REPUBLIC OF TÜRKİYE
YILDIZ TECHNICAL UNIVERSITY
GRADUATE SCHOOL OF SCIENCE AND ENGINEERING

VALUE-BASED URBAN DATA GOVERNANCE: THE STRATEGIC ROLE OF URBAN OBSERVATORIES

Eda GÖRÜN

MASTER OF SCIENCE

Department of Applied Urban Science and Urban Innovation

Program of Applied Urban Science and Urban Innovation

Supervisor

Assoc. Prof. Dr. Erhan KURTARIR

July, 2025

REPUBLIC OF TÜRKİYE

YILDIZ TECHNICAL UNIVERSITY

GRADUATE SCHOOL OF SCIENCE AND ENGINEERING

VALUE-BASED URBAN DATA GOVERNANCE: THE STRATEGIC ROLE OF URBAN OBSERVATORIES

A thesis submitted by Eda GÖRÜN in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE** is approved by the committee on 23.07.2025 in Department of Applied Urban Science and Urban Innovation Program of Applied Urban Science and Urban Innovation (English).

Assoc. Prof. Dr. Erhan KURTARIR
Yildiz Technical University
Supervisor

Approved By the Examining Committee

Assoc. Prof. Dr. Erhan KURTARIR, Supervisor
Yildiz Technical University _____

Assist. Prof. Dr. Deniz ERDEM OKUMUŞ, Member
Yildiz Technical University _____

Assoc. Prof. Dr. Melis OĞUZ ÇEVİK, Member
Gebze Technical University _____

I hereby declare that I have obtained the required legal permissions during data collection and exploitation procedures, that I have made the in-text citations and cited the references properly, that I haven't falsified and/or fabricated research data and results of the study and that I have abided by the principles of the scientific research and ethics during my Thesis Study under the title of "Value-Based Urban Data Governance: The Strategic Role of Urban Observatories'' supervised by my supervisor, Assoc. Prof. Dr. Erhan KURTARIR. In the case of a discovery of false statement, I am to acknowledge any legal consequence.

Eda GÖRÜN

Signature

Dedicated to all the young people of Türkiye,

who still look to tomorrow with hope in their hearts

and choose to belong to the whole with peace and kindness

ACKNOWLEDGEMENTS

I would like to express my gratitude to my thesis advisor Assoc. Prof. Dr. Erhan KURTARIR, who provided continuous academic guidance throughout my academic journey. I am deeply thankful for the space he created where I could freely share my ideas and for being a companion to my curiosity and enthusiasm for research. I would also like to thank all my professors in the Applied Urban Science and Urban Innovation Program who inspired me not only with their knowledge but also with their perspectives during my master's education.

I would like to thank my dear family, Birol GÖRÜN, Nurten GÖRÜN and Deniz GÖRÜN, who have given me all kinds of support since I can remember, who have always been behind my decisions, who have encouraged me to be a kind, selfless and good person, for their labor, love and understanding.

I would like to thank Serhad Utku KARA, who has never withheld his love and support throughout my academic journey, who made me believe in a bright future when I was hopeless. Finally, I extend my deepest thanks to all my dear friends, with whom I have tried to make sense of life together and whose presence and colors have nourished me along the way.

Eda GÖRÜN

TABLE OF CONTENTS

LIST OF ABBREVIATIONS vii
LIST OF FIGURES ix
LIST OF TABLES x
ABSTRACT xi
ÖZET xiii
1 INTRODUCTION 1
1.1 Problem Definition & Aim of the Thesis 1
1.2 Research Questions 2
1.3 Structure of the Thesis 3
2 THE ROLE OF DATA IN URBAN STUDIES 7
2.1 Definition of Data 7
2.2 The Evolution of Data-Driven Planning 10
2.3 The Power of Data and Urban Data Politics 17
3 VALUE-BASED URBAN DATA MANAGEMENT APPROACH 23
3.1 Urban Data Management, Governance and Strategy 23
3.2 Global Standards and Initiatives on Urban Data Management 26
3.2.1 Indicator Standards for Smart Cities 27
3.2.2 Spatial and Geographic Data Standards 29
3.2.3 Open Data Principles and Initiatives 32
3.2.4 Legislation and Data Governance Framework 35
3.3 Urban Observatory as a Comprehensive Approach 38
3.3.1 Origins 39
3.3.2 Definition 40
3.3.3 Principles 41
4 COMPARATIVE ANALYSIS OF URBAN OBSERVATORIES 45
4.1 Real-time Urban Intelligence Platform: Newcastle Urban Observatory 48
4.2 Place-based Co-production Network: Mistra Urban Futures 51
4.3 University-Government Knowledge Partnership: Gauteng City-Region Observatory 54

4.4 Government-led Monitoring Platform: Qassim Local Urban Observatory.. 58
4.5 User-centric Urban Data Platform: Australian Urban Observatory 60
4.6 Comparative Analysis: Insights from Urban Observatories..... 63
4.6.1 Institutional Structure and Thematic Focus as Foundational Aspects 68
4.6.2 Data Governance and Indicator Strategies as Technical Backbone.... 69
4.6.3 Stakeholder Engagement and Policy Impact as Societal Value..... 72
5 CONCLUSION **75**
5.1 Strategic Assessment of the Urban Observatory Model: SWOT Analysis .. 77
5.2 Gap Analysis and Potential Contributions in Türkiye..... 79
5.3 Further Research..... 86
REFERENCES **88**
A SEMI-STRUCTURED INTERVIEW GUIDE **98**
PUBLICATIONS FROM THE THESIS **99**

LIST OF ABBREVIATIONS

ANPR	Automated Number-Plate Recognition
API	Application Programming Interface
AUO	Australian Urban Observatory
AURIN	Australian Urban Research Infrastructure Network
CCTV	Close Circuit Television
CSV	Comma Separated Values
DGGIS	Directorate General of Geographic Information Systems
DIKW	Data-Information-Knowledge-Wisdom
DPIA	Data Protection Impact Assessment
DTO	Digital Transformation Office
EU	European Union
GCIF	Global City Indicators Facility
GCRO	Gauteng City-Region Observatory
GDPR	General Data Protection Regulation
GIS	Geographic Information Systems
GPS	Global Positioning System
GUO	Global Urban Observatory
IBM	International Business Machines
ICT	Information and Communication Technologies
IMM	Istanbul Metropolitan Municipality
INSPIRE	Infrastructure for Spatial Information in the European Community
IoT	Internet of Things
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JSON	JavaScript Object Notation
KPI	Key Performance Indicators

PDPA	Personal Data Protection Authority
PDPL	Personal Data Protection Law (KVKK)
LIP	Local Interaction Platform
Mistra	Swedish Foundation for Strategic Environmental Research
MEUCC	Ministry of Environment, Urbanization and Climate Change
NHMRC	National Health and Medical Research Council
NGO	Non-governmental Organisation
NUO	Newcastle Urban Observatory
OGC	The Open Geospatial Consortium
OGP	Open Government Partnership
QUO	Qassim Urban Observatory
PhD	Philosophiae Doctor
SDG	Sustainable Development Goals
SWOT	Strengths, Weaknesses, Opportunities and Threats
Sida	Swedish International Development Cooperation Agency
TNGIS	Turkish National Geographic Information System (TUCBS)
U4SSC	United for Smart Sustainable Cities
UJ	University of Johannesburg
UK	United Kingdom
ULASAV	National Smart City Open Data Platform
UN	United Nations
UNDP	United Nations Development Programme
UN-Habitat	United Nations Human Settlements Program
UNECE	United Nations Economic Commission for Europe
UO	Urban Observatory
VGI	Volunteered Geographic Information
WCDD	World Council on City Data
Wits	University of the Witwatersrand

LIST OF FIGURES

Figure 1.1 Thesis Methodology **6**

Figure 2.1 The DIKW Hierarchy according to **8**

Figure 2.2 Key milestones in the evolution of digital and data-driven approaches in urban studies after 1960 ..... **17**

Figure 3.1 Core components of a holistic urban data ecosystem..... **26**

Figure 3.2 The 8 principles of open government data **33**

Figure 3.3 UK data ethics framework, adapted from..... **37**

Figure 4.1 Methodological framework for comparative case study analysis **47**

Figure 4.2 Global distribution of selected urban observatory centres and operation areas **47**

Figure 4.3 NUO Portal Interface: a) schematic layout b) interface snapshot **49**

Figure 4.4 An example of GCRO'S published vignettes: a) schematic layout b) interface snapshot..... **57**

Figure 4.5 AUO's liveability planning platform interface: a) schematic layout b) interface snapshot..... **62**

LIST OF TABLES

Table 1.1 Research questions and the chapters in which they are addressed **3**
Table 4.1 Newcastle Urban Observatory indicator list **50**
Table 4.2 List of Qassim Urban Observatory partners **58**
Table 4.3 Comparative Matrix for Urban Observatory Cases **66**
Table 5.1 SWOT Analysis for Urban Observatory Model **78**
Table 5.2 Gap analysis of key challenges for urban data management in Türkiye **83**

ABSTRACT

Value-based Urban Data Governance: The Strategic Role of Urban Observatories

Eda GÖRÜN

Department of Applied Urban Science and Urban Innovation

Master of Science Thesis

Supervisor: Assoc. Prof. Dr. Erhan KURTARIR

In an era defined by multiple crises ranging from climate change, environmental degradation to socio-economic inequality, cities are increasingly compelled to adopt data-driven and innovative approaches. Nonetheless, conventional planning practices often fall short in addressing these dynamic and complex issues revealing the urgent need for data-driven approaches. This thesis argues that effective urban planning and management relies on a robust, data-driven approach, positioning value-based urban data as the cornerstone for developing innovative solutions.

The effectiveness of urban policies is directly tied to how urban data is defined, its quality, and how it is managed. This study suggests a new way of looking at urban data emphasizing transparency, contextual relevance and public value. Within this framework, the urban observatory model is presented as a comprehensive approach that integrates data governance, public engagement and policy relevance.

Through a comprehensive literature review, it traces the historical evolution of urban data use, explores global standards, initiatives and apply a critical lens to data-centric paradigms such as the smart city model. The research proceeds with a comparative case study of five urban observatories recognized by UN-Habitat. Using a comparative matrix, the institutional models, thematic focus, digital infrastructure, participatory features and contribution to urban policy of these

observatories are analyzed to uncover best practices, common success factors and challenges.

The findings illustrate how urban observatories can foster sustainable urban data ecosystems when designed with robust governance mechanisms. The study ultimately offers guiding principles for urban practitioners, particularly in Türkiye, where urban data initiatives remain emergent. It advocates for the adoption of urban observatory models tailored to local conditions, promoting ethical and participatory urban data governance. This research contributes both conceptually and empirically to the growing discourse on data-driven urbanism and lays the groundwork for future studies on urban observatories and holistic urban data ecosystems.

Keywords: Data-driven urban planning, urban innovation, urban observatories, value-based urban data

ÖZET

Değer-Temelli Kentsel Veri Yönetişimi: Kentsel Gözlemevlerinin Stratejik Rolü

Eda GÖRÜN

Uygulamalı Kent Bilimi ve Kentsel İnovasyon Anabilim Dalı

Yüksek Lisans Tezi

Danışman: Doç. Dr. Erhan KURTARIR

Günümüzde şehirler, iklim değişikliği, çevresel bozulma ve artan sosyo-ekonomik eşitsizlikler gibi çok boyutlu ve birbirine bağlı krizlerle karşı karşıyadır. Bu karmaşık sorunların yönetilmesinde geleneksel planlama yaklaşımların, uzun vadeli ve statik yapısı, katılımcı mekanizmalardan yoksun oluşu gibi özellikleri sebebi ile yetersiz kaldığı görülmekte; bu durum, veri temelli ve yenilikçi yaklaşımlara olan ihtiyacı ortaya koymaktadır. Bu doğrultuda bu tez, etkili kent planlama ve yönetişiminin ancak güçlü bir veri yönetişim çerçevesine dayandırılarak mümkün olabileceğini savunmakta, toplumsal fayda, şeffaflık ve sürdürülebilirlik gibi değerleri temel alan kentsel veriyi yenilikçi çözümlerin geliştirilmesinde temel bir unsur olarak konumlandırmaktadır.

Kent politikalarının etkinliği, kentsel verinin nasıl tanımlandığı, kalitesi ve nasıl yönetildiği ile doğrudan ilişkilidir. Bu tez, kentsel veriyi çok aktörlü ve dinamik bir ekosistem içinde, sosyal fayda üreten bir kamu değeri olarak ele alan yeni bir bakış açısı sunmaktadır. Bu bakış açısı dahilinde kentsel gözlemevi modeli, veri yönetişimi, katılım ve kentsel politika üretimi süreçlerini bütüncül biçimde ele alan bir yapı olarak önerilmektedir.

Çalışma kapsamında kapsamlı bir literatür taraması yoluyla kentsel veri kullanımının tarihsel dönüşümü irdelenmiş; küresel standartlar ve inisiyatifler analiz edilmiş, akıllı şehir gibi veri odaklı kentleşme paradigmalarına eleştirel bir perspektif sunulmuştur. Araştırmanın uygulamalı kısmında ise, UN-Habitat tarafından tanınan beş kentsel gözlemevi örneği karşılaştırmalı vaka analizi yöntemiyle incelenmiştir. Bu gözlemevleri kurumsal yapıları, tematik odakları,

dijital altyapıları, katılımcılık düzeyleri ve kent politikalarına etkileri bakımından değerlendirilmiş, iyi uygulamalar, ortak başarı faktörleri ve karşılaşılan zorluklar karşılaştırmalı bir matris aracılığıyla ortaya konmuştur.

Bulgular, kentsel gözlemevlerinin sağlam yönetişim mekanizmalarıyla tasarlandığında sürdürülebilir kentsel veri ekosistemlerini nasıl geliştirebileceğini göstermektedir. Çalışma, özellikle kentsel veri girişimlerinin hala gelişmekte olduğu Türkiye bağlamında kentteki karar vericilere yönelik yol gösterici ilkeler sunmakta, yerele özgü kentsel gözlemevi modellerinin benimsenmesini, bütüncül, etik ve katılımcı kentsel veri yönetişimini teşvik etmektedir. Bu araştırma, veri odaklı kentleşme üzerine büyüyen söyleme, hem kavramsal hem de ampirik olarak katkıda bulunmakta ve kentsel gözlemevleri ile bütünsel kentsel veri ekosistemleri üzerine gelecekteki çalışmalar için zemin hazırlamaktadır.

Anahtar Kelimeler: Değer temelli kentsel veri, kentsel gözlemevleri, kentsel inovasyon, veri temelli kentsel planlama

1
INTRODUCTION

1.1 Problem Definition & Aim of the Thesis

In today's multi-crises era, cities face increasing climate change, environmental degradation, social and economic inequalities and urban shocks. Traditional planning approaches often fall short in responding to these rapid and complex challenges. The growing need for data-driven, agile and innovative solutions underscores the importance of urban data as the backbone of an effective urban planning and urban management. Planning is a process where making effective decisions is not possible without relying on data. Considering this, innovative perspectives on data, particularly value-based urban data are essential for addressing urban problems in this complexity.

The scope, quality and governance of datasets enhance the impact of urban policies, enabling precise solutions to urban challenges. Within this framework, urban data is expected to be treated not simply as technical inputs, but as governance assets embedded in institutional systems and political processes. However, there are critical gaps on data approach among city officials and other stakeholders.

At the national level, the absence of unified data ontology or standardized framework limits interoperability and consistency across institutions. Furthermore, national frameworks often fail to incorporate granular city-level data, resulting in a low ability to respond to local and diverse needs and (Greene & Meixell, 2017).

At the local level, municipalities and other public institutions frequently face limited access to up-to-date and dynamic data. This challenge is compounded by underdeveloped data cultures and low data literacy within local administrations, which reduce the uptake of evidence-based decision-making. Furthermore, limited institutional capacity prevents the ability to address emerging urban challenges.

Weak coordination among local actors, including public institutions, civil society and the private sector leads to fragmentation (UNDP, 2024). Altogether, these shortcomings reveal the need for structural reforms to create an inclusive and effective urban data ecosystem.

This thesis aims to establish a holistic approach to address these institutional, technical and policy gaps in the use of urban data within urban practices, focusing a value-based data management approach. In this context, the urban observatory model is considered as an innovative tool for data management, guiding data-driven transformation in line with sustainability, equity and resilience. The research conducts a comparative analysis of national and local urban observatories operating in diverse geographical scale and administrative contexts, examining how these institutions are organized and what thematic areas they prioritize, which indicators they utilise and how they develop data strategies for handling urban data which is reflection of cities, their habitants and interactions between them. Based on this analysis, this thesis aims to develop a comprehensive approach on urban data and to demonstrate the contribution of urban observatories to the design of inclusive and sustainable urban data ecosystems for Türkiye context, where urban data management initiatives are still under development.

1.2 Research Questions

To achieve the aim of this study, the goal is to examine the structural and functional characteristics of urban observatories through comparative analysis and exploring how urban data is produced and managed across diverse initiatives. It seeks to offer valuable insights to support policy development and encourage the adoption of comprehensive urban data approaches. For this purpose, research questions that guide the study, along with the chapters and sections in which they are addressed, are presented in Table 1.1. The main research question sets out the overall purpose of the study and outlines the strategic role of urban observatories in value-based urban data management. Sub-research questions divide this general question into conceptual, technical and practical components, allowing for a more in-depth analysis. Together, these questions shape both the analytical and structural framework of the thesis. Each sub-question is linked to the thematic focus of a specific chapter, enabling the thesis to progress in a coherent and logically

structured manner, where each chapter contributes to addressing the main research aim.

Table 1.1 Research questions and the chapters in which they are addressed

Main Reseach Question	How do urban observatories collect and manage urban data and how can they foster value-based urban data ecosystems that support sustainability, equity, and resilience in urban governance?	
Sub-Research Question 1:	How has the role of data in urban studies evolved over time?	Chapter 2: *Section 2.2*
Sub-Research Question 2:	What technical and ethical barriers limit the effective use of data in urban decision-making?	Chapter 2: *Section 2.2, 2.3*
Sub-Research Question 3:	What global standards shape the urban data ecosystem and why is the urban observatory considered a comprehensive approach within this landscape?	Chapter 3: *Section 3.2, 3.3*
Sub-Research Question 4:	What are the key features, success factors and challenges of urban observatory implementations worldwide?	Chapter 4:
Sub-Research Question 5:	How can the urban observatory model be adapted to Türkiye to advance value-based urban data governance?	Chapter 5:

1.3 Structure of the Thesis

This thesis consists of five main chapters. The introduction chapter defines the main research problem and the aim of the thesis and presents the research questions. In addition, the structure of the thesis and the methodological framework are outlined for a clear understanding of the study's overall approach.

The second chapter, structured around a literature review, begins by examining the conceptual evolution of data, followed by an examination of its expanding meaning and modes of use within urban context. This chapter reviews the historical development of data-driven urban practices and policies, tracing how data, which gained importance in the 1960s through operations such as modelling and census, progressively become more influential, resulting in the emergence of the smart city paradigm in the early 2000s. This chapter concludes by offering a critical lens on

data-intensive approaches, drawing on theoretical perspectives such as platform urbanism and the surveillance society. All things considered, the second chapter seeks to develop a multi-layered, comprehensive understanding of urban data, through conceptual exploration and critical perspective.

The third chapter shifts the focus toward how data should not only be managed from a technical perspective but also be governed through robust frameworks that taking ethical considerations into account, ensure equitable access and meaningful contributions to the public good. In pursuit of this goal, the chapter explores a range of global and local initiatives, including globally recognized indicator systems, spatial and geographic data standards, open data principles, international data protection regulations and data ethics frameworks. These components underscore the need for a holistic and value-based approach on urban data ecosystems, within the urban observatory model is addressed in the chapter as a comprehensive approach. The origins, definitions, principles, and functions of urban observatories have been explained in depth.

The fourth chapter presents a comparative case study analysis that identifies common patterns, challenges, and best practices across urban observatories. Within the scope of this analysis, from an initial pool of thirty-two observatories that recognized by UN-Habitat, five cases were selected based on criteria such as geographic diversity, scale of observation, data accessibility and information scope. These criteria were selected to ensure that case study sample reflects a robust and insightful comparison. Geographic diversity allowed to understand how observatories function within different socio-political contexts. The scale of observation allowed for an examination of how data these mechanisms operate across different administrative levels from national to local and lastly data accessibility and information scope ensured sufficient level of transparency, usability and documentation to enable meaningful analysis. These cases were subjected to a detailed review in terms of their institutional structure, thematic focus, digital infrastructure, levels of participation, and contributions to urban policymaking. These dimensions collectively represent the capacity of urban observatories in addressing complex urban issues with a holistic approach. A comparative evaluation matrix was developed using secondary data sources, including official websites, published reports, open data platforms, and peer-

reviewed academic literature. The chapter ultimately seeks to reveal key principles that demonstrate how urban observatories can be effectively structured to enhance data-driven urban management and decision-making processes.

Finally, the fifth and concluding chapter clarifies the overall findings of the study, offering a comprehensive evaluation of how urban data should be overseen with an emphasis on ethical, participatory and contextual concerns. It begins with a SWOT analysis, drawing on global practices to examine the model's strengths, weaknesses, opportunities and threats. This is followed by a gap analysis that contextualizes urban observatories for Türkiye, identifying structural, infrastructural, and governance shortcomings in the current urban data ecosystem and outlining the potential contributions of urban observatories in addressing these gaps. Building on insights from the comparative analysis and the strategic evaluation of the model, the chapter outlines a set of principles to guide urban policymakers in the design and implementation of urban observatory models and offers recommendations for future research aimed to reveal the potential of the study to be developed.

The structure and flow of the chapters along with the alignment between the main and sub-research questions and the corresponding methodological steps are visually summarized in Figure 1.1 below. The diagram illustrates how the research evolves from the formulation of research questions and conceptual framing around urban data toward an exploration of literature, case selection, development of a comparative matrix based on selected good practices using primary and secondary data, ultimately leading to the discussion of findings and the identification of how urban observatories can contribute to addressing existing gaps in urban data approaches in Türkiye.

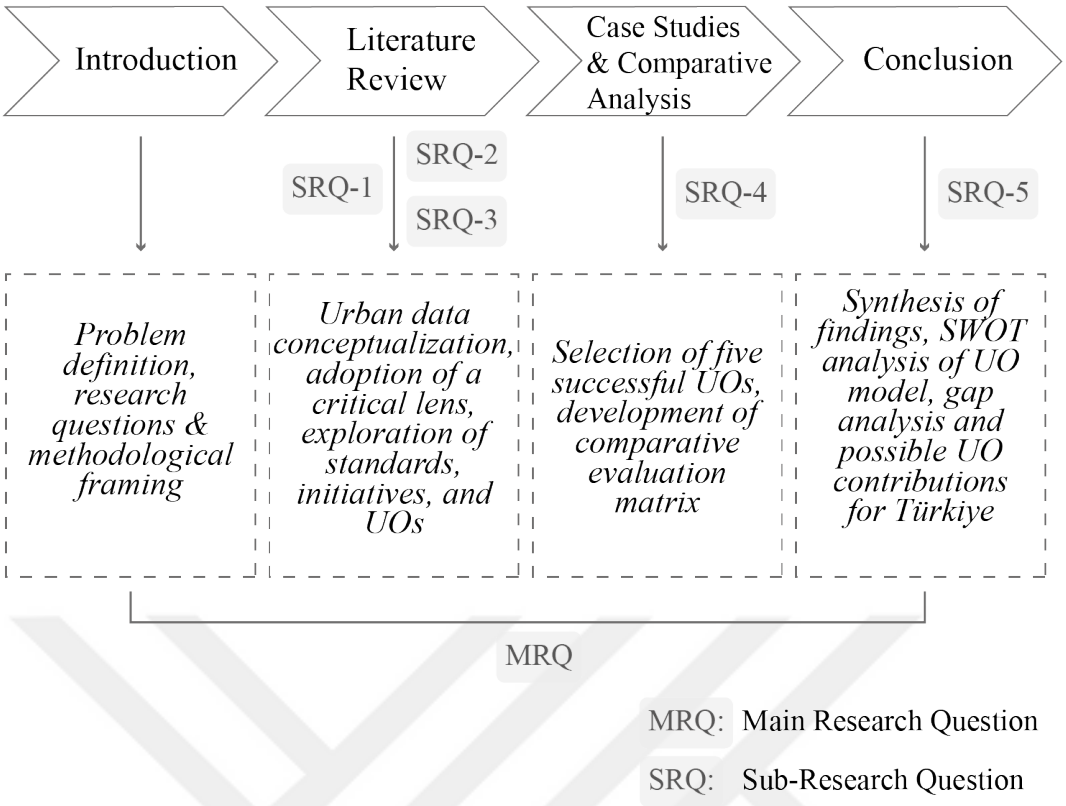


Figure 1.1 Thesis Methodology

Following this structural overview, the next chapter lays the conceptual foundation of the thesis by exploring the evolving role and meaning of data within the field of urban studies, tracing its historical trajectory, shifting understandings and its increasing significance in shaping contemporary urban planning and governance practices.

