DATA GOVERNANCE IN SMART CITIES: PERSONAL DATA AS PRIVATE ASSET, COMMONS, AND/OR PUBLIC GOOD?

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ABSTRACT

Data is increasingly framed as an integral part of municipal governance as city administrations seek to deliver public services online and employ insights from data analytics. Real-time data collection in city spaces and the digital transformation of urban infrastructure are turning cities into "smart cities" according to many commentators. Since these digital technologies often rely on commercial algorithms implemented in public facilities, smart city initiatives are often governed by public-private partnerships. Predictably, smart cities pose new governance challenges in which data access, collection, use, and commercialization often come into conflict with the interests of individual and collective privacy, equality, and democratic participation. The aim of this dissertation is to explore the political economy of this new data governance regime as it marks a transition from mass data collection online to mass data collection in city spaces.

This study draws on the concept of assetization, which has emerged in science and technology studies (STS) over the last few years. Assetization theory explores emerging socio-economic arrangements by analyzing the complex processes of co-construction between contemporary capitalism, technology, and society. In the empirical chapters of this thesis, I examine different forms of asset governance as they relate to digital personal data in two smart city initiatives: Sidewalk Toronto/Quayside and the City of Barcelona's DECODE. These forms of asset governance include private, public, and commons forms of asset governance, which have very different implications for how municipalities manage the collection, use, and commercialization of personal data.

My dissertation includes three key findings. First, data governance in smart city initiatives can be usefully theorized as a form of asset governance in light of the specific political economic logics that underpinned the proposals for Sidewalk Toronto and DECODE. Second, both smart city initiatives aimed to generate monetary value from digital personal data but failed to balance the interests of business with public and collective interests. Third, the policymakers and citizens engaged with these smart city initiatives displayed a variety of non-economic expectations and attitudes toward data, a phenomenon I conceptualize in the dissertation as "affective data governance."

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ABBREVIATIONS

CCLA: Canadian Civil Liberties Association

D-CENT: Decentralized Citizen Engagement Technologies

DECODE: Decentralized Citizen-Owned Data Ecosystems

DSAP: Digital Strategy Advisory Panel

GDPR: European Union's General Data Protection Regulation

GE: General Electric

IoT: Internet of Things

MIDP: Sidewalk Labs' Master Innovation Development Plan

OSA: Open Space Alliance

PA: Public Administrator

PIPEDA: Personal Information Protection and Electronic Documents Act

UDT: Urban Data Trust

WTMA: Waterfront Transportation Management Association

WHT: Waterfront Housing Trust

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CHAPTER I

ASSETIZATION OF PERSONAL DATA IN TECHNOSCIENTIFIC CAPITALISM: FROM ONLINE SPACES TO SMART CITIES

In July 2019, Khalid Alexander, a community organizer from San Diego, USA, learned about the municipality's new smart city partnership[1] with General Electric (GE) (Irani & Alexander, 2021). Smart, new streetlights were installed predominantly in the neighborhoods where the city's most marginalized communities lived; data from the streetlights was expected to help the local police solve crimes, the municipality allocate resources efficiently, and entrepreneurs develop new products. Alexander attended a public engagement event held by the partnership and was shocked to learn that the streetlights were recording video and audio footage from the streets and on private property. The data[2] was then uploaded to GE's cloud computing infrastructure, where multiple company partners had access to it. It took more than a year for Alexander and a coalition of local organizers to persuade the city council to defund the smart city initiative and pass an ordinance that regulates the use of surveillance technologies in San Diego. San Diego has stopped paying for GE's services, but the streetlights continue to operate. The municipality has simply lost access to their feed. While battling with the activists, GE sold the streetlights to another company; all the municipality could do was take the new owner to court.

The story of the contested San Diego–GE partnership, publicized by activist Khalid Alexander and Lily Irani, a science and technology studies (STS) scholar, is striking in many respects. It bridges central STS questions on whether artifacts have politics (Winner, 1980); how

[1] Here and throughout the text, I refer to the public-private partnerships (PPP) as a form of contractual arrangement between the state and the private sector (Dunn-Cavelty & Suter, 2009). The partnerships in the areas of smart city and data governance take multiple forms and typically rely on a contract tailored for a specific purpose (Verhulst et al., 2019; Valverde and Flynn, 2020).

[2] For stylistic reasons, I will be using the word "data" in the singular form. While grammatically incorrect, this usage has become widespread in the academic texts in North America and Europe.

technology and society shape each other (Pinch & Bijker, 1987); and what sociotechnical imaginaries drive today's technology policies (Jasanoff & Kim, 2015). Other pertinent questions come from the fields of critical data and surveillance studies: which communities have been disproportionally affected by the deployment of digital surveillance in cities (Benjamin, 2019; Sengupta & Sengupta, 2022)? What institutional arrangements will ensure the residents are included in decision-making regarding the installation and use of smart city technologies (Cardullo et al., 2020; Morozov & Bria, 2018)? And how do we define the citizens' rights in smart cities (Calzada, 2018, 2020; Kitchin, 2021, 2022; Valverde & Flynn, 2020)? These questions and the studies that address them point to a significant theoretical and policy need for research on smart cities as they are increasingly deployed around the world.

Yet there is one question that underpins the multitude of conceptual, empirical, and policy concerns related to smart cities: how have technology companies managed to populate urban spaces and services with data-gathering devices (Zwick & Spicer, 2021)? According to many critical accounts, the data economy is dominated by large technology monopolies—often known as "Big Tech" [3]—which seek to collect as much data as possible and use it to develop new products and services (Sadowski, 2020a; Zuboff, 2019). In doing so, Big Tech firms become de facto owners of the personal and user data[4] they collect (Cohen, 2017; Birch & Adediji, 2023), which is enabled by their control of the material infrastructure that supports underpinning this data collection (Lehdonvirta, 2022). I define personal data in the following section. According to many policymakers and academics, these large technology companies have found ways to insulate themselves from competition: they block competitors and competing products, dominate markets, and control the websites on which we increasingly rely for essential services (FTC, 2014; US Competition in Digital Markets, 2021; Nylen, 2022). Reflecting on the negative group dynamics in data markets, Mazzucatto et al. (2022) argue that the data economy is a "behavioural" problem and should be addressed as such. It is in this political–economic context

[3] In this dissertation, the terms "Big Tech" and "platforms" refer to several large companies that provide online services and describe themselves as "platform services" (e.g., Facebook, Uber). In the next chapter, I analyze the concept of "platform capitalism" that outlines the economic and legal practices employed by these companies in pursuit of market domination.

[4] In the context of online data collection, academic researchers (e.g., Birch & Adediji, 2023) have studied "user data", defined as the information collected under user agreements (e.g., the terms and conditions contracts the internet users accept before they get access to many websites). To put it simply, the contracts define some types of information as user data to ensure the data collectors have control over it. I will return to the discussion of novel terms for data and contractual agreements in Chapter IV, where I will show the practical ways personal data is turned into tradable commodity.

that technology companies market smart cities as data-driven solutions to a range of societal problems (e.g., crime, congestion, and ill-health). Hendrikse et al. (2022, p. 60) label the expansion of extractive data practices into new realms as the "big techification of everything."

I explore the governance of digital personal data in smart cities by drawing on the STS concept of "assetization", which is an STS approach that engages with political economy (Birch, 2020; Birch & Muniesa, 2020). Assetization theory explores the functioning of emerging socio-economic arrangements and sheds light on the complex processes of co-construction between contemporary capitalism, society, and technology.

Researchers have applied assetization theory to study the extractive data practices of technology monopolies (Birch et al., 2020; Birch et al., 2021; Birch & Bronson, 2022), data governance policies in North America and the European Union (Guay & Birch, 2022), markets for personal data (Beauvisage & Mellet, 2020), open data (Vezyridis & Timmons, 2021), health data (Geiger & Gross, 2021), data-driven agriculture (Bronson, 2022), fertility technologies (Wiel, 2019), patents (Kang, 2020), and much more. Through these rich and diverse case studies, assetization research emphasizes three key trends in contemporary, technoscientific capitalism: the growing role of science and technology in the functioning of industries and markets; the advent of an asset-driven economy, where rent-seeking has become a predominant way of generating revenues; and the defining role of expectations and imaginaries of the future in the assetization processes (e.g., what is expected to bring profits in the future is valued highly in the present).

Assetization studies have led me to examine the political–economic nature of data governance, which is often seen as purely technical or politically neutral by policymakers (e.g., boyd & Crawford, 2012; Kitchin, 2014a, 2014b; Green, 2019). To do this, I have undertaken a comparative study of two (failed) smart city initiatives: Sidewalk Toronto/Quayside[5] project in Toronto, Canada, and the Decentralized Citizen-Owned Data Ecosystems (DECODE) in Barcelona, Spain. The goal of my study is to explore these two smart city initiatives as sites of contestation over the public, private, and commons governance strategies of digital personal data. Sidewalk Toronto was conceived as a private technology system that was meant to run on

[5] Sidewalk Toronto was redubbed Quayside, with the former being a project name for the partnership between Sidewalk Labs and Waterfront Toronto and the latter being a local toponym for the 12-acre swath of land at the foot of Parliament Street in Toronto, where the smart city was being planned.

private data and collectively controlled smart city infrastructure, while DECODE was meant to facilitate the public and collective ownership of data and smart city infrastructure. From a methodological perspective, these initiatives represent two contrasting cases of smart city governance.

I conceptualize the three key data governance strategies as forms of asset governance: data as a private asset (Birch et al., 2020, 2021; Srnicek, 2017; Pozner & Weyl, 2018), public good (Hoyer, 2019; Prainsack, 2019a; Starkbaum & Felt, 2019), and as commons (Morozov & Bria, 2018; Artyushina, 2020, 2023; Wu et al., 2021). I draw on assetization theory to explore how technology professionals, policymakers, and civic actors balance commercial, public, and collective interests in the smart city governance.

I seek to address three research questions in this dissertation:

- What are the social, economic, and political frameworks that underpin public, private, and commons governance of data in smart cities?
- How do government, industry, and civic actors define the public interest in the governance of smart cities?
- How do novel legal and technical definitions of personal data affect the decision-making around smart cities?

As I explain in Chapter II, an STS approach to data governance draws on the vision of data as a form of knowledge production. Building on this vision, my research questions seek to explore connections between the ostensibly technical aspects of smart city development and governance with the visions of the future and socio-economic objectives of these projects. The first question situates data governance within the fields of science & technology studies and critical data studies, as a set of practices shaped by economic, social, and political contexts of their origin. The second question addresses various visions of the public interest implicated in smart city projects, taking Sidewalk Toronto and DECODE as case studies. The third questions centers on the novel legal and technical definitions of data created by smart city projects. In the empirical chapters of this dissertation, I argue that novel definitions of data were key to the business model of Sidewalk Toronto and the City of Barcelona's smart city initiative.

The rest of the Introduction is structured as follows: section 1.2. explores the connection between the concept of the "data asset," as it has been framed in industry and policy discourses, and a rentier type of economy. Section 1.3. provides an overview of several theories that analyze

data-driven capitalism and explains the choice of assetization theory as the primary theoretical framework in this study. Section 1.4. situates this dissertation within the fields of STS and critical data studies, and addresses the policy relevance of the smart city scholarship. Section 1.5. discusses the issues of surveillance, privacy and autonomy brought on by data-driven technologies and amplified in the smart city environments. The concluding section provides an overview of the dissertation and its main results.

1.2. Digital Personal Data as an Asset

A commonly used definition of digital personal data is that introduced in the European Union's General Data Protection Regulation (GDPR) (Edwards, 2018, p. 9): "any information relating to an identified or identifiable natural person." The distinction between an already identified and a potentially identifiable person in this definition is crucial as it expands the scope of legislation to the types of data that may not immediately be seen as personal (Fink & Pallas, 2020). For instance, in the 2016 Breyer case, the European Court of Justice ruled that dynamic IP addresses the German government was collecting from its citizens were detailed enough to reveal the identity of a person and as such should be protected as personal data. Lilian Edwards (2018) further elaborates that a natural person may be identified by their name, identification number, location, and any other factors specific to the person; and that is why Article 4 of the GDPR provides a set of case studies for "non-nymic" personal data. Non-nymic personal data may include genetics, physical traits, as well as economic, cultural, or social identity.

