In the context of technical privacy solutions, there are many valuable methods. Essentially, intelligent data aggregation techniques should be utilised when viable to reduce the amount of raw personal data being communicated in the smart network (Bartoli et al., 2011). If combination techniques can be combined into smart devices through the network in the absence of raw personal data, this could both increase the device decision-making efficiency by reducing the used storage space and cut down on the amount of personal information moving through the smart network.

6.3.2. Artificial intelligence threats

The smart city uses information and communication technology (ICT), adding to the development, implementation, and innovation of smart cities to focus on upcoming challenges. The challenging factor in smart city functions is security and privacy where ICT is utilised for improving city service quality, the execution of services, and interactivity, lowering costs and improving the public engagement with the government. Thus, smart city efforts are created for the effective management of the cities (Jegadeesan et al., 2019). Smart lighting, transportation systems, electricity, and water and waste management are the most popular smart city initiatives as discussed in the literature review chapter (Ju, Liu and Feng, 2018). Across the city residents, growing challenges in the geographic expansion are frequently magnified by the changes in the smart cities' economy and social changes (Anisetti et al., 2018). Quality of life and traditional city infrastructures are affected by these challenges, as well as the demand for sustainability and maintenance. Smart city technologies will give organisations assist them in resolving development problems in future smart cities (Selvakumar et al., 2016). Innovations in AI technology allow for the improvement of the ability and efficiency of every smart city initiative (Habibzadeh et al., 2018; Wu et al., 2018). Consequently, new technology offers a huge share of new possibilities which has its own culture, policy, and infrastructure in relation to investments; this is where the technology implementation will be different in different ways (Osman, 2019; Allam and Dhunny, 2019). Nevertheless, many of the known smart city initiatives cannot constantly be applied as a success framework (Raj et al., 2020).

In recent years, the Internet of Things (IoT) technology development for data management has posed major challenges (Zhuravleva et al., 2019 and Shah et al., 2019). Many IoT systems

cannot offer adequate coverage, even for the most basic applications in smart cities. The personal data is managed on the Cloud in which digital devices such as smart phones frequently trade information with other users.

Overall, all smart city initiatives require data recovery and analysis to make knowledgeable choices and provide secure and privacy-aware services. Smart city systems need different techniques to protect the smart city data from cyber-crime and attacks as discussed earlier in this section (Section 6.3.). Smart cities propose a mixture of innovative planning and smart technology to encourage development, social security, wealth, education, and overall, better quality of life for its citizens. Smart cities offer an improved planning mixture, connected society, improved systems of development, and many more improvements in data management systems. While a smart city has many benefits for its citizens, its security and privacy are under attack as it heavily depends on data. Smart cities are meant to deliver a combination of modern planning, unified societies, and smart technologies as a way of encouraging development, social security, and better quality of life. Smart cities are more efficient with digital technologies and data, therefore improving the quality of life. Real-time data offers organisations the capability to track issues to understand how market developments shift and react with more beneficial and quicker solutions. Smart innovations often create new income-generating implements through innovative initiatives. IoT solutions promote collaboration with citizens and other utility organisations to successfully generate an original revenue source. Smart cities can, nevertheless, reduce the risk of malicious attacks and encourage the cost-effective use of an appropriate property and city infrastructure.

As interviewee P21 explained:

“If it helps to speed up the development process while ensuring safety and privacy, then yes. The majority of our work is heavily integrated with AI - we know AI could grow to become a very dangerous tool, and we follow our own principles on being mindful of this - and actually applying caution. This should be a similar principle for smart city frameworks.”

AI systems perform crucial tasks such as home systems and automated trading systems through to unique smart gadgets. The growing utilisation of AI offers health risks. For instance, service providers and device manufacturers may use data mining technology to overly analyse and take personal information that is not the main objective of the services concerned. Moreover, AI

intelligence attackers are increasingly common. Hackers can consider how integrated and skilled the Big Data systems are.

As interviewee P5 mentioned:

“Some of the common issues and challenges are: Stringent policies in the areas as data security and maintenance. Big Data analysis for structured and unstructured data and resources such as skilled personnel to interpret the captured data on periodical basis.

Need of advanced infrastructure which could be expensive to sustain for longer duration to a small and medium scale business organisation.”

In this case, Big Data plays an essential role in the processing of IoT data in a smart city to allow further research to recognise the developments and demands of the city.

To simplify issues, the management of an interconnected communication structure encouraging proper decision-making to gain access to contextual information in smart city applications and other development projects is crucial to solve the different security and privacy issues present. Moreover, improvements and controls for smart developments in real-time are necessary to deliver collaborative action. Big Data management will provide a design for comprehensive smart city data developments to allow for offline app development. Privacy, security, and confidentiality are the challenging components in smart city development that are believed to be a major factor in the smart city data management infrastructure. Hence, this section has been intended to improve the privacy and security characteristics of the data management interfaces in different smart city applications using artificial intelligence methods that deal with threats more efficiently.

The increased utilisation of intelligent applications has elevated many issues about security and privacy. In business and the governing of smart cities, it is crucial and essential to create more innovative safety frameworks. The proposed method of proper decision-making and the use of Big Data management, as well as the other offered methods in this section, intend to optimise the operational responsibility of users and eliminate the issue of the over-collection of data. A complete analysis of the efficiency and success of the approach has been performed. Measuring the security and privacy needed to protect confidentiality and details in the placement of the service in a data management server in smart cities has been shown in Figure 6-1.



Figure 6-1. Artificial intelligence and Big Data's affects in a smart city.

As shown in Figure 6-1, Big Data has fantastic qualities and potential for smart city services as part of them being improved and utilised more safely. Big Data is an enormous amount of data that organisations can analyse to make suitable strategic decisions.

6.3.3. Cloud security

When considering the smart city application, there is a massive amount of data that is collected. This section discusses what methods can be adopted to store this data in the Cloud and how secure this Cloud data storages is from cyber-attacks, Smart cities will feature many smart devices, each of which will be interactive with the smart network through the transfer, copying, and processing of data. This action will create an enormous amount of data, some of which will be personal and should be protected. To back up such large quantities of data, it is possible that smart cities will use Cloud systems. The major growing Cloud businesses use the internet to provide third party applications to people without them having to install applications on their own devices. This means that developers can create software that can then be easily scaled up through Cloud processing to meet the growing demand, like applications in a growing smart city. Cloud services provides remote data centre infrastructure accessibility, management, and monitoring by building a model that clients can pay for based on their use rather than having to build their own system. These Cloud services, alongside the Cloud data space, can help smart cities prevent the likelihood of restrictions enforced by physical storage which causes other types of privacy and security issues for the client. However, Cloud services present some challenges (Nassif et al., 2021). Cloud services complicate an already challenging security and privacy situation for the services engaged in making smart networks, for instance, optimising the energy supply in a smart city (Ijaz et al., 2016). Farming out the data services includes further security flaws, with Cloud service providers complicating matters further by increasing the need for select standards and using different methods for privacy and security.

Additionally, with Cloud service suppliers managing large quantities of personal and private information, it raises a lot of questions regarding responsibility and permissions in a smart city development. For instance, the client's privacy violation when smart cities permit third parties to collect, manage, and handle raw personal data, The issue presented here is an ethical and most likely legal one. Nonetheless, it is a challenge related to efficiency and reliability since data sharing and storage is vital for a successful smart city.

As participant P13 expressed:

“Security is highly paramount in smart cities as everything will be connected and will be in cloud. If it gets hacked, it may cause serious concerns to government, organisations and local public both financially and physically.”

As the interviewee mentions, it will not be possible to prevent all upcoming cyber-attacks, so when a cyber-attack strikes, the Cloud service business is responsible for the attack. However, the unpredictability of this issue makes it hard for Cloud service companies to stay viable. The Cloud service's financial and legal capabilities are important for the smart city to operate effectively, making potential technological development feasible. Consequently, accountability for data security will need to be communicated with the government in a way that helps the organisations stay viable, delivering the highest amount of Cloud security.

Data management is an extremely crucial task in a smart city as the manufacture, communication, and mining of data is what makes a smart city more effective and accessible than a conventional city. The unpredictability of cybersecurity leaves the data-centric smart city in a dangerous position. When the essential services and infrastructure are digitally connected and data reliant on the smart network, the threat of cyber-attacks comes to be much more serious. Thus, if a smart city chooses to use private sector Cloud systems, the private entity must be kept to greater than normal private sector standards. Since privacy and security are important for the viability of a smart city, businesses that handle a smart city's data should be controlled in a way that aspires to these objectives. Thus, a sensible balance will be required to be struck between the company responsibility for privacy and security attacks and restricting the amount of risk that a business needs to take on to stay financially sustainable. In this way, businesses will try to maintain their security and privacy objectives but not fear the consequences so much that they are unmotivated to offer Cloud services.

It is also crucial to create a governing system that can quickly detect crime without inflicting a high responsibility on private sector businesses. Organisations within the smart city must take

the initiative and guarantee their own accordance with the laws before a governing authority has to step in. the proposed method of doing this is through a method that uses the law as a system to ensure security for the companies and the clients while also guaranteeing their compliance with the legal policies (Sharma and Arya, 2022). These services would improve data security and guarantee that businesses were following data management laws. Businesses should also be controlled to gain the citizen’s trust. This would call for organisations and governments that set the law to control such actions so as to be transparent. Transparency should consist of timelines for data use in the smart system.

Data management goes further than Cloud services and government organisations. In reality, each smart device contributing to the smart system will be collecting and processing data. As the systems interact with the smart system, the appropriate data settings can be replicated and saved locally to increase the smart target response time (Sen et al., 2013). The time that the data is stored on local servers is very dependent on the smart system purpose.

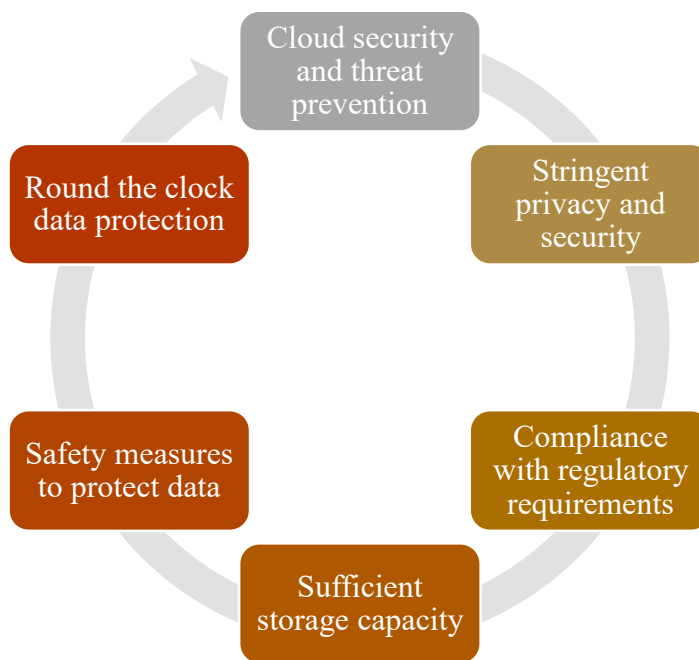


Figure 6-2: Cloud security measures

As shown in the Figure 6-2, created based on the analysis of the findings. by adopting robust measures we can ensure the safety and integrity of data within the cloud environment. These measures include comprehensive cloud security and threat prevention protocols, stringent privacy and security measures, adherence to regulatory requirements, ample storage capacity to accommodate data needs, implementation of safety measures to safeguard data, and continuous, round-the-clock data protection mechanisms. Together, these components form a

comprehensive structure aimed at mitigating risks and maintaining the confidentiality, integrity, and availability of data stored in the cloud.

The primary aim of a smart city is to improve the quality of services offered to citizens to improve their quality of life. Nevertheless, security and privacy are major challenges for our future cities. This section has defined some of the basic concepts of smart cities and emphasised the current main initiatives, developments, and industrial projects related to smart cities, as well as identifying the risks and challenges faced by smart cities in different areas.

Considering the future challenges in smart cities, this section highlights that in smart cities, privacy and public safety continue to be one of the main concerns that need more legal, systematic, and political consideration. To make this technology as valuable and reliable as possible for citizen adoption, it is important to fight against cybercrime in smart cities. This will require continuous effort and support from all stakeholders including the private sector, governments, legal institutions, network operators, and so on.

6.4. Lack of funding

The governments of smart cities can play a key role in allowing city reinvestment and modernisation using economic policy and public private partnerships (PPPs), which are important levers to capture investments that generate long-term value for the city, citizens, and businesses. Addressing the challenge of investing in smart city development needs innovative thinking that deviates from the conventional frameworks of infrastructure funding. Under conventional frameworks, infrastructure projects are funded using debt instruments (financing) whereby the city ensures investments from funding sources, for instance, development banks in the form of municipal relationships (Mirzaee and Sardroud, 2022). The money is used to pay for the expense of construction and there is usually a grace phase during which the project that received the funding is exempt from payment until the project is finished. When the infrastructure asset is operational and earning a revenue stream (funding), the proceeds are used to repay the principal and interest on the bond. This process assumes that the project has value that in smart cities falls into fundamental sectors like water, transportation, energy, and information and communications technology (ICT). The proceeds from its asset revenue stream can be only devoted to service the debt. In order to create an infrastructure and link everything online, the government needs a lot of funding and investment. Developing countries are already facing a money crunch due to other developmental activities, low tax collection, heavy

international loans, trade deficit, and other social problems, which can have economic and political impacts (Toh, 2020).

Economic impacts: The beneficial political impact that good smart city governance produces in relation to the city governments also gets translated into a positive economic impact where, first, smart cities can reduce their costs and second, they can get funds to create innovative projects.

Overall, the economic impact on the smart cities can be considered according to three different aspects:

- Cost reduction based on shared knowledge and staff training.
- Stimulation of the national investment in smart city projects.
- Participation in funded projects.

For instance, Interviewee P14 highlighted that:

“I believe that in terms of policy challenges are insufficient financial resources for the implementation, lack of agreement between all the stakeholders usually due to different points of view and lack of operational guidelines that define all the roles and responsibilities in order to avoid conflicts. In the specific case of smart cities, you need to add policies that ensure data security, funding and upgrade of existing infrastructures to be compatible with the smart scheme.”

Political impacts: Innovative smart city strategies and regulations are expected to empower enable large scale project implementation and roll-out (Angelidou, 2015). Smart cities require an adequate set of framework conditions in the field of policy and regulations so as to have the capacity to smarten up. As Interviewee P17 mentioned, the political role of the smart cities governments is:

“Funding services, coordinator, regulator of new strategies and regulations.”

To accomplish this objective, smart cities can collectively learn from one another to yield general lessons for the circumstances in which specific strategies are appropriate, and the types of localisations that can best contribute to success. This is especially true when more information about their true results, more extensive impacts, and long-term consequences become accessible. This work aligns smart city strategies from the local to national levels. On one hand, knowledge sharing is a positive mechanism for policymakers who have to take faster

decisions than in the past due to the rapidly evolving socio-political context. Then again, another constructive outcome is the response to forward thinking in policymaking practices (Accordino, 2013). In the end, an extra positive effect has to do with the way that access to contacts and information may leverage differences among the cities of bigger and smaller sizes.

Several factors make it difficult to finance smart cities projects. One common obstacle involves a technology risk: the project may be the first to deploy a particular technology, reducing investor confidence in the integration and usability of the technology in the absence of a demonstrable proof of concept. Another common barrier to financing smart city projects is stakeholder issues. It may also be hard to secure financing for a smart city project where it is difficult to monetise the benefits.

As participant P25 mentioned:

“Smart Cities are about multi-stakeholder collaboration to address societal challenges”

Later, P25 explains:

“Main challenges are related to ensuring sufficient commitment and financial support from stakeholders.”

In section 6.6 on stakeholder issues, the related challenges are explained more in-depth.

Other impediments to financing include projects that do not have a clear path to a steady revenue, where the return on investment (ROI) is uncertain, and where the unconventional nature of the smart cities projects based on interconnectivity with physical devices and infrastructure often lacks a traditional single sector focus that conventional financing favours.

Lastly, the types of financiers that will generally understand smart cities often have an infrastructure background. However, their preference is for long-term projects. The shorter-term nature of technology-related projects can be outside their remit or bring in additional risks and challenges to smart cities projects that need to be considered.

A key step in any smart city financing effort is developing a comprehensive strategic plan to capitalise on the project’s strong points. This can help to improve the initiative’s “investment readiness” and its access to finance. The plan should include a robust business model, a creative approach to funding and financing sources (finding new sources of revenue for projects and new business models for recovery and value capture), and innovative financing structures for investors.

On the other hand, a cross-cutting theme in smart city infrastructure funding is the re-distribution of risk and reward between the public and private sectors. This is explained in more detail in Chapter 8 section 8.2.4 (seeking additional funding) for the successful implementation of smart cities.

6.5. Lack of knowledge and awareness

This section in the challenges chapter explores implementation challenges as opportunities for moving beyond smart and connected governments by focusing on awareness in relation to the smart cities' new digital systems, sensors, and the Internet of Things (IoT) in the public sector. Following the review of the research literature for smart city implementation conducted from various perspectives, there is the emphasis of the selection of issues and challenges in the public sector. The theoretical framework uses the structure of knowledge and awareness in relation to the key smart city characteristics of adaptableness, difficulty, improvement, and willingness (D'Aniello et al., 2020). The research design for this work uses the findings from the interviews to explore the growing insights of smart city implementation. The ecosystem of smart cities, which is social and environmental, can create an opportunity to create systems to make citizens more engaged and aware of new methods of governing a city. The potential is huge. Communication, learning, and skill enhancement are all important. Digital technologies can provide a solution to this matter, especially when looking into the widespread use of the internet, for instance, among citizens. Innovative information technologies (IT), a high capacity for learning and innovation, and shared knowledge between citizens when shaping and developing the city are now at the centre of public policy rulings and are a goal for smart cities. Understanding such challenges will lead to a veritable city (Heynen, 2016).