2
THE ROLE OF DATA IN URBAN STUDIES

2.1 Definition of Data

Throughout the history, data has been a valuable resource that has been investigated deeply by multiple disciplines for improving and enhancing decision- making processes, and it has evolved into a discipline in its own right. Before examining data from an urban life perspective, we need to understand its meaning and how it has been conceptualized.

The term of data originates from the 1640s, meaning ‘a fact given or granted,’ as the classical plural form of datum, derived from the Latin datum meaning ‘(thing) given,’. First used in Latin, the term of data later entered the English language through mathematics and theology (Online Etymology Dictionary, n.d.). Over time, the definition of data has expanded to refer to scientific evidence collected through experiments, observations, and investigations (Borgman, 2015; Fox & Harris, 2013). In the contemporary era, it broadly encompasses its meaning to numbers, letters, symbols and observations that can be measured or recorded through various methods and are used to reinforce decision-making processes (Kitchin, The data revollution: big data, open data, data infrastructures & their consequences, 2014; Borgman, 2015).

Data carries no inherent meaning on it own. What makes data valuable are the processes which are transformed into knowledge, how individuals, teams, and communities generate it, the relationships formed throughout its lifecycle from creation to destruction and how it evolves in time. These questions enable us to approach data within a contextual framework (Borgman, 2015). At this point, it is useful to clarify a number of overlapping or frequently misunderstood concepts. Understanding the distinction between data, information, and knowledge, conceptualized through the Data-Information-Knowledge-Wisdom (DIKW)

hierarchy, as shown in Figure 2.1, provides a critical framework for analyzing the nature and value of data. This hierarchical framework, which has been strongly discussed since 1934, presents an organized version of the process, contributing to our understanding of how raw data is transformed inro actionable wisdom (Zeleny, 1987; Ackoff, 1989; Rowley, 2007).

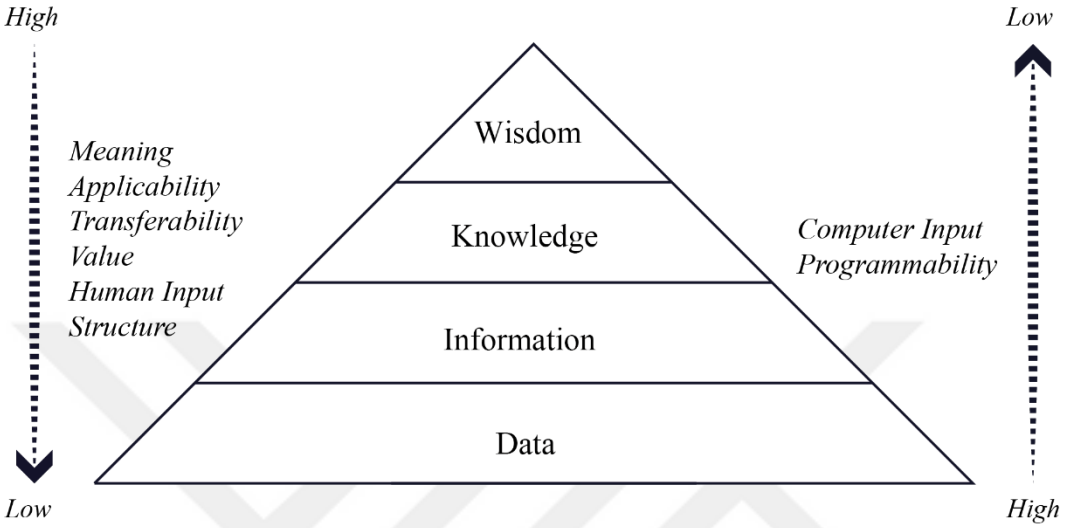


Figure 2.1 The DIKW Hierarchy according to (Rowley, 2007)

Within this framework, data is defined as "unorganized, unprocessed," discrete, and objective facts or observations (Chaffey & Wood, 2005; Pearlson, Saunders, & Galletta, 2015). Information, by contrast, is regarded as processed data that contributes to understanding of a subject and supports decision-making processes (Chaffey & Wood, 2005). Knowledge is a more complex concept, seen as a combination of data and information shaped by expertise or experience. At the top of the hierarchy is wisdom, which is associated with interpretation and understanding, grounded in ethical belief systems, and often referred to as an elusive concept (Rowley, 2007; Jashapara, 2010). Ultimately, it reveals that the process by which data becomes meaningful depends on the different actors by which it is produced and used. Rather than being an entirely objective process, it is shaped by social, cultural and epistemological factors (Rowley, 2007).

From this perspective, it becomes clear that data cannot be evaluated independently of its context. Kitchin (2018) defines urban data as "a key input for understanding city life, solving urban problems, formulating policy and plans, guiding operational governance, modelling possible futures and tackling a diverse set of other issues'' (Kitchin, Lauriault, & McArdle, Data and the City, 2018).

The role of data in urban studies is deeply connected to the historical development of cities themselves. Long before the digital data infrastructure, the discipline of urban planning emerged from efforts to collect and interpret data used to understand and respond to the problems of industrial cities. Some of the earliest attempts on urban data gathering were seen in public health and social policies. For instance, Edwin Chadwick (1842) used sanitary statistics to link poor living conditions with disease. Likewise, John Snow's cholera maps (1849) reveal health inequalities by linking the disease and contaminated water. Another example is Charles Booth's poverty maps (1889), which are used to reveal urban poverty in London. With all these efforts, data enabled early planners and reformers to expose inequalities, reveal spatial patterns and inform urban policies. Based on these examples, it is fair to say that since the beginning of urban life, data has been produced about inhabitants of the cities, the activities taking place within them, and their connections to other places. In these early years of urban studies, such data were collected through methods such as cartographic measurements, interviews, surveys, observations, photography, manual mapping, and physical counting. These methods provided empirical foundations for early urban planning interventions and the beginning of a long-standing relationship between data and urban areas was marked. This relationship has been further strengthened with technological advancements, leading to a significant expansion and diversification of the urban data ecosystem.

Urban data can be classified into two primary categories: qualitative and quantitative. Quantitative data is presented as numbers such as units, prices, ratios and is typically countable and measurable. In the urban context, this can be seen in terms of traffic volumes, air quality measurements, population size and so on. Qualitative data, by contrast, is descriptive, conveyed through words rather than numerical values. In the urban context, this can be seen in terms of in-depth interviews, experiences of inhabitants, field observations and so on (Simister & James, 2020).

In order to examine today's expanding urban data ecosystem in greater depth, the general distinction between quantitative and qualitative data may be further refined through a classification based on data sources. Within such a framework, urban data can be classified as follows:

Administrative Data: Structured datasets collected routinely by governments and other public institutions to use for official processes. It includes census data, permit and licensing data, crime statistics, health records, public opinion polls and so on.

Geographic/ Spatial Data: Data that contains geographic location, it includes data types such as satellite imagery, land use maps, point of interest (POI), GPS signals and so on,

Sensor Data: Data that gathered from physical sensors embedded in the urban environment, it includes traffic sensors, environmental sensors, smart infrastructure and so on. These data types can be real-time.

Social Media and User Generated Content Data: Data that generated by individuals on digital social media platforms, forums and other online channels and apps.

Participatory and Crowdsourced Data: Data provided voluntarily by communities with participatory methods such as participatory mapping, focus group discussions, participatory photography, crowdsourced data generally gathered in online platforms (Biggs, et al., 2022).

These data types can be collected through tools such as remote sensing, online surveys, Internet of Things (IoT) sensors, open data portals and other modern techniques. These modern techniques have been used by city officials and various organizations to unlock the full potential of data, not only for its social benefits but also economic benefits such as the emergence of new sectors and the promotion of economic growth (European Innovation Partnership for Smart Cities & Communities (EIP-SCC), 2017).

2.2 The Evolution of Data-Driven Planning

The changes in the production and collection of urban data have reshaped how cities are perceived and governed over time. The role of data has shifted from a descriptive information source to valuable asset that guides urban policies. It is essential to trace how this understanding of data's utility evolved into a cornerstone of policymaking to fully appreciate the contemporary landscape of urban data. This has led us to the evolution of data-driven urban policies and digital transformation of urban environments. In doing so, this section begins its historical examination from the 1960s, a pivotal period marked by the emergence of national and municipal

efforts to systematically collect and interpret urban data. These efforts lay the foundation for urban indicators, urban data platforms in the following decades, marking the beginning of digitization and computational urbanism.

During this period, the recognition of computers, originally developed during World War II and continuously advanced since, are universal machines capable of being integrated into all aspects of human life. This realization triggered a broader societal transformation, which came to be known as the digital transformation (Batty, The digital transformation of planning, 2021). Its initial effects of this transformation in the field of urban planning were recorded in the United Kingdom, notably through data processing applications based on census data. In the following years, subsequent efforts largely focused on developing comprehensive and predictive computer models intended to inform urban policy and governance. Various planning agencies began employing computers to support tasks such as the decentralization of economic activities, land use planning, and traffic modeling. Nevertheless, it is widely acknowledged that these early attempts were largely unsuccessful. The main reasons were the lack of solid theoretical foundations, limited availability of data, and the fact that even the most basic levels of automation demanded significant transformations in hardware and software making these efforts difficult to implement in practice (Batty, The digital transformation of planning, 2021; Townsend, 2015). Consequently, the genuine integration of computers into urban processes did not occur until the 1990s, with the emergence of planning support systems. With the growing use of personal computers beginning in the 1980s, paved the way for human-computer interaction by the 1990s. During this period, computer cartography, which laid the foundation for Geographic Information Systems (GIS), and programs such as AutoCAD began offering planners and other user's new opportunities for visualization and spatial analysis. In parallel, management information systems began to be widely adopted, especially in urban governance (Batty, The digital transformation of planning, 2021). The primary benefit of these systems was their ability to organize data collected through routine bureaucratic processes, hence supporting more informed decision-making. Examples of data-driven administrative reforms from this era include the integration of crime reports into geographic databases to enhance police

efficiency and reduce crime rates, in addition to the development of fire risk assessment tools based on building data.

By the early 2000s, a new era had begun in which digital transformation became increasingly prominent in urban planning and urban governance, accelerating the adoption of data-driven approaches. As Batty (2021) notes, whereas computers had previously been used primarily to support planning and urban policy, this era witnessed the integration of data and information into the planning systems as a routine process. As cities experiencing persistent growth in population, infrastructure and utility demand and built environment, the volume and diversity of urban data expanded notably, leading to more holistic approaches to urban management. In this context, various studies began to explore emerging concepts such as the informed city, smart city, digital city whose foundations were laid in the 1990s (Mitchell, 1995; Ishida, 2022). The digital city concept, which is an early form of smart city concept, was largely shaped by the advancement of information and communication technologies (ICT), especially the internet, and as primarily associated with e-government initiatives.

The large volumes, velocities, and varieties of data produced by cities have been recognized as a major opportunity by both computer scientists and urban practitioners (Townsend, 2015). During this period, the field of urban informatics emerged as a scientific discipline aimed at discovering, describing, predicting, and explaining urban phenomena. This field laid the foundation for approaches such as the smart city paradigm (Townsend, 2015).

In this period, when knowledge-based services began to be employed across multiple layers of urban systems and digital sensors were introduced, the term “smart” entered everyday life through concepts such as smartphones, smart devices, and smart software. Apple’s announcement of the first smartphone in 2007 paved the way for the beginning of a new era. The smart city paradigm gained significant traction after 2010 and it evolved into a comprehensive urban strategy and has since become a central theme in planning discourse, fundamentally reshaped how cities are understood and governed (Dameri & Cocchia, 2013). In line with this shift, terms like “big” and “open” started to be widely used to describe everything from search engines and data storage to information access, software, and data itself. The

recognition of the term “smart” increased even further when the European Union began using it to frame its sustainability initiatives and urban development agendas.

Overall, these developments laid the foundation for the smart city movement. This gave rise to a collaborative ecosystem in which network companies such as Cisco, utility firms such as Siemens, and software providers such as IBM contributed the intelligence capacity that enabled these complex systems to operate (Dameri & Cocchia, 2013; Batty, Urban Informatics and Big Data, 2013).

Even though the first smart city attempts date back to 1994, IBM’s announcement of the Smarter Planet Project in 2008, which explored the application of sensors, networks and analytics to address urban challenges, marked a significant milestone in enabling formal recognition. Nevertheless, there is no universally agreed-upon definition of smart cities, Batty (2020) emphasizes that what defines them is the integration of communication and computation, emphasizing that they rely on multiple interconnected networks that link various computing systems to serve complex purposes. This connectivity refers not only to objects moreover it refers to interactions among individuals (Batty, Defining smart cities: High and low frequency cities, big data and urban theory, 2020). Smart cities are composed of interconnected urban components equipped with systems that learn from everyday human activities and automatically adapt to behavioral changes (Kandt & Batty, 2021).

Hall (2020) define smart cities as “a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance” (Hall, et al., 2000). The main motivation behind the smart city movement lies in the aim of generating added value by integrating diverse datasets. One of the defining and characterizing features of these combined datasets is that they generally consist of large scale data collections, recognized as big data, believed to hold the key to unlocking hidden dynamics and potentials of cities (Batty, Urban Informatics and Big Data, 2013).

Taylor-Sakyi (2016) defines big data as “large sets of complex data, both structured and unstructured, which traditional processing techniques and/or algorithms are

unable to operate on." The dimensions that define big data have evolved remarkably over the past two decades. At its inception, Doug Laney conceptualized big data in 2001 through the framework known as the 3Vs. These Vs are referred to volume, velocity and variety. As data-driven technologies and their implementations have become more widespread, this definition has expanded to include two additional dimensions, veracity and value (Hadi, Shnain, Hadishaheed, & Ahmad, 2015). In recent years, a sixth dimension, variability, has also been added (Sinaeepourfard, Masip-Bruin, Garcia, & Marín-Tordera, 2015). Together, these six characteristics now form the widely accepted model referred to as the 6Vs of Big Data.

Volume stands for the quantity of data gathered by companies, local authorities and researchers. It is the size and amount of the acquired data. Variety refers to the diverse range of data types. Big data could be structured and unstructured data such as sensor data, web log files, click streams, satellite images, photographs, videos, social media data, mobile data and so on. Velocity stands for needed time for process. Veracity refers to the reliability and quality of the data, Biases, missing values can affect data quality, and it can affect decision-making Value can be explained as usefulness and overall positive impact that can be derived from data. It defined by added value, as Batty (2013) notes, that the collected data can bring to the intended process. Lastly, variability can be explained as the changing nature of data, its inconsistency and unpredictable changes that occur such as changing data formats, shifts in how data is interpreted over time (Hadi, Shnain, Hadishaheed, & Ahmad, 2015; Jha, 2024).

Considering all these feautures, it can be argued that cities and big data show parallel stuctures, with similar traits such as complexity, scale, diversity and the dynamic nature. Every aspect of everyday life such as work, consumption, communication, travel, mobility, leisure is being captured and stored as data (Kitchin, Lauriault, & McArdle, Data and the City, 2018). When these datasets are merged, several key benefis of smart cities emerge: gaining new insights into how cities and their population function, discovering innovative ways to manage cities more efficiently and creating new opportunities for business growth and commerce by combining diverse data sources and services. One of the key considerations that should not be underestimated is the economic value that data can generate through smart city initiatives (Batty, Urban Informatics and Big Data, 2013).

While big data offers unmatched opportunities for prediction and projection, it can be limited in capturing more nuanced and contextual knowledge about complex urban environments and the people who live, move, and work in them. In this regard, alongside big data, which provides insights based on specific data points, the concept of 'thick data' emerges, aiming to understand the social context and connections between these data points (Wang, 2013; Hong, et al., 2022).

The idea behind thick data is not new. It is adapted from the anthropological term 'thick description' popularized by Clifford Geertz in 1973. Thick data offers an opportunity to understand what evidence is considered as valid, bring forward perspectives from less-heard groups, and to present the values and experiences of a specific community in detail, using the quantitative data provided by big data for smart cities. Insights derived from qualitative data such as ethnographic observations, interviews, and narratives contribute to improving urban experience.

Today, this complementary hybrid methodology that uses both big and thick data has become the focus of planning and urban studies. While big data reveals where problems are concentrated in the city and who they affect, the critical role of thick data methods in identifying relevant stakeholders and involving them in the process is beginning to be recognized (The Transport and Health Integrated Research Network, 2022). For example, in a study conducted in 2022, big data analyses such as aerial photography analyzed with machine learning techniques, heat mapping and identifying individual driving patterns with on-board cameras and sensors were used to determine where traffic collisions occur most frequently, while the thick data approach identifies the groups affected by these collisions (drivers, pedestrians, neighborhood residents etc.) and conducts in-depth interviews with them to uncover the underlying causes (Hong, et al., 2022). Such an approach, grounding quantitative patterns in lived experiences and human stories, opens the door to new ways of ensuring that data-driven insights reflect citizens real needs and deepen our understanding of complex urban environments.

The increasing volume and processing capacity of digital data has accelerated the use of artificial intelligence (AI) techniques in urban studies. AI is a technology that enables computers and machines to simulate human learning, comprehension, problem solving, decision making, creativity, and autonomy (IBM, 2024). Artificial intelligence is effective in quickly analyzing, classifying, and making predictions

about large data sets. Today, many planning support systems and urban modeling tools integrate AI algorithms such as machine learning, and it is expected that by the end of 2025, more than 30% of smart city applications will be AI-powered, transforming key aspects of city management such as mobility, housing, urban planning, land use, basic services, and resilience systems (OECD, 2025). However, the critical issue here is the extent to which AI tools are autonomous and how well they can take over the complex decision-making processes at the core of urban governance. Although AI can deliver rapid and consistent results in areas such as optimization, demand forecasting and projection, tasks such as creating a holistic urban planning vision and balancing different sectors and stakeholders remain beyond AI's current capacity (Othengrafen, Sievers, & Reinecke, 2025). Just as big data cannot be considered independently from thick data, similarly, training artificial intelligence models solely on quantitative data risks reproducing existing biases and disregarding the needs of communities, thereby increasing the risk of discrimination. In response to this situation, the concept of ‘responsible AI’, which takes into account these concerns and works with algorithms that respect, protect, and promote human rights, has become an important part of urban studies (Dhaou, Isagah, Distor, & Ruas, 2024). In this regard, initiatives regarding how this massive data will be gathered, managed and analyzed and what types of environmental, social and economic impacts may have become critical issues in planning and urban governance. In light all of these developments, Figure 2.2 illustrates the transformative key milestones in the conceptualization and implementation of data-driven approaches.

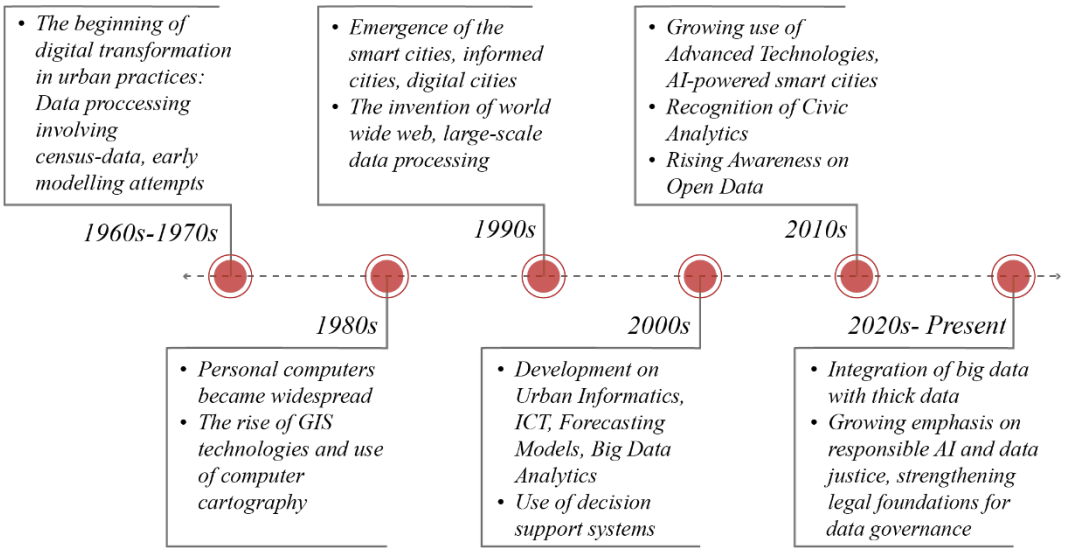


Figure 2.2 Key milestones in the evolution of digital and data-driven approaches in urban studies after 1960 (Dameri & Cocchia, 2013; Parra, Tort-Martorell, Alvarez-Gomez, & Ruiz-Viñals, 2023)

2.3 The Power of Data and Urban Data Politics

Beginning with the journey of digitalization in 1960s, data ecosystems have become more complex and multi-actor. With the adoption of software such as GIS and the emergence of e-governance applications in the 2000s, data has been recognized as a valuable asset and its transformative power is becoming apparent. During this evolution process, an environment was created in which citizen's movements and consumption behaviors began to be recorded (Kitchin, Cardullo, & Feliciantonio, Citizenship, Justice and the Right to the Smart City, 2018). Simultaneously, all this diverse data produced about cities and their inhabitants began to be seen as valuable asset for driving economic growth. Considering this potential, various organizations and businesses rapidly took steps toward digitalization. In response, entire industries were transformed into platforms based on internet technologies (Batty, Urban Informatics and Big Data, 2013). Sarah Barns (2014) defines that new urban form as 'platform urbanism'. This form, which places data and connectivity at the core of urban problems and treats them as field of opportunity, refers to a form of urban governance shaped by a type of capitalism whereby data capital is used to support new services and corporate acquisitions (Batty, The digital transformation of planning, 2021; Srnicek, 2016; Barns, 2020)

Global platforms have evolved from spaces of social connection and interaction into leading infrastructures that shape many aspects of contemporary life (Barns, 2020). Global leading companies such as Google, Apple, Airbnb, and Uber are shaping the infrastructure of urban space, influencing production and consumption activities within the city, and leveraging the power of data by extending their reach across much broader markets (Batty, The digital transformation of planning, 2021).

Urban big data has become the key to understanding the complex nature of cities. It has opened many doors throughout the development of urban systems and has emerged as fundamental resource of evidence for shaping social policies and economics. The critical issue here is whose interests this data power serves, and which individuals or groups benefit from its use. As Virginia Eubanks (2018) demonstrates, data can be used as a tool that enables the creation of digital discrimination, allowing individuals to be classified based on social indicators such as race, ethnicity, gender, and disability status (Kitchin, Urban Data Power: Capitalism, Governance Ethics and Justice, 2024; Gordon, 2019). Insights drawn from the combination of commercial, locational, and personal data, notably through urban platforms, can be used by algorithms to nudge and influence individual behavior (Barns, 2020). In this digital era, where algorithms increasingly shape how we live, it is unclear to what extent issues such as accountability, transparency, and justice are considered, given that algorithmic systems are constructed through subjective judgments that involve multiple moral assumptions and technical choices during their design and data collection processes. While data appears to present an objective reality, the ways where this reality is constructed remain deeply contested (Safransky, 2019).

Questions about how data is produced, used, who controls it, whose interests it serves, and whether ethical standards are considered, shape the agenda of urban data politics. One of the most significant examples in this context is the Quayside waterfront project, which was planned by Sidewalk Labs in Toronto, Canada.

The project was intended to be implemented through a partnership between Sidewalk Labs, a subsidiary of Alphabet, Google's parent company, and Waterfront Toronto, a partnered corporation established by City of Toronto, the Province of Ontario, and the Government of Canada to oversee and deliver the revitalization of city's waterfront (City of Toronto, n.d.). The project aimed to be the 'neighborhood

of the future' involving the redevelopment of a 12-acre site with plans to expand to an additional 800 acres (Moore M. , 2019). Quayside, envisioned as the neighborhood of future, aimed to become a digital urban experience hub, fully equipped with smart city technologies such as robo-taxis, heated sidewalks, autonomous garbage collection, and an extensive digital layer to monitor everything from street crossings to park bench usage. Nevertheless, the project was cancelled in 2020 and has since been regarded as a significant failure in the history of smart cities.

There were numerous reasons behind the failure of the Quayside project. A lack of transparency in data governance policies communicated to Toronto residents has been identified in the literature as one of the central issues contributing to the project's failure (Participedia, tarih yok; Cecco, 2019; Goodman & Powles, 2019) . As a result of this uncertainty, critical political questions emerged regarding how data flows would be used to make decisions about public services, who would control the platform, who would own the algorithms, and how the security of the collected data would be maintained (Moore M. , 2019).

Another major concern, widely discussed in the media, was privatization. Sidewalk Labs' proposal to fully privatize the delivery of public services, assume governance functions, influence local and urban policy, oversee its own operations and even collect taxes intensified existing anxieties about the project. This further public concerns and strengthens the perception that democratic values would be undermined (Kitchin, Urban Data Power: Capitalism, Governance Ethics and Justice, 2024). In this regard, one of the key public responses that emerged was the #BlockSidewalk campaign, initiated by residents and local actors. The campaign criticized promotional efforts led by Sidewalk Labs for promoting citizen participation as a central theme, despite lacking the policies and activities necessary to support such claims in practice. The campaign positioned itself as a movement advocating for the public to be included in urban development processes through fair, inclusive, and transparent mechanisms (Mann, Mitchell, Foth, & Anastasiu, 2020). Drawing from the example of Quayside Project, one of the key problems in cities where data-intensive approaches are implemented is the democratic deficit observed in the processes concerning how data is collected and used (Taylor,

Richter, Jameson, & Pulgar, 2016). The lack of clarity and openness in these processes has eroded public trust.