Digital data is collected with high granularity, across multiple sources, and in large volumes; when two or more datasets get combined, the identity of the data subjects can be easily revealed through cross-referencing. For example, a 2019 study, successfully identified 99% of the US residents using only publicly available datasets (Wells & Picker, 2019). This issue is exacerbated with the rapid adoption of the smart city technologies, that often combine real-time and historical data and may be used to create detailed profiles of individuals (Edwards, 2016; Purtova, 2022). The possibility for re-anonymization of data and the growing power of machine learning algorithms that parse data much faster than humans and all previous versions of software, has prompted legal scholars to argue that nearly every piece of digital data that helps single out an individual may be considered personal data (Purtova, 2018, p. 40).

There exist many framings of data, for example, there are ongoing debates in the European Union and the United States about the differences between personal data, personally identifiable information, sensitive data, and pseudonymized data. The US Office of Privacy and Open Government defines personally identifiable information as "Information which can be used to distinguish or trace an individual's identity, such as their name, social security number, biometric records, etc. alone, or when combined with other personal or identifying information which is linked or linkable to a specific individual, such as date and place of birth, mother's maiden name, etc." Under the GDPR (art.9.), sensitive data and pseudonymized data that can be linked to a natural person enjoy the same protections as personal data.

In this thesis, I use the definition of personal data as introduced by the GDPR because it has been widely adopted across jurisdictions, including in Canada. In Spain, where my second case study is located, the GDPR is enforced and the legislation has shaped the way DECODE project defined its relationships with citizens who provided the data for municipal smart city initiatives. When Sidewalk Toronto existed, the 2000 Personal Information Protection and Electronic Documents Act (PIPEDA) was Canada's federal privacy legislation that regulated the use of data in the private sector. There were no mentions of personal data in this legislation, and the notion of personal information the law centered on reflected the pre-big data and pre-AI legal context, where only some types of information existed in the electronic form (e.g., Office of the Privacy Commissioner of Canada, 2013)

In 2019, the PIPEDA was updated in accordance with the GDPR. As of 2019, PIPEDA defines personal information this way:

> Under PIPEDA, personal information includes any factual or subjective information, recorded or not, about an identifiable individual. This includes information in any form, such as: age, name, ID numbers, income, ethnic origin, or blood type; opinions, evaluations, comments, social status, or disciplinary actions; and employee files, credit records, loan records, medical records, existence of a dispute between a consumer and a merchant, intentions (for example, to acquire goods or services, or change jobs). (PIPEDA, 2019)

Similarly, the Privacy Act that regulates the use of personal information by the government was updated to include the notion if identifiability; and the latest proposed privacy

and data protection legislation, Digital Charter Implementation Act (Bill C-27), has been modelled on the GDPR.

Birch & Adediji (2023) employ the notion of "user data" to uncover the exact mechanisms through which data is being transformed into companies' assets. There are two ways to do that: first, technology companies redefine personal data as "user data" and enclose it in contractual agreements that entrench their monopoly control over data. Second, the companies use what Birch et al (2021) call "techcraft," entailing the construction of a set of automated audience metrics[6] that turn users into the measurements of viewership for the potential advertisers. The forms of economic ordering, contractual agreements and techcraft allow for the assetization of data, i.e., they help transform data into the revenue streams. Throughout the text, I will be referring to the key resource at stake in the smart city initiatives as personal data; I will be using the term "data assets" to describe the outcomes of the assetization processes. In the chapters IV and V, I provide an empirical analysis of the assetization practices described in the Sidewalk Toronto documentation and implemented in Barcelona's smart city initiative.

A pioneer of smart city research, Rob Kitchin (2014 a, 2014b) observes that personal data is now being collected in massive volumes and with significant granularity. Kitchin emphasizes three key characteristics of big data: volume, velocity, and variety. Indeed, today data is collected, processed, and stored in trillions of bytes; it is captured across multiple sources, often in real time; and the digital data profiles of individuals are much more detailed than any statistical survey or census could possibly be. Dan Bouk (2017) offers an insightful historical periodization of the history of personal data in the United States in the nineteenth and twentieth centuries, which led to the emergence of big data. Bouk's analysis echoes the classical history of statistics by Theodor Porter (1995), Michel Foucault's work on biopolitics (2010), and a recent study of the history of the GDP by Stephen Macekura (2020). In the nineteenth century, Bouk argues (2017, p. 88), personal data was collected as part of ambitious nation-building projects, focusing on collecting taxes and preventing unrest within marginalized social groups (e.g., people of color and indigenous populations). In the 1940–70s, Bouk continues, governments

[6] The audience metrics are the instruments deployed by technology companies to count and visualize the number of views/viewers for each piece of advertisement. As an example, Meta (formerly known as Facebook) would use the "potential reach" software tool to show the advertisers how many users will see their message. According to the 2018 class-action lawsuit, the numbers in these estimates were inflated: the tool counted fake and duplicated accounts. For more detail see Lomas, 2021b.

focused on the aggregated data that helped "mold" individuals into controllable masses through the means of education, public healthcare, and social work. The third and ongoing phase, Bouk argues (2017, p. 101) manifests the ascendance of extensively commodified digital personal data. These are digital personas created by internet users themselves and aggregated datasets created by technology companies. Both types of data are continually monetized and move from one dataset to another, with limited knowledge of the data subject. Frank Pasquale (2015) and Nick Srnicek (2017) investigate the business models of data brokers—companies that trade in digital personal data—and argue that the Internet itself has turned into a quasi-legal data market. The exact nature of the data collected by technology companies is often unknown to regular internet users, and the algorithms used to mine this data and sort individuals for insurance, marketing, and other purposes are often protected as trade secrets:

> The reputation business is exploding. Having eroded privacy for decades, shady, poorly regulated data miners, brokers and resellers have now taken creepy classification to a whole new level. They have created lists of victims of sexual assault, and lists of people with sexually transmitted diseases. Lists of people who have Alzheimer's, dementia and AIDS. Lists of the impotent and the depressed. Typically sold at a few cents per name, the lists don't have to be particularly reliable to attract eager buyers — mostly marketers, but also, increasingly, financial institutions vetting customers to guard against fraud, and employers screening potential hires. (Pasquale, 2014, p. 10)

Research by Ari Ezra Waldman (2022) shows that technology company monopolies' control over digital personal data is the foundation of the contemporary data economy, and both Facebook and Google spend millions of dollars lobbying against stronger data protection and privacy regulations to limit data collection.

In a widely cited article about the role of data metaphors, Luke Stark and Anna Lauren Hoffman (2019) argue that it is important to pay attention to the various conceptualizations of digital data employed in the technology industry as they reflect emerging ethical codes and often serve some political purposes:

> The metaphors we deploy to make sense of new tools and technologies serve the dual purpose of highlighting the novel by reference to the familiar, while also obscuring or abstracting away from some features of a given technology or practice. For example,

> as Dawn Nafus describes in the domain of data visualization, the idea that data wants to be freed—itself an offshoot of the earlier claim, "information wants to be free"—masks the labor expended in "freeing" data, especially in cases where data, in the words of her research subjects, are "stuck" or "disloyal." (Stark and Hoffman, 2019, p. 201)

As several scholars note (e.g., Birch et al., 2022; Zuboff 2019), industry and policy discourses increasingly frames digital personal data as a new asset class (e.g., WEF, 2011) and key driver of contemporary economies (e.g., OECD, 2019). Here, data has sometimes been described or conceptualized as the "new oil" (Ciuriak, 2018; The Economist, 2017; WEF, 2019), a key commodity (Morozov, 2019; Thatcher et al., 2016; West, 2019), private property (Brynjolfsson & Collis, 2019; Lanier, 2014; Posner & Weyl, 2018; Purtova, 2017), and a new form of capital (MIT Tech Review, 2016; Sadowski, 2019). Technology monopolies can be described as providing us with essential services and infrastructures in exchange for our digital data (Fourcade & Kluttz, 2020; Prainsack, 2019b).

There are some issues with treating data as a resource, however. First, digital personal data does not have any intrinsic value; second, data collection is nearly free, which means that technology companies can make revenues without investing in its extraction[7]; third, in most jurisdictions, data cannot be considered de jure private property; and, fourth, even if data subjects are compensated for their contributions, the payments are likely to be paltry. In practice, datasets are carefully crafted for the buyer, made legible for specific algorithms and purposes, and turned into the audience metrics (Manovich, 2001; Birch et al, 2021; Birch & Adediji, 2023); and the process of their valuation is highly dynamic (Beauvisage & Mellet, 2020; Leonelli, 2019). This price volatility in data markets is one reason why conceptualizing personal data as a product or commodity is problematic. Data valuations are much less reliant on fluctuations in supply and demand than they are on expert and market-based decision-making (Birch et al., 2021). Another reason behind the volatility is that data rarely ends up in the hands of the end buyer; instead, it exists in the form of data silos gathered and maintained by the large technology

[7] For example, internet plugins that track individuals across the Internet are cheap in production and upkeep; similarly, recent developments in electronics have made the movement and sound sensors as cheap as the online trackers. Some smart city devices, however, are much more expensive: for instance, the street cameras equipped with facial recognition technologies can cost up to several thousand dollars.

companies (Whittaker, 2021). Data is sampled and continuously licensed to be transformed into quantifiable "user metrics" and "audience engagements" to generate economic rents; data analytics here works as a means to turn personal data into techno-economic objects (economic assets) (Birch et al., 2021; Gilbert, 2021).

The fast-growing field of critical data studies provides valuable insights into the philosophical, political, and social issues related to the adoption of digital data in public and private sectors. Initially, the researchers criticized a popular belief in infallibility of data and data-driven insights (boyd & Crawford, 2012; Kitchin, 2014a). As an example, when smart city companies like Siemens began marketing their data-collecting devices and data analytics software to the public sector organizations (Townsend, 2013), they presented data as a mathematical tool that delivers objective vision of reality. Unlike the human accounts of reality, prone to mistakes and manipulations, the data vision (Beer, 2018) was often portrayed as an ingenious "scientific" tool adapted for practitioners (Green, 2019). In this view, "raw data" already existed in the world similar to a natural resource and simply waited to be discovered (Stark and Hoffman, 2019). In one of the earliest edited collections on the topic (Gitelman, 2013), historians and social scientists deconstructed the distinction between the "raw" and "manipulated data." The scholars have shown that data is best understood as a form of knowledge; every dataset is socially constructed, and its techno-social characteristics depend on the cultural and political aspects of its creation. It is important to consider the material and the technological aspects of data, e.g., cords, servers, and data cleaning (Kitchin & Lauriult, 2014c; Pink et al., 2018). This largely invisible work masks the growing power disparity between technological businesses that own the infrastructure needed to create and maintain data, their consumers, and data subjects whose data is being assetized (Lehdonvirta, 2022). Amazon and Alphabet, for example, are the leaders in data storage and computing power, which helped them monopolize the market of targeted advertising and can potentially help them control the market of artificial intelligence.

Empirical research that came out of the field of critical data studies gives many examples of the data being politically motivated, biased against the racialized and marginalized individuals, and crafted to achieve narrow formulated economic goals (Noble, 2018; O'Neil, 2016; Benjamin, 2019). For instance, in her comparative study of three data-driven welfare programs in the United States, Virginia Eubanks (2019) argues that data is nearly always used as

an evidence against the applicants and is intentionally used to cut the government spending. Ruha Benjamin (2019) discusses the many instances, in which data has been used by government and private actors to discriminate against the African Americans. The concepts of "data justice" (Dencick et al., 2022) and "data feminism" (D'Ignazio & Klein, 2020) have been created in response to this evidence of discrimination and abuse exacerbated by data. While data justice is an analytical framework that helps examine the negative consequences of digitalization through the lens of power relations, the concept of data feminism refers to an activist approach that calls for the pro-active use of data to combat injustice.