Other issues such as the lack of interest of citizens, even though good governance suggests more participation, relate to where the government sectors do not wish to engage people in every activity they do. Sometimes due to security and political reasons, they try to maintain a distance from the public.

Illiteracy is another challenge that was discovered in the interviews and literature from a governmental point of view. Basic knowledge of how to use smart mobile devices and computer and internet connectivity is an essential element in a technological era. Citizens residing in rural areas, tribal regions, poor households, and marginalized communities do not have an easy access to the internet or digital systems. To make effective use of ICT, the

government must initiate public programs and training activities to make e-learning available to all sections of society. Only then can people from various walks of life benefit from these services, meaning that there will be a cross-sectional development of society as a whole.

In this research, Interviewee P24 stated that they believe:

“A definition and basic guidance should be helpful as developing countries they may not have the awareness of smart city meaning.”

Backing up the statement of P24, participant P5 states that:

“I believe better awareness about the advantages of smart city projects to the public would empower the success ratio.

Synchronisation between the government and the industries to understand the need of smart city projects and its betterment towards the future would help too.”

Concerning the research question ‘What are the key policy challenges to developing smart cities?’, this study concludes that there is a current interest in developing digital applications to support public engagement such as health, urban mobility, the management of city infrastructures, and smart environments. The majority of researchers in the literature and more than 90% of the interviewees agree that the main components of the smart city is ICT, its successful development, and smart citizens. However, the concentration on raising the awareness of society is ignored by local governments while attempting to develop smart cities. Thus, the challenges and expectations of citizens need to be heard and a strong action plan for both sides of the communication needs to be ran by the governance of smart cities. This aids in the creation of a successfully implementation of a smart city plan. According to new research conducted by ATG Access (2021), almost 70% of the UK public do not know what a smart city is or the benefits that it can bring. This research aims to analyse the main components of a smart city and to identify frameworks for the governance of smart cities in order to more effectively develop a smart city with the involvement of citizens.

It is clear that educating the public on how smart cities can help solve many of the everyday issues inherent to urban life, such as safety risks, traffic congestion and a lack of security, will be key to solving these reservations.

Internationally, Singapore is perhaps the most famous example of a smart city success story. Visitors to the city-state have often reported that they feel like they are “living in the future”

due to the widely modernised public services. The key to this early success has been the high amount of senior use in the form of Singapore’s government-backed “Smart Nation” project. This government backing has legitimised the smart city concept on a global scale and provides an example for the UK to follow.

6.6. Stakeholder issues

Smart cities implement technologies to efficiently manage the assets and services provided to its stakeholders (citizens, technology suppliers, academics, local governments, city planners, municipalities) (Ardito et al. 2019; Anthony Jnr et al. 2020). Addison and Roe (2018) noted that the pressure from stakeholders can provide an essential driver for implementing solid strategies where a lack of it or an improper direction or management could only inhibit its implementation (Muduli et al., 2013). In this chapter, the participants noted that stakeholder issues are one of the challenges of the implementation of smart cities strategies within the United Kingdom. A few of the interviewees identified the lack of connectivity and collaboration between stakeholders as preventing the implementation of smart cities strategies. Some of the interviewees’ statements show that the lack of transparent governmental guidelines is hindering the implementation of smart cities strategies in the United Kingdom. Harmonious, Dashore and Sohani (2013) argued that governmental support is reflected as being an important part of the successful implementation of smart cities strategies which can be where some programs are designed to bring about improved awareness and objectives for companies and organisations or financial assistance in the form of funding or tax abolition. However, a lack of clarity in the governmental guidelines linked with smart cities developments (SCD) acts as a barrier and delays the sector’s adoption of smart cities strategies. Equally, Participant P23 noted:

“See less policy challenges, more the challenges of implementation and funding. The change required is enshrined in policy, but stakeholders are struggling to achieve change”

The above-mentioned statement of Participant P23 indicates that there is lenience in the organisations’ execution of governmental agreed policies due to the conflicting definition of its objectives.

The contingency factors studied were size, strategy, and the environment. The smart city collaborative ecosystem was conceptualized through the quadruple-helix framework which incorporates the local government, firms, universities or research institutions, and civil society.

As the local government is a key factor in the smart city and arguably the most influential stakeholder, it is assumed that how intensively it collaborates with other stakeholders influences the collaboration present in the overall ecosystem, and thus the performance of the smart city as a whole (Eichelberger et al., 2020).

The results of this research suggest that adopting a smart strategy is an important factor where there is a collaboration between a local government and its smart city ecosystem. The results also indicate that for certain types of partnership, the size of the ecosystem matters. The findings suggest that while local governments collaborate more with a larger group of stakeholders up to a certain point, too many stakeholders in an ecosystem may lead the local government to collaborate less. Also, environmental factors seem to matter but their relevance to different stakeholders may depend on the institutional setting. Taken together through the contingency lens, this indicates that municipalities can foster collaboration with their stakeholders across different types of situation. That is, there are some factors that seem to matter for collaboration, like strategy, despite the circumstances. However, for other factors that cannot be readily changed, there are measures that the local governments can put in place to increase the collaboration efforts.

6.7. Summary

This chapter has addressed the second research objective and research question.

“What are the key policy challenges when developing smart cities?”

Objective:

“To explore the policy development and challenges in the context of smart cities.”

This has been done by analysing the literature and the 25 interviews accomplished on key policy development in smart cities. This analysis provided the key policy challenges when developing smart cities from governance point of view. The data from the literature and the interviews had some differences, therefore this chapter analyses the findings to bring them together.

Regarding cybersecurity, the worldwide usage of smart applications has caused several security and privacy issues. The development of new and advanced security frameworks and frameworks is important and highly needed in both organisational and governmental aspects.

Encouraged by these aspects, this chapter has examined the findings from the literature and interviews on countermeasures from the perspectives of different fields. It has also examined the current issues and open challenges that have appeared in recent years to lay the foundation for further studies. Numerous protection systems and strategies have been established and improved in recent years (Meddahi and Shakshuki, 2019), although there is a long way to go to establish a framework that can guarantee the multiple security requirements of these quickly developing smart applications. It is fair to expect that in the following few years, mitigating the presented challenges will be the primary task of smart city associated investigations.

Out of 25 interviews with leading companies and individuals with a smart city background, more than 44% of them described the key policy challenges as relating to funding issues.

Also, 25% of the interviewees stated that data privacy and security are the key policy challenges to innovating smart cities. Some of the participants mentioned smart city collaborations as a key policy challenge. These findings are further elaborated in Table 6-1, providing a more detailed exploration of the data.

Table 6-1. Key policy challenges to innovating smart cities from a governance point of view

KEY CHALLENGES	PARTICIPANTS
POLITICAL LEADERSHIP (LACK OF LEADERSHIP/LACK OF OPERATIONAL GUIDELINES)	P1, P12, P20
STAKEHOLDERS	P8, P12, P23, P24, P23, P12, P25
FUNDING	P1, P6, P7, P8, P10, P11, P12, P13, P16, P23, P25
DATA SHARING/USING	P5, P21, P22
REDUCING EMISSIONs	P2
IMPROVING ENERGY EFFICIENCY	P2
SAFETY AND PRIVACY OF USER DATA	P4, P5, P6, P7, P8, P12
BEING INNOVATIVE	P5, P6, P21
CONNECTIVITY/COLLABORATION (CITIZENS/GOVERNMENTS)	P1, P3, P5, P8, P9, P15, P25
SMART CITY TECHNOLOGY INFRASTRUCTURE (IT/ICT)	P5, P6, P7, P12, P14, P24

Based on the thematic analysis of the second research objective and question, five main themes were identified:

- Digital innovation, the digital transformation of local public services, open data and data sharing, city performance and local growth, future infrastructure, and exports.
- Cybersecurity: privacy and security issues.
- Insufficient financial resources for implementation and stakeholder issues (Funding).
- Lack of awareness among policymakers and citizens.
- The smart city IT infrastructure must be agile and flexible to scale.

This chapter has successfully tackled the second research objective and corresponding question. By accomplishing this, it has paved the way for a deeper exploration into the government's role in the development of smart cities, a topic to be thoroughly examined in Chapter 7.

Chapter 7. Government role in smart city developments

7.1. Introduction

This chapter focuses on the analysis of the third research question and research objective i.e.:

“What role does the government play when developing smart cities?”

and

“To investigate and analyse the government role in smart cities development.”

Smart governance is a key factor within the smart cities panorama when analysing the successful implementation of smart strategies (Meijer and Bolívar, 2016). On top of individual smart city projects, many cities take part in smart city networks where best practices are shared and promoted among the members based on different aspects, including smart governance. Despite the potential positive outcomes that local councillors can obtain from the activities carried out by these networks, their influence in the public sector has been questioned in the literature, especially when practitioners and policymakers have questions about whether networks really do work or are counterproductive for cities (Turrini et al., 2010 and Ferraris, 2020). Therefore, this work aims to contribute to the literature on the councillor's governance in complex networks and on network performance by focusing on the existing network coordination mechanisms with a particular interest in how these can contribute to successful smart city network governance.

This study seeks to establish a theory where the smart cities' governance policies impact on the innovation capacity at the local authority level, spurred by its networked method of operation. This should relate to new trends in city governance (Eisenhardt and Graebner, 2007; Yin, 2014). The scope of this work is not to provide statistical validity or reliability when establishing a successful smart city network but to analyse the systematic review in a particular moment where the smart city concept is embedded in most political, economic, social and technological initiatives taken on by local and national governments.

Overall, this chapter attempts to identify the envisaged results of smart city governance. Significant efforts have been undertaken to distinguish the distinctive segments of smart city governance, as well as the differences between the different results. For instance, Meijer and Bolivar (2016) picked a classification in terms of first, second and third results to describe

smart city governance results (Meijer and Bolivar, 2016) which include (1) improvements to the city, (2) changes in the position of the government in comparison to other urban actors, and (3) changes to the government organisation.

7.2. Findings

7.2.1. Smart governance

Corresponding to the literature, Giffinger (2014) expressed that smart governance is one aspect of smart cities which incorporates all qualities associated with governmental participation and services for citizens, including the implementation of the local government. The literature describes a smart city as a city that operates best in the six components of smart environment, smart citizens, smart governance, smart economy, smart mobility, and smart living.

However, smart city research can be seen as a part of the e-government research area; it is a city that must have a smart city government that is liable for governing the city using suitable policies that run in the direction of smart city goals. It is an urban region that should have a culture of innovation, economic development, good quality of life, security, and sustainability in its social, economic, and environmental aspects (Scholl, 2014).

In the literature review chapter, this study identified the factors offered in smart city initiatives which include citizen participation, Information and Communication Technologies (ICTs), decision-making processes, and smart governance. This also links to the aspects normally found in e-government initiatives (Bernardo, 2017). Smart governance can, across its collaboration between technologies, citizens, policies, and resources, support successful city governing which is on the road to a successful smart city (Chourabi, 2012). Smart governance is consequently at the centre of smart city initiatives (Belissent, 2011). Likewise, Bernardo (2017) and Chourabi et al. (2014) clarified the related factors of smart governance that can be found in the literature which include collaboration, leadership, participation and partnership, communication, responsibility, and transparency. The literature supports the findings in the interviews as P14 explained:

“In my opinion smart governance is the combination of Information and Communication Technologies (ICT) in the internal administrative operations of governments to reach governability, efficiency, honesty, transparency, accountability, inclusion, and fairness for citizens.”

The future analysis indicate that the governance framework of smart city initiatives follows the same standards as the governance framework for e-government (Alawadhi and Scholl, 2016), that is to say, being responsible, collaborative and involved. This section aims to gain a better grasp of how the smart city initiatives in the literature compare to the findings in the interviews, and how they have been implemented.

The social, political, organisational, and technological context of the cities can change a lot. Hence, it is difficult to have a simple solution for smart cities that embraces this range of settings. Consequently, it is challenging to create smart city solutions that are appropriately designed to the local context (Estevez et al., 2015).

The interviewees' responses to the research question were organised according to four different factors: social, organisational, political, and technological. The social factor concentrates on the importance of the citizens' perception of fitting to improve their contribution to the city activities (Streitz and Stephanidis, 2013), as well as having capable citizens engaged in ICT for the purpose of leveraging the ICT industry. The social aspect of smart cities can be fairly diverse in terms of the aspect of collaboration between organisations to cut costs. Research centres allow innovation (Huestis and Snowdon, 2011) and create a space for citizen participation (Khan et al., 2014), as pointed out by the interviewees.

Participant P15 explained the importance of citizen participation in the technological and governmental aspects.

“Resident participation is a key part of the governance structure, yet many residents do not trust audio and video sensors. Safeguarding the public trust in smart cities technologies is a key driver of how governance should be formed.”

Backing up the statement by the interviewee, the technological aspect highlights the technical difficulty of discovering the right solutions for some cases such as smooth public services and interconnectivity among systems.

Smart city initiatives confront multiple challenges: political, governmental, social, and technical, as mentioned earlier. To face these challenges, it is essential to involve the human capital as part of the calculation related to the four dimensions (Batty, 2012). The political challenges mentioned by the interviewees focus on issues such as governmental efficiency (i.e., collaboration of government agencies). The governmental challenges stated by the interviews

included endorsing responsible and transparent governance and linking all stakeholders in a collaborative way.

As Interviewee P12 stated:

“Lack of operational guidelines that define all the roles and responsibilities in order to avoid conflicts. In the specific case of smart cities, you need to add policies that ensure data security, funding and upgrade of existing infrastructures to be compatible with the smart scheme.”

The technical challenges, which have been analysed in the next section, discuss the technical difficulties of the solution, such as being able to make a viable platform to develop seamless public services. Governments need to build an appropriate physical, social, and economic infrastructure to facilitate the smooth foundation of smart governance.

For example, Interviewee P1 stated:

“Governance is good because although it slows down development for making solutions. If it did not do that, people working on developing smart cities would think less about how to develop it right - that is morally and ethically - so that it is a good system.”

The risks linked with smart city implementation can come from the implementation itself. Cities can have an organisational, implementation and social capacity, as discussed in the Chapter 6 from the organisational issues standpoint, but few economic resources, knowledge and awareness, or technology access (Cisco, 2018). For supervising and assessing the performance of smart cities implementation, it is crucial to have appropriated measurement processes and impact and performance indicators ready to use (Smart E.C and Cooperation, 2014).

The type of governance methods used for implementing a smart city initiative believe in the crucial importance of the following: firstly, finding the best solution; secondly, encouraging the participation of all stakeholders; and lastly, promoting the management and coordination of the plan.

The answers to the question - *“What role does the government play in developing smart cities?”*- are conceptualized in the framework category. It is possible to understand that all participants said that to have a collaborative or/and involved governance framework, they are in need of expressing the same principles as the smart governance and e-government supported by the literature in this research.

This section highlights smart governance as a key factor in the implementation of smart cities where a smart governance framework is used by the smart city government for accomplishing their aims by utilising the appropriate policies to meet the objectives. The principles behind the smart governance framework can significantly enable creativity and innovation in the implementation of smart cities. The versatility of smart city contexts such as technological, economic, social, political, organisational, governmental, and social challenges and risks also relate to the implementation goals of policies, management, and technology found in the analysed initiatives, undoubtedly stressing the appropriate smart cities solutions. To address this issue, the in-depth analysis indicates that all initiatives are relying on technologies and smart governance which helps us to conclude that the creators of smart city initiatives are considering them to be vital fundamentals and factors when developing smart, developed, innovative and sustainable cities.

7.2.2. Smart mobility

Various smart cities around the globe have been dependent on information and communications technology (ICT) for more economical and effective city management and to create sustainable, smart, and comprehensive city development, including mobility solutions. These ICT solutions focus on diverse and complicated issues such as economic issues, environmental risks, and the need to enhance their citizens' quality of life, encompassing mobility challenges. Innovative ICT applications are constantly demonstrating that they are the best viable options to be used by city developers for resolving these issues, including those related to mobility. Although a trend for developing smart cities methods emerged both within the scientific literature and at the city administration level at the end of the 20th century, nowadays, people face more of a stable development of interest regarding the smart city concept and are looking for a more comprehensive vision while counting more qualitative features (Gil-Garcia et al., 2015 and Gorelova et al., 2021).

To be properly understood, the use of ICT in governance processes needs to be framed within the longer process of technology-driven public sector development. This process, over the last few decades, has contributed to shaping a novel vision of the public sector where information sharing, transparency, openness, and collaboration are key concepts with tremendous organisational and policy implications. This slow yet steady process has considerably contributed to rendering more complex the “business of government” in terms of the

competences required, the institutional and organisational arrangements, policy action responsiveness, and appropriateness (Ferro and Gil-Garcia, 2010).

Participant P7 explains:

“Smart city is a city that uses information and communication technologies (ICT) to improve quality of life of its citizen and increase operational efficiency, share information with them and improve the quality of government services within the city.”

In the governance of urban areas, city managers are faced with the challenge of balancing three overriding concerns: achieving a high quality of life for all citizens, maintaining economic competitiveness, and protecting the natural environment (GlobeScan and MRC, 2007). More and more, ICT is becoming a vital tool in the governance balancing act as part of buildings, transport networks, and utilities systems (Economist Intelligence Unit, 2010).

There seems to be a general belief among the political, academic, and professional worlds about the importance of the role that ICT may play in the governance of a city. In this section, the discussion will try to shed some light on what type of contribution such technologies may offer as well as on how their potential may be turned into reality.

The role of ICT in smart city governance is to firstly enable new paradigms of production, distribution, and governance, to transform institutional and social organisation, and to inform individual choices and activities.

The interview findings suggest:

P5:

“It aims to improve urban life through engagement of the public, industry and other interested groups for more sustainable integrated solutions and addresses city-specific challenges from different policy areas such as energy, mobility and transport, and Information and Communication Technology to develop innovative solutions and participate in governance.”