Beyond enhancing urban life and promoting well-being through the integration of technology, smart cities must also develop mechanisms that enable urban trust in order to succeed. The fact that citizens are frequently positioned as direct producers of data can lead to their being perceived merely as data points or just consumers. Hence, this transforms citizens into actively monitored and directed subjects, thus causing various ethical and societal concerns (Taylor, Richter, Jameson, & Pulgar, 2016; Kitchin, Urban Data Power: Capitalism, Governance Ethics and Justice, 2024). Citizens who feel they are constantly being surveilled are unlikely to embrace the smart city movement. In this context, David Lyon's (1994) concept of the "surveillance society" offers a valuable and explanatory framework for understanding the social dynamics and implications of data-intensive approaches in cities.

Since modern times, systematic surveillance, an inescapable part of our social and everyday lives, has become increasingly institutionalized with the advancement of ICT technologies. Detailed information about our personal lives is collected, stored, and processed daily in databases owned by large corporations and government agencies. David Lyon (1994) defines this condition as the surveillance society. What is emphasized here is that surveillance refers not solely to an action, but to a condition felt by individuals whose personal information is being collected. When people become aware of the details of the data held by institutions, they begin to ask questions such as who has access to this information and how this information is being used. In this regard, serious concerns emerge around key areas such as human rights, privacy, freedom, and democracy (Lyon, 1994). According to Lyon (1994), the efforts of today's bureaucratic institutions to monitor complex data about different population groups go beyond a mere administrative concern; surveillance is, in fact, deeply bound up with our compliance with the current social order and serves as a mechanism of social control.

With the advancement of new technologies in cities, a wide range of data types has begun to be recorded. These include mobile phone records, social media posts, volunteered and crowdsourced geographic information, identity and address data, CCTV footage, sensor outputs, ANPR (automated number-plate recognition) for

traffic flow, GPS data, banking transactions, Wi-Fi usage, travel card activity, healthcare records, driver and vehicle registration data, utility usage (such as water, electricity, and gas), education records, and criminal histories. Overall, these data sources constitute much of the information that is collected and shared on a daily basis in urban environments (Taylor, Richter, Jameson, & Pulgar, 2016). The critical issue, regardless, lies in how the institutions or actors who possess this data choose to use the power of urban data.

In light of all these discussions, the essential question that arises is as follows: Are we moving toward a data-driven urban future characterized by minimal collection of personal information, supported by ethically designed algorithms, guided by measurable indicators to address climate change, enhance efficiency in traffic and resource management, reduce crime rates, and enable advancements in the healthcare sector? Or are we building a dystopia where Big Brother is watching us all, individuals are categorized and socially sorted, privacy is systematically violated, and fundamental rights are under constant threat? (Orwell, 2021; Kitchin, Cardullo, & Feliciantonio, Citizenship, Justice and the Right to the Smart City, 2018).

All of these debates show the necessity of approaching data, which is a backbone of planning and urban governance, in terms of its ethical, political, and societal implications. Risks such as the surveillance society, privacy violations, social segregation and algorithmic bias contribute to a context where urban governance harms democratic values by neglecting the social layer. Nonetheless, the fundamental issue lies in how we will take action and develop solutions in response to these disadvantages, since digital technologies have permeated cities entirely and have become integral elements of our work environments, daily routines, and the systems that make urban life more liveable.

Consequently, even though data has been a fundamental component of urban life throughout the historical evolution and has been produced and collected with numerous tools with the advancement of technology, it continues to be an asset that enables the functioning of cities and solving complex relationships by becoming more valuable every day. How data is collected, by whom, for what purposes and with what level of transparency directly shapes urban planning efforts, resource allocation and the lives of citizens can bring risks and inequalities. However, rather

than entirely dismissing the potential offered by urban big data, it is the responsibility of all professionals engaged in urban studies to integrate these technologies into accountable, transparent, and participatory frameworks. This would allow them to address a range of urban challenges such as urban inequalities, climate crisis, disaster management and so on to contribute to the redesign of cities in ways that benefit not only a privileged few but all urban stakeholders (Kitchin, Reframing, Reimagining and Remaking Smart Cities, 2018).

In the next chapter, the focus will turn to urban data management initiatives developed to address this need and to transform the power of data into public value, with particular emphasis on the institutional model of the urban observatory as a key mechanism serving this purpose.

3
VALUE-BASED URBAN DATA MANAGEMENT APPROACH

As the preceding chapter highlighted, the evolving meaning and increasing importance of urban data has necessitated a more comprehensive approach. As cities strive to harness the transformative potential of urban data while ensuring that it serves the public good, a structured, value-based approach to urban data management becomes vital. The term value-based emphasizes considering data beyond its technical function focusing instead on its potential to generate social and community value in alignment with local priorities. This value-based approach requires the implementation of normative principles such as transparency, participation, fairness, sustainability and public good in the entire life cycle of urban data from its production to its use. The terms that need to be prioritized to make this approach possible are urban data management, data governance and data strategy.

3.1 Urban Data Management, Governance and Strategy

The value-based urban data management approach requires the production and collection of urban data within an ethical framework, equitable access, and the establishment of a robust governance model that ensures its meaningful contribution to the public value. To build such an approach, it is first necessary to understand the existing urban data landscape, since one of the core shortcomings of today's data-rich cities, and a common issue within digital transformation processes, is the tendency to act first and develop the infrastructure afterward. The development of an ethical and legal framework must be considered part of that infrastructure and constitutes a critical component for fostering a data-driven culture.

When current data types based on ownership and accessibility, it can be categorized as personal data, proprietary data, government data, open and public data, and

organic or crowdsourced data (Engin, et al., 2020). Personal data refers to ’any information that relates to an identified or identifiable living individual’ as defined in EU General Data Protection Regulation (GDPR). In urban context, we can interpret this as a data that comes from official records such as household, education, immigration, crime, health and so on. Also, it can be derived from digital transactions, mobile phones and social media usage. On the other hand, proprietary data is owned by an individual or organization, for example banking, retail and other forms of consumer data. Governmental and administrative data produced by government departments, and national agencies through routine operations and censuses. Open data, on the other hand, refers to data that freely available for re-use for any purpose without restrictions. It can be disseminated through government data platforms. Public data is similar to open data, but it refers to any data that is in the public domain and access might be restricted due to sensitivities and costs. Lastly, organic data refers to ‘cumulative data recoded through automated tracking of transactions of all sorts’ such as data produced by web search engines, sensor-based data (traffic cameras etc.) (Engin, et al., 2020). On the other hand, crowdsourced data is collected through participatory processes or generated with the effort of people on collaborative projects such as OpenStreetMap, it usually used to solve computer-hard tasks that cannot be addressed by automated processes (Engin, et al., 2020; Li, Wang, Zheng, & Franklin, 2016).

The evolving urban data landscape is opening up a new world of challenges. The increasing variety and volume of data types have turned data management into a complex challenge with multilayered, organizational, and collaborative dimensions (Bozkurt, Rossman, Konanahalli, & Pervez, 2023). As previously discussed in earlier chapters, questions concerning how data is produced, who can access it, how it is shared, and under what ethical framework it is used, require a critical examination of urban data governance.

Weber (2009) defines data governance as a framework that outlines the roles and responsibilities. It is operationalized through the implementation of data policies, guidelines, and standards that align with the mission, strategy, values, norms, and culture of the institution responsible for establishing this framework (Weber, 2009).

Data governance is addressed by Reichental (2020) under four main categories:

The first of these components is policy. A clear guideline must be established to govern how data should be handled, particularly how it is collected or generated, used, stored, and shared (Reichental, 2020). In the urban context, this could involve maintaining transportation or energy efficiency data and establishing corresponding backup protocols. It may also include defining access levels on public data-sharing platforms or setting data-sharing principles among departments within local authorities.

The second one is data quality. Ensuring data quality requires that a dataset comply with criteria such as accuracy, completeness, validity, consistency, uniqueness, timeliness, and fitness for purpose (IBM, 2022). Large-scale data collection in cities makes it difficult to meet all of these standards, requiring the development of appropriate methodologies. The quality framework can be strengthened through practices such as aligning data collection with standardized indicators and conducting cross-validations between different sources. As an illustration, by comparing administrative records with citizen-reported data.

The third component is data compliance, which refers not only to alignment with organizational policies, but also industry and governmental policies and broader regulatory frameworks (Reichental, 2020). Key considerations in this context include the protection of personal data, restrictions related to public data access, and the ethical use of AI technologies and algorithms, which is the most criticized dimension within smart city development.

Lastly, business intelligence refers to collecting, managing and analyzing data to yield meaningful insights that inform operations. (IBM, 2021). At the city scale, the analysis, presentation and visualization of data through real-time dashboards, urban data platforms and decision support tools play a critical role in supporting value creation.

As cities continue to embrace data-driven culture, all components of urban data governance become essential to create sustainable, equitable and evidence-based urban futures. One of the key points here is the proper adoption of the concepts of data management, data governance and data strategy in order to handle data effectively. A data strategy addresses the question of ‘why’ It defines how an organization makes decisions and determines its areas of focus based on its core

objectives, especially in uncertain situations. Data management turn these strategies into action and focuses on the question of 'how' the data will be handled. Lastly, data governance functions as a tactical layer, establishing procedures and rules that answer questions such as 'who, what, when, and where' and enable concrete action. These three layers are interconnected and should not be treated separately if a strong and holistic approach is to be developed, as shown in Figure 3.1 (Etzel, 2024; Ponkratova, 2022). Building on the foundational understanding of data management, data governance and data strategy, these concepts must be supported by standardized frameworks to ensure consistency, interoperability, and accountability in practice.

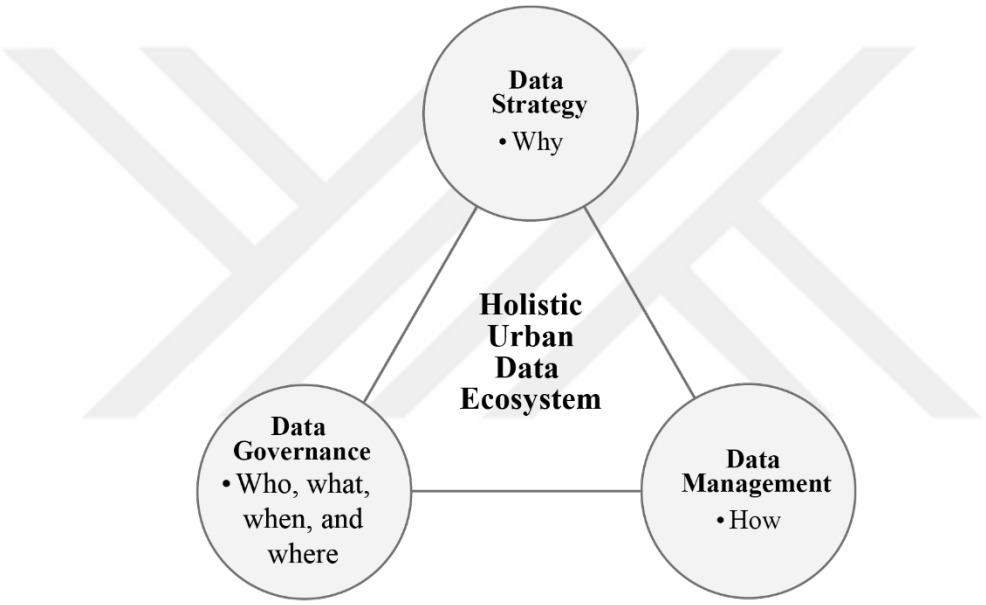


Figure 3.1 Core components of a holistic urban data ecosystem

3.2 Global Standards and Initiatives on Urban Data Management

This section reviews global standards and initiatives that enable the effective handling of urban data. It explores the underlying principles of these standards, examining how they are conceptualized and applied in practice to support value-based urban data approach to urban data management. This examination includes the formulation of indicator standards to assess the performance of cities, setting spatial and geographic data standards to enable interoperability, adoption of open data principles to promote transparency, and development of legislation and ethical frameworks to enforce accountability and ensure privacy. In addition to global

standards and initiatives, this section also examines current practices and regulatory efforts in Türkiye. The analysis of Türkiye-specific approaches not only contextualizes international frameworks at the national scale, but also serves as a basis for the gap analysis and policy recommendations that will be elaborated in the conclusion chapter.

3.2.1 Indicator Standards for Smart Cities

The large volume of data generated from various sources contributes to a complex data ecosystem, and policy makers often struggle to manage this complexity effectively. Accordingly, urban indicators serve as fundamental tools for transforming data into something meaningful and actionable (Huovilaa, Bosch, & Airaksinen, 2019). Urban indicators contribute to the systematic and goal-oriented collection of data to make main urban challenges measurable. Developed for purposes such as evaluation, comparison, and monitoring, these indicators are essential components of a data-driven culture.

The International Organization for Standardization (ISO) introduced the first international standards on cities in 2014. These standards were developed using the Global City Indicators Facility (GCIF) framework and input from the ISO Technical Committee on Sustainable Development of Communities (McCarney P. , 2015). ISO 37120 focuses on the performance of city services and quality of life. ISO 37122 provides indicators for smart cities and ISO 37123 offers indicators for resilient cities. These indicators have been developed to help cities to support urban policy development and priority settings, measure performance of city services and quality of life and learn from other cities that implement the indicators and enable comparison (ISO, 2018). The indicators cover a wide range of thematic areas including economy, education, energy, environment, finance, fire and emergency response, governance, health, recreation, safety, shelter, solid waste, telecommunication and innovation, transportation, urban planning, wastewater and water and sanitation (Midor & Plaza, 2020). The data collection and analysis conducted with a collaborative effort between the national statistics offices, ministries responsible for urban issues, city and metropolitan authorities and research community. Data collection processes across these twenty-one thematic areas, carried out by knowledgeable experts, enable the value creation and most

informed judgement (ISO, 2018). Therefore, it becomes possible to strengthen evidence-based urban policy making.

In response to successful implementation of these indicators, the World Council on City Data (WCDD) was launched in Toronto, Canada in 2014 to help cities embrace ISO standardized, independently verified, and globally comparable city data to make data-driven decisions and it has developed the first system for ISO 37120 certification and Global Cities Registry (McCarney P. , 2015; WCDD, n.d.). To support the UN Sustainable Development Goals, WCCD, as a partner of the Global Partnership for Sustainable Development Data, provides high-quality, standardized, and globally comparable city-level data in the context of SDG 11 (Global Partnership for Sustainable Development Data, n.d.).

Another example of international initiatives is the Urban Indicators Programme of the United Nations Human Settlements Programme (UN- Habitat) that was established in 1988 to urgent global need to improve the base of urban knowledge by helping countries and cities collect standardized urban data (Global Urban Observatory, 2003) . This initiative led to the development of Urban Indicators Database, maintained since 1996, which continues to serve as an important source for urban policy. The indicators are developed under the five thematic areas: shelter, social development, environmental management, economic development and governance. The data collection process for these thematic areas was carried out through a collaborative approach involving UN-Habitat, governmental and non-governmental institutions and consultants at the city and country levels. This effort was guided by the principles of ensuring that the collected data was of the best available, the latest available and fully documented (Global Urban Observatory, 2003).

Over time, with the adoption of SDGs and the New Urban Agenda, the need for system approach became more pronounced and a single monitoring framework requested by UN-Habitat and various stakeholders. Therefore, in 2019, Global Urban Monitoring Framework has established for a wider approach to urban data management that that would align to the protocols of data sharing and comparability at the global level (UN-Habitat, 2022).

A further example is the International Telecommunication Union's (ITU) standardization activities. ITU is the United Nations specialized agency in the field of telecommunications, ICTs. It has recognized the transformative potential of ICTs for improving the quality of life and social services in cities (Sang & Li, 2023). ITU, Economic Commission for Europe (UNECE) and UN-Habitat coordinate United for Smart Sustainable Cities (U4SSC), an UN-wide project supported by 17 UN bodies. It aims to evaluate the progress of over 150 cities using U4SCC key performance indicators for smart sustainable cities based on ITU standards in order to achieve SDG 11 goal. The results of the key performance indicators (KPI) evaluations are disseminated through city snapshots, factsheets and verification reports. In addition to KPI evaluations, U4SCC develops innovative financial instruments, procurement guidelines for smart sustainable cities, and guiding principles for artificial intelligence in cities. Therefore, it plays a significant role in digital transformation of cities and the development of their data-driven culture (Bueti & Sah, 2024).

3.2.2 Spatial and Geographic Data Standards

Urban data cannot be considered apart from its spatial context. As the frequently cited expression states, ''Everyting happens somewhere''. Throughout the history, spatial data has been collected through a broad range of methods such as radar imagery, real-time sensors, remote sensing and crowdsourced initiatives such as OpenStreetMap, GPS recievers that are embedded in devices and has opened the door for many opportunities for cities. The critical role of spatial and geographic data in addressing urban challenges has been widely recognized by organizations, leading to the development of numerous initiatives aimed at integrating spatial data into urban policy and decision-making processes.

One of the earliest initiatives for spatial data standards is The Open Geospatial Consortium (OGC). It is an international voluntary consensus standards organization that was launched in 1994. Within the OGC, more than 475 commercial, governmental, nonprofit, and research organizations around the world collaborate in a consensus process to encourage the development and adoption of open standards for geospatial content and services, GIS data processing, sensors, data modeling and so on (Reed, 2013). As Carl Reed (2013) noted, ''Although the organization itself has changed over the years, OGC's initial mission was to get past

proprietary data formats so that users and technology providers could more easily share geospatial data, without giving up their proprietary formats or specific spatial database technologies. Instead, they can expose geospatial data through standard interfaces and formats''.

The OGC (2017) defines open standards as standards that are:

-Freely and publicly available,

-Non-discriminatory,

-No-license fees,

-Vendor neutral,

-Data neutral,

-And based on consensus.

In addition to this definition, the OGC noted that open standards are not the same as open source. Open source refers to free and open-source software which has been made available under a free software license with the rights to run the program for any purpose (OGC, 2017).

Consequently, the open standards developed by OGC have served as a global reference point focused on ensuring the interoperability of spatial data. Producing and collecting spatial data in line with these standards offers opportunities for data compliance and promotes data sharing among institutions and organizations. Through these efforts, the OGC has become a leading initiative in fostering a culture of data sharing and contributing to the establishment of transparent, sustainable, and interoperable spatial data ecosystems.

Another example is the INSPIRE Directive (Infrastructure for Spatial Information in the European Community) formally adopted in 2007, a framework established by the European Union to create a common spatial data infrastructure across EU members. Its main objective is to inform environmental policies and related activities that may have an impact on the environment and establish a legislative regional approach (Joint Research Centre, n.d.). INSPIRE emphasized that spatial data should be collected only once and stored where it can be most effectively maintained. Seamless integration of spatial information from various sources should be possible, enabling widespread use across many users and applications. In

addition, data collected at one level or scale should be shareable across all levels. The need for readily and transparent geographic information for good governance should be recognized. Lastly, it should be easy to discover what geographic information exists, how it can be used for specific needs and what conditions it can be accessed and applied. In line with these principles, INSPIRE implements a robust data strategy and it enables to harness the value of spatial data (Joint Resarch Centre, n.d.).

Another goal of the INSPIRE Directive is to handle major challenges affecting the availability and accessibility of spatial data. These challenges include issues such as incomplete or missing spatial datasets, the redundant collection of the same data by different organizations, inconsistencies in spatial data collection practices, insufficient documentation of existing datasets, lack of standardization of data formats that prevent comparison or integration, and cultural, institutional, financial, or legal barriers that hinder or prevent the sharing of available spatial data (British Geological Survey, 2025). To overcome these barriers, INSPIRE creates metadata that improves the accessibility of existing data. It contributes to the harmonization of data themes in support of environmental policies across the European Union, facilitates the discovery, visualization, and download of spatial information, and promotes agreements on network services and technologies. Furthermore, it supports the implementation of coordination and monitoring mechanisms (British Geological Survey, 2025). Guided by this holistic approach, the INSPIRE Directive has also played a pioneering role in the development of data standardization practices in other countries. Türkiye is among these countries.

In Türkiye, the growing importance of information infrastructure was initiated under the eEurope Action Plan launched in 2000, which aimed to support the country's transition toward an information society. In 1990s, Türkiye had begun to take first steps toward data standardization in order to facilitate coordination and information exchange among institutions. In line with the objectives of the eEurope framework, Türkiye started the e-Transformation Türkiye Project. One of the key outcomes of this project was the establishment of the Turkish National Geographic Information System (TNGIS/TUCBS). As demonstrated in the National Geographical Information Strategy and Action Plan (2020), the main objectives include ensuring accessible geospatial data for all, expanding the use of geospatial

data services across processes, fostering the geospatial information industry to support the renewal and transformation of institutional processes, establishing sustainable institutional structures and financial support systems, increasing the availability of qualified education and promoting lifelong learning opportunities, and developing a monitoring and reporting system that aligns with decision-support systems, integrates directly with operational processes, and addresses both producer's and user's needs (MEUCC, DGGIS, 2020).

In developing policies and strategies for TUCBS, the INSPIRE Directive served as a basis, and data-sharing services were created to enable integration with the INSPIRE Directive. After 2010, the TNGIS infrastructure and data guidelines were finalized, systems enabling inter-institutional data exchange were developed, and the TUCBS Portal was launched for public access (Tatar, et al., 2021) The aim of this portal was to provide users with access to data produced and updated by public institutions, and the shared datasets were generated in line with OGC standards (MEUCC, DGGIS, 2020).

3.2.3 Open Data Principles and Initiatives

Smart cities are learning environments rather than fully evolved urban forms and they serve as centers of urban innovation. One of these innovations is the use of open data in urban governance. Open data initiatives contribute to enhancing transparency, empowering citizens, increasing civic participation, fostering innovation, and reforming public services and support the development of innovation economy (Ojo, Curry, & Zeleti, 2015). What makes open data valuable for cities is the social and economic benefits it can generate. As interoperability increases and diverse datasets are integrated, new knowledge and insights will emerge, and these complex data structures will pave the way for new fields of application (Open Knowledge Foundation, 2012).

With the executive order signed by Barack Obama in 2009, the adoption of open data as a cultural norm within government institutions was encouraged, leading to the launch of the Open Government Initiative. In 2011, the establishment of the Open Government Partnership (OGP) created a global network that institutionalized open data policies, bringing together more than seventy countries and over one hundred local governments and civil society organizations. The

United States has led OGP efforts as a member of the Steering Committee since its founding and also carries out OGP efforts domestically through establishment and implementation of Open Government National Action Plans (Open Government Initiative, n.d.). The evaluation process of OGP shows that when civil society is involved in designing and implementing OGP action plans, commitments are better implemented, produce more changes in government practices (Open Government Partnership, n.d.). This illustrates how transparent and inclusive governance frameworks can lead to more effective and committed implementation of open data strategies. The open government data principles that enable all of these objectives are outlined below in Figure 3.2.

Data must be…	
Complete	All data are made available, subject to privacy, security or pirivilege limitations.
Primary	Data is as collected at the source, with the highest possible level of granularity, not in aggregate or modified forms.
Timely	Data is made available as quickly as necessary to preserve the value of the data.
Accessible	Data is available to the widest range of users for the widest range of purposes.
Machine Processable	Data is reasonably structured to allow automated processing.
Non-discriminatory	Data is available to anyone, with no requirement of registration.
Non-proprietary	Data is available in a format over which no entity has exclusive control.
License-free	Data is not subject to any copyright, patent, trademark or trade secret regulation. Reasonable privacy, security and privilege restrictions may be allowed.

Figure 3.2 The 8 principles of open government data (Joshua Tauberer, n.d.)

In line with these principles, progress has been made in policy areas such as the right to information, gender and inclusion, digital governance and rights, protection of civic space and natural resources, and corruption. Within this framework, the OGC has played a significant role in fostering the development of an open data culture.

Over the last few years, local governments have increasingly embraced open data portals as strategic instruments to promote transparency, strengthen public participation and improve the efficiency of urban services. To illustrate with a successful example, Edmonton's open data platform, initiated in 2010, is considered a notable case. It features a city dashboard that not only presents open data alongside visualizations but also allows users to monitor the city's condition

and measure municipal performance (Erginli & Tülek, 2020). The platform hosts 2,471 open datasets, categorized under themes such as urban governance, environmental services, demographics, finance, transportation, and the economy (Edmonton's Open Data Catalogue, 2025). The platform, which is enriched by various sources including surveys and real-time data, allows users to download geocoded datasets and explore them through interactive maps. Through the city dashboard, users can monitor how effectively municipal services are meeting their targets and review the performance criteria directly through the website. Innovative tools like this help maximize the value derived from data and contribute positively to urban life by promoting transparency.