Other theoretical frameworks that have proved to be useful in the studies of data governance are the notions of the gift (Fourcade and Kluttz, 2020), altruism (Veil, 2022), and solidarity (Prainsack, 2019), which have been used to explore non-monetary rewards in data and health industries. Theories of digital rights (Calzada, 2018, 2020), social justice (Taylor, 2017; Dencik et al., 2022), data feminism (D'ignazio & Klein, 2020), and data/digital sovereignty (Hummel et al., 2021; Floridi, 2020) examine the way data subjects can reclaim personal data and leverage all types of data for collective purposes.

The literature, however, pays limited attention to the role of a rentier economy in the transformation of digital personal data into key economic asset. In a rentier economy, information, human bodies, material artifacts, and physical spaces are treated as capitalizable property (i.e., an asset). In this thesis, I focus on the assetization of digital personal data to analyze the transformation in socio-technical practices that underpin the handling of personal information and the generation of value from it. Through this approach, I seek to contribute some new insights to the fields of STS and critical data studies. As previous research highlights:

> Increasingly, innovation in data-driven sectors is undertaken in pursuit of this sort of "data rentiership," entailing the extraction of revenues as the result of the ownership and control of a particular resource (or asset), primarily because of that resource's inherent or constructed productivity, scarcity, or quality. Here, a "data rent" represents the revenues that can be derived from ownership and control rights over personal data (as an asset) by a data "controller" or "processor." (Birch et. al., 2020: 474-475

To generate these economic rents, technology companies collect and retain volumes of data about their users through heterogeneous assemblages of online digital environments, data enclaves, technical devices, legal contracts, and collective standards (Birch, 2020a; Langley & Leyshon, 2017; Nieborg & Poell, 2018; Srnicek, 2016; Viljoen et al., 2021).

1.3. From Data Colonialism to Technoscientific Capitalism: Conceptualizations of the Existing Data Economy

In this section, I explore several important theories that examine the existing data economy through the lens of cultural, legal, social, and political analysis. I then trace common narratives and conclusions derived from these theories and briefly explain the choice of assetization theory as primary theoretical framework in this study.

Couldry and Mejias (2019) consider the data economy to be an iteration of "data colonialism." They seek to understand the transformative cultural and economic effects of data and data-driven technologies and view data colonialism as a reality, not a metaphor. The authors argue that "the extraction of value through data represents a new form of resource appropriation on a par with the landgrab (the seizure of land, resources and labour) that kicked off historical colonialism," (p. 3). Drawing on a series of examples, Couldry and Mejias (2019) connect historical colonialism and contemporary capitalism as it has developed in the Global South, on one hand, and how global technology companies engage in data extraction, on the other: for them, global technology companies extract data the same way as their predecessors extracted natural resources. Precision agriculture is a useful illustration of this type of extractive data economy, where Southern farmers are pushed by their governments to partner with global agriculture businesses and provide volumes of data about their everyday activities, land, and produce in exchange for discounted seeds and equipment (e.g., Fraser, 2018). By drawing these parallels, Couldry and Mejias offer valuable insights into the extractive rationalities prevalent in the data economy and bridge the concepts of capitalism and colonialism. However, some critics have pointed out that the concept of data colonialism is too narrow (i.e., it focuses on data extraction) and does not add significant epistemic value to existing research on digital surveillance or the history of colonialism (Mumford, 2022).

"Techno-feudalism," another term with complex historical connotations, was coined by Eric Posner and Glen Weyl in their book *Radical Markets* (2018). Posner and Weyl, followed by

a range of Marxist (Durand, 2021) and right-wing (Kotkin, 2020) authors, argue that the concentration of capital and power in the hands of a few technology companies is a manifestation of a sweeping economic transformation, in which digital feudalism has replaced capitalism. As with historic feudalism, techno-feudalism means that the majority of a population do not own the means of production and the extraction of capital is carried out through non-economic (political) means. The reason why the concept of techno-feudalism has been embraced by both sides of the political spectrum is that it is offers a simple and relatable framing of contemporary capitalism. Indeed, the so-called "techlash" (Foorhar, 2018) against the power of technology monopolies has united individuals from different political backgrounds. Yet, Evgeny Morozov argues that the concept of techno-feudalism has a limited heuristic potential, since its fails to account for the central drivers of capitalism that have not changed since the times of Marx:

> The techno-feudal thesis stems not from the advance of contemporary Marxist theory, but from its apparent inability to make sense of the digital economy—of what, exactly, is produced in it and how. If one accepts that Google is in the business of producing search-result commodities—a process that does require massive capital investment—there is no great difficulty in treating it as a regular capitalist firm, engaged in normal capitalist production. (Morozov, 2022, p. 120)

Another widely discussed concept is "surveillance capitalism." The idea of surveillance capitalism is often associated with the work of economist Shoshanna Zuboff (2019), although she was not the first scholar to use this term to emphasize digital tracking as the defining feature of the current economic order. Social scientists John Foster and Robert McChesney (2014) coined the term surveillance capitalism in an article that reflected on the concentration of private capital and the growing power of the military–industrial complex in the US. Foster and McChesney (2014) analyzed this political–economic transformation in relation to the emergence and normalization of new forms of surveillance and control in the American society. They further identified three focal points of the surveillance capitalism in the US: military/security, corporate-based marketing/media, and finance.

Zuboff's central argument echoes that of Foster and McChesney, yet she puts the onus of responsibility on technology monopolies. In her book, *The Age of Surveillance Capitalism,*

Zuboff (2019) argues that the business model of technology monopolies threatens individual privacy and autonomy. Her book was met with enormous interest as internet users were grappling with the tainted image of Silicon Valley in the wake of the Cambridge Analytica scandal. Focusing on the history and business practices of the main trailblazer, Google, Zuboff shows when and how technology companies realized that digital personal could become "behavioral data" and a means to predict and modify human behavior. The fact that technology companies track their users online is not a recent discovery (e.g., Pasquale, 2014, 2015), yet Zuboff highlights the massive scale of the targeted advertising industry. Zuboff further argues that the business of targeted advertising shapes organizational culture and the practices of all technology companies today:

> With Google in the lead, surveillance capitalism rapidly became the default model of information capitalism on the web and, as we shall see in coming chapters, gradually drew competitors from every sector. This new market form declares that serving the genuine needs of people is less lucrative, and therefore less important, than selling predictions of their behaviour. (Zuboff, 2019, p. 93)

Zuboff has been criticized for focusing primarily on the privacy and autonomy aspects of the data economy while downplaying the issues of monopoly and inequality and for the belief that market mechanisms can correct the faults of surveillance capitalism (Haggart, 2019; Morozov, 2019b). Indeed, for Zuboff, companies like Apple that charge their users to keep data on their devices, is a viable alternative to businesses that exploit personal data through online advertising. Other critics claim that Zuboff misunderstands the business model of technology monopolies: instead of trading in data, they sell access to users' screens and attention (Birch et al., 2021; Gilbert, 2021). Another point of criticism is that Zuboff has gravely overestimated the surveillance potential of Big Tech (Doctorow, 2020).

The fourth concept that has gained traction in academic literature is "informational capitalism." Cohen (2019) attacks the widespread belief that the data economy operates in a lawless space and analyzes the legal regime where digital personal data escapes data protection and privacy laws and effectively becomes technology companies' private asset. The concept of "informational capitalism" refers to a set of legal changes that have made possible the creation of immaterial capital and a political economy where technology companies have been insulated from any form of democratic oversight; moreover, technology companies proactively use

lobbying and legal loopholes to limit the scope and effectiveness of government regulation. Specifically focusing on the USA, these legal changes have to do with trade secrecy, the First Amendment, contract law, and privacy: technology companies have framed trade secrets and data as forms of de facto property, modified and challenged contract laws, internationalized their business practices to circumvent national legislation systems, and defended themselves in courts in the US by posing as purveyors of free speech. Unlike Zuboff, who writes about threats to individual privacy and autonomy, Cohen is concerned with the collective harms brought about by the data economy. For Cohen, informational capitalism poses an immense threat to our democratic institutions.

The terms "platform capitalism" and "Big Tech" are popular in both academic and media discourses. With the former, Nick Srnicek (2017) aims to put the data economy in a historical perspective through an analysis of four technology companies: Airbnb, Amazon, Google, and Uber. He argues that platform businesses are defined by three characteristics: they act as intermediaries between different actors (e.g., users, small businesses, and advertisers); they help users build their own products and services; and they thrive on network effects. Expansive growth, monopoly, and unlimited data collection help the platforms find new forms of revenue. Srnicek's argues that in its economic logic, platform capitalism is no different from the capitalism of the 1970s. Other platform studies researchers see some novelty in platform capitalism, in that technology monopolies: provide individuals with essential services (Fourcade & Healy, 2017; Poell et al., 2019; Prainsack, 2019b); bypass government regulation pertinent to vendors and service providers by legally defining themselves as intermediaries (Langley & Leyshon, 2016); and take tolls from both producers and consumers who use the platforms' multisided markets (Komljenovic, 2020; Nieborg & Poell, 2018; Pistor, 2019). Mazzucato et al. (2021) call the hidden fees that platform companies charge their partners and clients a new form of taxation. Predictably, technology companies employ their familiar strategies of expansive growth and market domination when they expand their businesses in the physical realm through surveillance and monopoly ownership of digital and physical infrastructure (Gekker & Hind, 2019; Morozov, 2015).

Regardless of how one conceptualizes contemporary digital and data economy—as a new iteration of capitalism or capitalism by other, technological, means—the question of who owns and controls data is central. This dissertation focuses on the major transformation in practices of

handling personal information and generating value from it—specifically the ascendance of a rentier data economy. Analytically, I draw on the concepts of assetization and technoscientific capitalism (Birch, 2020; Birch & Muniesa, 2020) to explore the socio-technical practices both private and public actors deploy in their treatment of personal data as a tradable resource—an asset. Drawing on my two case studies, Sidewalk Toronto and DECODE, I explore the socio-technical dilemmas and conflicting objectives as technology professionals, public officials, and activists develop proposals and governance mechanisms for living in smart cities.

Birch and Muniesa (2020) define an asset as a legal construct that protects one's rights over a certain resource and helps generate economic rents from this resource. For instance, a movie file can be easily copied, but it is illegal to do so because the file is protected by copyright. The licensee receives a fee every time someone buys or rents it. The assestization relies on the combination of intellectual property (IP), licensing, and contractual law. IP rights allow the holder to exclude others from using an item in question or demand licensing fees for access to it. This applies universally, irrespective of whether anyone has made an agreement with the holder in advance. The scope of the license is ultimately determined by the scope of the IP right. When it comes to data, however, the picture is rather different. Data is rarely protected by copyright; in most cases, technology companies rely on contractual agreements for data access, reuse, and commercialization.[8]

Assets are often constituted by forms of sole ownership or control, which means that one has a legal right to restrict access to the resource. Furthermore, the owner and the holder of control rights can be different parties (e.g., a house is owned by an Airbnb client, yet the company collects economic rents generated by the lease); and the value of assets is socially contingent: it is based on the attitudes and expectations of investors. This latter aspect is especially important from the STS perspective, where assets are significantly more than an economic resource:

> An asset, though, is more than a simple property claim; it is, more fundamentally, a political claim on the future, especially through the right to future revenues. And this creates a political and policy dilemma when it comes to IoT and its extension of data collection and exploitation. (Birch, 2022)

[8] My research participants and other data sources nevertheless often use the term "data licencing agreement" to refer to contracts the central function of which is to provide access to data against a remuneration.

The assetization of digital personal data is part of a broad socio-technical transformation, where nearly every aspect of human life has become a source of economic revenues and profits. This is the essence of technoscientific capitalism:

> The implications of the rollout of IoT, smart cities, AI, and a whole array of other digital technologies is that everything in our lives could be progressively transformed into an asset that someone can own, trade, and capitalize. (Birch, 2022)

As my primary theoretical framework, assetization theory is based on the idea that economic assets and the logic of rentiership they symbolize have come to define contemporary capitalism. I build on this scholarship to examine the socio-technical practices, policies, and governance mechanisms that define the management and control of personal and user data in emerging smart cities, drawing on Sidewalk Toronto and DECODE as comparative case studies.