The major issue is that the concept of a smart city is used broadly and also understood differently, sometimes to the point where the idea seems utopic. The majority of researchers, the representatives of companies and governmental organisations, and also citizens of the cities agree that the main components of a smart city are ICT, its successful application, and smart citizens. However, the concentration on increasing awareness of society is being neglected by

local governments while attempting to develop smart cities. Therefore, the demands and expectations of citizens need to be heard and a clear framework for both sides of the communication need to be set up by the governance of the smart cities, whether or not it is reaching to create a successfully operating smart city.

Regarding smart city mobility, as a supplement to public transport services, smart mobility offers various solutions: sharing mobility, mobility as a service, mobility on demand and self-driving transport systems (Deloitte, 2015; European Commission, 2021). The main smart mobility objectives are decreasing pollution and traffic congestion, improving people's safety, reducing noise pollution, enhancing transfer speed, and lowering transfer costs (Benevolo et al., 2016). Innovative mobility and connectivity solutions are intended to enable quick access to services.

Hence, Interviewee P16 suggest that:

“The implementation of an integrated, accessible, and sustainable public transportation system tailored to the needs of citizens is the quintessential solution for addressing the deficiency in smart city mobility.”

Considering the aim of the study and the main factor for a successful smart city is to identify the propositions for the government in order to more effectively develop a smart city with the involvement of citizens. Smart mobility is one of the main factors of the smart city concept (OECD, 2020). It is centred on improving transportation in smart cities. Mobility optimisation can be accomplished by introducing innovative solutions for citizens, enabling information and communication technology (Falco et al., 2018).

Therefore, Integrating the insights gleaned from the literature review with the findings obtained through the interviews, it is essential that mobility technologies are easy to use and easy to understand to get more effective and satisfactory outcomes. These topics are covered in the literature, and each topic is debated. (See section 2.4.3 in chapter 2 and section 3.3.4 in chapter 3) This chapter assesses the literature findings and interviews and goes more into discussing two smart mobility solutions, public transport services and sharing mobility.

The governments of smart cities are required first to establish the main sharing mobility services presented to the citizens by analysing the most innovative products developed that are available online and across mobile devices. The findings of the interviews claim that the inter-modality issue, that every so often contains areas and times not efficiently covered by the public

service (Arcidiacono and Pais, 2018; D’Urso et al., 2022), is able to be resolved by its combination with more innovative sharing mobility solutions in terms of means, technology, and other strategies. Certainly, it can add to the public urban mobility services offered by private organisations and offer one of the most comprehensive and innovative smart mobility solutions. Car sharing and digital smart mobility solutions include bikes and electric scooters. The majority of them suggest the “free floating” option which requires that the vehicle can be left at any location in the city in authorised parking spaces. This causes flexible, fast, and efficient customer use. The results show that the majority of citizens consider an integrated smart mobility solution to be helpful for public mobility. Car sharing has now grown to be incredibly well known and most citizens are familiar with it or are least know one type of solution. Moreover, through the participatory method, it was discovered that shared means of transport such as bicycles and cars are known even though they are not necessarily used. The findings from the interviews and literature reflect that such a fairly limited use of shared mobility solutions needs to be investigated further. One more issue that appeared in the analysis is the need to increase the visibility of sharing initiatives and promote more participation.

The implementation of a large range of innovative transport means, as well as the improvement and effectiveness of the traditional urban mobility method, is contained within the policy plans of all innovative smart cities. As occurred in both the literature and the interview findings, to accomplish the framework shift to smart mobility, not only it is required to fund efficient and intuitive ICT applications and technological infrastructures but there also needs to be a fundamental change in business models, institutional governance, and citizens behaviour. It is important for governmental institutions, particularly in large cities, to change the old methods used in the cities and adopt the best perceived solution to reduce the total citizens' use of private transportation as an environmentally-friendly solution (Mugion et al., 2018). Based on the interview findings, this study suggests many solutions to be implemented to enhance the urban services provided by smart mobility providers and policymakers. The results emphasise the significance of the development of smart mobility services and infrastructure based on more advanced and reliable IT solutions; these measures need the contribution of smart mobility providers and policymakers. Also, future research can expand the attention to other smart mobility services developed in the smart city framework.

7.2.3. Smart environment

Smart cities and their citizens are more frequently affected by environmental factors (Jabareen, 2013). This poses new problems for smart city planners, such as corporate environmental pollution. When organisations face environmental regulatory difficulty, they are required to answer government requests appropriately (Marquis et al., 2011), and their directors are encouraged to participate in factors from outside the market system in order to achieve institutional validity and decrease the management doubt (Marquis and Qian, 2014). In a smart environment context, organisations confronting more environmental governing pressure will gradually emphasise environmental legitimacy, start to be environmentally responsible by implementing active environmental strategies, and develop their environmental performance (Berrone et al., 2017). Consequently, perceived environmental regulatory pressure impacts their environmental pollution.

The monitoring pressure recognised by organisations in various regions is diverse. Firstly, even though the main government is increasingly concentrating on environmental protection, several local governments give more thought to improving their environmental growth as their main goal according to their governmental work (Luo et al., 2017). The central government's environmental regulatory force is not fully communicated to the local regions by the local governments; therefore, the environmental monitoring pressure is used on local organisations among the regions. Next, the information irregularity between firms and governments impacts organisations perceived environmental monitoring pressure. The absence of environmental monitoring power creates the local governments' information on corporate environmental methods, making it look unrealistic, establishing an institutional void in corporate environmental management (Kassinis and Vafeas, 2006). Alternatively, the information trade based on a conventional infrastructure is limited by situations such as space and time (Marras et al., 2018), forcing some businesses to avoid the limited monitoring pressure by not having timely access to government information related to environmental policies.

P7 explained how the government plays an important role:

“Government plays the role of the main funder of such projects, making sure that common standards and regulations are in place. coordinate between stakeholders involved in smart cities projects.”

E-government combined with new generation information technology can decrease the information irregularity between organisations and local governments. As a primary component of a smart city, e-government has developed a valuable direction of modern public sector informatisation, utilizing information and communication technology to successfully improve the communication between businesses or citizens and government departments (Tolbert and Mossberger, 2006). Effective e-government construction decreases the lack of communication with local governments, extends the information receipt channels for the preparation and implementation of government policies, and assists businesses to help them better capture the information on environmental governance. Businesses recognise better environmental monitoring pressure from the local governments and therefore should limit their own environmental pollution in answer to tensions from the government. Likewise, effective e-government construction improves the local governments' strength when monitoring the environmental activities of local businesses, inspiring the governments to precisely pressure businesses, consequently engaging them in environmental operations and demanding they realise less environmental pollution and a better public health and safety performance.

As interviewee P4 expressed:

“I believe smart cities are becoming more and more demanding in our daily life only because it helps solve our problems easily using automated connections with everyone about everyday activities such as smart traffic light, automatic parking, monitoring air pollutants, etc.”

The analysis discovered that the e-government structure of a smart city is connecting environmental pollution with businesses that use innovative technology in the smart city to help reduce pollution and eventually create a more sustainable and environmentally-friendly city for citizens.

The findings emphasise the significance of an information system in businesses that understands the environmental monitoring pressure from local governments, which enhances the associated literature regarding the institutional limits on businesses and safety management (Dubey et al., 2015). Delivering government monitoring pressure is an essential element affecting the level of environmental monitoring pressure felt by businesses. Additionally, the construction of the government information infrastructure is an important source of information

mechanisms, especially e-government construction, which has played a significant role in improving the information interaction between businesses and governments. This advances the study of business environmental management by combining the managing effect of the information processing ability of businesses. Based on the information system that affects the businesses' perceived environmental monitoring pressure from governments, the information processing capability of businesses, precisely its artificial intelligence level, can regulate the information exchange among businesses and governments and moderate the perceived monitoring pressure, clarifying the connection between e-government and business environmental pollution.

Regarding urban environmental safety and the social sustainable development of smart cities, the findings give new indications for policy makers to help them better develop environmental governance. In an era of the rapid development of information and communication technology (ICT), informatisation has become a key future development of government. Governments can better obtain the environmental information of local organisations in this way.

The environmental pollution issue not only threaten the living environment of citizens and causes public health and safety issues. These issues present big challenges to urban safety and pollution control. The development and structure of smart city has certainly resulted in new visions to resolve these rising environmental and social crises. Because e-government creates an effective information trade platform between government agencies and businesses, the information flows between businesses and the government become smoother. In this way, governments improve their information irregularity with businesses by knowing more environment compliance information. Businesses can also sense more environmental monitoring pressure induced by their institutional work. In order to gain environmental authority, businesses that perceive a high pressure have a tendency to apply environmental safety activities and decrease their own pollution levels.

7.2.4. Smart living

In the context of smart living, new concepts of life in the city need the processes of the governance of the smart city to use innovations and planning to solve the challenges faced in daily social life (Schwab, 2017). For Camboim et al. (2019), smart cities are complicated ecosystems, populated by people of different interests, who can be urged to work with each other, pursuing a sustainable environment and an acceptable quality of life. From the

perspective of smart cities, quality of life implies positive situations that cause an improvement in the citizens' cognitive, subjective, and affective wellbeing (Carvalho et al., 2018). These helpful circumstances occur through behaviours and feelings which can improve socialization, allowing less aggression in society, more happiness and friendships, and making people healthier and kind towards each other (Bertram and Rehdanz, 2015, Montgomery, 2013, Corrado et al., 2013; Gehl, 2010).

To deal with problems such as being without a job, homelessness, pollution, illness, and aggression (Neirotti et al., 2014) triggered by fast global housing developments, cities are searching for tools to enhance the living conditions of their people and, alongside this, Information Technology (IT) looks promising. Therefore, cities can utilize IT in the governance process to identify and develop smart ways to deal with the challenges of the public and private sectors. This situation marks the combination of two developments, digital innovation and the process of development in the mission to become a smart city (Chourabi et al., 2012).

Backing up the findings in the review of the literature, participant P2 mentioned:

“Cities (urban areas) that deploy IoT and other ICT applications in order to increase efficiencies, reduce costs and enhance the general quality of life”

Therefore, quality of life is a key factor in the development of smart cities (Giffinger et al., 2007, De Guimarães et al., 2020). Nevertheless, the concept of smart cities is recent, so there are numerous research gaps linked to the factors that impact quality of life. Corresponding to Nilssen (2019), the concept of smart cities is still believed to some extent to be elusive due to its complicated characteristics. According to Shen et al. (2018), there is only a small amount of research assessing what outcomes have been accomplished in the practice of utilizing policy measures in smart cities. Concerning the concept of smart cities linked to quality of life, according to the literature findings and in agreement with Ruhlandt (2018), smart cities need a systematic awareness of the different components of smart city governance and a framework to measure these components. Corresponding to Meijer and Bolívar (2016) and Meijer et al. (2016), as the literature review chapter noted, there is a need for the progression of practical research that delivers responses and a theoretical understanding between technology and governance, the role of government management, and sharing governance structures that endorse development in a smart city.

In view of the above, after conducting the interviews, this study identified five potential key factors mentioned by the experienced participants and backed up by the literature findings: Transparency, Partnership and collaboration, Participation of citizens, Engagement and Responsibility in relation to quality of life in smart cities.

Transparency

The literature findings highlight that the design of a smart city influences the quality of life of its citizens, encouraging them to be informed, educated and participative (Albino et al., 2015). However, other findings highlight that the government of smart cities plays an important role in the management of the city and transparency when making decisions, which relates to better engagement between the government and its citizens.

As participant P14 expressed:

“Transparency is working in a way that it is effortless to find out what actions are taken by the authorities. Transparency implies honesty, communication, and accountability.”

Transparency, participation, and collaboration are measured as important methods to produce a democratic environment, seeking the creation of policies aimed at a transparent and engaging government (Harrison et al., 2012). Transparency is positively related to quality of life in the framework of smart cities.

Collaboration

In addition to transparency, the citizen’s collaboration in decision-making practices is emphasised as being important to the governance of smart cities (Schware and Deane, 2003). According to Giffinger et al. (2010), citizen engagement in decision-making is one of the reasons to be considered a smart city, as well as the public services, transparent governance, and policy strategies. Engelbert et al. (2019) underlines the importance of the role of citizens in the development of smart cities, stressing their effective participation in the governance process.

Backing up the findings in the literature, interviewee P15 explained:

“Decisions can't be made without a governance structure. So, governance is key and must include the community.”

Also, P12 stated:

“I think that the main challenge is that is not easy to come to an agreeing point which makes more difficult the decision-making process”

Therefore, it could be said that collaboration in decision-making is clearly linked to quality of life in the context of smart cities from the government’s point of view.

Participation of citizens

Smart city governance is believed to be capable of solving different city issues, pointing to sustainable development and quality of life in the city environment (Lee et al., 2013). To describe a smart city, the participation of citizens is considered to be a significant element as it seeks to enhance the effective participation of the human and social capital (Caragliu et al., 2011; Dameri, 2013), highlighting the empowerment of citizens as a way to help the decision-making procedure and guarantee the development of more involved processes, allowing society’s life expectancy to be improved (Papa et al., 2015).

The connection between quality of life and the participation of citizens is strengthened through the findings which highlight that a city can be smart when investments in citizen participation and social capital, as well as transportation and the (ICT) communication infrastructure, are composed with sustainable economic development and better quality of life, as well as the management of natural resources, through participatory governance.

As interviewee P15 expressed:

“Resident participation is a key part of the governance structure, yet many residents do not trust audio and video sensors. Safeguarding the public trust in smart cities technologies is a key driver of how governance should be formed.”

In view of the above, Participation and Partnership is certainly connected to quality of life in the context of smart cities.

The related findings about the impact of smart governance on quality of life from the perspective of smart cities concern the facets of transparency, collaboration, participation, and accountability in the public awareness.

The findings from the literature and analysis of the interviews suggest that quality of life is determined and clearly affected by the aspects that make up smart governance. The findings show that transparency has a high impact on quality of life in the context of smart cities. Meanwhile, transparency makes effectiveness and success in city governance possible, as well as the subsequent suitable service delivery, influencing better social wellbeing and definitely impacting the quality of life of citizens. This has been verified by the studies of Khademian (1998) and Chourabi et al. (2012), as presented in the literature chapter. The collaboration concept offers a great relationship with quality of life. This result can be clarified, to some extent, by the engagement of citizens in the governance process which allows for a sustainable environment in which citizens are agents of change, capable of together contributing to the improvements made in social wellbeing and quality of life.

Based on the idea that the smart city's aim is to increase quality of life, the main part of this research is verifying that quality of life is affected by the facets of smart governance.

The consequences of the collective framework bring to the fore the relevant findings regarding the impact of public governance on quality of life in the context of smart cities under the facets of Transparency, Collaboration, Citizens' participation, and Communication and Accountability, all of which are positively associated with quality of life related to citizens.

In addition to the findings of this research, it is worth saying that the transparency of the government has the greatest impact on quality of life as well as the other analysed factors from the literature and interviews. It was the one that had the highest influences found. This outcome emphasises the significance of government information sharing and engagement with citizens, and also the use of ICT to contribute to decreasing corruption and improving the equality of citizens. Based on the findings in this research, this section indicates future studies that can examine the identification of other issues that impact public governance and quality of life in smart cities. Another significant aspect is to examine the policies that the governments of smart cities utilize to functionalise the factors found in this section such as transparency, collaboration, the participation of citizens, and accountability.

7.3. Summary

The role of the government of smart cities when implementing of smart city projects was uncovered through the thematic analysis of the literature review and the interviews with 25 participants. This analysis was performed to make it easier to determine the role of the government in smart city development. By discussing these findings, the third research objective and research question have been answered:

“What role does the government play when developing smart cities?”

and

“To investigate and analyse the government role in smart cities development.”

Out of the 25 interviews with the leading companies and individuals with a smart city background, most of them described the role of governance as very important in developing smart cities. The laws and regulations of governments help to implement the smart city initiative.

Table 7-1 provides a comprehensive summary of the overarching themes and sub-themes discussed throughout this chapter.

Table 7-1. Government role in smart city development findings

Overall Themes	Sub-Themes
Smart Governance	<ul style="list-style-type: none"> • The smart governance framework is used by the smart city government to accomplish their smart city aims by utilising the appropriate policies for the objectives. • A smart governance framework can significantly enable creativity and innovation in the implementation of smart cities. This is technological, economic, social, political, and organisational.

Smart Mobility	<ul style="list-style-type: none"> • Establishing and promoting sharing mobility services. • Facilitating the integration of innovative transport means such as bikes, electric scooters, and car sharing into existing transportation systems. • Implementing policy plans that fund efficient ICT applications, towards environmentally-friendly transportation options.
Smart Environment	<ul style="list-style-type: none"> • Environmental monitoring pressure from governments on businesses.
Smart Living	<ul style="list-style-type: none"> • Transparency of the government has the greatest impact on quality of life. • Better quality public service results in better quality of life and the satisfaction and happiness of citizens.

Chapter 8. Solutions for the successful implementation of smart cities

8.1. Introduction

This chapter focuses on the analysis of the fourth research question and the fourth research objective:

“To explore the key drivers for implementing smart cities projects.”

and

“What solutions can be followed or implemented to guarantee the successful implementation of smart cities’ projects?”

Cities nowadays, and particularly in the upcoming years, tend to be developing and emerging at the point that humankind would have never thought about before. Over half of the human population currently lives in cities or around them. In line with Caragliu and Nijkamp (2013). In a smart cities book (pp. 185-207) published by Routledge, it is estimated that according to the urbanisation trend, 70% of the human population is likely to be living in cities by the year 2050, which, as per the United Nations, would total about 2.5 billion people. The implications of Information and Communication Technology (ICTs) have come together extensively where technology is capable of impacting not only our environment but also the infrastructure and function of the entirety of the smart city. ICT is being designed in order to improve the efficient collaboration between different systems and services in the city and to create a sustainable city environment. For it to be called a smart city, the use of ICT must be effectively calculated at the first place. Along with the more frequent application of ICT and its effective management, modern societies are gaining more knowledge every day. A larger percentage of people are willing to use ICT in their daily lives which also has had a massive impact when developing smart cities. The importance of citizens in a smart city is big, even though the local governmental organisations need to be responsible for informing the people and participating in the development of smart cities, thus, the new ways of successful communication need to be set.