The growing emphasis on the principle of transparency has also shaped national agendas. In Türkiye, open data initiatives within the public sector gained momentum after the 2010s. A key milestone was the action stated in the 2020–2023 National Smart Cities Strategy and Action Plan: "National and local smart city open data platforms will be established, and their functionality and sustainability will be ensured." In this context, the National Smart City Open Data Platform (ULASAV), developed by the Ministry of Environment, Urbanization, and Climate Change, stands out as a leading example. Under ULASAV, 174 institutions contribute to the platform, including local initiatives such as the Istanbul Open Data Platform, the Ordu Metropolitan Municipality Open Data Platform, and the Izmir Metropolitan Municipality. Across these platforms, particularly in metropolitan municipalities, more than 500 datasets have been made accessible to users, organized under categories such as economy, disaster management, environment, energy, and governance (MEUCC).

As mentioned above, while numerous initiatives have been introduced to promote the adoption of open data, there are also several barriers that hinder its widespread implementation. Key barriers include the lack of a clear and consistent open data vision among policymakers, limited financial resources, and insufficient knowledge and experience regarding how to expand the adoption of open data (Bătăgăn, 2014). Studies examining the barriers to open data adoption frequently highlight several key challenges. These include inadequate funding and lack of both financial and human resources, the absence of technical capacity and standard tools (e.g., lack of standard software or metadata standards), the dominance of a "business-as-usual"

culture that prevents the widespread adoption of open data as a priority, deficiencies in licensing frameworks and legal regulations, and concerns regarding data protection (Janssen, Charalabidis, & Zuiderwijk, 2012; Barry & Bannister, 2014; Çaldağ & Gökalp, 2025)., While these challenges are common across many initiatives, their prioritization often varies by geographic context. In the case of Türkiye, the main challenges to open data initiatives include concerns around data privacy, the absence of open data standards guides, as well as a lack of skills and a limited open data culture (British Embassy Ankara, 2020)

3.2.4 Legislation and Data Governance Framework

As the role of big data in urban operations continues to grow, various concerns have begun to emerge. Throughout almost every stage of the data lifecycle[1], there are concerns regarding the handling of sensitive and confidential data (ServiceReda, n.d.). These concerns address the needs such as anonymizing data to protect individual's identities, restricting access to data, and including provisions for data sharing when obtaining informed consent (Eynden, Corti, Woollard, Bishop, & Horton, 2011).

Within this framework, one of the most effective instruments is the GDPR, which came into force in 2016 by the European Union. The primary objective of the GDPR is to contribute to the establishment of a comprehensive framework for data governance. Personal data protection is considered a fundamental right, and the regulation provides a legal foundation to safeguard individual rights and freedoms. It also seeks to contribute to the accomplishment of an area of freedom, security, and justice, support the realization of an economic union, foster economic and social progress, promote the strengthening and convergence of economies within the internal market, and enhance the well-being of natural persons (The European Parliament and the Council of the European Union, 2016). GDPR offers a standardized framework across a wide geographical area (e.g. EU member states)

[1] Data lifecycle refers to the process of handling data from when it's first generated to when it's interpreted into meaningful and actionable insights. It can be split into 8 stages: generation, collection, processing, storage, management, analysis, visualization, and interpretation. During the entire process, feedback mechanism is applied to enable consistent learning and improve decision-making (Harvard Business School)

and sets out obligations for organizations that process personal data and ensures the protection of individuals' rights concerning data security (ServiceReda, n.d.).

In urban context, data privacy can be defines as ‘’…the preservation of the information that is collected, processed and disseminated that relates to an individual’s person, behavior, habits, communication, location, associations or feelings” (Curzon, Almehmadi, & El-Khatib, 2019). All of the large-volume urban data is collected by various sources such as transportation, healthcare industry, education, retail, utilities and so on (Stefanouli & Economou, 2019). In that regard, according to Art 4., GDPR defines data such as name, identification number, location data, health information and online behavior as personal data and sets out specific principles for the proccessing of all such data within urban operations (The European Parliament and the Council of the European Union, 2016).

To illustrate, a smart mobility service provider subject to GDPR must treat location data as personal data and carry out its data processing activities accordingly. These operations must comply with the principles of “privacy by design” and “privacy by default,” as outlined in GDPR Art. 25. These principles ensure the effective implementation of data protection measures throughout the design and operational stages of any process, taking into account factors such as the technology used, the scope and purpose of data processing, associated costs, and potential risks to individual’s rights and freedoms. In this regard, the organization providing mobility services should, in compliance with the regulation, limit data collection to location data only and avoid gathering additional information unnecessarily (Stefanouli & Economou, 2019; The European Parliament and the Council of the European Union, 2016). Consequently, GDPR offers a detailed framework for regulating data-driven urban practices, enhancing their reliability and legitimacy.

Another relevant study in this area is the UK Data Ethics Framework, published in 2018, which provides a national-level ethical guideline for data related activities. In addition to legal regulations such as the Data Protection Act (1998) and the Freedom of Information Act (2000), which form the foundation of data protection in the United Kingdom, this framework helps authorities integrate data into decision-making processes in an ethically appropriate and responsible manner (OECD, 2023). The framework outlines actions that can be implemented to uphold three core principles: transparency, accountability, and fairness. Transparency

refers to ensuring that actions, processes, and methodologies are open, understandable, easily accessible, and free of charge. Accountability addresses oversight mechanisms and effective governance. Lastly, fairness refers to identifying potential unintended discriminatory effects on individuals and social groups and minimizing these effects to uphold human rights and sustain democratic values (Government Digital Service and Central Digital and Data Office, 2020). The specific actions that support these principles and provide practical considerations are outlined as shown in Figure 3.3:

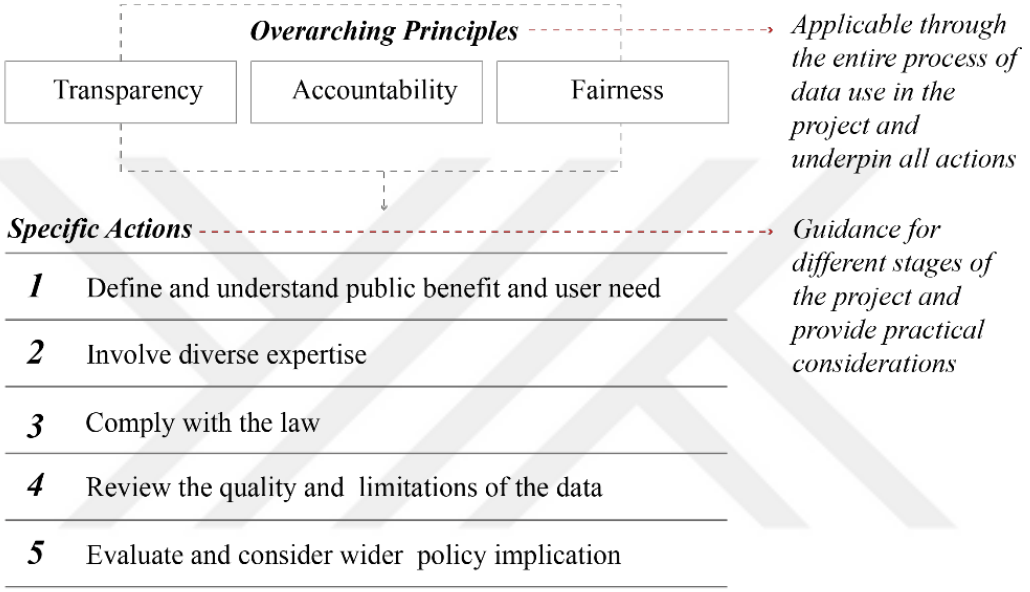


Figure 3.3 UK data ethics framework, adapted from (Government Digital Service and Central Digital and Data Office, 2020)

Similar to these efforts to establish a robust legal framework for data governance, Türkiye has also introduced several legal regulations to strengthen its accountability and digital infrastructure within the scope of digital transformation. The Personal Data Protection Law, came into force in 2016, aims to safeguard the privacy of personal data and ensure the protection of fundamental rights and freedoms. The data collected by authorities through digital services, social welfare systems, public transportation applications, and urban information systems, largely fall under the scope of this legislation. To fulfill the responsibilities assigned by this law, the Personal Data Protection Authority (KVKK) was established. The authority consists of a board and a presidency, with the board exercising its powers independently (Director General of Presidency's Lawand Legislation, 2016). The Digital Transformation Office, established in 2018, under the Presidency of the

Republic of Türkiye has further accelerated this transformation process. Its responsibilities include formulating and implementing the national digital transformation roadmap, contributing to the digital transformation of the public sector, regulating the cost of digital services, supporting specific technological projects, advancing data-driven technologies such as big data and artificial intelligence, and developing and managing initiatives such as the National Data Dictionary and the National Open Data Portal. Through these activities, the office has contributed extensively in fostering a data-driven culture in Türkiye (Gündoğan & Bingöl, 2024).

Within the scope of Strategic Goal 1.2 of the 2024–2030 National Smart Cities Strategy and Action Plan, it is stated that "In order for the new and diverse types of data generated in smart cities to have widespread impact, the standards for their production and sharing, as well as principles of interoperability, must be supported through a sustainable structure. This also includes preventing duplicate investments and data production and requires the establishment of strong legal frameworks alongside strategic and technical guidelines." In that regard, further progress and accelerated efforts in this area are anticipated (MEUCC, n.d.).

As the final point, the way urban data is governed directly influences the capacity to respond to complex urban challenges (OECD, 2023) While enhancing this capacity and bringing more value to data, it is equally important to ensure that individual rights and democratic values are not compromised in the process.

3.3 Urban Observatory as a Comprehensive Approach

The global standards, national and local initiatives, governance principles and frameworks reviewed above offer critical guidance on how urban data should be managed effectively. Nevertheless, turning these standards and principles into a comprehensive and applicable model in practice requires multi-stakeholder mechanisms that are responsive to local conditions. In this regard, urban observatories represent a comprehensive approach. They not only help to create a systematics urban data ecosystem but also integrate value-based data into decision-making processes, thereby transforming it into social benefit. This section will examine how these observatories emerged, the principles on which they are built, and how they function within data-driven urban governance.

3.3.1 Origins

Historically, the concept of ‘observatory’ has been primarily linked to the natural sciences such as astronomy, climatology and geophysics and can be traced back to ancient times (Neves, Gallardo, & Vecchia, 2017; Dick, 2020; Aubin, 2008). Nonetheless, the integration of this concept into urban studies began to take shape in the 1960s. In his 1962 article titled ‘’The Contributions of Political Sciences to Urban Form,’’ Professor Robert Coldwell Wood argued that the field of urban politics had significantly lagged behind the both the natural and social sciences in terms of addressing observable phenomena (Morales, 2023). He attributed this gap to the absence of scientifically reliable encyclopedia of knowledge and experience. In response, he proposed the establishment of a nationwide network that would allow local governments to consolidate their knowledge and experience, conduct experiments, and compare findings. This mechanism was envisioned as a way to provide trustworthy feedback to urban policymakers and contribute to the development of policies and programs aimed at addressing urban challenges (Williams, 1972).

In pursuit of this objective, meetings were organized with mayors from across the country, alongside practitioners and academics. As a result of these meetings, a working conference of city officials and urban affairs experts was held to draft the structure for such a system. Following the conference, much like the many collaborative forums and discussions we see today between city officials and scholars, the conference revealed a fundamental divide between practitioners and academics. While the practitioners requested applied research that could support immediate solutions to everyday issues such as financing, pollution, and public transportation, academic participants, aligned with Wood’s original vision, argued for a focus on pure research and systematic data gathering (Williams, 1972). Nevertheless, it became clear that there were common interests among the participants. Hence, the concept was adopted by urban actors and early examples of implementation started to emerge.

Based on these initiatives, urban observatories were structured to facilitate collaboration between local governments and universities. Governance models of the observatories varied across cases. While some observatories were established within universities, others were formed as independent non-profit organizations or

house within city agencies. From the beginning of these initiatives, it was agreed that four key factors would be considered in deciding research priorities: the research needs of local governments, the balance between policy relevance and academic interest, the potential for mutual reinforcement between research projects and community service activities and the visible outcomes within a relatively short timeframe. Following the fulfillment of these initial priorities, it was agreed that future discussions would likely focus on enhancing active citizen participation in policymaking, evaluating initiatives and programs based on measurable success criteria, and developing solutions to the financial challenges faced by city officials (Williams, 1972).

This early approach emphasized the importance of empirical research in shaping urban policies, addressing urban challenges and creating urban knowledge. Building on these principles, in 1997 UN-Habitat established the Global Urban Observatory. The main goal of this observatory was to develop innovative solutions to urban information crisis. While the initial urban observatories focused primarily on United States cities, GUO expanded the model to a global scale, and it began partnering with local and national official in selected countries to develop systems for urban data collection and align with international development goals. The Global Urban Observatory aims to describe a comprehensive process to produce, analyze and disseminate the value-based urban data needed by local decision-makers and international monitoring entities and start to make informed decisions on behalf of the citizens of cities (UN-Habitat, 2019)

3.3.2 Definition

The establishment of urban observatories has commonly been encouraged by the United Nations through the Global Urban Observatory program housed within the UN-Habitat, and UN-Habitat's Data and Analytics Unit has further supported the establishment of these observatories by providing direct training and technical assistance. UN-Habitat is coordinating 374 urban observatories worldwide including 101 in Africa, 143 in Asia and 130 in Latin America (UN-Habitat, 2025)

As defined in UN- Habitat's guideline published in 2019: ''An urban observatory is a local network of stakeholders responsible for producing, analyzing and

disseminating data on a meaningful set of indicators that reflect collectively prioritized issues on sustainable development in a given area or country''.

3.3.3 Principles

The main objectives of urban observatories include developing, collecting, and analyzing data based on localized indicators to monitor various urban issues; establishing permanent mechanisms for urban monitoring aligned with the SDGs; disseminating information to strengthen transparency and accountability; fostering local ownership of urban indicator systems; and encouraging the use of urban data in both local and national planning and policymaking processes. Together, these objectives offer a comprehensive framework for making urban data meaningful (UN-Habitat, 2019).

To achieve these goals, two types of urban observatories are typically established: local urban observatories and national urban observatories. Although they operate at different scales, both structures share a common framework and perspective. Local urban observatories can be situated within an existing city department, a non-governmental organization, or a university. Their primary aim is to develop a data ecosystem that supports decision-making on local urban issues and to enhance dialogue among local stakeholders, ultimately enabling a city-level participatory governance model.

One of the core priorities is fostering collaboration with other local urban observatories through the sharing of knowledge, resources, and methodologies to enable the dissemination of information at national, regional, and global levels. A key focus of local observatories is the production of "State of the City" reports, which assess whether local goals aligned with the SDGs and the New Urban Agenda are being met. These reports also include policy scenarios and best practice examples (UN-Habitat, 2019).

National urban observatories, on the other hand, are institutions established to coordinate the collection of urban data at the national level. They may function as oversight bodies that monitor the activities of local urban observatories or operate independently as hubs that generate their own data and knowledge resources. These observatories can also serve as consultative bodies responsible for shaping the national urban policy framework and coordinating the broader urban data

ecosystem. By organizing training programs related to the production and use of empirical information, they help ensure that both policymakers and technical professionals involved in data management are properly qualified. In summary, national urban observatories can act as umbrella institutions for both local initiatives and nationwide efforts, playing a key role in regulating multi-level, multi-actor relationships. Together, these two typologies support the creation of a comprehensive framework capable of addressing the complex and multi-scalar nature of urban operations (UN-Habitat, 2019).

An examination of the structure of urban observatories reveals that, in order to fulfill their ultimate objectives, they often operate through a consortium that includes government institutions, universities, community-based organizations, and private entities. As categorized by Dickey, Acuto & Washbourne (2021), these activities can generally be categorized under five main categories:

Information Gathering and Mobilization: One of the core functions of urban observatories is to ensure the regular collection, storage, and dissemination of urban data. In these data gathering processes, the observatories mostly rely on urban data produced by other institutions or available in the public domain.

Research and Knowledge Production: Another key function for urban observatories is the development of their own research programs. These programs can be designed using innovative, locally participatory methods aimed at addressing specific urban challenges.

Policy Development: Research and knowledge production contribute to urban policy by developing context-specific tools for local urban challenges and by creating comparable indicator systems aligned with global goals.

Capacity Building: Urban observatories embrace the co-production and co-learning approach, particularly through engagement with citizens, institutions and other observatories. This perspective allows it to building capacity through exchange of best practices and resources among the stakeholders.

Advocacy and Facilitation of Dialogue: Urban observatories frequently develop citizen engagement tools to strengthen context-specific local solutions. Hence their scope of activity is often shaped around fostering dialogue between citizens, communities, non-governmental organizations, and government actors.

Furthermore, the development of urban observatories involves several key stages. The process is primarily composed of two main phases: the inception and feasibility assessment phase, and the organizational development phase.

At the first stage, the core questions focus on whether there is a demand for monitoring systems to support urban planning and management, and whether an actor exists to lead the development of the observatory. Urban priorities are identified within this framework, ensuring alignment with global standards. Once local ownership is ensured, the next steps involve establishing a steering committee and designating a host institution. A crucial consideration when identifying stakeholders is the inclusion of potential funding entities within the committee to ensure the observatory's financial sustainability through a robust funding plan. Moreover, assessing existing technical and institutional capacities constitutes a critical dimension. International urban data governance mechanisms and best practices are reviewed and adapted to the methodology of the urban observatory. Based on these stages, the formulation of an action plan that defines objectives, indicators, responsibilities, and resource needs completes the institutional and technical feasibility process, thus concluding the first phase (UN-Habitat, 2019).

In the second phase, the focus shifts to shaping the institutional structure of the observatory, ensuring its consistency and long-term sustainability while laying the foundation for robust data collection processes. This stage involves defining the observatory's vision and mission, identifying thematic focus areas, determining the geographic scope (such as city-level or regional), developing methodologies for data production and indicator systems, specifying the formats for tools and outputs, and setting up effective dissemination strategies. Collectively, these actions build the operational framework that supports the observatory's goals and long-term sustainability (UN-Habitat, 2019). In summary, urban observatories serve as comprehensive model in shaping data-driven urban policies by providing a systematic foundation. The two-phase methodological approach adopted during their establishment ensures both technical and institutional sustainability, while also allowing for adaptability across various scales and thematic focuses.

The discussions in this chapter highlight the need for a diverse range of standards and initiatives for building a common language for urban development worldwide. These initiatives reviewed above enable co-learning across cities with comparable

insights and an integrated approach. In addition, in the context of open data initiatives, urban data becomes more valuable when it is accessible and fosters participation. Another issue is that handling data with ethical principles is not an optional feature but an inherent component of responsible urban innovation. To enable all of this, models such as urban observatories can serve as operational bridges to create a holistic approach on urban data strategy through the aspects such as stakeholder collaboration, indicator development, thematic focus and the creation of innovative tools. Therefore, this model plays a strategic role in delivering the integrated and value-based data management approach which is essential for understanding the complexities of contemporary cities.

4
COMPARATIVE ANALYSIS OF URBAN OBSERVATORIES

While the scope of urban observatories, organizational structure, objectives and methodologies and their impact on urban policies vary across countries, they share a common goal of improving urban sustainability through systematic data collection and analysis. In this context, a comparative case study analysis conducted to identify common trends among existing urban observatory practices. While UN-Habitat officially recognized a total of 374 urban observatories worldwide, only 32 of these founded in the publicly available 'Urban Observatory Profiles' dataset hence the scope of this analysis has been shaped by the national and local observatories listed in this dataset (UN-Habitat, 2025). Secondary data such as official web sites, published reports, data portals and open data sources of the relevant observatories and scientific literature were examined. To complement the secondary data, a semi-structured expert interview was conducted with Executive Director of the Gauteng City-Region Observatory (GCRO) and a member of the GUO-Net (Global Urban Observatory Network) Steering Committee. This direct consultation provided invaluable first-hand insights that enriched the interpretation of the case studies offering an in-depth perspective beyond publicly available documentation.

Among the thirty-two observatories, the five cases with the most suitable content for the thesis study in terms of geographic diversity (Figure 4.2), observation scale, data accessibility and information scope were selected. The selection of these criteria was made to guarantee that the case study sample would provide a solid comparison. The understanding of how observatories function within different socio-political contexts was enabled by geographic diversity criteria. The scale of observation enabled an examination of how these mechanisms operate across different levels of administration, from national to local. In addition, data accessibility and information scope ensured adequate transparency, usability and

documentation to enable meaningful analysis. Selected cases reflect a broad spectrum of urban data practices, governance models, thematic orientations, and digital capacities. Given that urban observatories operate simultaneously across multiple dimensions, it would be limiting to apply a single classificatory axis. In order to underscore the uniqueness of each case and strengthen the comparative depth of the analysis, each observatory is introduced with a typological title that reflects its most defining characteristic. This variation in typological framing points to the multidimensional nature of urban observatories and allows each case to be interpreted within its own contextual logic.

The analyzed cases were evaluated through a comparative matrix based on explanatory dimensions. In the final stage of the analysis, common trends and challenges observed across the cases were identified (Section 4.6). The emerging findings have revealed key principles on how urban observatory models can be shaped in relation to data-driven planning and decision-making processes. Ultimately, this analysis provides insights that may guide the development of future urban observatory models in the context of Türkiye. The figure below (Figure 4.1) presents the methodological framework described above, showing the basic flow of the analysis for a clearer understanding.

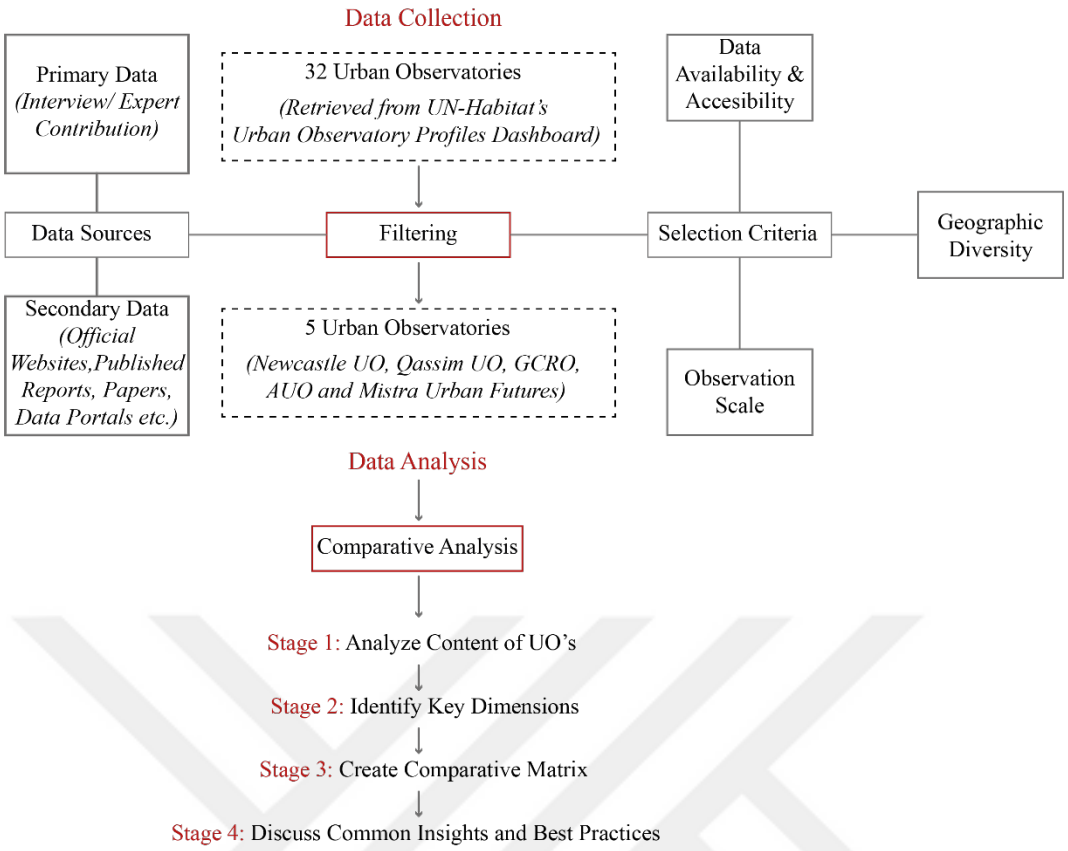


Figure 4.1 Methodological framework for comparative case study analysis (Prepared by the author)

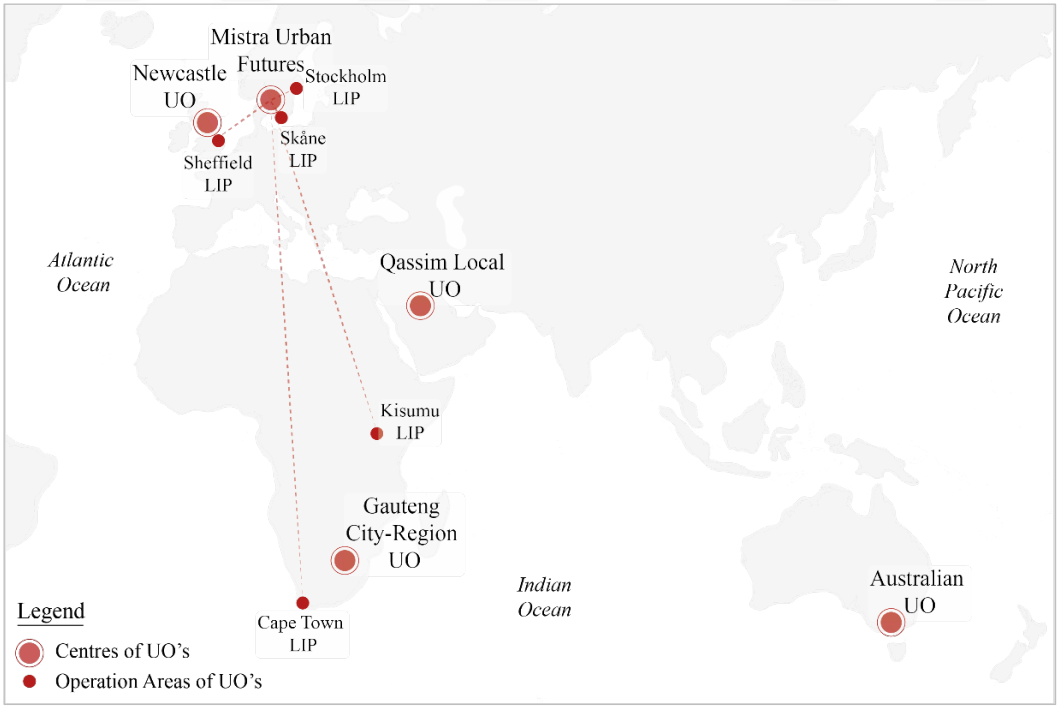


Figure 4.2 Global distribution of selected urban observatory centres and operation areas (Prepared by the author)

4.1 Real-time Urban Intelligence Platform: Newcastle Urban Observatory

The Newcastle Urban Observatory (NUO) began its early work in 2014 with a sensor-based research initiative and data collection efforts. It was officially launched in 2017 as part of the UK National Urban Observatory Programme, becoming the largest open platform for urban sensing data in the UK (Chapman). Funded primarily by Newcastle University and the UK Collaboratorium for Research on Infrastructure and Cities (UKCRIC), which is overseen and funded by the Engineering and Physical Sciences Research Council, the NUO operates within an academic institutional framework. It based in Newcastle University's Urban Sciences Building on Science Central (Newcastle University, 2017).