1.4. Conceptualizing the Smart City

The origins of the term "smart city" are unclear although many researchers believe it was coined in the 2007 IBM marketing campaign for its data analytics software (Söderström et al., 2014; Sadowski & Bendor, 2019). Historians of smart city technologies like Adam Greenfield (2013), Anthony Townsend (2013), and Shannon Mattern (2015, 2020) argue that the global smart city movement was brought into existence by the triumvirate of IBM, Cisco Systems, and Siemens when the companies began marketing their communication and data analytics products to city administrations. Technologically sophisticated and costly, smart city initiatives have often been implemented through public–private partnerships (Goodman, 2020; Valverde & Flynn, 2020). Municipalities employ smart city branding to attract investments by promoting their cities in international rankings as the most "innovative," "intelligent," and "green" (Hollands, 2008, 2015; Edwards, 2016). Longtime leaders of the smart city rankings, the municipalities of Barcelona and Singapore promote the smart city idea through popular international exhibits.

Smart city devices owe their technological design to the military aircrafts and the business analytics software of the 1980s-1990s. Mattern (2015) demonstrates that the first business analytics software, called the Bloomberg Terminal (Figure 1.1.), was modeled on the flight cockpits of military planes employed during World War II. A precursor of today's city

dashboards (Figure 2.1.), Bloomberg Terminal was used to track commercial assets and estimate financial risks. Today, city dashboards are employed by nearly all municipalities, law enforcement agencies, and emergency services in North America and Europe, to track the movement of people and vehicles, and analyze real-time data about fires and crimes.

Figure 1.1. Bloomberg Terminal, 2009. (Image source: Ryuzo Masunaga/Bloomberg)

Epistemologically, Mattern (2015) argues, the smart city concept reflects an original, paramilitary vision of the city as a set of quantifiable indicators that require acting on. Another smart city scholar, Ben Green (2019), similarly argues that smart city advocates depict the city as a set of problems that could be solved mathematically, failing to recognize the "beautiful messiness" and unpredictability of socio-technical processes. In the famous manifest *Against the Smart City*, architect Adam Greenfield (2013) makes an argument that all existing and abandoned smart city projects have existed in the "generic" time and space and promised to "fix" urban problems through the one-size-fits-all approach.

Figure 1.2. Professor Rob Kitchin, one of the creators of Dublin's City Dashboard. The dashboard visualizes real-time data from multiple street cameras and environmental sensors across the city. (Image source: Dublin City Council)

The transition from business analytics to city governance was not easy or seamless: in the United States, IBM launched the Smart City Challenge competition to identify municipal issues that could be solved using digital data (Wiig, 2016). Yet even if a problem was identified correctly, data would not necessarily provide a solution. In 2008, IBM's first smart city pilot in Portland was shut down because the data-driven urban planning software failed to provide any meaningful results (Townsend, 2013, pp. 82-83). The original app relied on over 1500 equations to analyze the planning issues of Portland; the number of equations was eventually cut down to 150 because city workers could not master them. The app's greatest output was the suggestion to install additional bicycle lanes to help fight obesity among Portland's population. In New York City, RAND Corporation's data-driven planning tool suggested cutting down the number of fire stations but failed to account for traffic (Greenfield, 2013). As a result of this planning decision, a series of devastating fires happened in several neighborhoods in Queens. In Kansas City, an automated traffic management system built by Cisco Systems failed to address traffic jams (Williams, 2019, n.p.).

Today, the term smart city usually refers to a variety of technologies from CCTV to open data portals to fiber optic cables to digitalized public services. Kitchin (2014, pp. 2–3) divides

the smart city definitions into two broad categories: first, as digital devices embedded into the fabric of the city and, second, as a policy vision, where digital technologies are expected to facilitate an urban knowledge economy by helping the people to become "smarter."

The first notion, popularized by industry professionals (e.g., the G20 Global Smart Cities Alliance) refers to the smart city as a set of ubiquitous digital networks:

> On the one hand, the notion of a 'smart city' refers to the increasing extent to which urban places are composed of 'everyware' (Greenfield, 2006); that is, pervasive and ubiquitous computing and digitally instrumented devices built into the very fabric of urban environments (e.g., fixed and wireless telecom networks, digitally controlled utility services and transport infrastructure, sensor and camera networks, and so on) that are used to monitor, manage and regulate city flows and processes, often in real-time, and mobile computing (e.g., smart phones) used by many urban citizens to engage with and navigate the city which themselves produce data about their users (such as location and activity). (Kitchin, 2014, p. 2)

For Townsend (2013), who also defines the smart city through its technological components, the digitization of urban infrastructure is set to become a new industrial revolution. He believes that urban technologies will soon enough become green and efficient through the help of big data. The terms "smart cities" and "big data" have been often used interchangeably to describe any technological investment in urban infrastructure (Hashem et al., 2016; Löfgren & Webster, 2020). One major disadvantage of this definition is its all-encompassing nature; if any piece of digital technology employed in the urban environments may be called a smart city, then the smart city concept does not have any significant heuristic potential.

Kitchin's second definition frames the smart city as a policy trend where municipalities partner with technology vendors to promote a knowledge economy:

> On the other hand, the notion of a 'smart city' is seen to refer more broadly to the development of a knowledge economy within a city-region (Kourtit et al. 2012). From this perspective, a smart city is one whose economy and governance is being driven by innovation, creativity and entrepreneurship, enacted by smart people. Here, ICT is seen as being of central importance as the platform for mobilising and realising ideas and innovations, especially with respect to professional services. In other words, it is how ICT, in conjunction with human and social capital and wider economic policy, is used to

> leverage growth and manage urban development that makes a city smart. (Kitchin, 2014, pp.2–3)

Kitchin's second, policy-centered, definition of the smart city muddies the boundary between the early 2000s studies of "networked urbanism" (Graham & Marvin, 2002; Mitchell, 2004; Sassen, 2018; Varnelis, 2012) and the fast-evolving smart city scholarship (Greenfield 2013; Kitchin, 2014a, b; Kitchin, 2015, 2016; Mattern, 2015, 2020; Sadowski, 2020; Sadowski & Pasquale, 2015; Wiig, 2013). The notion of "splintered urbanism" introduced by Graham and Marvin (2002) has informed several generations of urban studies and economic geography researchers who have investigated how the entrance of transnational companies in a region has nearly always contributed to the emergence of prestigious city hubs while facilitating land dispossession and loss of livelihood for the underprivileged and racialized communities. While the fields of networked urbanism and smart city research have an important common theme—the commercialization and privatization of city spaces and services—networked urbanism studies offer fewer insights into digital personal data, the socio-technical nature of which, as I argue in this thesis, has a critical impact on the contemporary city economy.

What differentiates the smart city initiatives from past city revitalization projects is the granular digital personal data that smart city devices capture in public spaces (Edwards, 2016, p.1). To account for the role of data in smart city initiatives, in this thesis, I adopt the definition of the smart city proposed by Natasha Tusikov (2020, p. 71). Tusikov defines the smart city through two technological characteristics: first, it is comprised of networks of sensors attached to real-world objects embedded in the urban environment and, second, the presence of networks of communications technologies that enable real-time data collection, streaming, and analysis to deliver services and integrate information and physical infrastructure. Tusikov highlights the connection between the commercialization of data collected in the city spaces and the privatization of city governance:

> The pervasive data collection that characterizes smart cities blurs traditional distinctions between public and private spaces within urban environments. The public might reasonably expect that data collected in public spaces might be under the control of the state. However, depending on legal frameworks and the systems of publicly and privately operated sensors and infrastructure in smart

> cities, the resulting data may be partially or exclusively in private control. (Tusikov, 2020, p. 71)

As I argued in the empirical chapters of this dissertation, the smart city concept retains close connections with the instruments of financial asset management epitomized by the Bloomberg Terminal. Robert Hollands (2008, 2015) famously proclaimed that the corporate smart city is the only smart city that really exists.

1.5. Privacy, Autonomy, and Citizenship in Technoscientific Capitalism

Digitalized cities tend to exacerbate key issues brough on by the extractive data practices of technology companies; these issues concern individual and collective privacy, self-identification, civic liberties, and citizenship. The legal regimes that regulate how data about individuals is gathered, processed, and used are subject of numerous academic studies. Existing research frameworks address different legal aspects of the data economy, including privacy (Citron, 2022; Nissenbaum, 2009; Veliz, 2022), racism and inequality (Benjamin, 2019; Eubanks, 2018; Noble, 2018), monopoly (Moore & Tambini, 2022), and data subjects' empowerment through digital rights (Calzada, 2018, 2020; Kitchin, 2021, 2022; Morozov & Bria, 2018). In this section, I address key issues that smart city initiatives have brought from cyber spaces into city spaces. My main argument here is that, as a socio-technical regime, technoscientific capitalism facilitates new forms of private governance that manifest through invasive surveillance, digital profiling, and social sorting; all of these issues have been exacerbated by smart cities.

In a widely cited article *Law for the Platform Economy*, Julie Cohen (2017) explains how, in US society, the right to privacy has been continuously overridden by the interests of national security, efficiency, and entrepreneurship. The problem is as much epistemological as it is practical: Cohen points to the lack of connection between privacy research and contemporary studies of identity. In the US, privacy studies predominantly draw on orthodox economic theory and frame privacy as a matter of consumer protection, thus failing to recognize the full spectrum of harm brought on by data-driven technologies. Reconfiguring the concept of identity as a fluid and socially constructed self-impression, Cohen shows how the mundane practices of private and public digital surveillance diminish the autonomy and citizenship of individuals:

> Privacy shelters dynamic, emergent subjectivity from the efforts of commercial and government actors to render individuals and communities fixed, transparent, and predictable. Networked information technologies mediate our experiences of the world in ways directly related to both the practice of citizenship and the capacity for citizenship, and so they configure citizens as directly or even more directly than institutions do. By these increasingly ordinary processes, both public and private regimes of surveillance and modulation diminish the capacity for democratic self-government. (2013, p. 1912)

Anita Allen (2022) coined the term "Black Opticon" to emphasize the numerous ways public and private digital surveillance affects the lives of African Americans in the US. African Americans have been commonly over-surveilled by police, discriminated against by banks, and suffer from various online fraud schemes. Allen provides several illustrations of this phenomenon, including a recent scandal involving a company called Geofeedia that had purchased data about the Black Lives Matter protestors and sold it to the police. African Americans are the targets of many elaborate scams, including from sites that promise to give them access to their credit history. Allen's study echoes the argument made by Safiya Noble (2018), whose research demonstrates the existence of what she calls "digital redlining" that affect individuals from racialized and marginalized communities. Ruha Benjamin (2019) has traced today's invasive and inequitable technologies to the utopian technology culture of the 1990s and its racial disparities; Benjamin further argues that the ways digital personal data is collected online and how algorithms are trained on it create digital environments that perpetuate existing social and economic inequalities.

The scholarship of Salome Viljoen (2021) similarly points to a major gap in the existing privacy research. While stressing the need to protect individual rights, existing studies do not account for the collective risks associated with the governance of digital personal data. An example that Viljoen discusses in of her articles is that FBI has been reportedly using a tattoo recognition application to covertly identify members of organized criminal groups. Through this approximation, all persons with certain tattoo images on their bodies were added to the FBI database and became potential suspects. Similarly, an individual could find themselves included in a police database because their neighbor or someone they knew had been included in that database. Viljoen argues that privacy and data protection laws need to be updated to protect digital personal data as a democratic medium:

> This shift, in turn, theorizes a different approach to data in law—from an individual medium expressing individual interests, to a democratic medium that materializes population-level, social interests. Like other mediums of social relation, the governance of data raises political questions regarding what individuals are owed and owe one another on the basis of these material relations and how to distribute relevant benefits and risks among one another. (2021, p. 62)

When it comes to the deployment of smart cities in North America, racialized individuals have been disproportionally affected by the use of CCTV and facial recognition technologies in the streets. Recent studies by Jathan Sadowski (2020b) and Rebecca Williams (2021) demonstrate that, in the US, law enforcement agencies have been the biggest clients of smart city vendors. Research in Canada (e.g., Robertson et al., 2020) confirms the same trend: Canadian law enforcement agencies actively employ data-driven policing tools, and these tools primarily target racialized communities.