Table 8-1, detailing the solutions when implementing smart cities, indicates a comparison of the solutions found in the literature and the ones that the interviews uncovered. It is evident

that the solutions are on a different scale: (1) the solutions from the literature are more on a macro scale while the (2) solutions from the interviews are more on a micro scale.

Table 8-1. Solutions for implementing smart cities

No.	Solutions from the literature	Solutions from the interviews
1	Collaboration among stakeholders	Collaboration between the local government and stakeholders
2	Smart city plan	Smart city strategy
3	Collaboration between citizens and the government	Develop strong partnerships and collaboration
4	Funding	Seek additional funding

8.2. Findings

Based on the review of the existing literature and findings of the interviews, four key drivers for implementing smart cities projects were identified.

8.2.1. Collaboration with stakeholders

Collaboration between stakeholders is highlighted in the literature as one of the essential factors in the successful development of smart cities (Komninos et al., 2019; Snow et al., 2016). Cities engaged in smart city initiatives pursue the development of collaborative systems which create “relationships between citizens, government, business, and educational institutions” (Appio et al., 2019). This was also mentioned by 40% of the interviewees:

Participant P25 expressed:

“Smart Cities are about multi-stakeholder collaboration to address societal challenges, for instance related to the energy transition.”

Also, P7 stated:

“Collaborate with stakeholders as smart city plan must be in place.”

This falls in well with the concept that solving challenges needs cross-sectoral collaboration which can be described as “collaborations involving government, business, non-profits and charities, societies, or in general the public all together” (Bryson et al., 2006). Collaboration is

also proposed as being suitable for overcoming socio-technical difficulties in digital government perspectives (Ku et al., 2016) such as smart city environments managed by local governments. In smart cities, collaboration can also lead to improved performance (Appio et al., 2019; Komninos et al., 2019; Snow et al., 2016) or smarter solutions as it is recognised that it is challenging for one organisation to resolve the problems of citizens alone (Chen et al., 2019). As a smart city environment compiled of several stakeholders, it is difficult to manage (Angelidou, 2014). Understanding the factors that lead to improved collaboration in smart city environments will improve both the smart city literature and practice by working on methods to improve implementation.

As interviewee P8 expressed:

“Lack of alignment between city vision and stakeholders and collaboration issues”

Future highlights:

“Successful implementation of SCs requires developing a comprehensive top-down strategy that links and integrates the various initiatives and stakeholders within the city as a whole, whilst ensuring citizen-centric solutions. “

Therefore, this section analyses the collaborations among stakeholders and looks at the enabling factors. It is recognised that the related smart city technologies themselves can support the relations among stakeholders, therefore improving collaboration. In this line, this study calls on the literature from the field of e-government. Studies in this field have recently connected the role of the local government in controlling smart city environments within an e-government framework. This method has implications when it comes to collaboration in a smart city system (Reggi and Gil-Garcia, 2021; Sancino and Hudson, 2020). The literature on e-government thus suggests a useful perspective to understand collaboration within the smart city system. This literature has engaged with the question of collaboration between stakeholders, implying a number of features to facilitate collaboration such as administrative support, leadership, and trust (Chen et al., 2019). Digital government researchers have also discovered the phases of development, whereby each phase engages the stakeholders more competently (Janowski, 2015). In this perspective, the aim is to understand what factors in particular will contribute to more intensive collaboration among the stakeholders in the smart city context. While the smart city literature extensively discusses collaboration, as noted above, no literature was found that identifies such contingency factors.

While the smart city literature has discussed the factors that may influence relations between the local government and citizens (Simonofski et al., 2021), this chapter goes further to

recognise how the local context and environment can affect the collaboration between the local government and a broader set of stakeholders.

As P11 explained:

“I think a well detailed plan needs to be drawn, focussing on the goals and functions the city wants to improve. This plan should stablish as well, the governance structure, policies and a decision-making process.”

P11 also highlighted:

“Collaboration with all the stakeholders, stablishing strong partnerships and ensure additional funding for the project is very important.”

Backing up the interviewees' statement, smart city governance is recognised as a type of digital governance concept working in a socio-technical structure (Dawes, 2009). In particular, the digital government framework has been used to believe in the collaboration in smart city ecosystems (Reggi and Gil-Garcia, 2021; Sancino and Hudson, 2020). Furthermore, specific types of collaborative relationships within smart cities are affected by the methods found within digital government initiatives (Mills et al., 2021). Therefore, as a smart city concept, a digital government is also found to be a way to help sustainability and encourage citizens (Janowski et al., 2018).

Digital government involves a system made up of the following stakeholders: government actors, private businesses, other non-government entities, and citizen groups. In the digital government evolution, a new governance concept emerges that connects these stakeholders in a state of collaboration (Janowski, 2015). The digital government lines up with the concept of the government playing an organisation role in reaching the public goals, although with the other stakeholders actively collaborating (Janowski et al., 2018).

Interviewee P22 mentioned:

“The use of digital and telecommunication technologies, use of information and communication technologies allows governments to optimise resource usage.”

This interviewee believes that digitalisation helps to optimise resource usage and also helps with the city's connectivity. Leveraging the digital government literature allowed us to structure the local government as the main factor in the smart city framework, offering tools and cooperative action methods to create public value (Picazo-Vela et al., 2022) while not

being in control of the stakeholders, who remain independent. This provides the structure of how stakeholders can balance their roles during the collaborative processes, but it does not explain what factors may promote the local government to collaborate in the first place. It is suggested that adopting a smart strategy is important for cities aiming to advance their collaboration with the other smart city stakeholders. As established, a smart city strategy relates with the more intensive collaboration between the local government and other smart city stakeholders.

Additionally, cities should be mindful that the size of the smart city ecosystem can impede the collaboration with other stakeholders. For big smart city ecosystems, this study recommends a smart city administrator or a devoted smart city department for improving collaboration. This supports the literature in recognising the role of smart city managers as ‘horizontal managers’ who are accomplished at collaborating with stakeholders and who are talented at breaking down sectorial silos to establish initiatives across many fields (Michelucci et al., 2016), gathering consensus among a diversity of stakeholders (Engelbert et al., 2021). The bigger the set of stakeholders in the smart city collaborative ecosystem, the more funds may be needed to commit to ensuring that the local government stays connected to it. A director of this sort may still be valuable in smaller ecosystems but less crucial. Consequently, precious urban resources may be more helpful in other areas.

Our findings also suggest that the smart characteristics, in specific environments and governance, are only important when looking to improve the collaboration with its citizens. However, this raises doubts about the efforts made by cities toward other smart characteristics. The collaborative ecosystem has been outlined as a key element of smart cities, supporting smarter solutions that lead to sustainability, economic development, and a generally improved quality of life. Therefore, understanding the aspects that support collaboration across the stakeholders is important for smart city implementation. In response, this study considered the digital government literature to explain the role of the local government in collaboration with other stakeholders in smart city collaborative ecosystems. It then assessed how different relative and environmental contingency factors affect the strength with which the local government collaborates with various stakeholders in its smart city ecosystem.

8.2.2. Smart city plan

A smart city pushes new technology, data, and innovation to improve the life quality, efficiency, and sustainability outcomes. This includes inserting technology within the city in

the form of sensors, Internet of Things (IoT) connectivity, and other information gathering infrastructure.

Although development aims to transform city planning under its vision of sustainable development, it appears that its implementation is becoming even more complicated due to the rising demand of consumer society which supposes the need to reach a representative level of development, even at the cost of environmental damage. One of the main reasons for revolution in cities is due to population growth. In other words, while currently there are more than 50 megacities with roughly 10 million residents, back in the day, only seven had reached a million (Komminos, 2013). On the other hand, the correct distribution of power and authority is something that needs to be considered in city planning. It can be said that cities governed with a view to engage in just distribution show greater long-term prosperity and competitiveness compared to those governed in an authoritarian manner (Clarke, 2013). Also, one of the main components of smart city planning is the widespread incorporation of millions of smart devices and technologies connected to the Internet of Things. This generates results in the form of both saved and real-time data. “Real-time” implies the immediate delivery of this info to users, instead of being saved and accessed later.

Interviewee P17 expressed:

“By using technology, smart cities can gather data that is intended to improve planning and development for cities, and potentially improve people’s life.”

As discussed in Chapter 6 earlier on the importance of using technology and digital resources, this section will go more in depth into how technologies can help with smart city planning.

Backing up the literature findings, interviewee P24 believes that the solution is:

“Defeating the urban and social challenges utilising technologies adequately to their needs.”

Where citizens live in more developed cities, there are now billions of IoT devices all around the globe. At any given time, these technologies receive, record, and send out information which is available to customers right away. These smart devices and services can significantly increase the citizens’ quality of life.

This leads to the second component of smart city planning. This important part rotates around governments effectively supervising, utilising, and answering to this data and user feedback to

increase the liveability and resource productivity for people. A successful smart city depends on not only the installation of these systems but also on the efforts of the governmental and business bodies to use them for the good of the citizenry. The adoption of these strategies is to better serve the people.

Comparing the literature review and interviews, this study identified eight key areas where smart cities are making important developments. These broad areas are listed below with some smart technology examples as taken from the interviews.

Mobility: Interviewee P5 explained:

“Government strategy aims to improve urban life through engagement of the public, industry for more sustainable integrated solutions and addresses city-specific challenges from different policy areas such as energy, mobility and transport, and Information and Communication Technology to develop innovative solutions and participate in governance.”

Security: Interviewee P14 expressed:

“Security is one of the important processes in smart cities development, digitising infrastructure carries some significant risks. A coordinated cyberattack where a hacker gains control of IoT connected devices could be damaging.”

Energy: Smart streetlights, home energy automation systems, and the distribution of automation systems.

Water and waste: Water quality monitoring, digital tracking, and payment for waste disposal.

Economic Development: Interviewee P5 also highlighted:

“Smart city provides enhanced citizen and government engagement, reduced environmental footprint, effective data-driven decision making, increased digital equity, economic development opportunities.”

Engagement and collaboration: Interviewee P11 said:

“The main challenge I would say is political as to implement this successfully the involvement of highly placed political leaders is required to gain the engagement from the public and many other stakeholders.”

The implementation of smart technology enables the governments of smart cities and citizens to collaborate and exchange data in modern progressive ways. At some point, it is expected to see more such services and systems incorporated into city development plans.

Smart cities go further than the conventional basic infrastructure – they offer an entire new functioning public service that runs entirely in a digital space. Instead of being concentrated on just one aspect of a citizen’s life, such as new roads or public transport contributions, the realised smart city would work creatively across all sectors. In this manner, letting new collaborations exist between previously disparate infrastructure systems.

8.2.3. Developing strong partnerships and collaboration

Throughout the last few decades, there have been new studies in the academic literature on the importance of partnerships, particularly public-private partnerships (PPPs), which emerges from sharing responsibilities, risks, and resources for an improved outcome (Koppenjan and Enserink, 2009). Furthermore, PPPs help aid in the creation of networks by stakeholders, which enables innovation (Dupont et al., 2015).

Considering the impacts of partnerships on the urban environment, cities tend to cooperate with the public and private sectors. Towards this objective, the use of platforms increases as part of the innovation and delivery of services by different actors (Borghys et al., 2020). Simultaneously, the city authorities wish to efficiently use public resources, reduce the public expenditure, and deliver innovative and appropriate solutions related to the new opportunities for social and economic development (Ham and Koppenjan, 2002; Koppenjan and Enserink, 2009; Liu et al., 2020). One of the key factors in slowly creating multiple diverse networks is the establishing of partnerships between heterogeneous entities, for example, private companies, citizens, and multi-diverse stakeholders (Caragliu and Del Bo, 2019; Desdemoustier et al., 2019; Khare et al., 2011; Liu et al., 2020; Pedro and Bolívar, 2018).

According to Chourabi et al. (2012), smart city initiatives seek to improve the productivity and effectiveness of select aspects. Typically, this helps result in greater collaboration between stakeholders. However, it is crucial to assess the effect that planning has on the type of partnership. Thus, there is a need to understand the effect of smart city initiatives when establishing partnerships between different entities in the urban area.

Interviewee P8 explained:

“Collaboration and integration amongst various stakeholders and enabling Knowledge management issues including lack of fit between organisation strategy, leadership, structure, time allocation and culture. The difficulty of capturing tacit knowledge, lack of knowledge

management policies, lack of knowledge mapping methods, organisational and cultural issues,”

Recently, climate change and overpopulated cities have increased the concerns of policymakers. In trying to manage such issues, cities have established strategic planning to make decisions based on all important aspects. With strategic planning, the public authorities will boost their capability to manage their resources efficiently and reach the preferred outcome effectively.

One method for facing these growing problems is the formation of PPPs as explained earlier. Each possible partner proposes a different set of abilities and funds. Entities from the private sector offer access to finance, accrued knowledge, organisational efficiency, and innovation. Together, they gain support to defeat inefficiencies and possible limitations, for example, reducing the level of uncertainty and risks (Wang et al., 2019). Equally, public organisations offer social responsibility, environmental awareness, and local knowledge while developing the benefits offered by the private partners (Liu et al., 2020; Wang et al., 2019). Consequently, projects in the form of PPPs can possibly prevent market collapse, resolve problems efficiently and effectively, and serve as a system to plan and implement smart city projects (Ham and Koppenjan, 2002; Liu et al., 2020).

Apart from advantages, PPPs can cause some challenges (Anvuur and Kumaraswamy, 2006). In some instances, there is a lack of trust, compromise, and an inadequate legal framework to help the city benefit (Casady and Peci, 2021). Moreover, many public officials need technical and financial abilities to monitor the private sector (Ruiters and Matji, 2016) and to detect the creation of extra added value (Anvuur and Kumaraswamy, 2006).

Simultaneously, several studies show the likelihood of there being a challenging relationship between the public and private sectors concerning city initiatives (Vanolo, 2014). In most cases, the success of the partnership is affected by three existing factors (de Villiers, 2009; Koppenjan and Enserink, 2009).

- The participation of citizens.
- The appropriate sharing of resources.
- The strategy of each actor.

Corresponding to this concept, the appropriate implementation of smart city-oriented initiatives is associated both with the city's geographical qualities and the distribution of city resources (de Villiers, 2009). These characteristics impact the role that a city can play in the partnerships.

Supporting this interview, P7 explained:

*“Develop strong partnerships seek appropriate and sufficient funding insure maintainability.
Pilot testing must be in place.”*

P11 expressed:

“Stablishing strong partnerships”

While P12 said:

“Develop strong partnerships.”

The interviewees see the profit in strong partnership and funding which has been analysed in more depth in the next section, supporting the interviewees' argument, In partnerships with the city government, partnerships mostly concentrate on improving the local supply chains and innovation (Manville et al., 2014). Although they do not necessarily contribute to sustainability, they can overcome any wastefulness and the absence of innovation, incorporating existing public services into the projects. Recent methods of public management, where the government manages to be more efficient, make it expected that public authorities will collaborate more with each other (Popa, 2017).

Establishing partnerships with various entities in the ecosystem helps the municipality improve the successful achievement of smart city projects. The structure of partnerships is impacted completely and significantly when other individuals are derived from the private or public sectors. Otherwise, other kinds of stakeholders and educational partners do not indicate there is statistical importance at a satisfying level.

The results indicate that drivers from the private and public sectors have a vital responsibility in the city ecosystem for assisting government to implement smart city-oriented initiatives. Additional research is needed. As for the different forms of actors in the city ecosystem, the resolving effect requires further analysis. It will be beneficial for city policymakers to take into consideration the different sorts of relationships present. While an academic collaborator may not seem to play an essential role in general, it is essential to study the various stakeholders' potential roles in the city environment. These two approaches will shed light on the motives for not playing such a substantial role in implementing smart city initiatives.

Cities attempt to create different strategies and implement them effectively and efficiently. In some instances, they are successful and in other instances, they are not. The stakes are greater when the strategy focuses on the digital aspect of the city. In this effort, this section of study shows that relationships with private and public entities can assist the public organisations in accomplishing their initial objectives. The collaboration of the private sector with various

public organisations will provide positivity when bridging any cognitive gap concerning the involvement of a city. Partnerships are offering the ways to accomplish the required results and therefore lead to the successful implementation and accomplishment of the smart city projects.

Simultaneously, a city demands the monitoring of its everyday activities and resource usage as it can disrupt other initiatives that take place within its borders. Thus, if a city recognises its advantages, characteristics, and the various roles it can have in the urban ecosystem, its partnerships can speed up the implementation process of innovative smart city developments. This catalytic effect can impact the benefits a city can achieve from several of its partners. When the role of a city is distinct and according to its initial planning, collaborators can offer answers regarding its successful implementation. As most of the world's cities are slowly registering the post-Covid-19 period, urban organisations are evaluating different situations that can assist them in facing the aftermath of the pandemic. Throughout this revolution, a city partnering with different entities from the public and private sectors can, perhaps, assist in shaping the future of the city environment. Potential next steps can shed light on the different distinctive characteristics such entities have. Analysing such different partnerships closely and considering their different characteristics may possibly encourage and help the targeted initiatives. This could be a benefit for entities when they demand funding.

8.2.4. Seeking additional funding

Recent research has highlighted the challenges associated with funding smart city projects and examined various methods through which cities governments can choose to finance their smart developments across different funding and financing strategies (Khan et al., 2020).