The main objective of the NUO is to develop a city-wide network of sensors that captures the interactions between buildings, infrastructure, people and the natural environment considering that cities are complex environments and sustainability can be achieved by identifying these interactions. One of the specific characteristics of the NUO is its deployment of over 4000 sensors across Newcastle and Gateshead, measures over 60 environmental indicators and generating approximately 5000 observations every minute. It makes it the UK's largest urban sensing data platform and the largest collection of open, environmental, real-time data in Europe (Newcastle Unviersity, 2019).

In terms of governance, the observatory follows a multi-stakeholder governance model, integrating strategic partnerships with governmental bodies, private sector partners and academic researchers. NUO plays a critical advisory role at local, national and international levels, shaping the discourse on urban policy and governance by bridging the gap between academia and practice. Collaborations extend to local councils, universities (e.g. Sheffield and Bristol), enhancing the NUO's research capabilities and data collection efforts. It enhances data literacy and engagement through workshops, seminars and other initiatives, democratizing access to scientific knowledge and empowering citizens to participate in the co-creation of urban knowledge and solutions (James P. P., 2024).

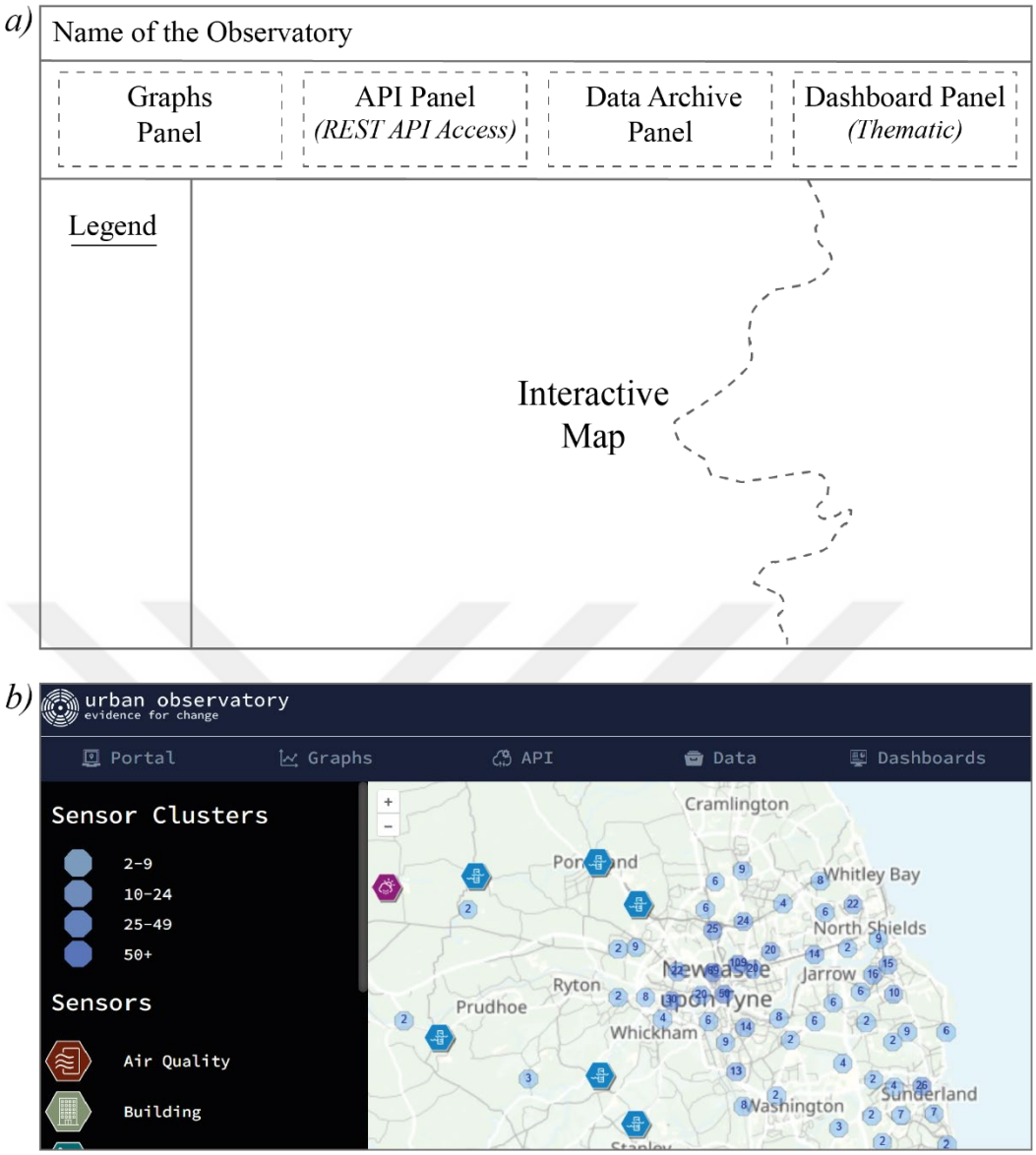


Figure 4.3 NUO Portal Interface: a) schematic layout b) interface snapshot (Newcastle Urban Observatory, n.d.)

The Figure 4.3 presents the interface of the NUO, emphasizing its capacity for real-time environmental monitoring and open data accessibility. The scope of collected data that can be downloaded from data archive panel includes real-time and historical datasets such as air quality metrics, hydrological variables, vehicle and traffic statistics, pedestrian movement, meteorological data. Detailed indicator list can be seen in Table 4.1. Data are acquired through a combination of sensor streams, CCTV cameras, satellite data smart building and IoT technologies and are made accessible via APIs in open formats such as JSON and CSV (The Newcastle Urban Observatory, n.d.). According to the observatory's guiding open data principles and commitment to transparency, accessibility and vendor non-exclusive

data sharing policies, real-time data visualization is supported through dashboards and interactive maps through the observatory's portal and Newcastle University's online library.

Table 4.1 Newcastle Urban Observatory indicator list (Newcastle Urban Observatory, n.d.)

Themes	**Indicators**
Air Quality	CO, NO, NO2, Nox, O3, Particle Count, PM1, PM10, PM2.5, PM4
Water Level	Relative Water Level, Water Level
Water Quality	Depth, Dissolved Oxygen, Dissolved Oxygen Percentage, Fluorescent Dissolved Organic Matter, NH4+N, NO3-N, Salinity, Specific Conductance, Turbidity, Specific Conductance
Weather	Dew Point, Humidity, Humidity, Rain, Rainfall, Solar Radiation, Sunshine Hours, Temperature, Visibility, Wind Direction, Wind Speed
Building	Internal Humidity, Internal Temperature
People	Walking
Sensor Metrics	Battery
Vehicles	Journey Time, Plates Out, Plates In, Plates Matching, Plates Out

NUO's data production and collection activities are supported by a governance framework that takes into account both technological and ethical dimensions. Three principal ways are used to assess the reliability and quality of the large volumes of sensor data collected by the observatory. One is the detection of questionable or impossible values and invalid data through automated anomaly detection. Considering the difficulty of the automated process because of the many unique possibilities, the system is supported by human intervention. The second is the recalibration of sensors. This process enables the capture of seasonal differences in the performance of sensors (e.g., air quality measurements). By working together with sensor manufacturers, which helps to improve the algorithms of the urban observatories, improves sensor quality and ensures accurate measurements. The third method is to collect customer feedback on data quality by using platforms such as Twitter or e-mail reporting systems (James, et al., 2022). With this method, NUO enables to-way interaction and quality control, making data user active participants

in the ecosystem. Another aspect of NUO's data governance framework is the establishment of ethical guidance, which has been discussed as a critical element of a robust urban data management structure in the previous sections. NUO conducted a Data Protection Impact Assessment (DPIA), which is one of the requirements of the GDPR's protection by design principle, according to its resources that may contain personal information such as CCTV. No personally identifiable data is stored within NUO's systems. (James, et al., 2022; Wolford, n.d.). These approaches and practices, which improve the reliability of the observatory, serve as examples for addressing the shortcomings in urban data governance described in the previous sections.

Based on data collected and compiled observations, Newcastle Urban Observatory contributes to the development of more informed urban policies, thus supporting decision-makers in building more resilient cities. As an illustration, the COVID-19 pandemic, the observatory provided local stakeholders with an adaptable and responsive dashboard, powered by its real-time data infrastructure. This enabled the policymakers to formulate COVID-19 policies and explore the interrelations between social behaviours, mobility patterns and environmental indices. Additionally, NUO has contributed evidence for local government pedestrianization schemes, the Newcastle Clean Air Zone and has been a long-term partner of the city council on its digital transformation journey and the award of smart city of the year in 2019 (Dickey, Acuto, & Washbourne, 2021; James P. P., 2024).

In conclusion, Newcastle Urban Observatory serves as a real-time urban intelligence platform that highlights the importance of collaboration, co-creation, open science and data in uncovering and addressing complex urban challenges and it stands as a significant model in shaping the cities of tomorrow with an innovative understanding.

4.2 Place-based Co-production Network: Mistra Urban Futures

Mistra Urban Futures was began its activities in 2010 as an international co-production and knowledge platform and research centre, headquartered in Gothenburg, Sweden. Towards the end of its 10-year funding period in 2019, it was ultimately integrated into Gothenburg Centre for Sustainable Development. The

vision of Mistra Urban Futures is to strive fair, green and dense urban areas and its main mission is to localize SDGs, connect local to global and generate and use knowledge to transitions towards sustainable futures through transdisciplinary co-production and co-creation (Mistra Urban Futures Website , n.d.).

Mistra Urban Futures was governed through a consortium model. The Gothenburg Consortium comprised seven partners, including four public bodies and three research organizations. It was represented by a council, which focuses on the long-term development of the centre and promoting collaboration between its members and its external partners. While the administrative coordination was led by Chalmers University of Technology, no single institution held centralized authority. It was co-funded by Swedish Foundation for Strategic Environmental Research (Mistra), Swedish International Development Cooperation Agency (Sida), Chalmers University of Technology, City of Gothenburg, Gothenburg Region Association of Local Authorities, County Administrative Board of Västra Götaland and IVL Swedish Environmental Research Institute, international partners and several funding agencies which fund specific research projects (Reepalu, Moser, Robinson, Dodman, & Engström, 2015).

Its core operational model was built around Local Interaction Platforms (LIPs) which functioned as place-based observatories and innovation hubs in cities across the Global North and South such as Gothenburg, Skåne and Stockholm in Sweden, Sheffield-Manchester in the UK, Kisumu in Kenya and Cape Town in South Africa. LIP played a vital role in shaping centre's international growth. Each LIP developed its own thematics focus based on its local needs such as urban poverty in Kisumu, low-carbon development in Gothenburg. Through the LIPs, the main aim of Mistra Urban Futures was to make transdisciplinary research as a form of participatory research possible (Polk, 2015; Perry, Patel, Bretzer, & Polk, 2018)

Mistra Urban Futures adopted a participatory and context-specific approach to data generation in its projects and pilot studies, an approach that is integrated with the centre's transdisciplinary research model. In line with the principle of co-production, qualitative data was produced through participatory methods such as deliberative workshops, interviews, scenario-building sessions, mapping, field surveys and other techniques. These datasets were supported by administrative and

spatial datasets available at the city level, collected from academic institutions, local governments, community organizations and digital platforms like Kolada.se[2].

Rather than developing a standardized list of indicators or automated data systems, MUF enabled each LIP to design its own data strategy based on local urban challenges, stakeholder needs, and institutional capacities. As an illustration, in its comparative pilot project, SDG 11 targets and indicators were examined and developed to test their local applicability, measurability, and relevance. Within the scope of this pilot project, major challenges identified included data gaps, issues on data quality, lack of compliance with methodological standards, and the non-availability of disaggregated data. It was noted that the implementational capacity of local governments, along with their technical capabilities, data production infrastructure, and political context, directly influenced the effectiveness of these indicators (Simon, et al., 2015).

The project outputs of the centres were assessed using both qualitative and quantitative evaluations, with a focus on co-production processes and urban sustainability. The transparency and accessibility of research findings were emphasized, promoting open access to publications and datasets where possible.

To institutionalize knowledge production, the centre established a 'Research School' to foster interdisciplinary engagement and applied research skills among PhD students and early-career researchers. Alongside, Research Network was developed to facilitate thematic and methodological collaboration among researchers, practitioners, and public sector representatives. Open-access books, policy-oriented reports, academic papers, and briefs have been published on the Mistra Urban Futures website (Mistra Urban Futures Website , n.d.).

In conclusion, Mistra Urban Futures offers an alternative model of urban observatory practice that prioritizes co-production, participatory research and place-based sustainability transitions. Through its transdisciplinary and multi-scalar

[2] Kolada is an open and free-access database that provided 6000 key performance indicators (KPI's) related to Swedish municipalities and regions. It is managed by the Council for the Promotion of Municipal Analysis (RKA), a non-profit organization formed in collaboration between the Swedish government and the Swedish Association of Local Authorities and Regions (SKR). The platform offers tools for analysis, comparisons across sectors. It also provides API enabling developers and analysts to integrate data into external tools like Excel, Power BI, or custom applications (Kolada.se, n.d.)

governance structure, developed projects, initiatives and pilot studies like Local Interaction Platforms, Research School and Research Network, Mistra Urban Futures demonstrated how urban observatories function as inclusive urban knowledge ecosystems rather than data hubs.

4.3 University-Government Knowledge Partnership: Gauteng City-Region Observatory

The Gauteng City-Region Observatory (GCRO) was established in 2008, serves as a regional urban observatory spanning major cities like Johannesburg and Pretoria and surrounding areas in South Africa. It was established through a collaborative partnership between the Gauteng Provincial Government, the University of Johannesburg (UJ). Its unique governance structure enables it to operate as both a research center and a boundary organization, bridging academia and public policy implementation and create a knowledge partnership. It receives core funding from the government, alongside in-kind support from UJ and Wits (Dickey, Acuto, & Washbourne, 2021).

The motivation behind establishing the GCRO was to conduct policy-relevant research specific to the local context. According to this motivation, GCRO's research focus is generally guided by government objectives; despite that, it maintains academic independence and accountability through its affiliation with two universities (Washbourne, Culwick, Acuto, Blackstock, & Moore, 2021). It seeks to develop an economically competitive, spatially integrated, environmentally sustainable and socially inclusive it aims to serve everyone with an interest in city, including national, provincial and local administrations, private sector, non-governmental organizations (NGOs) and civil society (Moore R. , 2016; UN-Habitat, 2019).

The observatory facilitates this objective through generation of up-to-date and relevant data, both qualitative and quantitative, drawn from sources such as census records, GIS and remote sensing data, collected and analyzed at multiple spatial scales due to its extensive geographic coverage. In line with UN-Habitat's Global Urban Observatory requirements for observatories to develop and use indicators at the city-region level, GCRO has developed its pioneering project called the Quality of Life (QoL) Survey, a household-based survey, stands out as on the region's most

extensive social research efforts, addressing themes such as socio-economic circumstances, to service delivery, psychological well-being and other complex characteristics of residents (Hamann, Miles-Timotheus, Naidoo, Naidoo, & Khanyile, 2024). All of its datasets are accessible from an open-source data sharing platform called DataFirst. This example and the many works produced by GCRO have evolved from the adoption of the principle of' open-ended sharing of data' (Gotz, Fatti, Seedat, & Washbourne, 2024). Due to its open-source data repository and freely publicly available research outputs, GCRO is able to analyze their datasets through different analytical lenses and thanks to its growing number of local and international research partners. Another issue on GCRO's approach on data governance is securing the data hence GCRO operates under the strict ethical protocols and all the data is anonymized to prevent any tracing back to individual households or persons in public representations (Seedat, 2025).

GCRO's collaborative governance structure enables it to lead long-term strategic initiatives, such as the Green Asset and Infrastructure Project. It demonstrates how observatory-led research can help embed ecological thinking into urban infrastructure planning. Using a "CityLab" format, it offers platforms for dialogue between practitioners and scholars, enriching both the practical application and academic exploration of green infrastructure in metropolitan contexts (GCRO, 2014).

Nevertheless, the GCRO encounters a number of systemic and operational challenges in its efforts to achieve coherence and coordination across the city-region. Among these are the disconnectedness of available spatial data, challenges in securing and protecting data, different approaches to its gathering and storage across various departments and levels of government (Washbourne, Culwick, Acuto, Blackstock, & Moore, 2021). In addition to these, Rashid Seedat, executive director of the GCRO's and member of the UN-Habitat Global Urban Observatory Network (GUO-Net) steering committee, emphasized that the most important challenge lies in the data collection phase itself based on his experience on QoL Surveys. He indicated that although face to face surveys yield the best results, the method is costly. Moreover, due to South Africa's high crime rate, it is difficult to collect data in middle class and wealthier areas. This often leads to a low participation rate, with only about 50% of households agreeing to participate. In

essence, high expense, security-related access limitations and low participation rates appear to be widespread issues in the data collection process (Seedat, 2025).

In conclusion, with all its components, the GCRO stands as a compelling model for a city-region observatory. Its hybrid institutional design has enabled it to respond dynamically to the needs of the Gauteng Provincial Government while retaining scholarly integrity through its affiliations with two leading universities. Maps of the month, vignettes, policy briefs, annual reports, and many other freely available outputs reflect GCRO's strong commitment to knowledge dissemination and co-production, as shown in Figure 4.4 (Gauteng City-Region Observatory, n.d.). The figure presents a vignette titled 'Protection of LGBTQ+ Rights Across Africa', which integrates spatial data, legal status indicators, and survey results. It combines a thematic map, current situation and public perception data to reveal complex issues in an accessible format. The structured layout format highlights GCRO's ability to synthesize complex quantitative urban data into accessible and visually engaging products, facilitating understanding and wider public access to knowledge. This approach exemplifies how data visualization can serve as a planning tool in support of social equity and human rights.

In conclusion, GCRO's ability to adapt, its approach on university-government knowledge partnership, and its dedication to the public value of knowledge collectively position it as a key precedent for city-region observatories navigating the complexities of metropolitan transformation.

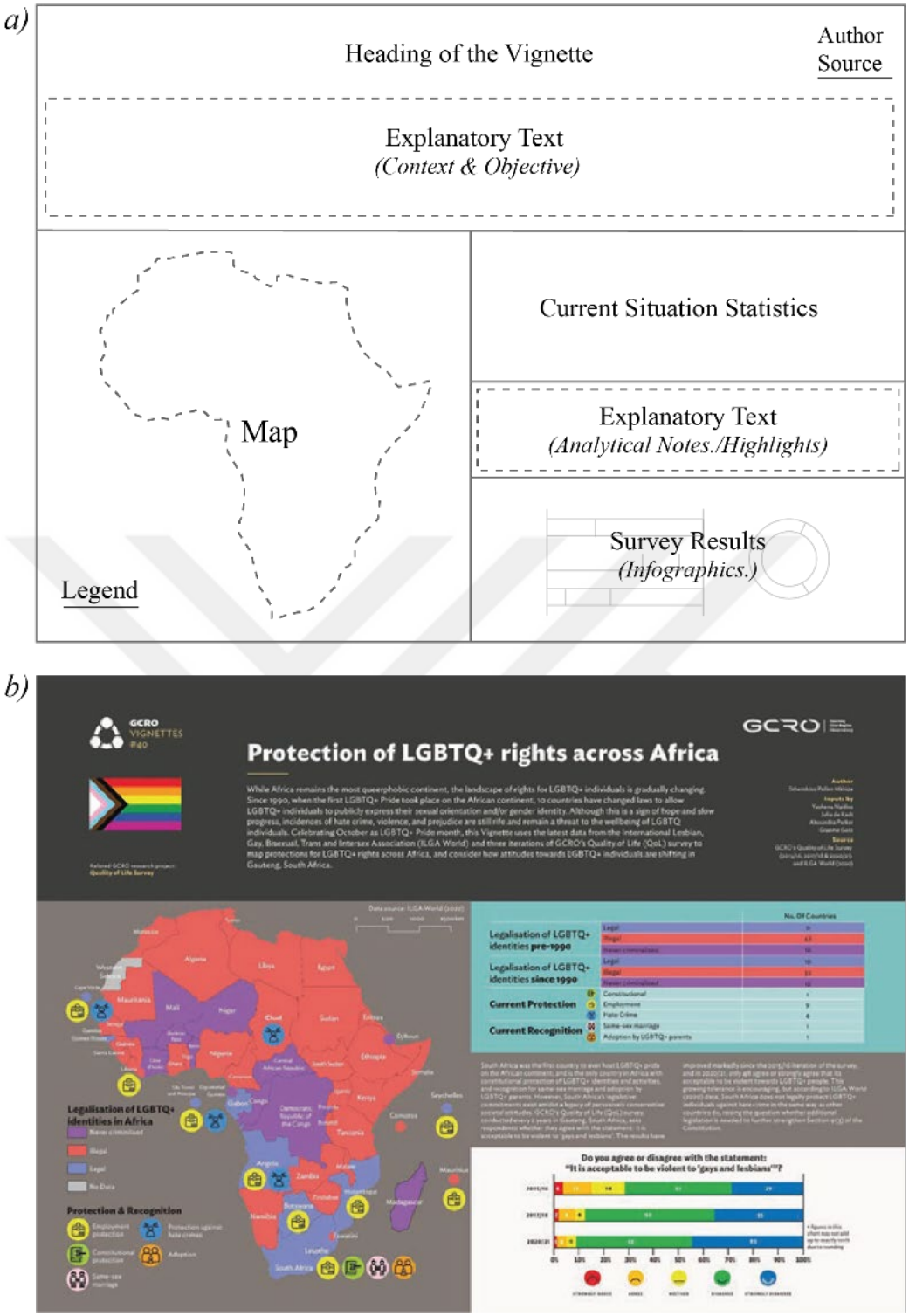


Figure 4.4 An example of GCRO'S published vignettes: a) schematic layout b) interface snapshot (Gotz, Fatti, Seedat, & Washbourne, 2024)

4.4 Government-led Monitoring Platform: Qassim Local Urban Observatory

The Qassim Urban Observatory (QUO) was established in 2009 in Saudi Arabia. Initially, the spatial scale of the observatory was limited to Buraidah city, later it was expanded to cover 13 major cities across the Al-Qassim Region, representing a prominent city and regional level urban observatory. The main motivation at inception was to help monitor socioeconomic trends in Buraidah city. Over time its role evolved to provide a uniform approach for collecting and managing urban data and tracking performance against local, national and global agendas within the region. Operating under a government-led model, the observatory functions as a mechanism for evidence-based decision-making, aligning local urban policy with national strategic objectives such as the Kingdom of Saudi Arabia's Vision 2030 and National transformation Programme 2023, by generating various urban indicators in support of development across multiple sectors (Al-Qassim Region Municipality; UN-Habitat, 2020).

Qassim Urban Observatory is governed through a multi-stakeholder model involving 18 partners including a diverse set of national and local authorities besides a university. List of the partners can be seen in Table 4.2. These entities collectively form the Qassim Urban Observatory Council, ensuring coordination across institutional and administrative layers.