Frank Pasquale's (2015) study and the Federal Trade Commission (2019) investigation into the US$200 billion market of data brokers shed light on the inner workings of the data economy. The data brokers (e.g., Experian) purchase digital personal data from various services and vendors and create elaborate marketing profiles of internet users. The profiles categorize individuals by location, income, shopping habits, health, sexual preferences, and even trauma. The accumulation of digital personal data allows technology monopolies to practice the same rentier practices as do data brokers (Birch, 2020b). Birch et al. (2021) coined the term "techcraft" to describe how technology companies transform digital personal data into an economic asset through performative governance and valuation of user metrics. Zuboff (2019) argues that the technology monopolies' control over personal data translates into immense power asymmetry, where Big Tech can and does exploit the vulnerability of internet users. Ryan Calo (2014) coined the term "digital market manipulation" to describe the practice of leveraging personal data against consumers in digital environments.

The decisive move of technology companies into the market of smart cities raises serious issues concerning data ownership and consent:

> A key issue is the lack of opportunity in an ambient or smart city environment for the giving of meaningful consent to processing of personal data; other crucial issues include the degree to which

> smart cities collect private data from inevitable public interactions, the "privatisation" of ownership of both infrastructure and data, the repurposing of “big data” drawn from IoT in smart cities and the storage of that data in the Cloud. (Edwards, 2016, p. 1)

Indeed, acquiring consent to data collection and data processing in public spaces is rather problematic. With smart cities being public spaces managed through the public–private partnerships, there is a reasonable expectation on the part of the citizens that personal data won’t be collected there and, if collected, it will be managed by a public authority. In reality, data governance in smart cities is a complicated matter: the questions of data ownership and control are defined on case-by-case basis by contract agreements between multiple parties, and, often, data in these agreements is legally defined as a private asset of a smart city vendor.

European privacy and data protection legislation (GDPR) grapples with defining what constitutes personal data in the smart city and IoT environments. One way technology vendors bypass the robust protections provided to European users by the GDPR is by de-identifying data. Recent court cases, however, have pushed European data protection authorities to recognize pseudonymized data as personal data and introduce the legal definition of “identifiability” as a way to assess risks associated with certain de-identified datasets (Fink & Pallas, 2020). Nadeshda Purtova (2022) makes a compelling argument that, in the smart city and IoT environments, where a person is often identified through a single feature and is classified based on this feature, the definition of identity should be extended to include all types of identification that distinguish a person from a group.

1.6. Conclusion and Thesis Summary

Digital personal data has been increasingly recognized as a key source of value in private and public sectors (Ciuriak, 2018; OECD, 2019; WEF, 2011, 2019). Even in the public discourses, the transformation of data into a commercial asset has been reflected in the catchphrase “data is the new oil.” Scholars have offered various conceptualizations of the extractive data practices that dominate the internet, including platform capitalism, digital feudalism, informational capitalism, and assetization theory (technoscientific capitalism). Each notion emphasizes different aspects of the data economy, ranging from its cultural roots to political imaginaries to legal challenges. I use assetization theory (Birch, 2020a; Birch &

Muniesa, 2020) as my primary framework to focus on the political economy of data assets in urban settings.

Assetization theory frames an asset-driven data economy as part of a broad political economic transformation from a production-based to a rentier-based economy (Birch et al., 2020; Birch, 2022). In a rentier economy, revenues are generated through changes in control and ownership over mundane things that have been reconfigured as tradable commodities. Social media that rent out users' data and viewership to advertisers and smartphone applications that allow individuals to generate economic rents from their cars are among prime examples of rentiership. In this thesis, I argue that the smart city initiatives that turn urban infrastructure into the platforms for real-time data collection and data processing (Tusikov, 2020) represent a transition of a rentier data economy from online spaces into the physical realm. In rapidly digitizing and automated cities, the economic logic of data assets affects individual privacy and autonomy as well as city planning and governance.

Amid the global trend where municipalities rush to adopt data-driven technologies (Green, 2019; Greenfield, 2013) and often enter unprofitable public–private partnerships with technology companies (Valverde & Flinn, 2020), this dissertation has some policy relevance. This dissertation research is a comparative study of Sidewalk Toronto and Barcelona's DECODE project. The overall goal of this thesis is to explore two smart city initiatives as sites of the complex interplay between public, private, and collective interests in data governance. These initiatives represent two complimentary cases of data governance. Sidewalk Toronto was envisioned as a private technology system that runs on collectively controlled data and smart city infrastructure; DECODE was designed to facilitate the public and collective governance of data and smart city infrastructure.

With its hybrid, techno-social-material nature, the smart city is a perfect subject for STS research. Edwards (2016) and Tusikov (2020) show that smart cities, which are public spaces where personal data is collected, processed, and controlled by technology companies, pose significant governance challenges. Drawing on my two case studies, I demonstrate how the rentier practices of technology companies have penetrated city governance and negatively affected public officials' understanding of the public interest in smart cities.

The conclusions of my dissertation are threefold: first, data governance in the smart city initiatives can be theorized as a form of asset governance, since the political economic logics of

assetization dominate in the data governance proposals for Sidewalk Toronto and DECODE; second, both smart city initiatives aimed to generate value from digital personal data and failed to balance private interests with public and collective interests; third, policymakers and citizens engaged in these smart city initiatives displayed a variety of non-economic expectations and attitudes toward data, a phenomenon I conceptualize in the dissertation as "affective data governance."

In the following five chapters, this dissertation research explores the political economy of data assets, through the empirical study of Sidewalk Toronto and DECODE. Chapter II provides an analysis of the theories of political economy of data governance and smart city scholarship. Chapter III details the research design and methodology of the comparative case study. Chapter IV investigates the research data on the first case study, Sidewalk Toronto. Chapter V examines the research data collected about the second case study, DECODE, and provides a comparative analysis of the two initiatives. Chapter VI highlights key empirical findings of the study, discusses the theoretical contribution of the dissertation, and outlines its implications and possible future research directions.

CHAPTER II

THEORETICAL FRAMEWORK: THE POLITICAL ECONOMY OF DATA GOVERNANCE

2.1. Introduction

The dominant model of data governance online currently favors a small number of technology companies that have established de-facto data monopolies (Srnicek, 2017; Zuboff, 2019; Cohen, 2019). Yet, data governance in physical spaces (e.g., biometric collection, digitalized urban infrastructure, internet of things [IoT]) is subject to a complex coordination and contractual obligations between multiple interested parties. Increasingly, various public and private actors have begun to see value in reusing the data they accumulate: from personal data gathered by government agencies to consumer profiles generated by private vendors to mobility data captured by public transit and rideshare companies. Among these interested parties are governments, law enforcement agencies, civic actors, and businesses of various scale (European Commission, 2018; Meijer, 2018; Mercille, 2021; Micheli, 2022).

Data is increasingly framed as an integral part of municipal governance as city administrations seek to digitalize public services and expand their use of data analytics (Green, 2019; Zoonen, 2020; Löfgren & Webster, 2020). Real-time data collection in city spaces and the digitalization of urban infrastructure have been turning cities into "smart cities" (Kitchin, 2014b; Kitchin & Lauriault, 2014; Tusikov, 2020). Since these technologies often rely on proprietary algorithms implemented in the public facilities, the smart city initiatives are often run as public-private partnerships (Valverde, 2020). Predictably, smart cities pose new governance challenges in which the interests of data access, reuse, and commercialization often conflict with the interests of individual and collective privacy, equality, and democratic participation (Hollands, 2008, 2015; Edwards, 2016; Wiig, 2016). Some scholars argue that smart cities manifest a turn toward the privatization of city services and effectively put private technology providers in the position of regulators (Sadowski & Pasquale, 2015; Morozov, 2017; Sadowski, 2020; Carr & Hesse, 2020). Other researchers argue that, with the right governance approach, smart cities can

be designed to protect collective and public interests in data governance and stimulate grassroots activities (Morozov & Bria, 2018; Spicer et al., 2021; Pembleton et al., 2022).

The aim of this chapter is to explore the political economy of data governance as it marks a transition from online spaces to algorithmically managed and automated cities. As other parties beyond private technology firms begin accumulating and reusing digital data, they are devising novel governance frameworks and socio-technical systems that produce both monetary and social value from data (e.g., data trusts, data cooperatives). This chapter examines and synthetizes academic debates on the existing and emerging approaches to data access, valuation, and governance. This discussion is informed by science and technology studies (STS) and the literature on smart cities and critical data studies.

The concept of data assets is central to my analysis of the political economy of data governance. My primary theoretical framework, the assetization theory (Birch, 2020a; Birch & Muniesa, 2020), is underpinned by the notion that economic assets and the logic of rentiership they engender have come to define contemporary capitalism. STS researchers have applied the assetization lens to the studies of personal data, health data, and online user data (Birch et al., 2020, 2021; Vezyridis & Timmons, 2021; Geiger & Gross, 2021) and discovered three major trends: first, the assetization of data entails value-driven decisions regarding the types of data collected, shared, and marketed; second, data is turned into assets through the costly digital infrastructure controlled by a small number of actors; and third, even when data is configured as a public or collective asset, the pursuit of economic rents often overrides all other interests.

The chapter is organized as follows. Section 2.1 addresses the socio-technical dimensions of data governance through an STS lens. Section 2.2 scrutinizes the concept of assetization and explores the potential of assetization theory in the studies of data governance. Section 2.3 seeks to analytically connect the STS studies of data governance with the smart city scholarship. Section 2.4 addresses the political economy of emerging data governance approaches: data trusts, data collaboratives, data commons, and data cooperatives. Finally, the conclusion summarizes the key concepts of the chapter and explains how they will be put to work in the empirical chapters.

2.2. Researching Data Governance Through an STS Lens

For almost two decades, the internet and digital technologies that support its existence were frequently portrayed in academic and public discourses as immaterial, freely available, and politically neutral tools for individuals to connect and self-organize (Negroponte, 1996; Turner, 2016; Nissenbaum, 2017). In the area of internet governance, a multi-stakeholder approach to the administration of information and communication technologies was often confused with democratic governance (Haggart et al., 2021). This lack of understanding of the highly contested and tangible nature of digital technologies allowed several technology companies to quietly seize control over the data of internet users (Cohen, 2019; Waldman, 2022; Lehdonvirta, 2022).

More recently, scholars have argued that personal data harvested by large digital companies like Facebook and Google have been, for example, offered for sale, misused for political or economic purposes, and weaponized against marginalized groups (Noble, 2018; Birch et al., 2020; Moore & Tambini, 2021). Data governance has even been characterized by some as an exploitative relationship between technology companies and their users (e.g., Foroohar, 2021). A fast-growing field of critical data studies has emerged to analyze data governance and the data economy as a socio-technical activity embedded in the diverse cultural, social, political, and material contexts (Kitchin & Lauriault, 2014; Iliadis & Russo, 2016). Notably, a crucial, albeit hidden, part of the data economy are the underpaid and precarious workers who moderate online content and ensure the data that digital systems run on is legible and ready for downstream uses (Irani, 2015; Gillespie, 2018; Gray and Suri, 2019).

In STS, research on data governance is informed by the studies of scientific and technological governance (e.g., Jasanoff, 2006; Irwin, 2008; Barben et al., 2008; Guston, 2014). In seminal laboratory studies, Bruno Latour and Steve Woolgar (1986), Michael Lynch (1985), and Andy Pickering (1999) employed ethnographic methods to examine the core methodologies of science. The scientific laboratory became a key unit of analysis for STS researchers as a place where science and nature are co-produced and where the ethnographer makes visible the constellations of heterogenous resources that help scientists turn laboratory artifacts into scientific facts (Latour, 1987). As an example, Latour (1993) presents Louis Pasteur as a politician as much as a researcher and shows that Pasteur's success in improving public health in France depended on him leveraging a range of social, economic, and material resources. This has led some STS scholars to conceptualize the scientists themselves as elements in technoscientific

networks (Mialet, 2012). These STS studies employed the ethnographies and case studies to criticize prevailing theories about the nature of scientific research, namely the idea that there exists a critical knowledge asymmetry between trained scientists and the lay public; a belief in a universal rationality underpinning scientific knowledge that works regardless of the location of the researchers and their subjects; and the conception that somewhere there exists a single, uncontested truth that waits to be discovered by the scientists. Epistemologically, these STS studies tended to frame knowledge production and technological artefacts as embedded in the local practices and open to multiple framings (Bijker et al., 2012).