To successfully implement smart governance, it is necessary for them to plan and budget for their project and collect funds. Smart cities will only be able to obtain the best technological smart city solutions with the help of local involvement and financial investments. With the proportion of people set to be city-residents looking to rise to 70% by 2050 (Bibri, 2020), cities across the globe are looking to proactively invest in and modernise their infrastructure. The growth in urbanisation will exert great pressure on the existing infrastructure and on the overall quality of life. There must be an immediate development of the technological frontier so cities must be able to adapt to the expansion of the population. Consequently, it is necessary for the government to introduce technology and build smarter solutions to solve these problems and this is where smart funding comes to light.

The findings in the literature and conducted interviews suggest that a positive first step should be fiscal incentives such as tax abatements and qualified infrastructure bonds to specifically address the needs of a smart city project.

As participant P1 stated:

“In my view smart cities is the managing the journeys of every citizen within the city. For me and my company, it’s about looking at every single person and being supportive of their needs and requirements – health, finance, happiness, well-being, personal development etc.”

It will be possible to create fiscal incentives for the citizens of smart cities. Following the literature findings, to accommodate these needs, it looks like the most effective way to invite private sector investment will be to pursue an effective promotion strategy with both public and business owners. This, in turn, will invite both good publicity and hopefully, private investment. Municipalities should look to bring public and private investors and stakeholders together to discuss shared financing options and the splitting of risk and reward, accordingly creating a truly collaborative approach to funding.

To guarantee being better buy-cutting-edge, performance-based income sharing will also need to be a key feature of the delivery framework; both public clients and private stockholders will need to directly see the benefits of efficiency gains in the service delivery, as well as any extra value offered by the data, analytics, and insights related to the services enhanced or made possible. One idea may be to trial ideas within possible innovation areas in urban areas where the public infrastructure and private businesses are both concentrated on allowing it to pave the way for wider city coverage.

By guaranteeing a collaborative financial approach that considers the needs of the public and private sectors, the local government can ensure the implementation of digital developments that truly yield economic and social benefits for every citizen, business, and public authority that live and use the future smart city.

As mentioned by participant P19:

“Funding services, coordinator, regulator of new strategies and regulations.”

Also, P15 said:

*“Collaborate with stakeholders a smart city plan must be in place.
develop strong partnerships seek appropriate and sufficient funding insure maintainability.
Pilot testing must be in place.”*

This section identifies the five key barriers to funding smart cities as follows:

Firstly, stockholders have a view that there is a substantial risk involved in financing innovative solutions, particularly energy efficiency measures.

Secondly, the amount of investment required in big city development projects is also large in volume, and bigger projects by definition have more risks and uncertainty.

Thirdly, many low-carbon and transport initiatives have long periods for their investment return. Lastly, there is a limited opportunity for public funding. Public organisations are usually expected to get more for their money these days, and economic systems have bitten deep across Europe. This makes it hard for the city authorities to raise money. Stockholders are more worried if big public infrastructure projects are not financed by public funds because the risk is higher.

For smart city financing, there is a need for a clear first step and there should be fiscal incentives such as tax deductions and qualified infrastructure ties to particularly address the demands of a smart city project. It looks like the most successful way to invite private sector investment will be to engage in an effective marketing strategy with both the public and business owners. This will invite both good marketing and, positively, private investment. Cities should look to give their public and private investors and stakeholders time to consider shared funding options and the splitting of risk and reward appropriately, creating a genuinely collaborative approach to funding.

This section identified the possibilities and solutions to overcoming funding issues in smart cities. It suggests that one key issue is identifying areas of risk and decreasing the risks of investment. On the other hand, the public authorities might fund some areas of the project or provide loans to smart city developers. Cities also need to get smarter with their funding systems and frameworks, such as public-private partnerships, which have been used to good effect by large infrastructure projects. They need to understand that different investors have different approaches to risk, and make sure that the target appeals in the right direction. One problem that cities need to address is that of the public benefits. This can often not be monetised by developers but it may be necessary to permit reasonable amounts of public funding; often enough to decrease the costs sufficiently to attract investors. This can be looked upon as a way of charging taxpayers for the future benefits they will receive and may mean that national or international grants can be made available for innovative developments.



Figure 8-1: Seeking additional funding

Funding opportunities are presented in Figure 8-1, they help smart city development by identifying the available sources. However, financial challenges still have a growing impact on smart city development projects.

8.3. Summary

This chapter has addressed the drivers related to the successful implementation of smart cities by answering the fourth research question and fourth research objective:

“What solutions can be followed or implemented to guarantee the successful implementation of smart cities’ projects?”

and

“To explore the key drivers for implementing smart cities projects.”

Additionally, in the contributions to the literature and interviews, certain policy implications occur. Firstly, they suggest that having a ‘smart strategy’ is critical for cities aiming to expand their collaboration with the other smart city stakeholders as it was established that a smart city

strategy relates with a more intensive collaboration between the government and other smart city stakeholders. This is consistent with the literature and is generally supported as a strategy that has been recognised as a key factor in the successful development of smart cities. Smart city strategies have also been found to strengthen urban innovation systems, facilitate collaboration, and adopt new collaborations. Lastly, the development of strategies helps overcome the silos in government to improve the collaboration among stakeholders.

Furthermore, cities should be mindful that the size of the smart city ecosystem can impede its collaboration with other stakeholders. For large smart city ecosystems, this study suggests that a smart city administrator or dedicated smart city department will be useful when looking to improve collaboration. This aligns with the literature acknowledging the role of smart city managers who are accomplished at collaborating with stakeholders who can break down the sectorial silos to establish initiatives across many fields and garner consensus among a variety of stakeholders. The larger the set of stakeholders in the smart city, the more funds may need to be given to make sure that the local government stays connected to it. A manager of this sort may even be advantageous in smaller ecosystems but less crucial. Hence, valuable public resources may be more useful in other regions.

Regarding smart city planning, the complication of the management of cities makes it imperative to grow smart cities as a tool through which technology is put into the service of residents, not only for the collection of data but also for the managing of it for the profit of government entities under the principle of governance. The smart city is determined according to different factors as discussed in the previous chapters: the economy, environment, smart management and government, communication and technology, and quality of life. For this reason, a smart city is a region with the ability to learn using technology as a differentiating factor in the hands of organisations dedicated to development and research to improve the quality of life of citizens.

As mentioned earlier in the literature review chapter (Chapter 2), the worldwide number of citizens is expected to nearly touch 70% by the year 2050. How city planners can achieve a better HDI (Human Development Index) scores in heavily populated cities if a “people-first” approach is adopted, one that “creates together the physical, economic, social and environmental aspects of city living,” uses the principles of building green, efficient infrastructure and transportation systems, innovative developments, and nurturing “PPP” (people, public, private) partnerships and initiatives. Letting the people become “the eyes on the street” increases security and safety. Cities try to formulate different strategies and implement them successfully and efficiently. In some instances, they are successful and in other

cases, they are failing. The stakes are higher when the strategy concentrates on the digital transformation of the city. In this effort, this chapter shows that partnerships with private and public entities can help the governments of smart cities accomplish their initial goals. The cooperation of the private sector with various public organisations will respond positively to linking any gap about the involvement of a city.

Chapter 9. Framework for the implementation of smart city strategies within the United Kingdom

9.1. Introduction

This chapter addresses of the fifth and sixth research objective:

“To develop a strategic smart city governance framework.”

And

“To evaluate the strategic smart city governance framework.”

In this research, to accomplish the proposed aim and objectives explained in Chapter 1, a qualitative approach was applied, and a variety of data sources were analysed. The research development was split into two main sections, the literature review and interviews. The research and theoretical framework were determined to guide and control the review of the literature and interviews.

The literature review was divided into two chapters, (1) The fundamental information regarding the smart city concept and the role of governance and (2) Smart cities policy developments and challenges. An analysis and summary of the information gained was carried out gradually in all stages of the research. The sources of the data are addressed in Chapter 4 along with a more detailed discussion of the research process and methodology. The framework of this research includes the citizen, environment, economic, and digital perspectives in smart cities which the different elements of the framework helped to identify as part of the analysis, gearing the research toward answering the research questions.

This chapter discusses the developed framework derived from the examination of existing literature and insights gathered and analysed from interviews. The discussion not only outlines the frameworks construction but also analyses its effectiveness through the framework evaluation process, shedding light on its practical applicability and contributions to the developments of smart cities to enhance governance policies.

9.2. Theoretical perspective

The development of a useful framework is often essential for guiding and organising research endeavours, providing a systematic structure to address complex issues as mentioned by Meredith (1993) which defined a framework as a tool that helps with the identification and classification of the relevant factors. The first step in justifying a framework lies in identifying and understanding the research issues at hand. This involves an extensive review of existing literature which can be found in chapter two and chapter three of this thesis to determine the research gaps, and areas where further exploration is needed.

This smart city framework represents a creative approach to governance in smart cities, aiming to transform the role of governments by fostering a tripartite collaboration between citizens, government entities, and businesses. One of its primary objectives is to streamline the funding and implementation of smart city projects (Mirzaee and Sardroud, 2022).

By promoting collaborative financial investments from both the public and private sectors, the framework seeks to ensure smart cities development and the successful execution of innovative initiatives that enhance urban living. This financial synergy not only eases the burden on government resources but also encourages the infusion of cutting-edge technologies to address urban challenges effectively. Van et al., (2020) mentioned the adoption of Information and Communication Technologies (ICT) and Information Technology (IT) is a cornerstone of the smart city framework. Leveraging these technologies enables governments to optimise service delivery, enhance infrastructure efficiency, and improve overall urban management. The framework envisions the deployment of smart solutions, such as collaboration with stakeholders, creating a smart city plan and developing a strong partnership and collaboration and as mentioned earlier in this section seeking fundings that ease the pressure on governments on implementing smart city projects all by adopting, IoT devices, data analytics, and connectivity, to create a seamlessly interconnected city. By doing so, the government can not only provide citizens with more efficient and responsive services but also lay the foundation for a digitally advanced and sustainable urban environment.

Therefore, to achieve this goal, the formulated research questions that encapsulate the core issues and gaps identified, served as the foundation for subsequent investigations, which can be found in chapter one.

Once the research questions were established, interviews were conducted to gain insights from relevant stakeholders and experts in the field. These interviews contributed valuable qualitative data, suggesting perspectives that have not been fully captured in the existing literature. The

synthesis of information obtained from both the literature review and interviews allows for the construction of a comprehensive framework. The proposed framework serves as a guide, systematically organising key components and relationships to address the aims and objectives of the research. By combining findings from scholarly sources and firsthand perspectives gathered through interviews (Yüksel and Yıldırım, 2015). The resulting framework is not only theoretically grounded but also enriched with practical insights, enhancing its relevance and applicability to real-world scenarios.

Moreover, the proposed smart city framework addresses the importance of solving stakeholders' issues by promoting open communication and collaboration channels and participatory decision-making. It encourages engagement between citizens, government officials, and businesses to identify challenges and collaboratively develop solutions. Creating knowledge and awareness about smart cities is another key aspect of the framework, aiming to empower public or private sector with the understanding and skills needed to actively participate in the smart city transformation (Eichelberger et al., 2020). The proposed framework strives to build a well-informed and engaged community that plays an integral role in shaping the future of the smart city.

Table 9-1 serves as a visual roadmap, delineating the origins of research aspects, whether from the literature review or data analysis. This distinction is crucial for transparency, allowing readers to detect theoretical foundations from empirical insights. It provides a clear methodological overview, enhancing the study's credibility and enabling a better understanding of how theoretical knowledge aligns with on-the-ground perspectives, fostering a comprehensive analysis.

Table 9-1. Framework components from literature review and data Analysis (LR= literature review, DA= data analysis).

Chapters	Literature Review	Data Analysis	From LR and DA
Perspectives			
Citizen	-	-	x
Environment	-	x	-
Digital	-	-	x
Economic	-	x	-
Key policy challenges			
Smart city technology infrastructure (IT/ICT) issues	x	-	-
Cybersecurity: safety and privacy issues	-	x	-

Lack of funding	-	X	-
Lack of knowledge and awareness	X	-	-
Stakeholder issues	-	-	X
Government role in smart city developments			
Smart governance	-	-	X
Smart mobility	X	-	-
Smart environment	-	-	X
Smart living	-	-	X
Solutions for the successful implementation of smart cities			
Collaboration with stakeholders	-	-	X
Smart city plan	-	-	X
Developing strong partnership and collaboration	-	-	X
Seeking additional funding	-	-	X
Framework for implementation of smart city strategies within the United Kingdom	-	-	X

9.3. Strategic framework

A developed strategic framework indicates a path for the implementation of a successful smart city within the United Kingdom. The important issues emphasised in this this framework, include highlighting the importance of the smart city strategy, developments, and the government’s role to improve quality of life for citizens within smart cities.

The proposed framework (Figure 9-1) was developed based on the findings from the literature review and the analysis of the interviews conducted with key influential business CEOs in the smart city sector. The framework is comprised of three stages, namely, the Inputs, processes and output. which will be explained in detail below.

The framework follows a systematic approach based on the Epstein and Buhovac’s (2010) corporate sustainability framework. The inputs incorporate the organisation’s internal and external forces that put pressures on the decision-makers and processes that prompt the adoption of new smart city strategies. Once the inputs are identified and evaluated, the top management and decision-makers can formulate and implement appropriate actions within their processes. This could be achieved through the adoption of a government management strategy, as well as the selection of an appropriate guiding perspective for addressing the proposed challenge. organisations’ actions lead to outputs in the form of smart city strategy performance. This is grouped into businesses, government, and citizen performance. A

continual feedback loop is included within the framework to keep the framework from becoming outdated and help in the strategy development and implementation of existing and future smart city projects.

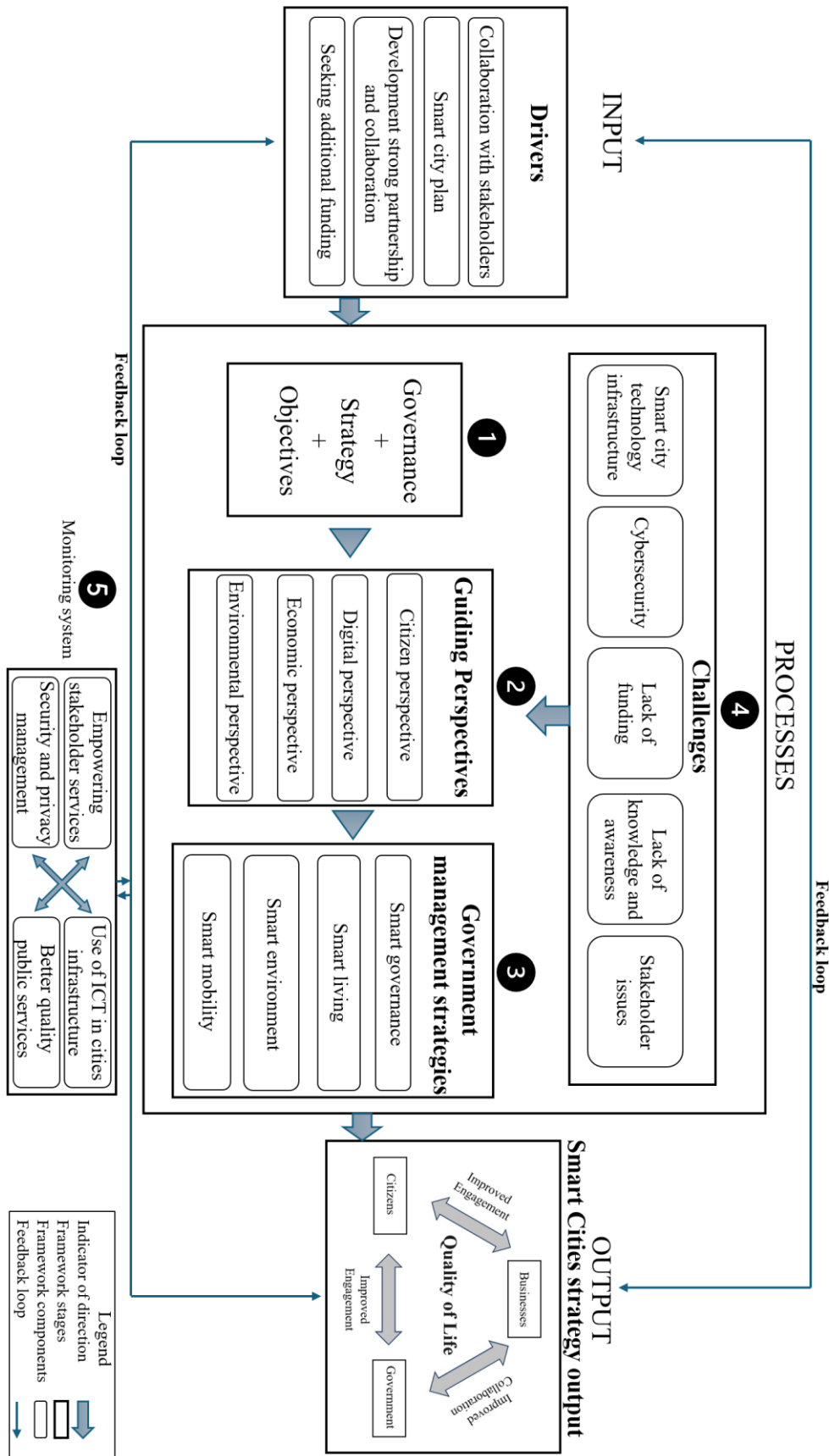


Figure 9-1. An integrated framework of implementing smart city strategies in the United Kingdom

The proposed framework above is accompanied by the Table 9-2, which serves as a comprehensive reference tool, that offers nuanced guidance on each element within the framework. This dual approach ensures that users can readily access structured information while also benefiting from detailed insights into each aspect of the framework. By providing such comprehensive guidance, the framework becomes significantly more practical and user-friendly, empowering the public or private sector to navigate with clarity and confidence throughout the frameworks to implement the appropriate strategy for smart city challenge at hand (Yin, 2014). Whether used for decision-making processes, or implementation strategies, this combined resource enhances understanding and facilitates effective application of the framework's principles.