Table 4.2 List of Qassim Urban Observatory partners (Al-Qassim Municipality, 2025)

Ministry of Human Resources and Social Development
Ministry of Justice
Ministry of Municipal and Rural Affairs and Housing
Ministry of Education
Ministry of Health
Ministry of Culture
Communications, Space & Technology Commission
Ministry of Environment, Water, and Agriculture
Saudi Commission for Tourism & Antiquities
General Directorate of Public Security
Ministry of Interior
Ministry of Sport

Table 4.2 List of Qassim Urban Observatory partners (Al-Qassim Municipality, 2025) (continued)

Ministry of Housing
Ministry of Transport and Logistic Services
Qassim University
Ministry of Media
Ministry of Civil Service
Real Estate Development Fund

Since its inception, the QUO's indicator framework has evolved through three stages. Between 2009 and 2014, the focus was primarily on Milennium Development Goals and city-level indicators. From 2015 to 2017, it integrated the City Prosperity Index created by UN-Habitat into its framework. From 2018 to 2020, it shifted toward monitoring indicators aligned with the SDGs. By 2019, the set of indicators tracked had grown significantly, from 84 to 229, capturing a wide spectrum of areas such as economy, infrastructure, social inclusion, housing, transport, governance, environment, tourism, and agriculture. Therefore, it has 115 global indicators, 120 Kingdom Vision 2030 Indicators and 59 local indicators (Qassim Urban Observatory, 2022).

QUO relies on a wide network of official data providers, drawing information from sources like General Authority for Statistics, governmental entities, NGO's and the private sector (Al-Qassim Region Municipality; UN-Habitat, 2020). It also relies on specialized surveys such as housing surveys, national identity surveys and tourist surveys to inform specific metrics (Qassim Urban Observatory, 2022). While the technological platforms, tools and data formats used by the observatory are not explicitly disclosed in public sources, the observatory emphasizes a structured and standardized approach to data management, enabling coherent integration of localized data into broader national and global reporting frameworks.

The observatory's participatory approach ensures an inclusive and consultative process for data gathering and validation. This involves collaboration with various stakeholders across both governmental institutions, local communities and other stakeholders. As an illustration, the observatory participates in events and activities such as Buraidah Spring Festival that are held in the region as a part of the observatory missions to inform citizens about the observatory, its importance in decision-making. Furthermore, recognizing the importance of accurate and up-to-date data, the observatory conducts tourist surveys at the festival, aiming to collect

data on the characteristics of visitors and their perceptions of tourism services provided in the city. Despite the collaborative approach, in terms of open data policy, there is a lack of publicly available information on the procedure of data access, usage rights and other issues on digital infrastructure employed such as platforms for visualization, mapping or analytics are not disclosed in publicly available sources.

The observatory's work has had notable impacts on urban policy. Most significantly, it produced the first Voluntary Local Review for SDG 11 in the Middle East, focused on Buraidah city, hence setting a benchmark for localized SDG reporting (Al-Qassim Region Municipality, 2018). Furthermore, the overall situation of the indicators presented, enabling national and global scale monitoring, and facilitating the classification of urban issues according to their priority for intervention. Additionally, it has provided evidence-based insights to guide improvements in urban service delivery, such as enhancing bed capacity, establishing air quality monitoring stations and so on. Ultimately, the Qassim Urban Observatory represents a government-led monitoring model that serves as a reference for many local urban observatories by operationalizing global goals at the city-level.

4.5 User-centric Urban Data Platform: Australian Urban Observatory

The Australian Urban Observatory (AUO) launched in 2017 and developed over three-year period until 2020. It is a university-led observatory hosted by the Centre for Urban Research at RMIT University in Melbourne. It focuses on sharing knowledge with residents and policymakers to improve health and liveability across communities and create equitable and healthy places. The AUO's aim is to transform complex urban data into easily interpretable indicators with user-friendly digital platform, serving planners, local governments, and communities across Australia's 21 largest cities. It emphasizes that easy-to-use tools provide a critical link between policy and research evidence and knowledge mobilization into policy and practice (AUO, n.d.; Davern, Both, Murray, Roberts, & Norzahari, 2023)

The AUO is supported through a broad network of collaborators that reflects it position at the intersection of academic research, public policy and health planning.

Key contributors included the National Health and Medical Research Council (NHMRC) supported Centre of Research Excellence in Healthy Liveable Communities, the Clean Air and Urban Landscapes Hub of the National Environmental Science Program, and The Australian Prevention Partnership Centre, funded by NHMRC and supported by partners such as VicHealth and SA Health (AUO, n.d.). Institutional support is provided by RMIT University through its Urban Futures Enabling Capability Platform. On the infrastructure side, organizations like Australian Urban Research Infrastructure Network (AURIN), the National e-Research Collaboration Tools and Resources (Nectar) and the Australian Research Data Commons provide technical and data-service support. Among these partners, AURIN plays a foundational role in enabling the AUO to integrate standardized data across Australian cities. AURIN also has been recognized by UN-Habitat as an urban observatory and stands out as a platform that provides urban data, spatial analysis tools and overall digital infrastructure at the national scale (AURIN, 2023). The collaboration between two observatories, recognized by UN-Habitat, offers various benefits. It not only strengthens the operational and technical capacity of the observatory but also exemplifies the evolving role of urban observatories as embedded actors within multi-stakeholder knowledge centers. While AUO delivers clear and actionable indicators for local governments and policymakers, AURIN provides the high-quality, standardized data and digital infrastructure required to produce them. This kind of coordination strengthens the observatories. Furthermore, it plays a critical role in ensuring comparability at the global level.

Building on this collaborative framework, one of the core operations of the AUO is the development of liveability indicators. The platform delivers 42 indicators across 9 domains of liveability, walkability, social infrastructure, transport, food, alcohol, public open space, employment, housing (Australian Urban Observatory, 2023). The AUO sources its data from Australian Bureau of Statistics, utilizing boundaries defined by the Australian Statistical Geography Standard. Its spatial analyses are primarily conducted through GIS-based methodologies, with data commonly presented in formats like CSV. Operating under a not-for-profit model, the observatory restricts access to detailed, suburb and neighbourhood level data to its funding partners, while making indicators at the local government area level freely

available. This approach reflects a semi-open data policy that seeks to balance public accessibility with financial sustainability.

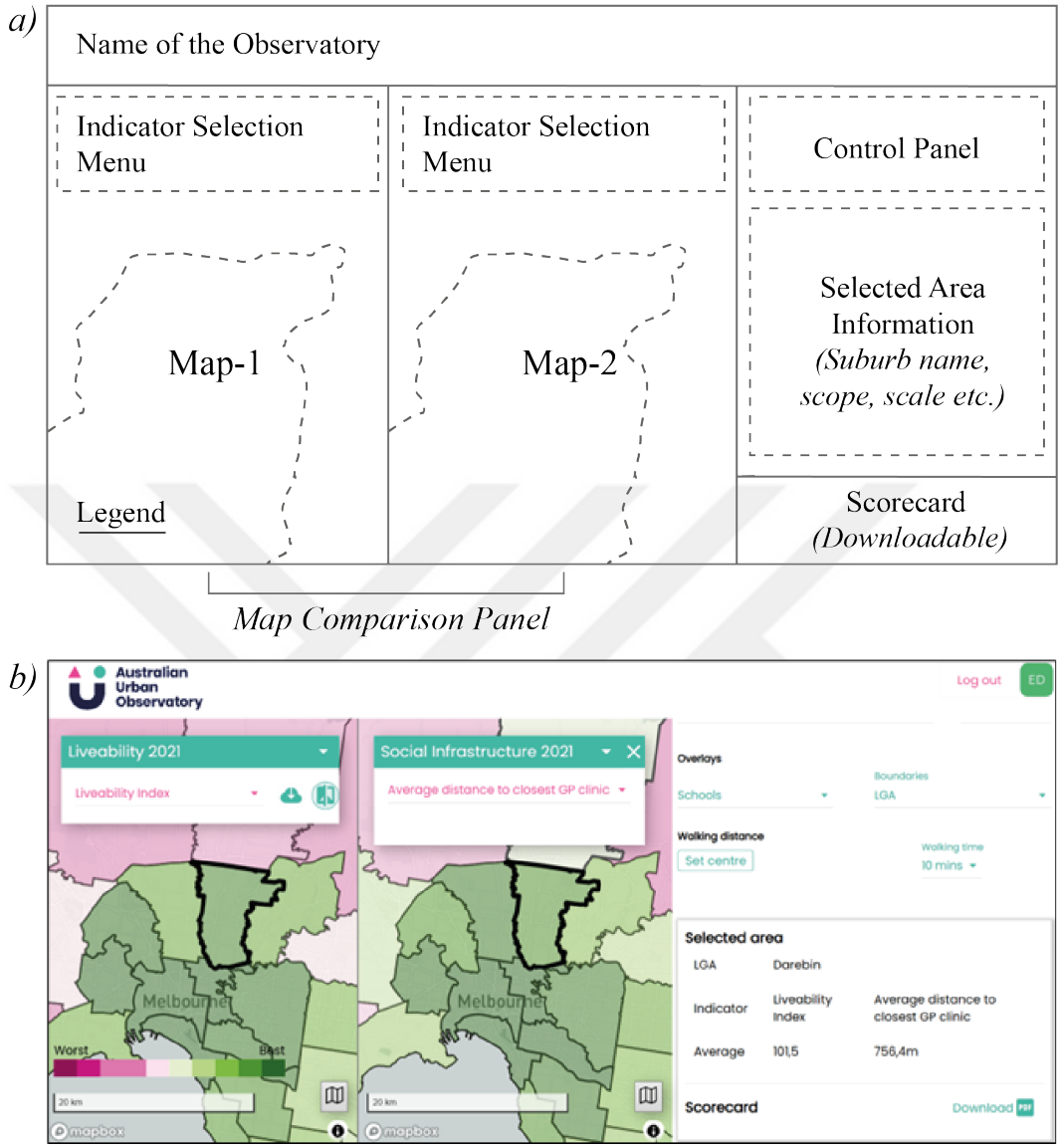


Figure 4.5 AUO's liveability planning platform interface: a) schematic layout b) interface snapshot (AUO, n.d.)

The AUO's digital liveability planning platform, developed with open-source software, includes digital map portals, dashboards, city-level liveability scorecard and transport health assessments tools. Such data-driven platforms make a significant contribution to urban governance and support fostering a culture of innovation in urban planning. As illustrated in Figure 4.5, the platform offers a user-friendly interface with map comparison panel for indicator comparison, a control panel showing contextual information at various levels and downloadable scorecards. In designing the AUO platform, a methodology described as 'end-user

software engineering' was adopted, creating a structure tailored to user needs throughout the idea development, design, and testing phases (Ko, et al., 2011). The aim was to ensure that urban data and indicators could be understood not only by technical experts but also by researchers, decision-makers, practitioners, and various civil society organizations hence the platform strengthens evidence-based policy making and shapes the urban planning strategies through various geographic levels.

Despite its many contributions to urban knowledge creation, the AUO has faced several challenges. Urban observatories could act as a bridge between academia and public institutions, and each sector comes with its own concerns and limitations. Since its inception, one of the fundamental challenges for the urban observatory has been navigating the constantly evolving policy environment within the public sector, along with the need for rapid response, maintaining trust-based relationships, and similar institutional pressures. On the research side, limited funding, incomplete or complex datasets spread across multiple administrative levels, negotiations with data custodians, and various technical and institutional difficulties have also emerged as core challenges for the AUO (Davern, Both, Murray, Roberts, & Norzahari, 2023).

Overall, the Australian Urban Observatory represent an urban observatory model that effectively integrates public health, urban planning and spatial data science. It enabled comparative and place-based analysis across Australian cities with a user-friendly interface. Ultimately, it underscores the potential of academic observatories to drive data-driven urban policy.

4.6 Comparative Analysis: Insights from Urban Observatories

This section presents a comparative analysis of the five urban observatories reviewed in the preceding chapters. It seeks to identify common patterns, key differences, and design insights, which can inform future models of urban observatories. Although each observatory operates within a unique socio-political, institutional and technological setting and across varying geographies and scales, analyzing them through a common set of explanatory dimensions provides a clearer understanding of how urban observatories are conceptualized, organized and implemented in practice.

To enable a systematic and structured comparison across the five observatories studied, a comparative matrix has been developed (see Table 5.3). The comparative matrix is structured around eight key dimensions, ranging from institutional models and thematic focus to data type and digital infrastructures, open data levels, participatory practices and contribution to policy. The rationale and scope of each dimension are outlined below.

The 'Institutional Model' dimension is essential for understanding the governance, funding mechanism and sustainability of an urban observatory. 'Thematic focus' reveals the specific urban challenges or areas of interest that an observatory prioritizes. 'Data Type & Digital Infrastructure' dimension is fundamental as it details the raw material and the technological backbone of an urban observatory. 'Indicator Development' is about how raw data is transformed into meaningful metrics for urban assessment and policymaking.

'Open Data Level' dimension is critical for assessing the accessibility, usability, and transparency of an observatory's data. In this study, open data levels (very high, high, medium, and low) were classified based on the eight core principles of open government data, as outlined in Figure 3.2 (p. 25). These levels were determined by the extent to which each observatory aligns with these principles. Observatories fulfilling seven or more open data principles were categorized as very high, indicating comprehensive openness through real-time, machine-readable data, open formats, licensing, and public accessibility. The high level (5-6 principles) reflects strong but not full alignment, often with primary data and open formats but minor access or licensing limitations. Medium (3-4 principles) includes observatories sharing derived indicators, limited machine-readability, or restricted access. Low (1-2 principles) denotes minimal openness, often limited to non-reusable formats like PDF reports.

'Participatory feautures' highlight how stakeholders are involved in the observatory's process to enhance the legitimacy of an observatory. 'Innovative Outputs' showcases the unique tools developed by an observatory to demonstrate how observatories translate complex data into user-friendly formats that can inform planning and decision-making. Lastly, 'Contribution to Policy' dimension illustrates the ultimate success of an urban observatory in shaping solutions to local urban issues.

The following Table 4.3 summarizes the findings across all five cases according to these eight dimensions. This matrix serves as a foundational tool for the thematic discussions that follow in sections 4.3.1 through 4.3.

Table 4.3 Comparative Matrix for Urban Observatory Cases (Prepared by the author)

Key Characteristic / Name of the Urban Observatory	**Institutional Model**	**Thematic Focus**	**Data Type & Digital Infrastructure**	**Indicator Development**	**Open Data Level***	**Participatory Feautures**	**Innovative Outputs**	**Contriution to Policy**
Real-time Urban Intelligence Platform: Newcastle Urban Observatory	Multi-stakeholder (Academia-led)	Real-time environmental monitoring	**Data Type:** Administrative Data, Sensor Data, Social Media Data, Spatial Data **Tools:** IoT and sensor-based data, API's, real-time dashboards, interactive maps	60+ indicator (Air quality, building, people, vehicles, water level, water quality, weather)	Very High	Knowledge co-production and dissemination	Real-time Data Portal and Dashboards (City Hearhbeat, Rainfall Radar etc.)	Informed Clean Air Zone Policy, Mobility Decisions, Smart City Design
Government-led Monitoring Platform:Qassim Local Urban Observatory	Multi-stakeholder (Government-led)	Saudi Arabia's Vision 2030, SDG's	**Data Type:** Administrative Data, Spatial Data, Sensor Data **Tools:** Not detailed in available sources	229 Indicators across infrastructure, economy, housing etc.	Low	Knowledge co-production and dissemination, community engagement (tourist survey, national id survey, housing survey)	Voluntary Local Review (VLR)	Informed Healtcare and Environmental Monitoring, Localized SDG Monitoring
University-Government Knowledge Partnership: Gauteng City-Region Observatory	Multi-stakeholder (Partnership between universities and provincial government)	Quality of Life (QoL)	**Data Type:** Administrative Data, Spatial Data, Social Media Data, Sensor Data, Participatory Data **Tools:** GIS-based analysis tools, remote sensing	QoL Survey Indicators (Socioeconomic and spatial indicators at municipal levels)	High	Knowledge co-production and dissemination, community engagement (participatory mapping, household survey, workshops)	QoL Survey and Visuliazation Dashboard, Citylab	Supported Hosusing, Transport and Equity Strategies, Long-term Urban Policy Evaluation

Table 4.3 Comparative Matrix for Urban Observatory Cases (Prepared by the author) (continued)

Key Characteristic / Name of the Urban Observatory	**Institutional Model**	**Thematic Focus**	**Data Type & Digital Infrastructure**	**Indicator Development**	**Open Data Level***	**Participatory Feautures**	**Innovative Outputs**	**Contriution to Policy**
User-centric Urban Data Platform: Australian Urban Observatory (AUO)	Multi-stakeholder (Academia-led)	Liveability, Health Planning	**Data Type:** Administrative Data, Spatial Data, Crowdsourced Data **Tools:** Dashboards, Interactive Maps, Scorecards, Assessment Tools	42 indicators across 9 domains (Walkability, public transport, open space, food access)	Medium	Knowledge co-production and dissemination	Liveability Scoring Tool, Transport Health Assessment Tool	Supported Health Policy, Wellbeing Plans and informed spatial plans
Place-based Co-production Network: Mistra Urban Futures	Multi-stakeholder (Academia-led)	Sustainability transitions, co-pruduction, inclusive governance	**Data Type:** Administrative Data, Spatial Data, Sensor Data, Participatory Data **Tools:** Not detailed in available sources	No unified indicators (Localized, context-specific indicators by LIP's)	Low	Knowledge co-production and dissemination, community engagement (workshops, interviews, scenario-building sessions, field surveys)	Local Interaction Platforms, Research School, Research Network	Supported climate policy, urban poverty strategies and transdiciplinary research perspective on urban policy

*Open data levels in this table are evaluated using the eight principles of open government data, as outlined in Figure 3.2 (p. 25). Each observatory's level was determined through a qualitative review of publicly available documentation, including portals, technical infrastructure descriptions and published reports. The rationale and criteria guiding these evaluations are elaborated in detail in Section 4.3.2.

4.6.1 Institutional Structure and Thematic Focus as Foundational Aspects

A robust urban observatory is built on strong institutional structure and a thematic focus. These two dimensions together describe the core identity and operational scope of an observatory.

A review of global examples indicates that, despite having different governance structures, most urban observatories are coordinated by public authorities in collaboration with academic institutions, frequently adopting multistakeholder governance models. Observatories commonly housed within universities or research centers as demonstrated in GCRO, Newcastle Urban Observatory and Australian Urban Observatory and jointly administered by consortium as observed in Mistra Urban Futures. This governance structures influence not only the observatory's operational framework. It also determines their legitimacy, how they are perceived and accepted by urban actors, whether they are considered trustworthy, and provides a foundation that facilitates their integration into decision-making processes and urban management. Furthermore, it enhances access to essential resources such as funding, human capital, and technological infrastructure.

As mentioned by Rashid Seedat, most urban observatories do not directly involve the private sector due to their profit-driven logic. However, as in the GCRO case, the private sector has an important role to play in the provision of certain data sets such as economic data and infrastructure services such as mining, financial services and so on. According to Seedat, collaboration should ideally be established with private sector bodies, such as chambers of commerce or industry associations, rather than individual companies to support broader economic development and investment promotion.

In all analyzed cases, financial sustainability is pursued not solely through local authorities' funding, but also by mobilizing resources from research institutions, private sector actors, and other partners. These insights suggest that for urban observatories to operate effectively and sustainably, they must be institutionalized within governance structures that enable multi-stakeholder participation and prioritize collaborative planning.

One of the common characteristics of the analyzed observatories is the identification of thematic focuses to provide direction for the observatory's knowledge production and support the development of place-based policies. Although there is no standardized framework, the findings from the five case studies indicate that these thematic areas tend to cluster around key objectives such as environmental monitoring, public health, quality of life, spatial justice and urban equity. As observed in Mistra Urban Futures, the establishment of instruments such as 'Local Interaction Platforms' plays a crucial role in informing place-based policy initiatives.

When determining a thematic focus, alignment with global goals and strategies, as well as the use of measurable indicators, are among the key principles that contribute to the effectiveness and success of urban observatories.

4.6.2 Data Governance and Indicator Strategies as Technical Backbone

It is the interaction between defining what needs to be measured and establishing the infrastructure and processes to measure it that transforms raw data into a powerful insight for cities. Together, these components form the methodological framework of urban observatories.

As we have seen in cases, data governance plays a critical role in urban observatories. It ensures that urban data is accurate, reliable, ethically managed. Key aspects include maintaining data quality and standardization, employing advanced data collection technologies, implementing open data policies, and endorsing data privacy regulations.

Most urban observatories implement internal mechanisms such as data dictionaries, metadata standards and quality control protocols to ensure data integrity and standardize data quality. These instruments define parameters such as time period, frequency, source, method of collection, data format. As an illustration, the AUO provides metadata information for each of its 42 indicators, while GCRO provides index methodology of its Quality of Life Surveys.

In addition, some observatories aim to align with international frameworks and global standards, such as ISO 37123: Sustainable Cities and Communities, Indicators for Resilient Cities, which focuses on establishing definitions and methodologies for a set of indicators on resilient cities.

Methods employed for data collection vary significantly across cases, ranging from sensor-based systems to remote sensing, surveys and other participatory methods depending on each observatory's thematic focus. One such example is Newcastle UO, according to its digital infrastructure on real-time data gathering and monitoring systems based on IoT technologies.

Furthermore, GIS is a core spatial data technology used as an analysis and visualization tool. For instance, GCRO integrates survey results with geospatial analysis, enabling neighborhood-level mapping of social vulnerability, service access, and quality of life. AUO similarly employs spatial analytics to generate liveability indicators at the Statistical Area 1 (SA1) and Statistical Area 2 (SA2) levels, using geocoded data derived from national census datasets, infrastructure maps, and transport networks. GIS technologies not only support static map outputs, but it also provides interactive maps and web-based dashboards that allow policymakers and other users to compare and explore urban data.

Open data policies play a critical role in shaping the transparency, efficiency, and reusability of urban data. The eight principles of open government data provide a comprehensive benchmark for evaluating the openness of the UOs approach on urban data. The open data level assessment outlined in Table 4.3. focuses on the qualitative alignment of observatories with these principles.

Across the five cases reviewed, observatories demonstrate diverse degrees of openness. In this context, NUO offers machine-readable, real-time data in non-proprietary formats with open access and minor limitations on license and compliance mechanisms. It offers datasets standardized formats including CSV and JSON through publicly accessible dashboards and APIs. With these features, NUO has been evaluated as having a very high level of openness.

In contrast, the Qassim UO demonstrates a very low level of openness, as it provides data primarily through PDF-based institutional reports. There is no standardized metadata, no use of open formats and no application of open licenses.

The Gauteng City-Region Observatory falls within the high level of openness, offering downloadable visual outputs, primary microdata in open formats (CSV/STATA), under open license (CC BY-SA 4.0) (Kadt, Götz, Fatti, Parker, &

Hamann, 2022), though some datasets are restricted and registration may be required.

The Australian Urban Observatory is assessed at a medium level, while Local Government Area level data is openly published, more granular spatial datasets at the suburb level are offered through a subscription-based portal. Despite this limitation, data is machine-readable and well-documented.

Lastly, Mistra Urban Futures conceptualized openness not as a technical requirement but as a process-oriented practice, emphasizing transparency in research design and knowledge co-production. While its outputs are not machine-readable, resulting in low level of openness, its transparency on research design and stakeholder involvement reflects an alternative form of openness.

A notable characteristic of all cases is the principle on data protection and access governance that is commonly implemented with specific access levels to ensure protection of sensitive information. In this regard, access arrangements have been published on data platforms within cases, and clarification text and regulations regarding the protection of personal data have been provided by urban observatory committee. Additionally, compliance with data regulations emerges as a fundamental principle in cases.

One of the key features is the inclusion of a data strategy in several studies. This strategy, encompassing a description of the role and responsibilities of stakeholders, the aim of data production, technical infrastructure and capacity, relevant policy, legal, or regulatory requirements and an articulation of how data value will be derived facilitates the transition to data-driven culture and its integration on decision-making processes for cities (Reichental, 2020).

Analyzed cases such as AUO and GCRO have formalized data frameworks that define roles, access protocols, metadata standards, and long-term data maintenance plans. Nonetheless, Newcastle has developed a robust data infrastructure supported by partnerships and API-based systems, while Qassim UO follows a more centralized approach because of its government-oriented approach. Overall, the presence of a coherent data strategy contributes to addressing complex urban decision-making processes.

Within this data ecosystem, indicators provide the basis for monitoring and performance evaluations supported by a transparent and systematic data governance framework. As stated in UN-Habitat's guideline (UN-Habitat, 2019), one of the core aim of all urban observatories is to promote local ownership of urban indicator systems and to support to the development of a culture of monitoring and assessment. As observed in the Qassim Urban Observatory, some cases employ frameworks such as the City Prosperity Index, which aligns with the SDGs and integrates environmental, social, and economic components within a single framework, highlighted in the guideline. While some observatories are capable of creating over 200 indicators, others create a more compact indicator system. What is critical here is ensuring that the indicators are directly related to the operational scope of the observatory, linked with local priorities and that the necessary infrastructure such as data availability and measurability is in place. In parallel, defining comparable indicators facilitates the assessment of performance levels of observatories and alignment with global goals.