In recent years, STS researchers have turned their gaze to the governance of science and technology, and these more recent studies have furthered the key arguments made in laboratory studies (e.g., Wynne, 2001, 2007; Jasanoff, 2011; Jasanoff and Kim, 2015; Guston, 2014). Among the concepts employed in the STS studies of scientific and technological governance are *co-production* (of nature, technology, and society), *boundary work*, *situated knowledge*, *networks*, and *assemblages*. The term *co-production* was originally developed by Latour (1987) who observed how the concepts of nature and society originated through the processes of mutual co-construction in the scientific laboratory; this concept was then revisited by Jasanoff (2006; 2011), whose empirical studies have demonstrated that neither knowledge nor technology can be separated from the contexts of its development and implementation.

The concept of *boundary work* (Gieryn, 1983) has been employed in the studies of policymaking in the areas of science and technology. STS studies have shown that policymaking is much more than technocratic decision-making based on scientific expertise (Leigh Star, 2010; Bowker et al., 2016). Interaction between the natural and the political worlds is described as a continuous process of redefining the boundaries between the public and the private (Jasanoff, 2012). The boundary work in this context is the practice of experts and bureaucrats to create concepts and make decisions that protect their institutional positions; through the boundary work discourses and practices get shaped, challenged, and revisited by the actors. The notion of *situated knowledge* (Haraway, 1988) is employed by STS researchers who critically approach the claims to "democracy" and "public opinion" and define these concepts in contextual and contingent terms. For instance, rather than advocating "responsible governance" or "democracy," STS scholars explore from whose perspective these value-driven statements are made. The notions of *networks* and *assemblages* in the studies of technological governance demonstrate that

policymaking is often characterized by uncertainty and doubt (Nowotny, 2006; Wynne, 2001, 2007).

Researching data governance from an STS perspective means opening up the categories of *data* and *governance* to empirical examination. Data, through this lens, is a form of knowledge:

> Like events imagined and enunciated against the continuity of time, data are imagined and enunciated against the seamlessness of phenomena. We call them up out of an otherwise undifferentiated blur. If events garner a kind of immanence by dint of their collected enunciation, as Hayden White has suggested, so data garner immanence in the circumstances of their imagination. Events produce and are produced by a sense of history, while data produce and are produced by the operations of knowledge production more broadly. Every discipline and disciplinary institution has its own norms and standards for the imagination of data, just as every field has its accepted methodologies and its evolved structures of practice. (Gitelman and Jackson, 2013, p. 3)

Data does not exist in the world unless it has been generated by someone to achieve particular purposes (Manovich, 2001, p. 224). Even when data is collected automatically and in bulk, the operating algorithms require precise instructions as to which datapoints should be considered valuable, and which should be ignored as "noise." Valuable data, therefore, is the data sought after by particular individuals. Being yet another form of knowledge production, this "imagined" and crafted data inevitably reflects the values and aspirations of its creators. The data is always embedded in the local practices and is often subject of intense controversy (Anderson, 2017; Leonelli, 2019; Loukissas, 2022).

The concept of governance refers to the shift away from the top-down government approach to the administration by diverse stakeholders, groups, and institutions (Fuller, S., 1999; Lyall & Tait, 2005; Rose-Ackerman, 2017). In both academic and policy discourses, the notion of governance has been gradually replacing the language of science and technology policy. Instead of being framed as the government business, development and regulation of science and technology have come to be seen as a matter of engagement with a number of interested parties, including academic institutions, citizens, industries, and political groups. In this context, governance is defined as a range of rules, standards, norms, claims, and organizational

mechanisms pertaining to the development and control of science and technology (Irwin, 2008, p. 584). It also refers to the various forms of self-governance (Barry, 2001) and the modes of thought that guide the social actors involved in the process of policymaking (Jasanoff & Kim, 2015).

An STS lens adds validity to the claim that the term *governance* may be more versatile than the term *policy* as it reflects the view of governance as a collective endeavor (Irwin, 2008, p. 584; Guston, 2014). STS studies have been documenting how political power becomes decentralized and government actors function as only one element in sociotechnical networks and assemblages. In this situation of uncertainty and political division, STS scholarship emphasizes the importance of trust in public institutions and the need for government actors to respect alternative views of policy dilemmas (Zavestoski et al., 2006; Cruikshank, 2007).

2.3. Digital Personal Data as an Asset: Key Policy Trends and Empirical Research

Digital data has characteristics of non-rivalrous and nonexcludable goods, whose "ownership" rests on de facto control rights rather than de jure property rights (Purtova, 2015, 2017; Scassa, 2018; Cohen 2019; Delacroix & Lawrence, 2019). In practice, then, digital personal data mostly exist in the form of private data siloes, usually created and maintained by Big Tech (Whittaker, 2021; European Commission, 2020).

The majority of digital platforms operate as "data enclaves" (Birch, 2020) where the companies generate value from the data they collect by limiting access to it (Beer et al., 2019; Birch et al., 2020, 2021). This has been conceptualized as data rentiership by Birch et al. (2020), who argue that the contemporary economy is driven by the extraction and capture of value through different modes of ownership and control over resources and assets; digital personal data, as a valuable asset, is inextricably linked to this extractive, rentier economic logic and practices.

A range of new metaphors for digital personal data has surfaced in the policy, academic, and media discourses; they reflect the transformative effect of data on nearly every aspect of our lives. Data has been described as the "new oil" (The Economist, 2017; WEF, 2019); as a commodity (Thatcher et al., 2016; West, 2019); as a fictitious commodity (Haggart, 2018); as property (Purtova, 2015, 2017; Scassa, 2018); as labor (Arrieta Ibarra et al., 2018; Bietti, 2019); and as a new form of capital (Sadowski 2019). STS research alerts us to the significance of the

metaphors (Stark & Hoffman, 2019) and sociotechnical imaginaries (Jasanoff & Kim, 2015) that are implicated in the understanding and treatment of data in policies and public discourse on the data economy. According to Sadowski and Bendor (2019), these discursive instruments help technology companies divert the public attention from their extractive data practices. Similarly, Birch et al. (2020) argue that equating data to natural resources helps legitimize the status quo in which personal data is treated as free to collect and transform into private assets. Other studies, though, point to counter-narratives produced by data subjects themselves who seek to challenge the control and power of the corporations over personal data (D'ignazio & Klein, 2020; Dencik et al., 2022).

In the public and policy discourses, data is increasingly framed as the driving force of contemporary economies and as a new asset class (Birch et al., 2021). An early example of this perspective is a 2011 report by the World Economic Forum (WEF) entitled *Personal Data: The Emergence of a New Asset Class*. The Chairperson of the WEF, Klaus Schwab, predicted that data will become a new source of value for businesses and governments:

> This personal data—digital data created by and about people—is generating a new wave of opportunity for economic and societal value creation. The types, quantity and value of personal data being collected are vast: our profiles and demographic data from bank accounts to medical records to employment data. Our Web searches and sites visited, including our likes and dislikes and purchase histories. Firms collect and use this data to support individualised service-delivery business models that can be monetised. Governments employ personal data to provide critical public services more efficiently and effectively. (WEF, 2011, p. 5)

In 2019, the Organization for Economic Co-operation and Development (OECD) declared that data is transforming the economies and societies and becoming a new source of monetary and social value:

> Today, the capacity for acquiring and managing data is expanding rapidly through the proliferation of devices, services, and sensors throughout economy and society. This phenomenon has been described by terms like "big data" and "Internet of Everything." In this highly connected environment, algorithms not only create value from data, but the data in turn improves algorithms, leading to "machine learning" and the development of artificial intelligence. Increasingly linked to physical resources and conditions, this

> growing interaction between data, algorithms, things and people translates into a "data-driven" economy and society. This transformation makes data a resource and an asset to be traded that underpins the trade of other goods and services. (OECD, 2019, p.7)

Taking a more critical view, Shoshanna Zuboff (2019) argues that such personal data collection is part of a broader shift in our economies towards surveillance capitalism. She argues that the transformation of data into a new asset class is paramount to the success of companies like Google and Facebook which naturalize digital tracking as an alternative payment for their "free" Internet services: "Every casual search, like, and click was claimed as an asset to be tracked, parsed, and monetized by some company . . . eventually, companies began to explain these violations as the necessary quid pro quo for 'free' internet services" (p. 52).

Only data has never been "free" for data subjects, data collectors, and data processors. Complex and costly processes of assetization are involved in making data legible and useful to technology companies and, further, transforming data points into capitalizable property.

In the field of STS, a body of research has emerged that tries to understand the emergence of and transformation of things into assets. STS scholars have used the concept of assetization to explore the transformation of digital data, including personal data, health data, and internet user data, into a techno-economic object (e.g., Beauvisage & Mellet, 2020; Prainsack, 2020; Vezyridis & Timmons, 2021; Ebeling, 2021; Geiger & Gross, 2021; Komljenovic, 2021; Rikap & Lundvall, 2022; Birch & Bronson, 2022). Assetization theory (Birch, 2020a; Birch & Muniesa, 2020) emphasizes three trends in the contemporary, technoscientific capitalism: (a) the growing role of science and technology in the functioning of industries and markets; (b) the advent of an asset-driven economy, where economic rents have become a predominant way of generating revenues; and (c) the defining role of expectations and imageries of the future on the assetization processes (e.g., what is expected to bring profits in the future may have a high value in the present). The asset has come to define contemporary capitalism. Unlike the commodity, which is constituted by market exchange, the asset is embedded in the logic of capital investment; that is why unprofitable companies can be valued at billions of dollars on Wall Street (e.g., Uber). Yet the of the assetization processes is not limited to the economic relations; nearly everything in this new economy can become an asset:

> By asset, we mean something that can be owned or controlled, traded, and capitalized as a revenue stream, often involving the valuation of discounted future earnings in the present—it could be a piece of land, a skill or experience, a sum of money, a bodily function or affective personality, a life-form, a patent or copyright, and so on. (Birch & Muniesa, 2020, p. 2)

The assetization studies provide valuable insights about the socio-technical processes, involved in turning data into a techno-economic object: first, the assetization of data is a socio-technical process; second, data is turned into a valuable, tradable resource through the costly digital infrastructure controlled by a small number of actors; and third, even when data is configured as a public or collective asset, the pursuit of economic rents often overrides all other interests.

For instance, Vezyridis and Timmons (2021) explore several data-sharing initiatives between the British public health agency NHS and its private partners. Through these partnerships, the NHS sought to configure health data as an asset and achieve multiple objectives including making public healthcare more efficient, facilitating scientific research, and sustaining the economy through the profits made from data. However, patient data resists assetization on multiple fronts. First, the data-sharing initiatives faced a lack of quality data because medical offices in the United Kingdom did not have standardized practices of data collection and management and could not allocate staff to curate the data. Second, when data was collected and managed through the private data-sharing platforms, they immediately became unavailable to the academic researchers who could not afford the licensing fees. Because of this informational and financial asymmetry, the data-sharing initiatives that promised to bring enormous scientific and public benefits (e.g., through the discovery of new drugs and better quality of healthcare) benefited only the companies that traded in health data.

Critically assessing the promise of data assets as envisioned by the WEF (2011), Beauvisage and Mellet (2020) explore the business of data markets. Data valuation manifests here as a set of socially contingent processes inextricably linked to the physical and digital infrastructure created by technology companies. Between 2009 and 2013, the authors studied several data management platforms that connected the internet users who wanted to market their data and the companies who sought to buy personal data directly from the data subjects. Few of these data-sharing platforms have succeeded: pieces of data that individuals were willing to share

with the potential buyers (e.g., internet browser histories) would be valued at a few cents per gigabyte. To make these datapoints valuable, they would need to be coupled with the curated consumer datasets maintained by the likes of Experian or Google. Beauvisage and Mellet argue that data brokers and the infrastructure they maintain are key to the complex processes of data valuation.