Table 9-2. Guidance for implementing the framework

Framework elements	guidance
Inputs	
Drivers:	
Collaboration with stakeholders	<ul style="list-style-type: none"> • Private and public engagement • Stakeholder collaboration • Support from governments of smart cities
Smart city plan	<ul style="list-style-type: none"> • City planning to meet the needs of citizens. • Economy and innovation • Environmental management • E-Government
Developing strong partnership and collaboration	<ul style="list-style-type: none"> • Clear governance structures • Public-Private Partnerships (PPPs) • Strategic planning to manage resources efficiently. • Engage and involve citizens
Seeking additional funding	<ul style="list-style-type: none"> • Competition based funding • Pay-For-Performance funding • Public and private funding • Governmental funding • Local community funding
Processes	
1. Governance, Strategy, Objectives	Governance represents the foundation and backbone of any organisation's activities. This determines the organisation's core purpose, core values, and end-objectives. In the case of successful smart city being the end-objective, the inclusion of such objectives should constitute the framing

	of the governance definition to ensure its success. The strategies represent the blueprints that the organisations need to follow to achieve their goals.
2. Guiding Perspectives	
Citizen	Set of roles and responsibilities for smart city citizens where collaboration with government is key, although, there is a need for governance where participation is the key factor, and citizens are included in a decision-making capacity.
Environment	<ul style="list-style-type: none"> • Resource utilisation and sustainability • Environmental impact mitigation • Sustainable development goals • Technological solutions • Public engagement and governance
Digital	<ul style="list-style-type: none"> • ICT solutions for efficiency • Enhancing social collaboration • Data-driven approach • Smart devices and IoT • Integration with city infrastructure • Technology and connectivity
Economic	<ul style="list-style-type: none"> • Resource optimisation • Sustainability and profitability • Technological integration • Business development and innovation • Leadership and policy implementation • Standards and regulations
3. Government Management strategies	
Smart governance	Refers to the use of ICT within governmental operations to achieve governability, efficiency, honesty, transparency, accountability, inclusion, and fairness for citizens.
Smart living	Smart living encompasses several key aspects: <ul style="list-style-type: none"> • Transparency • Collaboration • Participation of citizens • Communication and accountability • Use of Information Technology (IT)
Smart environment	Refers to an ecosystem where technological advancements, particularly in the realm of information and communication technology (ICT),

	are leveraged to monitor, manage, and mitigate environmental issues within a city.
Smart mobility	Refers to the integration of technologies into transportation systems to enhance efficiency, accessibility, and sustainability in cities. It involves various solutions such as sharing mobility, mobility as a service, mobility on demand, and self-driving transport systems. The primary objectives are to reducing pollution and traffic congestion, improving safety, lowering noise pollution, enhancing transfer speed, and decreasing transfer costs.
4. Challenges	
Smart city technology infrastructure (IT/ICT) issues	<ul style="list-style-type: none"> • Digital innovation • Cybersecurity issues • Insufficient financial resources • Lack of awareness among policymakers and citizens.
Cybersecurity: safety and privacy issues	<ul style="list-style-type: none"> • Cloud and data privacy • Cybersecurity management • RFID technology • IoT device vulnerabilities
Lack of funding	<ul style="list-style-type: none"> • Public-Private Partnerships (PPPs) • Economic and political impacts • Projects ROI uncertainty
Lack of knowledge and awareness	<ul style="list-style-type: none"> • Citizen engagement and participation • Digital literacy • Education and training
Stakeholder issues	<ul style="list-style-type: none"> • Lack of connectivity and collaboration • Diverse stakeholder groups • Financing and budgeting
5. Monitoring system	<ul style="list-style-type: none"> • Empowering stakeholder services • Security and privacy management • Use of ICT in cities infrastructure • Better quality of public services
Output	
Smart cities strategy output	Holistic framework that fosters collaboration, innovation, and citizen engagement to enhance the quality of life in smart cities through the effective use of technology and governance mechanisms.

9.3.1. Input

The inputs in the proposed framework represent the drivers for implementing smart city strategies initiatives. These drivers heavily dictate the organisational formulation for successful implementation of the smart city strategies. This level is a feedback loop to aid in the implication of solutions and to, over time, modify the framework by planning, capturing, and using the critical solutions, practices, and lessons learned from past, present, and future projects implemented in smart cities projects (Figure 9-2).

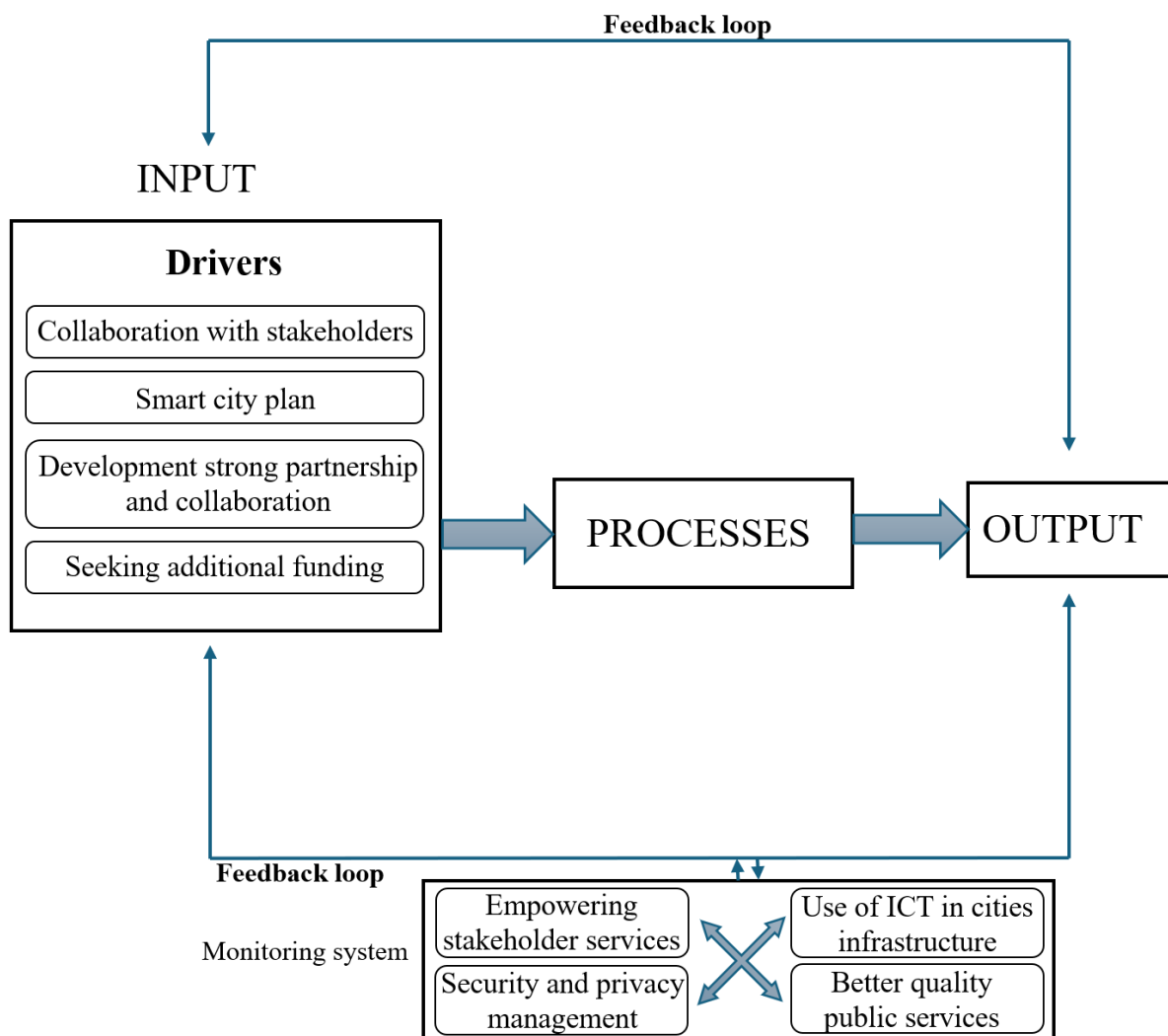


Figure 9-2. Framework: Drivers for the implementation of smart cities

The drivers offered for the implementation of smart cities is divided into four different sections: (1) Collaboration with the private and public sectors and stakeholders with help of the

governments of smart cities; (2) Development involving City planning, Economy and innovation, Environmental management, and E-Government; (3) Strong partnership and collaboration with the private and public sectors; and (4) seeking funding for smart cities projects to create a fully functional smart city for citizens.

In smart cities, collaboration can also lead to improved performance (Appio et al., 2019; Kakderi et al., 2019; Snow et al., 2016) or smarter solutions. It is recognised that it is challenging for one organisation to resolve the problems of citizens alone (Chen et al., 2019). As a smart city environment compiled of several stakeholders is difficult to manage (Angelidou, 2014), understanding the factors that lead to improved collaboration in smart city environments will improve both the smart city narrative and practice by delivering methods to improve implementation (See chapter 8).

9.3.2. Processes

The proposed framework is composed of four components, namely (1) Governance, strategies, and objectives, (2) The guiding perspectives, (3) Government management strategies, (4) The challenges. And (5) Monitoring system. The five main components of the framework's processes are as follows.

9.3.2.1. Level 1

Governance, strategy, and objectives: Governance represents the foundation and backbone of any organisation's activities (Carver, 2001). This determines the organisation's core purpose, core values, and end-objectives. In the case of successful smart city being the end-objective, the inclusion of such objectives should constitute the framing of the governance definition to ensure its success. The strategies represent the blueprints that the organisations need to follow to achieve their goals.

9.3.2.2. Level 2

Level 2 of the framework deals with the four main perspectives related to the concept of smart cities that this research is based on (Figure 9-1). Regarding the importance of managing smart cities by creating collaboration and engagement with citizens, this would be possible along with the effect of information and communication technologies (ICT) which allows governments to optimise its resource usage and eventually create a better city. Furthermore, this analysis of the data identified several emerging themes according to the smart city perspectives. Each of the perspectives individually have an impact on the implementation of

smart city strategies in cities, although this analysis indicates that they can also work closely with each other as well. The perspective in Figure 9-3 gives us a better understanding of the concept behind smart city development to allow us to create a successful framework.

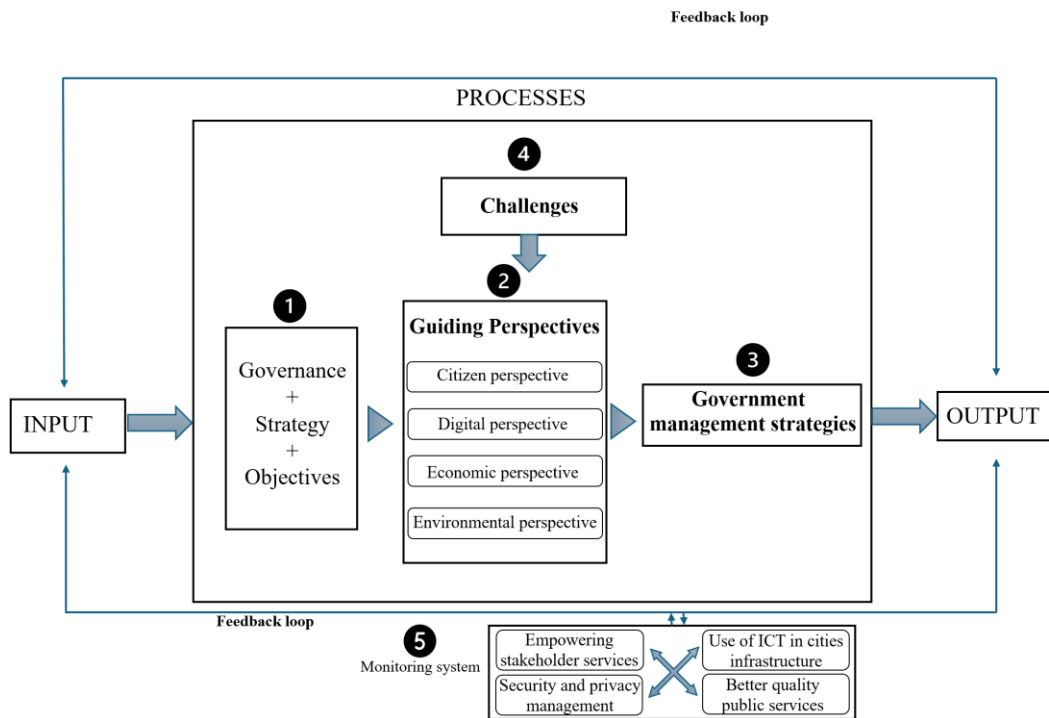


Figure 9-3. Framework: Smart cities perspectives

Each perspective offers important factors as listed below:

Citizen’s perspective: (1) Health, finance, wellbeing, and general needs, (2) governments need to concentrate on their citizens’ needs to maintain their quality of life, (3) reducing the cost of living, and (4) transparency with its citizens and sharing information is one of the most important services that needs to be provided by governments (refer to Chapter 5 section 5.2).

Digital perspective: (1) The use of digital and telecommunication technology, (2) collecting data and making data-driven decisions, (3) technology use to deliver essential public services to residents, (4) more data-driven cities, (5) providing real time information, (6) the use of information and communication technologies (ICT), (7) an intelligent entity providing real time information on aspects of life in the city, and (8) using AI technology (refer to Chapter 5 section 5.4).

Economics perspective: (1) Optimisation of resources (time, effort, and natural resources), (2) services linked by technology, and (3) safer public spaces and the promotion of sustainable practices in general (refer to Chapter 5 section 5.5).

Environmental perspective: (1) Smart city interconnectivity resulting in less energy consumption, (2) using less resources, (3) quick reactions in case of emergencies, (4) lower living expenses, (5) strategies that can help with daily life tasks, and (6) lower energy consumption and less use of resources, resulting in a more efficient and lower city (refer to Chapter 5 section 5.3).

9.3.2.3. Level 3

This level is the most complicated as it contains the important governmental roles. The level is composed of four different drivers as to better understand the processes in the government (Figure 9-4). Drivers of the government of smart cities include (1) Smart government, (2) Smart mobility, (3) Smart environment, and (4) Smart living (See chapter 7).

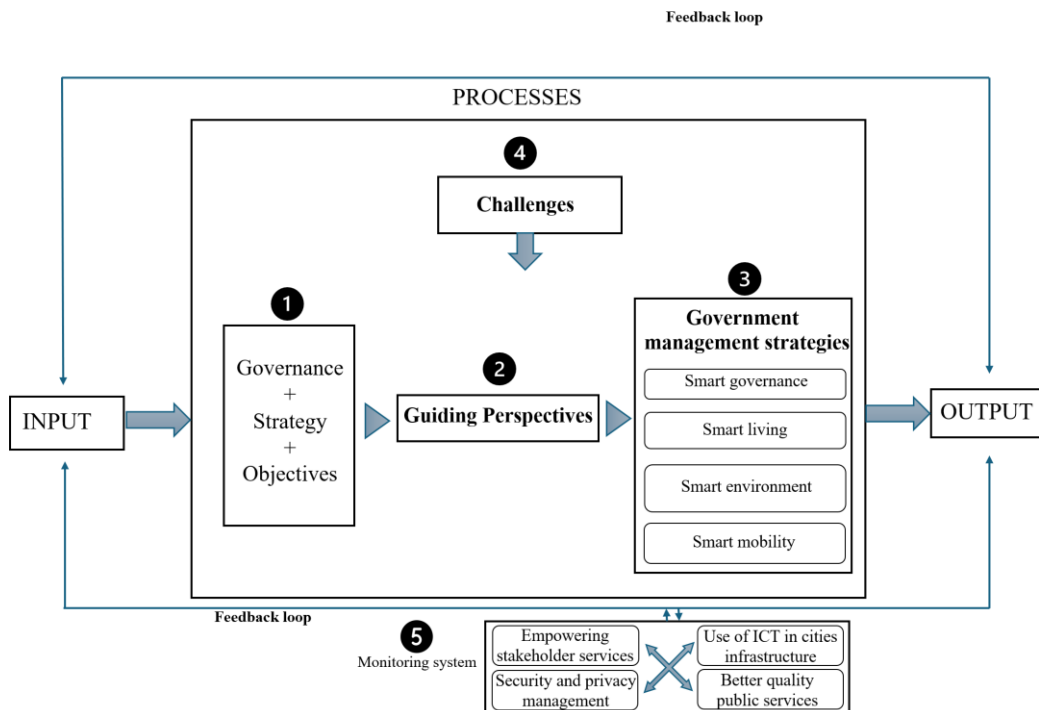


Figure 9-4. Framework: Government role in the smart city development of strategies

Smart cities are believed to be a complex ecosystem, encircled by innovation and creativity, pointed at the growth of a sustainable environment with a better quality of life for its citizens (Capdevila and Zarlenga, 2015). Therefore, governments and authorities are implementing policies and programs to accomplish sustainable development, economic development, and a better quality of life for their citizens (Shen et al., 2018) for them to be happier (Ballas, 2013). The results of the investigation show there to be significant relationships between the constructs. The findings also suggest the identification of strategic factors that can improve the smart city rulers in the development of policies and the activities of the government management that requires people to accomplish sustainable development goals. It is important that the findings promote improving the governance of smart cities to improve people's quality of life.

Governance networks: This refers to stable examples of social relations between commonly dependent actors, which form around public issues and are shaped, maintained, and changed through interactions between the involved actors (Koppenjan and Klijn, 2004; van Meerkerk and Edelenbos, 2014). The government focuses on the expanding operation of councillors in complex governing networks including public and private bodies (Copus, 2015). In these systems, councillors need to devise methodologies to impact and shape the policy decisions taken by individual players (Copus, 2015). The second part of the literature focuses on the role of mixed groups as fundamental segments of the governance structure regulating service ecosystems in cities (Connolly, et al., 2014). There is, additionally, another interesting stream of literature studying the conditions for success in shared governance networks. (See section 7.2.1 in chapter 7 and section 2.5 in chapter 2)

Knowledge that helps to understand networked governance:

- By demonstrating the significance of the councillor's soft power to influence public and private bodies.
- By demonstrating the relevance and state of service ecosystems within the framework of city governance.
- Thoroughly studying shared governance.