While these efforts demonstrate a robust data governance framework, certain challenges remain. One common challenge, as Rashid Seedat pointed out, is the lack of coordination and fragmentation. Different public bodies often collect data independently without centralizing it in a single repository therefore it makes it difficult to find and share data. Another issue is the use of advanced technologies among public institutions. Although most observatories incorporate sensor-based methods to some extent, many still depend on administrative data collected through outdated methods, especially in government-led models. This reliance on traditional methods limits integration and timely analysis. Lastly, lack of data sharing culture can lead to fragmented understanding of complex urban issues and duplication of effort and wasted resources (Seedat, 2025).

4.6.3 Stakeholder Engagement and Policy Impact as Societal Value

Ultimately, the success of an urban observatory is measured by its ability to urban outcomes in ways that promote equity, sustainability, and evidence-based governance through active stakeholder engagement and meaningful contributions to urban policy.

One of the common patterns of cases is the use of participatory methods throughout all stages from inception and feasibility assessment to organizational development. Based on the anaylzed cases, such as Qassim UO and GCRO, it is observed that tools like surveys and workshops are utilized during the data collection stage. Furthermore, Mistra Urban Futures' LIPs and GCRO's DataFirst and CityLabs underscore the importance of inclusive knowledge co-production. Within this framework, the participatory features of observatories have been evaluated under three categories: knowledge dissemination, knowledge co-production, and community engagement. These components are defined as follows:

Knowledge Dissemination: It refers to one-way and limited communication of research findings through formats like platforms, reports, dashboards, trainings etc.

Knowledge Co-production: It refers to a collaboration between various actor groups, including researchers, local authorities, and community actors, who jointly define problems, generate data, and interpret findings through mechanisms such as crowdsourcing, collaborative projects, in order to ensure shared ownership of knowledge, as noted by Polk (2015).

Community Engagement: It refers to the active involvement of citizens and community organizations in co-creation process through mechanisms such as seminars, workshops, surveys and other participatory methods to develop services based on real need of citizens (Jr., 2024).

When examining the primary objectives of urban observatories, it is seen that goals are set for urban management, infrastructure development, local administration and development of sustainability policies. Furthermore, urban observatory networks provide an opportunity for cities to compare their own development globally and make it possible to develop sustainable urban practices with global agendas such as SDGs, the Paris Agreement, and the New Urban Agenda. All analyzed cases have developed various innovative tools in line with their specific objectives, thematic focus, technical capacities, and resources. As shown in the matrix (Table 4.3), these tools contribute to the strengthening of environmental policies, the distribution of urban services, the enhancement of spatial plans, and the development of evidence-based urban policy, one of the core objectives of UN-Habitat's guide (2019).

As a final point, urban observatories serve as key models for promoting data-driven, participatory, and locally grounded urban governance. Through innovative tools, inclusive strategies, and alignment with global agendas, they contribute to more effective urban planning, evidence-based policymaking.

5
CONCLUSION

Data, while being a foundational component of many disciplines, holds as remarkably comprehensive meaning for cities. Since the beginning of urban studies, data has enabled the understanding of relationships within the city and opened many doors for solving complex problems. Throughout the history, data's meaning has changed in terms of how urban policymakers have handled it, the evolving and diversifying data types and its advancement with new technologies ultimately becoming a source of power today. One of the fundamental issues concerning urban data, as part of the ongoing digital transformation process, is addressing it within a holistic framework. A key consideration when building this holistic perspective is the establishment of standardized frameworks for generating comparable insights, facilitating data exchange and building a common language. However, many institutions contributing to urban policy face challenges due to the lack of these standardized data frameworks. In addition, open data policies that promote the transparency and accountability of these institutions along with participatory methods also form a pillar of this framework. These principles ensure that the value gained from data is shared across all urban actors, ensuring ultimate benefit.

One of the biggest challenges that arise in cities with the development of big data is the difficulty in developing urban trust towards governments, where citizens are concerned about privacy. In this context, the provision of ethical frameworks and legal basis to ensure that the power of data is used for public good and does not violate any human right or democratic values is another pillar of this framework. Considering all of these challenges, the holistic framework should be a guide for the problems faced by cities such as lack of coordination between institutions, weakness in data standardization, lack of open data culture and lack of technical and legal infrastructure.

Urban observatories represent a value-based approach to urban data making this holistic framework possible. They serve as bridges that can operationalize global data standards, governance principles and open data philosophy into actionable, locally adapted urban data management practices.

The five case studies examined within the scope of this thesis: Gauteng City Region UO, Newcastle UO, Qassim UO, Australian UO, and Mistra Urban Futures provide evidence for the successful implementation of value-based urban data management.

One of the fundamental characteristics of successful urban observatories is that they are often coordinated with public authorities in collaboration with academic institutions. Universities ensure the impartiality, objectivity and strong scientific basis of urban observatories. They also undertake a developmental role in technical capacity, such as collecting and integrating quantitative or qualitative data and checking data reliability and coherence (Coetzee & Smit, 2015).

Public authorities as another key stakeholder serve as primary partners in providing funding, acting as a facilitator for the financial sustainability of urban observatories. They offer essential contributions by coordinating relationships with other organizations, ensuring the practical application of urban observatory outputs, and generally guiding the entire process. While the examined case studies were predominantly structured around these institutions, the contributions of NGOs and the private sector are also extremely important for establishing a robust governance framework. NGOs, benefiting from their independence from policymakers, can strengthen the neutrality of urban observatories and act as intermediary organizations to facilitate citizen participation in observatories. On the other hand, the private sector can contribute to transforming outputs into economic value and providing the necessary technical infrastructure.

Another common pattern for success is the use of well-structured data governance frameworks as the technical backbone. These frameworks include layers such as the implementation of mechanisms to ensure data quality, the use of emerging technologies such as real-time data collection methods, the definition of legal infrastructure and ethical principles that ensure data security, the adoption of an open data culture, and the existence of institutionalized data strategies. In addition, most cases prioritized the development of site-specific indicator systems and they

link these systems to global frameworks. Thereby, monitoring and evaluation culture becomes a mandatory component of urban observatories and lifelong learning is ensured.

Finally, a common thread across all case studies is active citizen participation and the innovative outputs of urban observatories that enable evidence-based decision-making. These truly reveal the societal value of an urban observatory. The co-production of knowledge process, from the establishment phase through to the dissemination of outputs, forms a framework for sustainable and democratic urban data governance.

5.1 Strategic Assessment of the Urban Observatory Model: SWOT Analysis

To further understand the viability and replicability of the urban observatory model, a SWOT analysis was conducted to synthesize strengths, weaknesses, opportunities and emerging threats, as shown in Table 5.1. The SWOT analysis shows that the strengths of the urban observatory model, especially its multi-stakeholder structure, capacity to increase data literacy, and standard frameworks that promote an open data culture, are in line with global trends. These features align with international commitments such as the Sustainable Development Goals, the Paris Climate Agreement and the New Urban Agenda, enabling the model to position itself as a strategic tool in policymaking. In addition, its ability to integrate with new technologies such as IoT sensors and artificial intelligence and to serve as real-time decision support mechanisms enables observatories to respond quickly to urban crises.

However, the analysis also highlights critical interactions between weaknesses and threats. Outdated data collection methods in public institutions, a lack of institutional coordination and a weak data-sharing culture are fundamental structural issues that could limit the model's potential. Combined with threats such as economic downturns or changes in political priorities, these issues could affect the financial and operational sustainability of observatories. In this context, strategically combining strengths and opportunities will play a critical role in mitigating these risks. For instance, the existing multi-stakeholder structure could facilitate both technical capacity development and the establishment of independent

verification mechanisms. Similarly, adopting open data standards, clearly defining roles and responsibilities in data governance, and legally clarifying the roles of data owners, processors, and publishers can increase the model's reliability and create a sustainable platform for democratic data governance, providing answers to questions such as who made the changes, when, and why. This will increase the model's reliability and establish it as a sustainable urban data platform for democratic data governance.

Table 5.1 SWOT Analysis for Urban Observatory Model

Strengths	**Weakness**
Supports data literacy and skill development with educational programs and implements new technologies (machine learning, AI etc.) with their multi-stakeholder structure and strong relations with universities,	Reliance on outdated data collection methods in public institutions
Enhances public understanding via accessible dashboards and interactive maps.	Lack of coordination with official statistical systems and siloed operations on urban data across agencies
Empowers communities through co-design processes.	Lack of institutionalization of co-design, co-production methods introduced through project-based initiatives, revert to conventional bureaucratic routines and culture after projects end
Establishes standardized frameworks for open data licensing and fosters an open data culture.	Lack of business models for financing observatories
Assesses digital infrastructure readiness and identifies gaps (e.g., sensor networks, GIS systems).	Limited analytical depth of UO outputs due to skill deficits (in data management, GIS etc.)
Provides guidance on adopting interoperable data standards (e.g., OGC, INSPIRE).	Limited integration due to weak culture of data sharing
Leads pilot projects for city-wide data coordination, provides tools for monitoring data quality, ownership, and accountability across urban actors.	Remote data sourcing limits participation and representativeness, as many community members cannot engage effectively through digital means, making face-to-face methods more reliable but they entail higher financial and logistical costs
Helps develop a data-driven and evidence-based culture.	-

Table 5.1. SWOT Analysis for Urban Observatory Model (continued)

Opportunities	**Threats**
Go-to instruments for meeting the SDGs, Paris Climate Agreement targets, and the New Urban Agenda commitments	Change in government or political priorities can lead to funding cuts or even the dissolution of an observatory
The proliferation IoT sensors, satellite imagery, big data analytics, and AI increase an observatory's relevance by providing timely insights for crisis management	May encounter resistance when their data diverges from established policy narratives.
Enables effective responses with real-time monitoring to dynamic environmental, social, and economic pressures.	Concerns over cybersecurity and data breaches: a well-publicized leak or hack could erode public trust
Supports civic analytics and democratizing data.	During economic downturns or municipal budget crises, observatory functions might be deemed non-essential and see cuts.
Networking nature of UOs help observatories in developing cities adopt methodologies from more established one	Restricted use of data by only privileged or technologically adept actors can reinforce existing knowledge gaps.
Can be the vehicle to deliver transparency by creating open data principles.	The lack of independent verification mechanisms cause risk of data misuse or manipulation
Investing in data capacity yields tangible governance gains	Poorly designed or monitored algorithms and data practices can reinforce biases resulting in discriminatory urban policies

5.2 Gap Analysis and Potential Contributions in Türkiye

When examining urban data ecosystems in the context of Türkiye, although there is no formal urban observatory, there are various initiatives in this field, such as the growing smart cities agenda, open data portals developed by various local authorities and national efforts in data management, as can be seen in the examples in Section 3.2. A gap analysis was conducted to identify the structural, infrastructural, and governance gaps in this ecosystem and explore the potential roles that urban observatories could play, as shown in Table 5.2. In the table, the "Identified Gaps" section identifies areas for improvement in Türkiye's urban data ecosystem, while the "Desired State" section represents a synthesis of the desired state in various thematic areas, Türkiye's national strategic goals, local

governments' policy frameworks, and principles proposed in the academic literature on urban data governance and digital transformation.

Within this framework, certain patterns in current practices illustrate the nature and scale of these gaps in Türkiye's context. A notable example is that, while open data portals exist in major cities such as Istanbul and İzmir, they tend to function primarily as data repositories. Datasets are often uploaded once and not maintained or periodically updated. This limited dynamism reduces their practical value and weakens the potential of open data as a driver for continuous innovation. This technical shortcoming is linked to broader governance issues, including the centralization of decision-making and data authority, which may limit the operational autonomy of local administrations. As studies on developing country contexts indicate, "fragmented authority between central and local administration" for smart city initiatives can hinder coordinated (Tuysuz, Yazar, & Manga, 2022). The absence of an enabling policy environment could pose a risk to the operational effectiveness of urban observatories, which depend on broad and sustained cooperation among diverse actors.

Furthermore, the fragmentation of data across different public bodies remains a structural challenge. Ministries often manage their own datasets independently, while municipalities may not systematically exchange information with each other. In some cases, discrepancies between datasets produced by national statistical agencies and local authorities have sparked public debate such as inflation rate or poverty in Istanbul. These dynamics highlight the importance of establishing clear, standardised protocols for data sharing and validation. Additionally, the culture of freedom of information is not yet fully institutionalised in Türkiye, meaning that data acquisition processes can involve lengthy administrative procedures. Without streamlined access mechanisms, an urban observatory may spend time and resources on permissions before analysis.

Another key consideration is cybersecurity, given that municipal IT systems in Türkiye have occasionally been targeted by cyberattacks (Botha, Grobler, & Eloff, 2017; Search Inform, 2025) This highlights the importance of implementing robust protective measures to ensure data integrity and protect public trust. In addition to safeguarding against external threats, there is a broader need to establish safeguards against potential data misinterpretation or manipulation, whether intentional or

unintentional, by adopting clear quality control protocols and transparent verification processes.

While these gaps present considerable challenges, urban observatories could act as strategic enablers in overcoming them. Their multi-stakeholder governance model offers a platform for building trust, fostering cooperation, and ensuring data interoperability across jurisdictions. By embedding standardized protocols for data collection, validation, and sharing, they can mitigate institutional fragmentation and reduce the duplication of efforts.

In practice, UOs can support education and skill development by leveraging their strong links with universities to deliver targeted training in data literacy, urban analytics, and emerging technologies such as AI and GIS, while also providing real-world testing environments for these tools. They can enhance public awareness and data literacy through the translation of complex urban datasets into accessible dashboards, maps, and interactive platforms, enabling civic analytics, co-design processes, and participatory decision-making.

From an open data and transparency perspective, observatories can also establish transparent and regularly updated open data platforms, transforming static repositories into dynamic, user-friendly knowledge hubs. They can also create standardized licensing frameworks and foster a culture of data sharing and enable adoption of interoperable standards such as OGC and INSPIRE.

Most importantly, by aligning outputs with both local needs and national strategies, UOs can bridge the gap between data production and policy application ensuring that data-driven insights are both actionable and sustainable and enable adaptive responses to social, environmental, and economic pressures.

In summary, enabling value-based urban data management in Türkiye, particularly in metropolitan cities such as Istanbul where diverse and large volumes of data are generated, will require the establishment of organizational structures that bring together public institutions, universities, civil society, and the private sector; the implementation of programs that support public engagement, strengthen participation, and increase data literacy; the creation of a governance framework grounded in transparency and openness; the enhancement of technical infrastructure and adoption of data standards; and the integration of modern technologies into

evidence-based decision-making processes. In doing so, urban data can be leveraged to its full potential, ensuring that a value-based approach becomes a practical reality.

Table 5.2 Gap analysis of key challenges for urban data management in Türkiye (Hansen, Koonsanit, & Kulmala, 2025)[3]

Area	Current State	Desired State	Identified Gaps	Supporting Studies
Education and Skill Development	•Data-related skills are limited regarding data standards, data management, data analytics with a focus on innovative services and products, data security and privacy •Lack of qualified educators and trainers with industry experience in data science and big data for analyzing complex urban data	Increasing competent workforce in the field of data and artificial intelligence	• Lack of skills development programs in collaboration with the sector	Future Work: Turkey's Talent Transformation, McKinsey & Company, 2020, Digital Government Review of Türkiye, OECD, 2023, National Artificial Intelligence Strategy Action Plan (2024-2025)
Data Literacy and Public Awareness	•Limited data literacy among citizens and city officials •Lack of public awareness campaigns on data literacy, digital citizenship, and data privacy rights	High level of data and digital literacy, using participatory methods to improve communities, cities and countries through data-driven initiatives.	• Lack of public campaigns and systematic educational programs on data literacy and data privacy •Limited institutional mechanisms to raise awareness across diverse demographic groups	Duygulu, A., Doğan, S., & Yıldız, S. (2025)

[3] The structure of the table (i.e., rows and columns) was adapted from Hansen, Koonsanit, & Kulmala (2025), whereas the data and analysis were generated by the author.

Table 5.1 Gap analysis of key challenges for urban data management in Türkiye (Hansen, Koonsanit, & Kulmala, 2025) (continued)

Area	Current State	Desired State	Identified Gaps	Supporting Studies
Open Data and Transparency	•Open data portals (e.g., Istanbul, Izmir) exist in local authorities but are limited in number. Additionally, they usually function as data repositories, participation is low, datasets are limited and dispersed •Fragmented licensing practices and missing API/metadata transparency hinder usability of public data. •Lack of open standards and guides •Concerns about data privacy. •High cost	Adopting the principles of transparency and accountability in institutions and organizations and enabling the production of new value-added services	•Lack of unified open data standards and principles, •Lack of active use of open data platforms and non-sharing of high value-added data •Missing API documentation, fragmented licensing practices and absence of metadata disclosure prevent reuse, clarity, and interoperability	Yıldırım, M. E. , & Cömert, Ç. (2025), Open Data in Turkey, British Embassy Ankara (2020), Digital Government Review of Türkiye, OECD, 2023, Gündoğan & Bingöl, 2024, IMM's Strategic Plan 2020-2024, 2030 Istanbul Smart City Strategic Plan, National Smart City Open Data Platform (2023)
Technological Infrastructure	•Disparities in internet access quality and speed between urban and rural areas •Advanced technologies such as 5G, IoT are not yet widespread •Lack of standardized data formats, high data quality, up-to-date technological infrastructure •Lack of integration among public information systems limits data flow	Establishing an integrated information co-production and sharing infrastructure, developing geographical information infrastructure	•Low adoption of shared digital urban data platforms •Lack of sensor integration and cloud interoperability	Ay, S., Kilic, T. (2023), National Geographic Information Strategy and Action Plan (2024-2030), Turkey's National Data Dictionary Project (2019)

Table 5.1 Gap analysis of key challenges for urban data management in Türkiye (Hansen, Koonsanit, & Kulmala, 2025) (continued)

Area	Current State	Desired State	Identified Gaps	Supporting Studies
Data Governance	•Not standardized protocols, overreliance on institution-dependent protocols. •Lack of ethical framework. •Lack of coordination among institutions •Fragmentation in data protection legislation (e.g. KVKK, open data strategy) •Duplicate datasets across institutions reduce efficiency and create confusion in data management •Undefined data ownership causes accountability gaps and complicates data stewardship	Developing a comprehensive approach that includes standardization, legal measures and the implementation of automated processes to ensure secure, efficient and uniform data sharing	•Lack of coordination between institutions •Absence of a comprehensive urban data governance framework, citizen concerns over data security as a result of history of data breaches.	Data Governance Framework: Recommendation Report for Türkiye, UNDP, 2024, Turkey's National Data Dictionary Project (2019),
Data Culture	•Lack of urban trust and safeguards to foster data altruism and voluntary data sharing. •Resistance to data-driven decision-making, insistence on business as usual •Lack of data leadership •Freedom of information culture underdeveloped; obtaining datasets often requires lengthy permissions	Increasing public, university, private sector collaborations for innovative technologies and application	•Absence of tools to ensure the secure exchange of data and to empower citizens with the capacity to manage the permissions and consents associated with their data, •Limited data proficiency among public institutions. •Lack of continuous capacity building and lifelong learning •Procedural barriers for accessing public datasets	Digital Government Review of Türkiye, OECD, 2023, Data Governance Framework: Recommendation Report for Türkiye, UNDP, 2024

5.3 Further Research

Within the scope of this thesis, the following further research areas are identified to deeper understanding of subject matter, along with a discussion of its limitations. These recommendations aim to both enhance the applicability of urban observatory model and support the development of inclusive, sustainable urban data ecosystems in Türkiye.

Given that there is currently no institutionalized urban observatory operating in Türkiye, pilot implementations on local urban observatories can be developed in metropolitan cities such as Istanbul. This can enable testing the feasibility of data collection methods, technological infrastructures and operational models in a controlled environment, also uncovers what works and does not in urban observatories data collection, analysis and dissemination processes and can reveal specific institutional, technical, and social dynamics that shape urban data flows.

An additional area that could guide further research is participatory data collection methods. A detailed analysis of participatory data collection methods such as VGI and citizen sensing was not pursued in this thesis in order to maintain a balanced focus across the observatory's multiple components. Nevertheless, these methods are recognized for their capacity to enable accurate representation, foster community empowerment, improve data quality, build trust and transparency in data processes. Beyond their technical contributions, participatory methods are also valuable for generating thick data, which is defined as rich, contextual and qualitative insights that capture the lived experiences, perceptions and socio-cultural dimensions behind quantitative indicators. Rather than relying solely on technical metrics such as data volume or expert-defined accuracy, they emphasize social outcomes as key indicators of success. Future research could explore how these approaches can be systematically integrated into urban observatory models.

While this thesis acknowledges the critical importance of data protection in the context of urban observatories, the topic encompasses a wide array of complex and highly technical legal, infrastructural and governance dimensions such as implementation of cybersecurity protocols, ethical considerations on consent and anonymization and institutional responsibilities for data stewardship. Given the depth of this subject, a comprehensive analysis on data protection exceeds the scope

of this study. However, this very limitation reinforces the necessity of a detailed assessment of the challenges that observatories may face in terms of data security, privacy and ethical data sharing.

Lastly, a general gap analysis regarding the data management capacities, open data levels, and institutional maturity of local authorities in Türkiye is presented, based on existing literature in this thesis. However, due to the time and scope constraints of the thesis, direct empirical measurement or detailed comparative analysis was not conducted. Therefore, future research can focus on a comparative analysis for the data management capacities, open data levels and institutional maturity of local authorities in Türkiye, who are the main stakeholders of UOs. This analysis will also provide important insights on which public institutions should initiate pilot implementations.

In conclusion, this thesis has drawn on international experiences and best practices to identify the key parameters, methodological foundations and guiding principles of the urban observatory model. Rather than offering a finalized model, these findings provide a broad framework to inform future research and practical experimentation, positioning the study as an initial step toward advancing inclusive and value-based urban data governance in Türkiye.

REFERENCES

Ackoff, R. (1989). From data to wisdom. *Journal of Applied Systems Analysis*, 6-9.

Al-Qassim Municipality. (2025, February 8). *Qassim Urban Observatory*. Retrieved from https://portal.marsad-buridah.com/Pages/2/101/Home

Al-Qassim Region Municipality. (2018). *Voluntary Local Report for the Sustainable Development Goals 2030 for the City of Buraidah Goal No. 11.* Buraidah: AFM Consultants.

Al-Qassim Region Municipality; UN-Habitat. (2020). *State of Urban Development in Al-Qassim.* UN-Habitat.

Aubin, D. (2008). Observatory mathematics in the nineteenth. In E. Robson, & J. Stedall, *The History of Mathematics* (pp. 273-298). Cambridge University Library.

AUO. (n.d.). *Australian Observatory*. Retrieved April 10, 2025, from https://auo.org.au/about/

AURIN. (2023). *Australia's Urban Intelligence Network: Annual Report 2023.* Melbourne, Australia: Australian Urban Research Infrastructure Network (AURIN) and The University of Melbourne.

Australian Urban Observatory. (2023, September). *AUO Cities & Indicators.* Retrieved from https://auo.org.au/wp-content/uploads/2023/10/AUO-Cities-Indicators-September-202386.pdf

Barns, S. (2020). *Platform Urbanism: Negotiating Platform Ecosystems in Connected Cities.* Sydney, NSW, Australia: Sitelines Media.

Barry, E., & Bannister, F. (2014). Barriers to open data release: A view from the top. *Information Polity*, 129-152.

Bătăgăn, L. (2014). The Role of Open Government Data in Urban Areas Development. *Informatica Economică*, 80-87.

Batty, M. (2013). *Urban Informatics and Big Data.* London: University Collage London.

Batty, M. (2020). Defining smart cities: High and low frequency cities, big data and urban theory. In K. S. Willis, & A. Aurigi (Eds.), *The Routledge Companion to Smart Cities* (p. 460). London: Routledge.

Batty, M. (2021). The digital transformation of planning. *Urban Analytics and City Science*, 593-597.

Biggs, R., Vos, A. d., Preiser, R., Clements, H., Maciejewski, K., & Schlüter, M. (2022). *The Routledge Handbook of Research Methods for Socio-Ecological Systems.* New York: Routledge.

Borgman, C. L. (2015). *Big data, little data, no data.* United States of America: MIT Press.

Botha, J., Grobler, M., & Eloff, M. (2017, September 09). Global Data Breaches Responsible for the Disclosure of Personal Information: 2015 & 2016. *Proceedings of the 16th European Conference on Cyber Warfare and Security* (pp. 63-72). Dublin: University College Dublin.

Bozkurt, Y., Rossman, A., Konanahalli, A., & Pervez, Z. (2023). Toward Urban Data Governance: Status-Quo, Challenges, and Success Factors. *IEEE Access*, 85656 - 85677.

British Embassy Ankara. (2020). *Open Data in Turkey.* Ankara: Novusens Big Data Institute.

British Geological Survey. (2025, April 24). *EU INSPIRE Directive*. Retrieved from https://www.bgs.ac.uk/technologies/collaborations/inspire/

Bueti, C., & Sah, G. (2024, April 11). *International Telecommunication Union (ITU)*. Retrieved from Global Cities Hub: https://globalcitieshub.org/en/international-telecommunication-union-itu/#:~:text=ITU%20defines%20a%20smart%20sustainable,social%2C%20environmental%20as%20well%20as

Cecco, L. (2019, June 6). *'Surveillance capitalism': critic urges Toronto to abandon smart city project*. Retrieved from The Guardian: https://www.theguardian.com/cities/2019/jun/06/toronto-smart-city-google-project-privacy-concerns

Chaffey, D., & Wood, S. (2005). *Business Information Management: Improving Performance Using Information Systems.* Harlow: Finacial Times Prentice Hall.