The findings of Beauvisage and Mellet (2020) echo the central argument of another STS scholar, Tuukka Lehtiniemi (2017; 2019). Drawing on the notion of surveillance capitalism, Lehtiniemi explores another technological solution designed to help internet users manage their data—personal data spaces (PDS). The PDS promised to revolutionize the data economy by divorcing personal data from technology monopolies. Similar to the aforementioned NHS data-sharing initiatives and private data markets, PDS have failed in their mission: Big Tech still collects and markets personal data. Lehtiniemi points to some negative effects of the PDS in that they were designed to normalize data reuse and pushed internet users to share even more data than they had shared before.

Geiger and Gross (2021) explore the assetization of genomic data by consumer genomic firms. These firms operate in multiple markets and generate revenues from their consumer-oriented products, data licensing, venture capital, and intellectual property. The authors combine the concepts of "data capitalism" and "technoscientific" capitalism to explore the strategies and technoscientific means through which the consumer genomic industry has turned genetic data into an asset. The two approaches appear to be complementary for the purposes of the study: West (2019, p. 20) visualizes data capitalism as an economic system "in which the commoditization of our data enables an asymmetric redistribution of power that is weighted toward the actors who have access and the capability to make sense of information." In his vision of capitalism, Birch (2019) points to the fluctuating and socially contingent nature of assets: their value and very existence depend on the collective efforts of the actors who want these assets to exist; assets are created and controlled through monopoly practices, when the asset-holders create artificial scarcity. Combining these two perspectives, the study by Geiger and Gross (2021) demonstrates that success of the consumer genetic industry depends on the ability of the companies to control access to the pools of genetic information they assemble (through the specially crafted, restrictive digital infrastructure) and obscure the sources of this data. The authors then point to an important conceptual shift in how genomic data is framed in the industry

and policy discourses brought about by the industry: from seeing genomic data as commons or a public good to enclosing them commercially.

Assetization theory is similarly useful when applied to studies of data governance. A study by Guay and Birch (2022) examines the collective understandings of personal data as a political-economic asset in the policy discourses in the European Union and the United States. The authors analyze the socio-technical imaginaries that underpinned different developments in data regulations from 2008 to 2016 and show that two distinct governance regimes emerge in these different jurisdictions. While the EU emphasized data and privacy protection and sought to generate citizen trust through the harmonized data protection regulation and regulated data markets, the US policies prioritized social and economic benefits of data sharing over privacy risks. The regulations manifested an even more striking trend: while the EU chose an ex-ante and state-centered model of data regulations, the United States prioritized a post hoc and market-based model for addressing the challenges posed by personal data.

To summarize, the assetization studies reveal the centrality of a rentier economy for the existing data governance practices and point to the many challenges that face the actors who seek to reconfigure personal digital data as a public good or commons. As techno-economic objects, data assets may still resist commercialization[9]; data assets are not easily repurposed for the socially-beneficial purposes either as they, for instance, require human labor to prepare data for the open data portals or the generative AI software.

2.4. The Political Economy of the Smart City

In this thesis, I employ the definition of the smart city offered by Natasha Tusikov (2020, p. 71), who defines the smart city through two technological characteristics: first, the networks of sensors embedded in the urban environments; and second, real-time data collection, streaming, and analysis that deliver services and integrate information and physical infrastructure. The key strength of this definition is that it highlights the role of digital data in the smart city. As I argue in this section, many smart city studies focus on the epistemological and social aspects of smart city initiatives and ignore the issue of data governance. I build on this rich and insightful

[9] Please see Birch & Adeiji, 2023 for a detailed discussion on the means and labour that go into transforming data into commercially viable “user data”.

scholarship and then depart from it to examine the political and economic regime of data assets and its impact on the city governance.

The term "smart city" was coined in a 2007 IBM marketing campaign "Smarter Planet," which promoted data analytics products to municipalities (Townsend, 2013). Since then, the concept has gained traction in both academic and policy debates, and it has been variously defined. The range of definitions includes the idea of the 'smart city' as: as an economic strategy for municipalities looking to attract outside capital (Hollands, 2008, 2015; Vanolo, 2016; March & Ribera-Fumaz, 2016); policies aimed at the digitization of public services and enhancing Internet connectivity (UN Habitat, 2020; European Commission, 2021; Spicer et al., 2021); post-political city governance (Carr & Hesse, 2020); and an umbrella term for the administration of city resources with the help of information and communication technologies (Kitchin, 2014, 2015; Artyushina & Wernick, 2021). Recently, responding to the article by Ralf-Martin Soe et al. (2021), Kitchin (2022) argues that it might not be impossible to create a unified definition of the smart city since each smart city initiative reflects the cultural, social, and political dynamics of the community that has brought it to life.

Alan Wiig (2013, 2016) argues that the field of smart city research has inherited central themes of the networked urbanism studies of the early 2000s (Graham & Marvin, 2002; Varnelis, 2012; Dourish & Bell, 2011; Sassen, 2015; Mitchell, 2004). When cities began incorporating information and telecommunication technologies into their daily operations, theories of the knowledge economy (Druker, 1992), network society (Castells, 2004), and creative class (Florida, 2003) shaped the discussions about the city economies and their governance. The networked urbanism literature explored how the city administrations were striving to be included in the global economy and used creative labeling to attract foreign investments.

Amid an overwhelming enthusiasm accompanying these new urban dynamics, the networked urbanism scholars pointed to the issues of economic and social inequality that were sharply exacerbated by the development of new business districts and special economic zones. In particular, the concept of "splintered urbanism" introduced by Graham and Marvin (2002) has informed several generations of urban studies and economic geography researchers who examine how the entrance of transnational companies into various urban areas contributed to the emergence of prestigious city hubs while facilitating the land dispossession and loss of livelihood for the underprivileged and racialized communities. Across the Global South, the

smart city agenda has been used to deregulate businesses, and the existing special economic zones have been rebranded as smart cities (Levien, 2013; Datta, 2015).

Municipalities' infatuation with the smart city idea, Kitchin (2014b) writes, is part of the sweeping big data revolution, an epistemological turn that privileges "big data" as a key source of information and knowledge about the world. Not only is big data marketed as the best way to learn anything about the world, but also in terms of governance there is an alignment with corporate discourses where the private sector represents the "gold standard" of technological deployment to be achieved in the public sector (Hashem et al., 2016). City administrations often enter into data-sharing partnerships and agreements with telecommunication companies, transportation services, and energy providers with the expectation that it will generate significant budgetary efficiencies (Micheli, 2021). Green (2019) calls this a "cybernetic" policy strategy, where public servants strive to create informational feedback loops and use behavioural data to improve the existing public services and inform new policies.

Multiple studies in the field of critical data studies claim that a "new paradigm of objectivity" associated with the use of data in government work tends to misrepresent complex societal issues as problems that can be addressed mathematically (boyd & Crawford, 2012; O'Neil, 2016; Eubanks, 2018).

These criticisms of data-driven governance echo the central arguments of the now classic studies of modern bureaucracy by James C. Scott (2002) in *Seeing Like a State*. In this book, Scott analyzed multiple unsuccessful attempts to incorporate high modernist theory into the administration of cities, agriculture, and natural ecosystems. Scott arrived at the conclusion that planning and governance driven by technocratic principles tended to fail to thrive. In his recent book *The Smart Enough City*, Green (2019) references several examples of "high-modernist cities" from Scott's book (e.g., Robert Moses's "garden residences" in New York that turned into slums) and portrayed smart cities as new iterations of the same idea:

> The discredited tropes and schemes of high-modern urban planning rear their undying heads in the smart city, placing the future of urbanism at risk. The issue is not that today's data and algorithms are inherently flawed or malicious, but rather that ecological systems such as cities are far too complex to perfectly rationalize and that attempts to do so often create long-term damage. We need not fear technology in general—but if history is any guide, we must be wary of those who promote bold visions of science and

> technology as providing solutions that transcend history and politics to produce an optimal society. (Green, 2019, p. 217)

For Shannon Mattern (2021), the smart city is a locally rooted concept, as she revisits the history of the CompStat program and the RAND corporation's failure in Queens. In her research, she studies how former New York police officer Jack Maple created analog "crime maps" that were used by the police commissioner William Bratton to create the first computational statistics software, CompStat, in 1994. Matching the crime types and numbers with specific locations promised to help the NYPD better allocate scarce resources. Over two years after the software was adopted in New York, general crime rates across the city declined by 27.44% and the homicide rate decreased by a staggering 38.66% (Ash Center Award, 1996). Success of the CompStat program in New York spearheaded the adoption of computational statistics by law enforcement agencies across the United States and Canada. Unfortunately, the stellar record of CompStat was soon clouded by multiple reports of data manipulation and racial discrimination that were exacerbated by police officers' over-policing of marginalized groups (Eterno & Silverman, 2012). Likewise, in the early 2000s, then-mayor of New York Michael Bloomberg hired RAND corporation to assess where the city could cut costs. The RAND corporation's data suggested that the city had too many fire departments; unfortunately, the calculations failed to account for the heavy traffic in the city, and when several fire departments in Queens were shut down, devastating fires destroyed part of the neighborhood (Townsend, 2013).

Mattern (2015) argues that, epistemologically, smart cities retain close connection with the flight cockpits of the military planes employed in World War II that inspired their creation and the business analytics software of the 1980s where these technologies were first employed. This is a top-down, asset-driven vision of the city which still dominates the smart city industry:

> The risk here is that the dashboard's seeming comprehensiveness and seamlessness suggest that we can "govern by Blackberry" — or "fly by instrument" — alone. Such instrumental approaches (given most officials' disinclination to reflect on their own methods) can foster the fetishization and reification of data, and open the door to analytical error and logical fallacy. (Mattern, 2015, n.d.)

Yet, in practice, the deployment of smart cities means much more than a change in optics and metrics employed by the policymakers: it challenges the very divide between public and private governance. In her research on Sidewalk Labs' smart city project in Toronto, Tusikov (2019a) notes that smart cities raise multiple issues related to privacy and city governance because they put technology vendors in the position to regulate citizens and themselves:

> In this role, Sidewalk Labs is in the position of setting rules and standards for physical and digital infrastructure which, if the project goes ahead, will govern the smart city for decades to come. And it's doing so in a way that would unfairly privilege its own commercial interests. This is not simply a case of a vendor proposing to build streets or buildings in a certain way, with vendors retaining proprietary interests in the technologies they invent. For example, it wouldn't be unusual for a company to propose rolling out its prototype modular pavement, composed of interlocking pre-cast concrete pavers, for streets in Quayside, as Sidewalk Labs is proposing. But Sidewalk Labs also proposes to grant itself the capacity to set the rules that will govern the urban infrastructure within the project neighborhood. (Tusikov, 2019a)

Tusikov analyzes Sidewalk Labs' idea of introducing new street signage that would warn the citizens where in the city spaces they have been recorded (Tusikov, 2019b). She argues that, although this action is a step toward greater transparency in regard to street surveillance, it normalizes data collection in public spaces and does not leave many options for the city residents who do not want to be recorded. Elsewhere, Tusikov notes that smart cities effectively put city governance in the hands of the private actors, sidestepping the usual institutional arrangements that may contribute to democratic governance and oversight:

> Toronto's smart city project thus raises the classic question: what is the appropriate division of responsibilities and authority between public and private actors? In other words, who governs? Or, more precisely, who should govern? Typically, elected officials have the authority and legitimacy to set policies through publicly drafted legislation, with a clear, costed detailing of the regulatory powers and relationship with existing regulatory bodies. What's more for the public to perceive regulatory bodies as legitimate, those bodies need to be seen as independent from those they regulate. (Tusikov, 2020, p. 70)

In their analysis of smart city governance, Sadowski and Pasquale (2015) conducted a revealing thought experiment: in a city with fully automated traffic management, what happens when protestors block a road? Data-driven traffic control systems operate in many cities, and the algorithms have proven to show no mercy for the drivers who have forgotten to renew licenses or pay fees. In a situation of a peaceful protest, will the algorithm command police or other officials to forcibly stop and remove the people from the road as it does with vehicles that violate the rules? In a new iteration of the trolley dilemma, smart city technology may be the one deciding a person's rights to movement, freedom, and life itself (Stilgoe, 2017). In another publication, Sadowski (2020b) takes a further step and pointedly argues that smart cities, social media, IoT, and smart homes are the means of domination by Big Tech; technology companies aim to collect as much data as possible and use it to exercise control over their clients, partners, and users.