Considering the mentioned networks, network success depends on:

- The significance of the formalised coordination processes.
- Formalised principles to build the responsibility of decision-making.
- Well-planned networks.

- Contracting with stakeholders and organisations that are also key to understanding the performance of these networks (Cristofoli et al., 2012).

Shared governance: The requirements for success in shared governance systems makes a distinction among the three forms of network governance: Shared Participant governance, Lead Organisation governance, and a Network Administrative Organisation, following the work of Provan and Kenis (2008).

Against this backdrop, public system management skills may be split into two general classifications: the individuals who sustain the system and the individuals who steer it. Abilities of the former kind are typical of system ‘facilitators’ and ‘mediators’, while those of the latter kind are associated with system leaders (Cristofoli et al., 2014).

Activities consists of choosing the proper players and resources for the system, tapping into the skills, knowledge, and resources of others, picking up trust and building agreement (Agranoff and McGuire, 2001). In the end, re-arranging consists of altering and repositioning the system objectives when imperative changes happen in the system environment (Shortell et al., 2002). Integrating the previous streams of literature into a system governance environment, the components for the coordination of the system partners, and the ability of the network manager to run the network are reliable predictors of network governance performance. Kern and Bulkeley (2009) propose three governance methods available to city structures:

- Information and communication.
- Project funding and coordination.
- Recognition and certification.

Lastly, the difficulties faced by some cities when looking to take on board some of the technological solutions promoted within the network due to their local lack of technical knowledge and the promotion of joint contracting processes for members in need of a similar solution were identified as potential improvements.

9.3.2.4. Level 4

This level represents the challenges identified from existing literature and during the interviews (Figure 9-5). These are: (1) Smart city technology infrastructure issues, (2) Cybersecurity issues, (3) Lack of funding, (4) Lack of knowledge and awareness, and (5) Stakeholder issues. See chapter 6 where more detailed definition and information is provided. This is where

decision-makers assess and analyse the situation and identify the challenges that their organisation is facing and the issues that they must deal with.

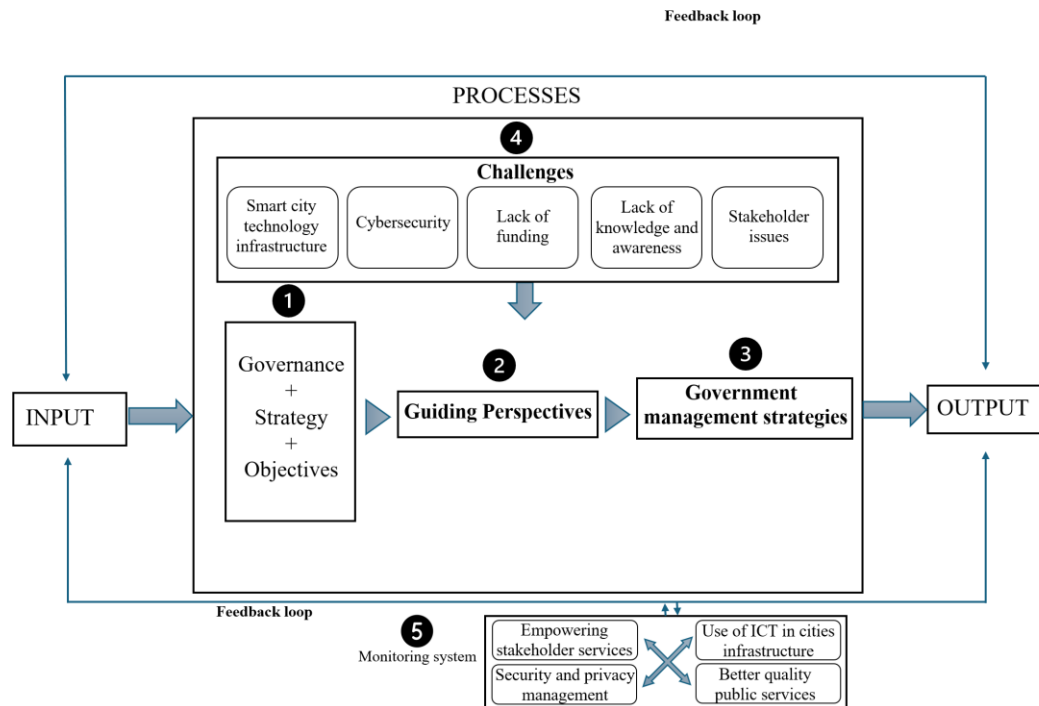


Figure 9-5. Framework: Key smart city policy challenges

Smart cities of all sizes, geographies, and levels of development have significant governance issues. For instance, the failure to designate a framework for cybersecurity or to assess privacy risks when obtaining new technology systems. However, this encourages governments to close these gaps and protect their cities' long-term interests by solving the issue for the time being.

Considering the future challenges faced by smart cities, research into and the analysis of interviews and the literature highlights that in smart cities, privacy and public safety continue to be one of the main concerns that need more legal, systematic, and political considerations. To make this technology as valuable and reliable as possible for citizen adoption, it is important to fight cybercrime in smart cities. This will require a continuous effort and support from all stakeholders including the private sector, governments, legal institutions, network operators, and so on.

The beneficial political impact that good smart city governance produces for the city governments also gets translated into a positive economic impact where, first, smart cities can reduce their costs. Second, they can get funds to create innovative projects.

Overall, the economic impact on the smart cities can be considered according to three different aspects: (1) Cost reduction based on shared knowledge and staff training; (2) Stimulation of the national investment in smart city projects; and (3) Participation in funded projects.

9.3.2.5. Level 5

Monitoring system:

A comprehensive monitoring system (included in the Figure 9-1) serves as a vital reminder for framework users involved in smart city projects. By continuously emphasising these four crucial aspects: (1) Empowering stakeholder services, (2) Security and privacy management, (3) Use of ICT in cities infrastructure, (4) Better quality of public services, essential for successful implementation of smart city strategy, throughout the project's lifecycle.

9.3.3. Output

The key elements of the framework for managing smart cities (Figure 9-6), represents the key elements that provide the pressure for change regarding the ways that the governments of smart cities collaborate and engage with businesses and citizens. The development of a new framework is crucial when improving the quality of life of citizens by developing a framework of collaboration for smart cities. Businesses, smart city governance, and every citizen all work together in various ways to confront the problem of smart cities. With the goal of learning at the centre, a framework is offered to demonstrate the relationships necessary for improvement.

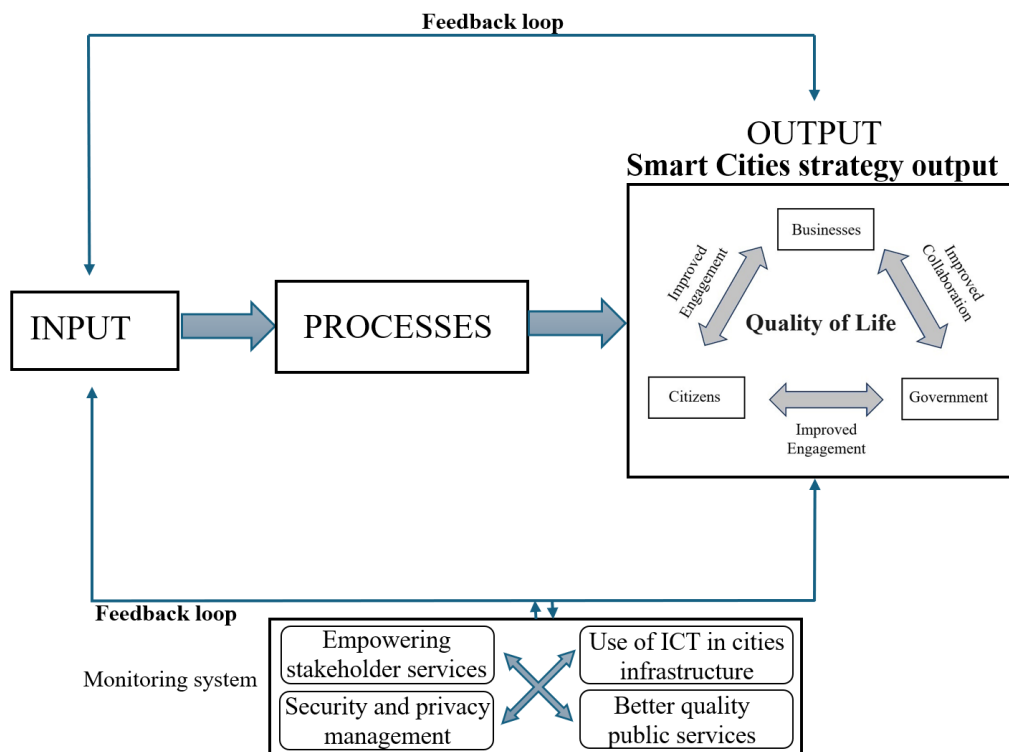


Figure 9-6. Framework: Managing smart cities and quality of life

As mentioned by El Hilali and Azougagh (2021), the connection between technology, citizens, and the collaboration between them leads to smart city success. The framework demonstrated above shows the importance of the engagement of citizens and the private sector and their collaboration with the government to implement a successful smart city.

Quality of life is at the centre of the output section of the framework in Figure 9-6. This is not to suggest that quality of life occurs abstractly, independent from the actors or processes. Rather, it is located centrally to show the outer influences on the process. The arrows indicate the two-way responsive effects of the process. The analysis of the first research question clearly indicates that CEOs and business owners (interviewees) are influenced by said process. Crucially, removing any actors of the framework will negatively affect the potential for reaching a good quality of life. The outcomes of this section suggest that the use of technology by citizens and eventually effective citizen engagement are both interlinked and dependent on effective interactions between all three of the actors involved. (See chapter 5 section 5.6)

9.4. Evaluation of the integrated framework

9.4.1. Introduction

The evaluation of the established framework utilised a qualitative approach through interviews conducted with experts involved in smart city projects. An evaluation is defined as provided by VAM (2006), “confirmation, through examination and the presentation of objective evidence, that the specified requirements for a particular intended use have been met”. Corbin and Strauss (2008) have stated that a framework evaluation is usually used within research studies as a tool to evaluate the quality of the research findings following a grounded theory. Additionally, the evaluation process attempts to ensure that the developed framework’s characteristics represent the general population and that it is not limited to the sample used for the initial data collection (Good and Hardin, 2003). The evaluation process in this study, was conducted by interviewing five professionals from the smart city sector. The professionals had a minimum of six years’ experience within the smart city sector. The classification of the interviewees is shown in Table 9-3.

Table 9-3: Classification of the interviewees for framework evaluation

INTERVIEW NO.	PARTICIPANT	ROLE	EXPERIENCE
1	E1	Director	>20
2	E2	CEO and Founder	>11
3	E3	Project Manager	>6
4	E4	Chief executive officer	>6
5	E5	CEO	>6

9.4.2 Responses

The framework was evaluated through the interviews conducted with professionals through Microsoft Teams and face to face meetings. The evaluation protocol (available in Appendix B) contains the interview questions that enabled the participants to comment on the proposed framework. A total of six questions were developed to assess the framework’s flow of information, usefulness, and understanding in addition to a question allowing for the addition

of any comments or suggestions from the interviewees, each interview lasted between ten to fifteen minutes. The majority of the interviewees praised the framework’s high level of comprehensiveness in relation to implementation of smart city strategies and the associated challenges within the smart city governance. There was a consensus amongst the interviewees regarding the usefulness of the framework within their organisations.

As interviewee E1 expresses:

“I believe the proposed framework demonstrates a comprehensive approach, covering various aspects crucial for enhancing the quality of life in smart cities, such as infrastructure, collaboration, and digital connectivity.”

They highlighted the framework’s ability to assist organisations in identifying related smart city challenges, mostly how it sheds the light on successful implementation factors and the challenges that the sector faces.

The five participants were asked the same questions, and the responses were tabulated in Table 9-4. All agreed on the usefulness and understanding of the framework. However, 20% of the participants identified the necessity for a clearer legend to enhance comprehension of the framework's flow.

As participant E5 recommended:

“In terms of areas for improvement, I suggest integrating a legend into the framework. It's crucial for improving the understanding of how the framework flows.”

Table 9-4. Evaluation questions responses

Questions	Good	Need for improvement
1. What is your opinion on the level of completeness in terms of the overall contents of the proposed framework?	5	0
2. What is your opinion on the level of completeness in terms of the logic (flow, sequence within the framework and how it mirrors what should be done) used within the proposed framework?	5	0
3. What is your opinion on the issues covered within the developed strategic framework?	5	0

4. What is your opinion on the level of understanding of the proposed framework?	5	0
5. Do you have further comments/suggestions regarding any areas that need to be improved/included/deleted within the proposed framework?	4	1
6. Would you recommend the framework for use in smart cities implementation? For the public or private sector?	5	0

The recommendations were reviewed, and a legend for better flow and understanding of the framework was created and incorporated into the framework.

This section focuses on assessing a framework designed for implementing smart city strategies through qualitative interviews with industry experts. Drawing on established definitions of evaluation, the study aims to confirm whether the framework meets the need of public and private sector in smart city projects. Interviews were conducted with professionals having at least six years of experience in the smart city sector. The evaluation process utilised a set of six questions to gauge the framework's comprehensiveness, usefulness, and clarity.

Interview responses revealed positive feedback on the framework's comprehensiveness and its ability to address key aspects of smart city implementation and governance challenges.

Overall, the evaluation underscores the framework's effectiveness in aiding organisations in identifying smart city challenges and facilitating successful implementation. The proposed framework is the culmination of not just the evaluation of the literature but of the evaluation of interviews of critical stakeholders in the smart city sector.

9.5. Summary

This chapter addressed the fifth and sixth research objectives:

“To develop a strategic smart city governance framework.”

And

“To evaluate the strategic smart city governance framework.”

This chapter proposed an integrated framework for implementing smart city strategies within the United Kingdom. It begins by discussing theoretical perspective guiding the development of the framework. The framework encompasses various perspectives such as citizen, environmental, economic, and digital, aiming to address the challenges faced by governments in improving citizens' quality of life.

The framework is structured into several levels: Inputs, Processes, and Outputs. Inputs focus on drivers for implementing smart city strategies, Processes detail governance, strategies, and objectives, Guiding perspectives, Government management strategies, and Challenges. Outputs highlight key elements necessary for smart city management, emphasising collaboration between governments, businesses, and citizens to enhance quality of life.

The strategic framework is developed based on a systematic approach, incorporating insights from literature reviews and interviews with industry experts. The framework then was evaluated through interviews with professionals in the smart city sector, with positive feedback indicating its comprehensiveness and usefulness in addressing smart city challenges.

Overall, the framework provides a structured approach for governments and stakeholders to navigate the complexities of implementing smart city strategies, ultimately aiming to improve citizens' quality of life.

Chapter 10. Conclusions and recommendations

10.1. Introduction

This chapter describes the research aim and objectives. To do so, the research process is described, and the conclusions and recommendations are presented.

10.2. Research process

Table 10-1. Research Process

Aim	The aim of this research is to develop a strategic framework for implementing smart city strategies in the United Kingdom to improve the quality of life for its citizens.
Research Objectives	<ol style="list-style-type: none">1. To explore the concept of smart cities.2. To explore the policy development and challenges in the context of smart cities.3. To investigate and analyse the government role in smart cities development.4. To explore the key drivers for implementing smart cities projects.5. To develop a strategic smart city governance framework.6. To evaluate the strategic smart city governance framework.
Research Questions	<ol style="list-style-type: none">1. What are the smart cities' perspectives?2. What are the key policy challenges when developing smart cities?3. What role does the government play when developing smart cities?

	4. What solutions can be followed or implemented to guarantee the successful implementation of smart cities' projects?
Research	Qualitative research
Ideology	Pragmatism
Approach to enquiry	Qualitative
Qualitative research design	Grounded theory
The main purpose of the investigation	Exploratory research due to the complexity of the smart cities' issues and the lack of comparable research in the field.
Sample technique	Snowball sampling
Sample size	25
Sample diversity	Directors, CEOs, Managers
Data collection method	Semi-structured interviews
Unit of analysis	City
Embedded unit of analysis	Individual employees
Method of analysis	Thematic analysis
Outcome of analysis	Framework

10.3. Conclusion

10.3.1. Key Findings

Objective 1: *“To explore the concept of smart cities.”*

Research Question 1: *“What are the smart cities' perspectives?”*

Several key findings have developed from the analysis of this research question. More data-driven cities and the use of technology are required for cities along with interconnectivity, resulting in less energy loss and less use of resources. Overall, the effects that come from improvements in quality of life along with the effect of information and communication technologies (ICT) allow governments to optimise their resource usage and eventually create a better city for their citizens. In addition, this analysis of the data identified from the interviews has made clear several emerging themes from the smart city perspectives, namely, Citizen,

Environmental, Digital and Economic perspectives. Each of the perspectives individually have an impact on the implementation of smart city strategies in cities, although this analysis indicates that they also can work closely with each other as well.

Objective 2: *“To explore the policy development and challenges in the context of smart cities.”*

Research Question 2: *“What are the key policy challenges when developing smart cities?”*

This study has revealed that to promote cities that provide a core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and the application of 'Smart' Solutions is needed.

According to the literature and findings from interviews, other important issues that are impacting the growth of smart cities include (1) knowledge and awareness, (2) stakeholder issues and, most importantly, (3) lack of funding. Based on the thematic analysis of the second research question, five main future key themes were identified.