Chapman, L. (n.d.). *National Network of Urban Observatories.* Retrieved from UK Collaboratorium for Research on Infrastructure and Cities (UKCRIC): https://www.ukcric.com/media/1661/1_urbanobservatories.pdf

City of Toronto. (n.d.). *Waterfront Toronto*. Retrieved May 17, 2025, from City of Toronto: https://www.toronto.ca/city-government/accountability-operations-customer-service/city-administration/city-managers-office/agencies-corporations/corporations/waterfront-toronto/

Coetzee, S., & Smit, J. (2015). Development of an observatory for spatial planning in South Africa: a best practice review. *Serena Coetzee1, Julian Smit2*, 326-338.

Curzon, J., Almehmadi, A., & El-Khatib, K. (2019). A survey of privacy enhancing technologies for smart cities. *Pervasive and Mobile Computing*, 76-95.

Çaldağ, M. T., & Gökalp, E. (2025). Understanding barriers affecting the adoption and usage of open access data in the context of organizations. *Data and Information Management*.

Dameri, R. P., & Cocchia, A. (2013). Smart City and Digital City: Twenty Years of Terminology Evolution. *Proceedings of the 10th Conference of the* (pp. 1-8). Milan, Italy: Universita Commercial Luigi Bocooni.

Davern, M., Both, A., Murray, K., Roberts, R., & Norzahari, F. (2023). Liveability research creating real world impact: connecting urban planning and public health through the Australian Urban Observatory. *Cities & Health*, 765-778.

Dhaou, S. B., Isagah, T., Distor, C., & Ruas, I. C. (2024). *Global assessment of Responsible AI in cities.* Nairobi, Kenya: UN-Habitat.

Dick, S. J. (2020). Pulkovo Observatory and the National Observatory Movement: A Historical Overview. In S. J. Dick, *Space, Time and Aliens* (pp. 403-416). Switzerland: Springer Nature.

Dickey, A., Acuto, M., & Washbourne, C.-L. (2021). *Urban Observatories: A Comparative Review.* Melbourne: Connected Cities Lab, Faculty of Architecture, Building and Planning, University of Melbourne.

Director General of Presidency's Lawand Legislation. (2016, April 07). Personal Data Protection Law No. 6698. Ankara.

DTO. (2024). National Data Dictionary Project. Ankara.

DTO. (n.d.). National Artificial Intelligence Strategy 2024-2025 Action Plan. Republic of Türkiye Ministry of Industry and Technology.

Duygulu, A., Doğan, S., & Yıldız, S. (2025). Data Literacy at School: A Scale Development Study. *Journal of Theoretical Educational Science*, 106-130.

Edmonton's Open Data Catalogue. (2025). Retrieved from City of Edmonton's Open Data Portal: https://data.edmonton.ca/browse

Engin, Z., Dijk, J. v., Lan, T., Longley, P. A., Treleaven, P., Batty, M., & Penn, A. (2020). Data-driven urban management: Mappingg the landscape. *Journal of Urban Management*, 140-150.

Erginli, B. E., & Tülek, M. (2020). *New Tools for Supporting Urban Policy: Open Data Platforms and Urban Dashboards.* İstanbul: TESEV Yayınları.

Etzel, W. A. (2024, August 29). *The role of Data Governance as tactical decision layer*. Retrieved from Medium: https://medium.com/@winfried.etzel/the-role-of-data-governance-as-tactical-decision-layer-273b8ac670b8

European Innovation Partnership for Smart Cities & Communities (EIP-SCC). (2017). *Rethinking the city: using the power of data to address urban challenges and societal changes.* London: BSI Group Headquarters.

Eynden, V. V., Corti, L., Woollard, M., Bishop, L., & Horton, L. (2011). *Managing and Sharing Data.* Colchester: UK Data Archive.

Fox, P., & Harris, R. (2013). ICSU and the Challenges of Data and Information Management for International Science. *Data Science Journal*.

Freedom of Information Act. (2000). *Government of the United Kingdom*. Government of the United Kingdom.

Gauteng City-Region Observatory. (n.d.). *Gauteng City-Region Observatory*. Retrieved April 06, 2025, from Gauteng City-Region Observatory: https://gcro.ac.za

GCRO. (2014). *Green Infrastucture Citylab.* GCRO.

Geertz, C. (1973). *The Interpretation of Cultures.* New York: Basic Books Inc.

Global Partnership for Sustainable Development Data. (n.d.). *World Council on City Data*. Retrieved May 2, 2025, from https://www.data4sdgs.org/partner/world-council-city-data

Global Urban Observatory. (2003). *Global Urban Indicators Database: Version 2.* Kenya: United Nations Publication.

Goodman, E. P., & Powles, J. (2019). Urbanism Under Google: Lessons from Sidewalk Toronto. *Fordham Law Review*, 457-498.

Gordon, F. (2019). Book Review: Virginia Eubanks (2018) Automating Inequality: How High-Tech Tools Profile, Police and Punish the Poor. New Yok: Picador, St. Martin's Press. *Law, Technology and Humans*, 162-164.

Gotz, G., Fatti, C. C., Seedat, R., & Washbourne, C. (2024). The Gauteng City Region Observatory. In E. S.-C. Innovations, *Debra Lam; Andrea Fernández* (pp. 25-58). Hertfordshire: The Institution of Engineering and Technology.

Government Digital Service and Central Digital and Data Office. (2020). *Data Ethics Framework.* United Kingdom: Government of the United Kingdom.

Government of the United Kingdom. (1988). Data Protection Act. Government of the United Kingdom. Retrieved from https://www.legislation.gov.uk/ukpga/1998/29/contents

Greene, S., & Meixell, B. (2017). *Hacking the Sustainable Development GOals.* Urban Institute.

Gündoğan, Y. S., & Bingöl, E. S. (2024). Open Government Data Applications in Turlish Public Administration: A Study on Metropolitan Municipality Portals. *Route Educational & Social Science Journal*, 170-194.

Hadi, H. J., Shnain, A. H., Hadishaheed, S., & Ahmad, A. H. (2015). Big Data and Five V's Characteristics . *International Journal of Advances in Electronics and Computer Science*, 16-23.

Hall, R. E., Bowerman, B., Braverman, J., Taylor, J., Todosow, H., & Von Wimmersperg, U. (2000). The vision of a smart city. *2nd International Life Extension Technology Workshop.* New York, USA: Brookhaven National Laboratory.

Hamann, C., Miles-Timotheus, S., Naidoo, D. L., Naidoo, Y., & Khanyile, D. S. (2024, October 21). *Quality of Life survey viewer (Survey 5, 6 and 7)*. Retrieved from GCRO : https://gcro.ac.za/data-gallery/quality-of-life/detail/quality-life-v-201718-survey-viewer/

Hansen, M. M., Koonsanit, K., & Kulmala, V. (2025). How can data contribute to Smart City innovation: a study from Thailand’s Smart City initiatives. *Frontier Sustainable Cities*.

Harvard Business School. (n.d.). *A Beginner's Guide to Data & Analytics.* Harvard Business School Online.

Hong, A., Baker, L., Curiel, R. P., Duminy, J., Buswala, B., Guan, C., & Ravindranath, D. (2022). Reconciling big data and thick data to advance the new urban science and smart city governance. *Journal of Urban Affairs*, 1-26.

Huovilaa, A., Bosch, P., & Airaksinen, M. (2019). Comparative analysis of standardized indicators for Smart sustainable cities: What indicators and standards to use and when? *Cities*, 141-153.

IBM. (2021, August 09). *What is business intelligence*. Retrieved from IBM: https://www.ibm.com/think/topics/business-intelligence

IBM. (2022, September 23). *What is data quality?* Retrieved from IBM: https://www.ibm.com/think/topics/data-quality

IBM. (2024, August 09). *What is artificial intelligence (AI)?* Retrieved from IBM: https://www.ibm.com/think/topics/artificial-intelligence

IMM. (2020). *2020-2024 Strategic Plan.* İstanbul: IMM.

IMM. (2024). *2030 İstanbul Smart City Strategic Plan.* İstanbul: IMM.

Ishida, T. (2022). Digital City of Kyoto. *Magazine Communications of the ACM*, 76-81.

ISO. (2018). *Sustainable cities and communities-indicators for city services and quality of life.* Geneva, Switzerland: ISO.

James, P. P. (2024). *Open Research Case Study: (The First) Ten Years of the Newcastle Urban Observatory.* Newcastle University.

James, P., Jonczyk, J., Bell, D., Chapman, L., Cowell, N., James Evans, D. T., . . . Tsoneva, E. (2022). *Urban Observatories Sensor Report.*

Janssen, M., Charalabidis, Y., & Zuiderwijk, A. (2012). Benefits, Adoption Barriers and Myths of Open Data and Open Government. *Information Systems Management*, 258-268.

Jashapara, A. (2010). *Knowledge Management: An Integrated Approach.* Harlow: Financial Times Prentice Hall.

Jha, G. (2024, October 1). *Understanding the 6 Vs of Big Data: Unraveling the Core Characteristics of Data-Driven Success*. Retrieved from Medium.com: https://medium.com/@post.gourang/understanding-the-6-vs-of-big-data-unraveling-the-core-characteristics-of-data-driven-success-38e883e4c36b

Joint Resarch Centre. (n.d.). *Overview*. Retrieved April 20, 2025, from INSPIRE Knowledge Base: https://knowledge-base.inspire.ec.europa.eu/overview_en

Joint Research Centre. (n.d.). *INSPIRE Directive*. Retrieved April 20, 2025, from INSPIRE Knowledge Base: https://knowledge-base.inspire.ec.europa.eu/legislation/inspire-directive_en

Joshua Tauberer. (n.d.). *The Annotated 8 Principles of Open Government Data*. Retrieved from https://opengovdata.org

Jr., B. A. (2024). The Role of Community Engagement in Urban Innovation Towards the Co-creation of Smart Sustainable Cities. *Journal of the Knowledge Economy*, 1592-1624.

Kadt, D. J., Götz, G., Fatti, D. C., Parker, D. A., & Hamann, C. (2022, March 2). *Quality of Life Survey V (2017/18)*. Retrieved from GCRO: https://gcro.ac.za/research/project/detail/quality-of-life-survey-v-201718/

Kitchin, R. (2014). *The data revollution: big data, open data, data infrastructures & their consequences.* California: Sage Publications.

Kitchin, R. (2018). Reframing, Reimagining and Remaking Smart Cities. In C. Coletta, L. Evans, L. Heaphy, & R. Kitchin, *Creating Smart Cities.* Routledge.

Kitchin, R. (2024). Urban Data Power: Capitalism, Governance Ethics and Justice. In O. Söderström, & A. Datta, *Data Power in Action: Urban Data Politics in Times of Crisis* (pp. 21-41). Bristol University Press.

Kitchin, R., Cardullo, P., & Feliciantonio, C. D. (2018, October 18). Citizenship, Justice and the Right to the Smart City. In P. C. Rob Kitchin, & C. D. Feliciantonio, *The Right to the Smart City.* Emerald Publishing.

Kitchin, R., Lauriault, T. P., & McArdle, G. (2018). *Data and the City.* Abingdon: Routledge.

Ko, A. J., Abraham, R., Beckwith, L., Blackwell, A., Burnett, M., Erwig, M., . . . Wiedenbeck, S. (2011). The State of the Art in End-User Software Engineering. *ACM Computing Surveys*, 1-44.

Kolada.se. (n.d.). Retrieved from Kolada.se: https://kolada.se/verktyg/fri-sokning/

Kontoksosta, C. E. (2021). Urban Inofrmatics in the Science and Practice of Planning. *Journal of Planning Education and Research*, 382-395.

Li, G., Wang, J., Zheng, Y., & Franklin, M. J. (2016). Crowdsourced Data Management: A Survey. *IEEE Transactions on Knowledge and Data Engineering*, (pp. 2296-2319).

London Museum. (2025, June 1). *How Charles Booth Mapped London Poverty*. Retrieved from https://www.londonmuseum.org.uk/collections/london-stories/how-charles-booth-mapped-london-poverty/

Lyon, D. (1994). *The Electronic Eye: The Rise of Surveillance Society* . Cambridge, UK: Polity Press.

Mann, M., Mitchell, P., Foth, M., & Anastasiu, I. (2020). #BlockSidewalk to Barcelona: Technological Sovereignty and the Social License to Operate Smart Cities. *Association for Information Science and Technology*, 1103-1115.

McCarney, P. (2015). The evoluiton of global city indicators and ISO37120: The first international standard on city indicators. *Statistical Journal of the IAOS*, 103-110.

McCarney, P. (2015). The evolution of global city indicators and ISO37120: The first international standard on city indicators. *Statistical Journal of the IAOS*, 103-110.

McKinsey & Company. (2020). *Future Work: Turkey's Talent Transformation in the Digital Era.* McKinsey & Company.

MEUCC. (n.d.). *2024-2030 National Smart Cities Strategy and Action Plan*. Retrieved May 05, 2025, from Smart Cities Platform: https://www.akillisehirler.gov.tr/2024-2030-semasi/

MEUCC. (n.d.). *National Smart City Open Data Platform Guidance Manual.* MEUCC.

MEUCC, DGGIS. (2020, June 30). Turkey Geographic Information System Board Decision. Retrieved from https://www.resmigazete.gov.tr/eskiler/2020/06/20200630-14.pdf

Midor, K., & Plaza, G. (2020). Moving to Smart Cities Through the Standard Indicators ISO 37120. *Multidisciplinary Aspects of Production Engineering*, 617-630.

Mistra Urban Futures Website . (n.d.). Retrieved from Our Research: https://www.mistraurbanfutures.org/en

Mitchell, W. J. (1995). *City of Bits.* London: MIT Press.

Moore, M. (2019, January 28). *Would you let Google run your city?* Retrieved from Prospect: https://www.prospectmagazine.co.uk/ideas/technology/42195/would-you-let-google-run-your-city

Moore, R. (2016). *The Gauteng City-Region Observatory- a Case Study.* Pretoria: Departmen of Planning, Monitoring & Evaluation (DPME).

Morales, J. E. (2023). Urban observatories and knowledge translation processes in the context of planning research and practice. *Revista Logos Ciencia & Tecnología*, 88-98.

Neves, G. Z., Gallardo, N. P., & Vecchia, F. A. (2017). A Short Critical History on the Develeopment of Meteorology and Climatology. *Climate*.

Newcastle Unviersity. (2019, May 20). *Cities in the Cloud*. Retrieved from Press Office: https://www.ncl.ac.uk/press/articles/archive/2019/05/citiesinthecloud/

Newcastle Urban Observatory. (n.d.). *Archive*. Retrieved March 12, 2025, from Urban Observatory: Evidence for Change: https://newcastle.urbanobservatory.ac.uk/data/

OECD. (2023). *Digital Government Review of Türkiye.* Paris: OECD Publishing.

OECD. (2023). *Smart City Data Governance: Challenges and the Way Forward.* Paris: OECD Publishing.

OECD. (2025, October 27). 5th OECD Roundtable on Smart Cities and Inclusive Growth. *Artificial Intelligence for Advancing Smart Cities*. Paris: OECD.

OGC. (2017). *Understanding OGC Standards*. Retrieved from OGC e-Learning: https://opengeospatial.github.io/e-learning/ogc-standards/text/services-ogc.html

Ojo, A., Curry, E., & Zeleti, F. A. (2015). A Tale of Open Data Innovations in Five Smart Cities. *48th Hawaii International Conference on System Sciences* (pp. 2326-2335). Galway: IEEE Computer Society.

Online Etymology Dictionary. (n.d.). *Origin and history of data*. Retrieved February 6, 2025, from Etymonline: https://www.etymonline.com/word/data

Open Government Initiative. (n.d.). *Open Government Partnership*. Retrieved January 23, 2025, from Open Government Initiative: https://obamawhitehouse.archives.gov/open/partnership

Open Government Partnership. (n.d.). *OGP Strategy*. Retrieved February 2, 2025, from https://www.opengovpartnership.org/strategy/

Open Knowledge Foundation. (2012). *Open Data Handbook*. Retrieved January 25, 2025, from https://opendatahandbook.org

Orwell, G. (2021). *Nineteen Eighty-Four.* Penguin Classics.

Othengrafen, F., Sievers, L., & Reinecke, E. (2025). From Vision to Reality: The Use of Artificial Intelligence in Different Urban Planning Phases. *Urban Planning*, 1-17.

Parra, X., Tort-Martorell, X., Alvarez-Gomez, F., & Ruiz-Viñals, C. (2023). Chronological Evolution of the Information-Driven Decision-Making Process (1950–2020). *Journal of the Knowledge Economy*, 2363-2394.

Participedia. (n.d.). *Participatory Planning in the Sidewalk Toronto Project*. Retrieved February 28, 2025, from Participedia: https://participedia.net/case/participatory-planning-in-the-sidewalk-toronto-project

Pearlson, K. E., Saunders, C. S., & Galletta, D. F. (2015). *Managing & Using Information Systems* . Hoboken, NJ : Wiley.

Perry, B., Patel, Z., Bretzer, Y. N., & Polk, M. (2018). Organising for Co-Production: Local Interaction Platforms for Urban Sustainability. *Politics and Governance*, 189-198.

Polk, M. (2015). Transdisciplinary co-production: Designing and testing a transdisciplinary research framework for societal problem solving. *Futures*, 110-122.

Ponkratova, E. (2022, April 20). *Don't panic: data management vs data strategy vs data governance*. Retrieved from Medium: https://eponkratova.medium.com/dont-panic-data-management-vs-data-strategy-vs-data-governance-4f4be391b898

Qassim Urban Observatory. (2022, April 20). *Qassim Urban Observatory: Toward a Bright Future.* Al-Qassim Municipality. Retrieved from Qassim Urban Observatory: https://portal.marsad-buridah.com/Uploads/2022/4/20/637860502646188715.pdf

Reed, C. (2013, December). Open Geospatial Consotium (OGC). (E. c. Rees, Interviewer)

Reepalu, I., Moser, C., Robinson, J., Dodman, D., & Engström, C. J. (2015). *Midterm Evaluation of Mistra Urban Futures.* Stockholm: Mistra .

Reichental, J. (2020). *Smart Cities for Dummies.* Hoboken, New Jersey: John Wiley & Sons.

Rowley, J. (2007). The wisdom hierarchy: representations of the DIKW hierarchy. *Journal of Information Science*, 163-180.

Safransky, S. (2019). Geographies of Algorithmic Violence: Redlining the Smart City. *International Journal of Urban and Regional Reserach*, 200-218.

Sang, Z., & Li, K. (2023). ITU-T standardisation activities on smart sustainable cities. *IET Smart Cities*, 1-7.

Search Inform. (2025, April 10). *Confirmed Data Breaches from Turkey and Thailand*. Retrieved from Search Inform: https://searchinform.com/blog/2025/4/10/confirmed-data-breaches-from-turkey-and-thailand

Seedat, R. (2025, June 11). GCRO Case Interview. (E. Görün, Interviewer)

ServiceReda. (n.d.). *GDPR Summary*. Retrieved May 05, 2025, from https://www.gdprsummary.com/gdpr-summary/

Simister, N., & James, D. (2020). *Quantitaive and Qualitative Methods.* INTRAC.

Simon, D., Arfvidsson, H., Anand, G., Bazaz, A., Fenna, G., Foster, K., . . . Wright, C. (2015). Developing and testing the Urban Sustainable Development Goal's targets and indicators – a five-city study. *Environment & Urbanization*, 49-63.

Sinaeepourfard, A., Masip-Bruin, X., Garcia, J., & Marín-Tordera, E. (2015). *A Survey on Data Lifecycle Models: Discussions toward the 6Vs Challenges.*

Srnicek, N. (2016). *Platform Capitalism.* Cambridge: Polity.

Stefanouli, M., & Economou, C. (2019). Data Protection in Smart Cities: Application of the EU GDPR. *Springer Nature Switzerland AG*, 748-755.

Tatar, C. Ö., Yılmaz, E., Lafcı, B., Küçükpehlivann, T., Aksoy, T., Ağaçsapan, B., & Sarı, S. (2021). Coğrafi Bilgi Sistemlerinin Türkiye'deki Tarihsel Gelişimi ve Mevcut Durumu. *GSI JournalsSerie C: Advancements in Information Sciencesand Technologies (AIST)*, 33-61.

Taylor, L., Richter, C., Jameson, S., & Pulgar, C. P. (2016). *Customers, users or citizens? Inclusion, spatial data and governance in the smart city.* Amsterdam: SSRN.

The European Parliament and the Council of the European Union. (2016, May 04). General Data Protection Regulation (2016/679). Official Journal of the European Union.

The Newcastle Urban Observatory. (n.d.). *Urban Observatory: Evidence For Change*. Retrieved April 4, 2024, from Urban Observatory: Evidence For Change: https://newcastle.urbanobservatory.ac.uk

The Transport and Health Integrated Research Network. (2022, June 21). *Collaborative working blog series: Working with big and thick data for collaborative urban planning and research*. Retrieved from https://think.aber.ac.uk/working-with-big-and-thick-data-for-collaborative-urban-planning-and-research/#:~:text=The%20rise%20of%20advanced%20computational,what%20they%20felt%20and%20why

Townsend, A. (2015). Cities of data: examinnig the new urban science. *Public Culture*, 201-212.

Tuysuz, S., Yazar, A., & Manga, M. (2022). Assessment of Tendency to Become a Smart City Among Turkish Cities in the Context of Underdevelopment: An Empirical Analysis. *Planlama*, 247-255.

UNDP. (2024). *Data Governance Framework: Recommendation Report for Türkiye.* New York: UNDP.

UN-Habitat. (2019). *A Guide to Setting Up an Urban Observatory.* Nairobi, Kenya: UN-Habitat.

UN-Habitat. (2022). *The Global Urban Monitoring Framework.* Kenya: UN-Habitat.

UN-Habitat. (2025, March 14). *Global Urban Observatories*. Retrieved from UN-Habitat: https://unhabitat.org/initiative/global-urban-observatories

UN-Habitat. (2025, March 16). *Urban Observatory Profiles.* Retrieved from Urban Indicators Database: https://data.unhabitat.org/datasets/GUO-UN-Habitat::urban-observatory-profiles/about

Wang, T. (2013, May 13). *Big Data Needs Thick Data*. Retrieved from Etnography Matters: https://ethnographymatters.wordpress.com/2013/05/13/big-data-needs-thick-data

Washbourne, C.-L., Culwick, C., Acuto, M., Blackstock, J. J., & Moore, R. (2021). Mobilising knowledge for urban governance: the case of the Gauteng City-region observatory. *Urban Research & Practice*, 27-49.

WCDD. (n.d.). *About the World Council on City Data Created by Cities, for Cities*. Retrieved May 02, 2025, from https://www.dataforcities.org/about-wccd

Weber, K. (2009). One Size Does Not Fit All—A Contingency Approach to Data Governance. *ACM Journal of Data and Information Quality*.

Williams, L. A. (1972). The Urban Observatory Approach. *Urban Affairs Quarterly* (pp. 5-16). Sage Journals.

Wolford, B. (n.d.). *Data Protection Impact Assessment (DPIA)*. Retrieved May 8, 2025, from GDPR.EU: https://gdpr.eu/data-protection-impact-assessment-template/

Yıldırım, M. E., & Cömert, Ç. (2025). Açık Veri ve Türkiye'deki Uçurum . *Turkish Journal of Remote Sensing and GIS*, 12-31.

Zeleny, M. (1987). Management Support Systems: Towards Integrated Knowledge Management. *Human Systems Management*, 59-70.

A
SEMI-STRUCTURED INTERVIEW GUIDE

Date of Interview:	11.06.2025
Interviewee:	R.S., Executive Director of GCRO, Member of UN-Habitat Global Urban Observatory Network (GUO-Net) Steering Committee
Duration:	40 Minutes
Interview Questions	
Q1: Considering the multi-stakeholder nature of urban observatories, which group do you think holds the most influence? What institutional challenges have you encountered in maintaining stakeholder collaboration over time?	
Q2: At which stages of the observatory workflow (e.g. data collection, selectin of indicators, stakeholder engagement) do you encounter the greatest challenges? What unexpected barriers have emerged?	
Q3: Could you briefly describe the data governance principles adopted within the Gauteng City-Region Urban Observatory, including how the observatory managed data privacy issues which are a major challenge in data-driven approaches, what ethical protocols or regulatory frameworks have been implemented in this context?	
Q4: What are your recommendations for the implementation of the urban observatory model in metropolitan cities where diverse and large-scale data are produced (e.g., Istanbul)?	

PUBLICATIONS FROM THE THESIS

Conference Paper

1. Görün E., Kurtarır E. (2025). ‘’Value-based Urban Data Management: A Discussion on the Urban Observatory Approach’’, 3rd International Thales Congress on Life, Engineering, Architecture and Mathematics, 24-24 April, Cairo, Egypt, p. 289-290