- Digital innovation, the digital transformation of local public services, open data and data sharing, city performance, and city growth.
- Cybersecurity (privacy and security issues).
- Insufficient financial resources for the implementation and to meet stakeholder issues.
- Lack of awareness among policymakers and citizens.
- The smart city infrastructure must be responsive and flexible.

Regarding the cybersecurity issues, the challenges found in the literature have provided a generalised view of the security and privacy challenges in smart cities by grouping all challenges into (1) Digital government, (2) Data privacy, (3) Smart city data management, and (4) Cloud Security. The interviews provided a more detailed and focused categorisation of the challenges faced in their businesses.

The study of the participant interviews provided six challenges: (1) Health and the privacy of patient data, (2) Financing, (3) Data Security and Data Privacy, (4) Artificial intelligence threats, (5) Big Data collection issues, and (6) Making smart networks. Most of these challenges must be addressed by the governments of the smart cities. Others like the artificial intelligence challenges are for the academic sector to conquer. (See section 6.3. in chapter 6)

Objective 3: *“To investigate and analyse the government role in smart cities development.”*

Research Question 3: *“What role does the government play when developing smart cities?”*

This research found there to be four main key roles for government to take on to implement the smart city initiative.

From the literature review and interviews, four key responsibilities were found. In order of most important to least, these are: (1) Smart governance, (2) Smart mobility, (3) Smart environment using e-government, and (4) Smart Living to improve quality of life for citizens. Through the analysis, the factors from both the literature and the interviews were brought together to form a unified framework of six drivers that were identified, which are:

- Source of capital for the financing of smart cities.
- Comprehensive strategic plan to capitalise on the project’s strong points.
- Smart governance framework.
- Environmental monitoring pressure from governments on businesses.
- Smart governance as a combination of Information and Communication Technologies (ICT) in the core governmental processes to achieve governability.
- Transparency of the government.

Objective 4: *“To explore the key drivers for implementing smart cities projects.”*

Research Question 4: *“What solutions can be followed or implemented to guarantee the successful implementation of smart cities’ projects?”*

The critical success of the drivers involved in the implementation of smart cities were mostly based on the interviews as organisations still struggle to find a sustainable solution to implement fully successful smart cities. This has made it near impossible to identify them in the literature. From the participant's interview analysis, the following critical success factors were identified: (1) Collaboration with stakeholders, (2) Smart city plan, (3) Developing strong partnerships and collaboration, and (4) Seeking additional funding.

Objective 5 and 6: “To develop a strategic smart city governance framework.”

and

“To evaluate the strategic smart city governance framework.”

A systematic framework was developed and evaluated. Based on the data collected and the finding from the existing literature.

The development of a new framework is crucial to improve the quality of life of citizens by developing a framework of collaboration for smart cities, where businesses, smart city governance, and all citizens work together in various ways to confront the problems of smart cities. With the goal of learning at the centre, a framework is offered to demonstrate the relationships necessary for improvement.

In relation to the research findings, the aspects that represented smart governance - Transparency, Collaboration, Participation and Partnership, Communication, and Accountability - and its influence on quality of life were observed according to the concepts described in Table 10-2.

Table 10-2: Governmental role in the successful implementation of smart cities

Driver	Definition
Transparency	Transparency is a tool of citizen empowerment, improves the battle against fraud, and represents the responsibility of public management with the propagation of accountability and decision-making (Schware and Deane, 2003, Chourabi et al., 2012, Harrison et al., 2012).
Collaboration	It represents the collaboration of citizens in the quest for solutions to the challenges of the city, constant action, and active participation with the government. Debating with citizens and due to the challenges of

	cities, the government have a tendency to take more successful actions (Chourabi et al., 2012, Harrison et al., 2012).
Participation and Partnership	The government can create partnerships with the private sector, educational organisations, communities and all public administration stakeholders. The partnerships with learning institutions, investing in technologies by doing so, creates skills for their use in the management of smart cities. Together with the private sector, collaboration for the implementation of new technologies can improve the economy. Non-profit and socially-funded organisations benefit from this participation and partnership which can encourage social and technological developments (Odendaal, 2003, Giffinger et al., 2010, Chourabi et al., 2012, Harrison et al., 2012).
Communication	Communication between the government and its citizens has a tendency to create more transparency in decision-making. It is important to emphasise the importance of technologies that connect the government and citizens so then communication is efficient (Chourabi et al., 2012).
Accountability	Accountability relates directly to the commitment of rulers to the management of funds and public assets. For this reason, the government does not use political administration to escape its responsibilities and obtain benefits. Hence, it is up to the

	<p>government to encourage anti-corruption measures and to ensure a smooth shift at the end of the elective directives so then continuity can arise in projects in developments (Johnston and Hansen, 2011, Chourabi et al., 2012).</p>
<p>Quality of Life</p>	<p>Quality of Life in the framework of smart cities is directly linked to government activities to encourage interactions between public and private entities with the goal of promoting sustainable development. Governors use technological innovations to offer services and products to citizens, which influence their quality of life. Government management can offer health, education, and security services more transparently and efficiently across the collaborative work of the government and citizens (Chourabi et al., 2012, Harrison et al., 2012).</p>

Regarding the smart city concept, its different perspectives, and the key factors to achieve quality of life in smart cities, several key findings developed from the analysis of the research question. First, more data-driven cities are needed with the use of technology as an intelligent entity providing real time information for the people. Second, there is evidence indicating a growth service linked to technology, leading the cities to provide better administration and safer public spaces while promoting sustainable practices in general. Third, all utilities being interconnected resulting in less energy consumption, less resources being required, more efficiency, fewer crimes, quicker reactions in case of emergencies and it being less costly to live. Finally, a preliminary investigation of several direct measures of quality of life indicate that the effect of information and communication technologies (ICT) allows governments to optimise their resource usage and eventually create a better city for their citizens.

10.4. Recommendations

- Being supportive of people's needs and requirements (health, finance, happiness, technology, wellbeing, personal development).
- To mainly concentrate on the needs of citizens and the requirement to improve quality of life and reduce costs.
- Sharing information with citizens to improve the quality of the government services within the city.
- A smart city/factory is a place where the traditional methods used by services and manufacturing are made more efficient through the use of digital and telecommunication technologies for the benefit of businesses/organisations.
- A smart city is a learning city. It means that smart cities learn through data, make data-driven decisions, and continually iterate to improve.
- Leveraging the power of technology to more equitably deliver essential public services to residents.
- More data-driven cities; the use of technology as an intelligent entity providing real time information for people.
- The use of smart devices capable of capturing and transmitting data which is then analysed in order to obtain information and make decisions (automated connections between smart devices).
- The use of digital and telecommunication technologies and the use of information and communication technologies (ICT) which allows governments to optimise their resource usage.
- An intelligent entity providing real time information on aspects of life in the city for the public to improve their quality of life.
- Using automated connections with everyone about everyday activities such as smart traffic lights, automatic parking and monitoring air pollutants.
- A smarter way of delivering and receiving sales orders.
- By using technology, smart cities can gather data that is intended to improve the planning and development of smart cities, potentially improving people's lives.
- Optimisation of resources (time, effort, and natural resources).
- Services linked by technology, leading the cities to provide better administration, safer public spaces, and the promotion of sustainable practices in general.

- Smart cities mean that all utilities are interconnected, resulting in less energy consumption, less resources required, more efficiency, less crimes, quicker reactions in case of emergencies, and it being less costly to live.
- A sustainable city that issues strategies to solve daily life tasks in a more environmentally-friendly way.
- Energy consumption and less use of resources, resulting in a more efficient city that is cost efficient.

10.4.1. Recommendations for the government

- **Smart Environment:** Providing worldwide accessibility; the availability of safe transport systems; traffic and parking systems; accessibility of bicycles and footpaths.
- **Smart Economy:** Implementation of ICT in businesses; design strategies for economic growth; promote creativity; provide support for citizens; develop business collaborations; provision of tax payment systems.
- **Smart Governance:** Promotion of online public services; encouragement of e-government strategies; provision of transparent governance; encouragement of citizen participation.
- **Smart Living:** Promotion of electronic health policies; provision of emergency response facilities; guarantee safety and better housing; provision of a 24/7 electric supply; provision of a 24/7 water supply; provision of metering and online payments.
- **Smart People:** Strategies for digital development; collaborations between knowledge centres; planning for future research developments and innovations.
- **Smart Mobility:** Pollution reduction innovations, provision of environmental security, provision of early warning systems.

10.4.1.1. Policy Recommendations

- The governments of smart cities need to stop wasting a lot of time and instead leverage the existing planning resources for the implementation of smart cities.
- Start to educate citizens and the private sector about smart cities.
- Strategically engage with digital leading businesses and adopt innovative technologies.
- Regarding finance and cyber security, trying to shift the mindset of cyber security so then it is a cost centred on cyber security as an investment.

10.4.2. Recommendations for the private and public sector

- Smart city ecosystems help stakeholders collaborate and grow.
- A smart strategy helps a city to successfully execute its projects.
- The government role affects the formation of partnerships.
- The government's role affects the execution of a smart strategy.
- PPPs help smart cities implement its strategy successfully.

10.4.3. Recommendations for security and privacy

Organisational security

- Recovery and back-up plan development.
- Data security management (passwords and 2-step verification).
- Public feedback meetings.
- Define the standards, tools, safety systems, and rules for the city.
- Develop policies concerning safety configurations.

Technological security

- Provide physical security for network and servers.
- Use a reliable connection such as a VPN (encrypted access).
- Secure any wireless network.
- Use a centralised system for verification and authorisation.
- Deploy a firewall at every connection point.
- Use strong authentication methods such as biometrics and smart cards.

Client/Citizens security

- Comprehensive training course for developers and administrators.
- Inform and increase the knowledge and awareness of safety issues.
- Alert and advise users where there are threats.
- Implant continuity plans and disaster recovery.

Legal security

- Respect the legal aspects of security.
- Use the safety standards and follow-up suggestions of national cybersecurity organisations and actors in IT security.
- Good practices of ICT use.
- Performance standards.

10.5. Future work

- Evaluation of the implementation of smart city strategies within the United Kingdom.
- Drivers of the implementation of smart city projects in developing countries.
- Benefits of the implementation of governance strategies in smart cities within the developing countries.
- Financial framework development for smart cities governance.
- Evaluation of the privacy and security methods used in the management of smart cities.

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Appendix.

Appendix A: Protocol for semi-structured interviews

Taking into account the literature findings and the research framework, a series of interview questions was developed to address the main research questions. The goal is to identify and highlight the crucial factors that help with the development of smart governance strategies. The literature is the source of the questions. The defined questions are for the outlining of the participants and the identification of their thoughts around the smart city strategy factors to follow. The interview questions also contain the participants' profiling data which required the participants to answer, in a state of non-anonymity, more complex questions on their organisations' strategy and professional information (organisation type, organisation sector, role category, job description, and industry type).

This research concludes that although there are considerable smart city dossiers in the literature, their governance framework and structural variations and development across different regions is lacking. Therefore, future work will focus on collecting data from smart cities projects and organisations through semi-structured interviews and questionnaires within the United Kingdom, as well as engage in a more in-depth exploration of governance issues and the challenges of smart cities.

The following objectives have been identified.

1. To explore the concept of smart cities.
2. To explore the policy development and challenges in the context of smart cities.
3. To investigate and analyse the government role in smart cities development.
4. To explore the key drivers for implementing smart cities projects.
5. To develop a strategic smart city governance framework.
6. To evaluate the strategic smart city governance framework.

The below interview questions were designed to tackle the aims and objectives of the research.

1. What are the smart cities' perspectives?
2. What are the key policy challenges when developing smart cities?

3. What role does the government play when developing smart cities?
4. What solutions can be followed or implemented to guarantee the successful implementation of smart cities' projects?



INVESTIGATION OF 'SMART CITIES' STRATEGIES

Sina Keshvardoost Doctorate student at University of Wolverhampton
Email(s):

Information Sheet

Aims and the objectives of the research:
Researcher: Sina Keshvardoost
Title of the project: Investigation of 'Smart Cities' strategies

The Smart Cities Mission is an innovative and new initiative by the governments to drive economic growth and improve the quality of life of people by enabling local development and utilizing technology as a means to create smart outcomes for citizens.

The main purpose of research is to explore how smart governance and smart strategy developments are the key factors when considering the successful implementation of smart cities strategies. Smart cities create an extensive variety of issues and challenges that often poorly organised to deal with by their respective governments as they grow in size and complexity.

Therefore, the objective is to promote cities that provide core infrastructure on the basis of smart governance and sustainable development to improve the quality of life.

This research explores through a systematic review of the key challenges and issues that governance of smart cities is facing on this network performance by focusing on the governance models, with a particular interest on how these can contribute to successful smart city governance framework.

This research concludes that although there are considerable smart city dossiers in literature, their governance model and structural variations development across regions is lacking. Therefore, Future work will focus on collecting data from smart cities projects and organisations through semi-structures interviews and questionnaires within the United Kingdom and more in-depth exploration of governance issues and challenges of smart cities.

The following objectives have been identified.

1. To explore the concept of smart cities.
2. To explore the policy development and challenges in the context of smart cities.
3. To investigate and analyse the government role in smart cities development.
4. To explore the key drivers for implementing smart cities projects.
5. To develop a strategic smart city governance framework.
6. To evaluate the strategic smart city governance framework.

Figure 1. Research interview information and objective sheet

INVESTIGATION OF 'SMART CITIES' STRATEGIES

A: Organization and Background Information

1. Date
2. Participant Name :
3. Organization Sector:
4. Organization Type:
5. Email:

B: Detailed questions on smart cities

6. In your view what does smart cities mean to you and your organisation?
7. Given your role in this organisation, please explain to what extent are you familiar with smart cities?
8. Give your job roles and responsibility
9. What are the key policy challenges to innovate smart cities?
10. What role does government play in developing smart cities?
11. What are the challenges your organisation is facing from governance point of view?
12. What solutions could be followed or implemented to guarantee the successful implementation of smart cities projects?
13. From your experience is there a need for developing and evaluating a framework/guidance document for the Governance frameworks for smart cities?

Consent form

INVESTIGATION OF 'SMART CITIES' STRATEGIES

Consent Statement

- I agree to participate in the above research project and give my consent freely.
- I understand that the project will be conducted as described in the "Information Sheet", a copy of which I have retained.
- I understand that I can withdraw from the project at any time and do not have to give a reason for withdrawing.
- I consent to participate in an interview with the researcher.
- I understand that my personal information will remain confidential to the researcher.
- I understand that my organization will not be identified either directly or indirectly.
- I have had the opportunity to have questions answered to my satisfaction.

Figure 2. Research interview question sheet

Appendix B: Framework evaluation protocol

Information sheet/ Introduction to the interview

Aims and the objectives of the research:

Researcher: Sina Keshvardoost

Title of the project: Investigation of the Smart Cities strategies within the United Kingdom

The Smart Cities Mission is an innovative and new initiative by the governments to drive economic growth and improve the quality of life of people by enabling local development and utilising technology as a means to create smart outcomes for citizens.

This research concludes that although there are considerable smart city dossiers in literature, their fundamental governance framework development across regions is lacking. Therefore, the aim of this research is to develop a strategic framework for implementing smart city strategies in the United Kingdom to improve the quality of life for its citizens.

This evaluation interview aims to refine and evaluate the proposed framework in terms of clarity, information flow and contents in terms of generic and detailed components. The proposed framework is a part of doctoral research study that required to develop a strategic framework for implementing smart city strategies. The proposed framework is based on the findings of literature review and 25 semi-structured interviews.

This interview gathers your responses which will help the researcher to evaluate the framework that will subsequently be applied for the effective implementation of smart cities. This cannot be successfully developed without your participation; therefore, you are invited to participate in the interview. This interview is estimated to take about 15 minutes.

In order to protect your confidentiality, privacy, dignity and anonymity, your answers will be attached with a unique participant number that will only be understood and accessed by the researcher. This will be stored in a password-protected computer that only the researcher has access to. Lastly, any data provided by you will be destroyed once the degree is achieved. The project has ethical approval for the study protocol from the University of Wolverhampton, which provides further assurance.

Research aims and objectives.

The aim of this research is to develop a strategic framework for implementing smart city strategies in the United Kingdom to improve the quality of life for its citizens.

To achieve this aim, the following objectives were developed.

Research objectives:

1. To explore the concept of smart cities.
2. To explore the policy development and challenges in the context of smart cities.
3. To investigate and analyse the government role in smart cities development.
4. To explore the key drivers for implementing smart cities projects.
5. To develop a strategic smart city governance framework.
6. To evaluate the strategic smart city governance framework.

Research questions:

1. What are the smart cities' perspectives?
2. What are the key policy challenges when developing smart cities?
3. What role does the government play when developing smart cities?
4. What solutions can be followed or implemented to guarantee the successful implementation of smart cities' projects?

Framework evaluation interviews consent form

Consent Statement

- I agree to participate in the above research project and give my consent freely.
- I understand that the project will be conducted as described in the "Information sheet", a copy of which I have retained.
- I understand that I can withdraw from the project at any time and do not have to give a reason for withdrawing.
- I consent to participate in an interview with the researcher.
- I understand that my personal information will remain confidential to the researcher.
- I understand that my organization will not be identified either directly or indirectly.

- I have had the opportunity to have questions answered to my satisfaction.

Print Name: _____

Signature: _____ Date: _____

Evaluation of the integrated framework

Questions	Responses
1. What is your opinion on the level of completeness in terms of the overall contents of the proposed framework?	
2. What is your opinion on the level of completeness in terms of the logic (flow, sequence within the framework and how it mirrors what should be done) used within the proposed framework?	
3. What is your opinion on the issues covered within the developed strategic framework?	
4. What is your opinion on the level of understanding of the proposed framework?	
5. Do you have further comments/suggestions regarding any areas that need to be improved/included/deleted within the proposed framework?	
6. Would you recommend the framework for use in smart cities implementation? For the public or private sector?	