Other studies by Shelton et al. (2015), and Wiig (2013, 2018) argue that "actually existing smart cities" often abandon public objectives to serve the purposes of private companies. In the case study of a smart city initiative in Atlanta, Georgia, Shelton and Lodato (2019) show how the smart city policies and public engagement initiatives seek to create a new political identity of a "general citizen." This discursive figure is being mobilized in support of various smart city initiatives. Moreover, the imaginary universal citizen replaces the actual citizens who could have voiced their concerns about the proposed developments:

> The reconfiguration of these socio-spatial relationships is not, however, just about going beyond the borders of the city, but also about how relationships within the city are changing, especially with respect to ways of imagining the different spaces of the city and the 'urban problems' posed by and within such spaces, and what kinds of interventions might be designed to ameliorate these problems. (Shelton & Lodato, 2019, p. 17)

Many researchers point to the fact that the smart city initiatives mostly benefit the highly educated and economically privileged segment of the population. As an example, Wiig (2013) studied the City of Philadelphia's "digital on ramp" initiative, an educational and professional retraining program that was proposed in the early 2000s as part of the smart city initiative to address the social and economic inequality in the city. Wiig analyses the primary economic reasons that have led to the municipality abandoning this initiative. As soon as the city started

partnering with IBM, Google, and other technology vendors who were interested in the city's property, all inequality concerns had been sidelined in the initiative.

To sum up, academic research points to a range of issues, brought on by smart cities, including the privatization of public spaces and infrastructure and immense governance challenges. Despite the many attempts to make smart city initiatives less technocratic, they still retain close connections to the top-down, asset-driven vision of reality epitomized by the Bloomberg Terminal. Some scholars conceptualize the smart city notion as yet another iteration of High Modernism, a XXth Century school of architecture that sought to reorganize cities using the principles of scientific method. Fast-growing body of research on the "actually existing smart cities" points to the numerous difficulties arising from parties trying to reconcile commercial and public interests in the public private partnerships.

2.5. Emerging Data Governance Frameworks in Smart Cities: Data as Public Good and Commons

In this section, I discuss the new forms of data governance that have emerged from the business-government partnerships underpinning smart cities in order to understand some of the governance frameworks emerging in smart city developments. The goal of this section is to situate my study of Sidewalk Toronto and Barcelona's smart city within a fast-growing body of academic research on data governance and conceptualize new data governance frameworks that have been piloted in the two smart city initiatives (i.e., data trusts, and data cooperatives).

In the early 2000s, IBM had to invest heavily in marketing campaigns and educational sessions to explain to municipal workers how digital data could be used (Wiig, 2015; Townsend, 2013). Over the next fifteen years, the transformation of the smart city into a policy buzzword marked a new trend during which city administrations began to seek partnerships with technology vendors, to boost their positions in the global investment ratings (Hollands, 2015; Vanolo, 2016). Recently, the smart city scholars have witnessed a growing interest in business-to-government data sharing in which city administrations have specific objectives regarding what data they want to use (European Commission, 2018; Michelli, 2022; Mercille, 2022). Commonly, city administrations who seek to leverage data for positive social impact, partner with transportation vendors, telecommunication operators, and energy suppliers.

Some scholars have conceptualized the data reuse initiatives by public authorities and nongovernment bodies as part of a broader shift toward the democratization of data governance with the goal to recognize the public benefits of data (Bass et al., 2018; Micheli et al., 2020). In Barcelona, for example, the smart city project has been discursively linked with the concept of digital sovereignty, which is understood as an ability to redistribute profits from the data economy within the city population and maintain technological independence from Big Tech and Spain (March & Ribera-Fumaz, 2015; Bria, 2016; Morozov & Bria, 2018).

City administrations access private sector data using various approaches, usually through the pilot or experimental projects that involve other actors (e.g., academic researchers, professional data stewards, NGOs) (Sarasa Funes, 2017; European Commission, 2020). Yet these initiatives are rare because private vendors are often unwilling to share data (Verhulst *et al.*, 2019; Mercille, 2021; Susha *et al.*, 2019; Martens & Duch-Brown, 2020).

The examples of data-sharing initiatives between municipalities and private vendors include data-sharing obligations (Bass et al., 2018; Micheli, 2022), data collaboratives (Verhulst et al., 2019; GovLab, 2017), data trusts/data intermediaries (Wernick et al., 2020; Artyushina, 2020a; Austin & Lee, 2021), and data commons/cooperatives (Scholz, 2016; Pentland & Hardjono, 2020; Frischmann et al., 2023).

Insightful research by the legal scholar Alina Wernick et al. (2020) sheds light on the many legal and practical difficulties that data governance professionals face when they deal with the data reuse. The existing data-sharing initiatives vary by the types of data being reused, types of access, limitations, and legal roles of the parties. Wernick introduces a “clearinghouse” model of data sharing that addresses these differences (Figure 2.1).

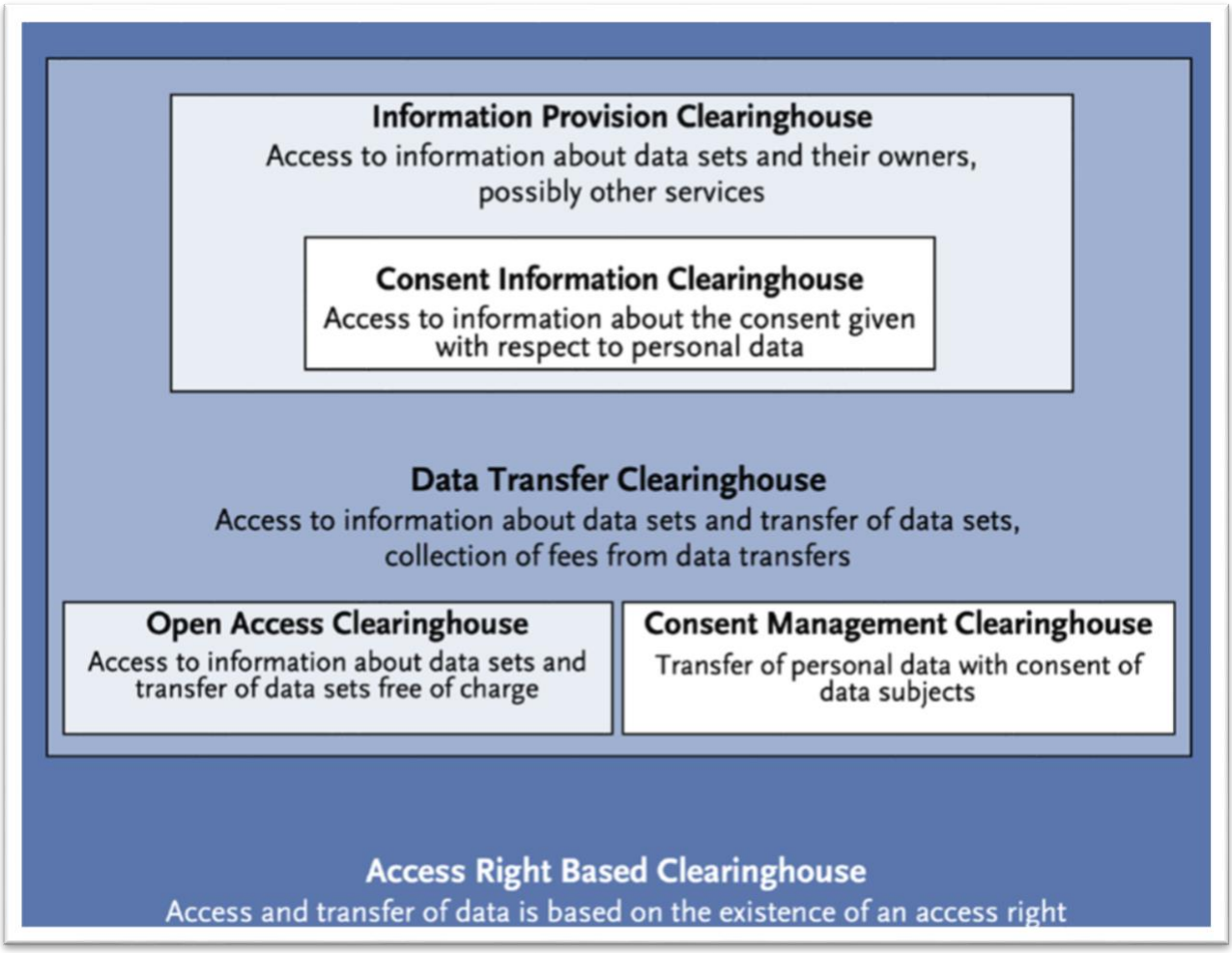

Figure 2.1. The concept of a data clearinghouse. (Image source: Wernick et al., 2020)

Data-sharing obligations are exemplified through the clauses that local governments include in their tenders for subcontracted services and regulatory requirements that force private actors to provide access to data (Micheli et al., 2022). The contract clauses mandate that the data collected by a company as a by-product of delivering a public service is made accessible to the city via open access or other formats (Bass et al., 2018; Verhulst et al., 2019; European Commission, 2020). Data is sometimes framed in these contracts as a public asset (Morozov & Bria 2018; Eurocities, 2019). The assumption here is that public bodies generate social benefits from data collected by private companies, whose work benefitted from public funding and access to public infrastructure (Couldry & Powell, 2014; Mazzucato, 2018). Data sharing by regulation occurs when government authorities request access to data in order to monitor the

implementation of, or compliance with, existing legislation (Klievink *et al.*, 2016). In this arrangement, data is required but not reused (Huyer & Cecconi, 2020).

As another type of data-sharing initiative, data collaboratives (also conceptualized as "data altruism," e.g., Veil, 2022) may take any form, from the short-lived Google Flu project where Google shared search data with the researchers to various mobility initiatives existing between commercial transport operators and municipalities, to the data pools established by multiple parties. The data of public interest can be donated, shared on collaboratives terms, or provided for compensation on the terms comfortable for a data controller. As Verhulst et al. (2019) and Susha et al. (2019) have pointed out, this emerging form of data reuse is rare and often short-lived for organizational and financial reasons (e.g., lack of interfaces for data sharing, scarcity of qualified personnel in city administrations, and lack of economic stimulus for commercial companies). Depending on the operational model, data sharing could be either an additional source of economic revenues for companies or a (data) relationship that enables data use for the social good (Bass et al., 2018).

I now turn to data trusts. The idea of a data trust simultaneously surfaced in the United Kingdom (UK Council, 2019) and the United States (McDonald, 2019) between 2017 and 2019, backed by the New York University GovLab's (GovLab, 2022) and MIT Media Lab's (Pentland et al., 2020) experiments around the professional training of data governance practitioners. An advocate for a data trust framework, Open Data Institute, defines it as "a legal structure that provides independent stewardship of data" (Hardinges, 2018). Elsewhere, the data trust is broadly defined as a professional steward that manages someone's data on their behalf (Delacroix & Lawrence, 2019; Wernick et al., 2020; Artyushina, 2021a). Central to the idea of data trusts are two components: professional data stewards and technical capacity to physically decouple personal data from the data collectors (e.g., keeping data in the public or communal data servers). Jack Balkin (2015) proposes the idea of the "information fiduciary," a legal responsibility for the data controllers to act in good faith toward their clients. If implemented, fiduciary obligations would, for instance, prevent Facebook from exploiting the sensitive data of their users, similar to how lawyers and doctors are prohibited from using their clients' data in any way except to provide their services (Balkin, 2020). In the United Kingdom, Tim Berners-Lee devised the idea of data trusts as personal servers that would help internet users store and manage their data independently from Big Tech (Finley, 2017).

These data trusts can take several different forms: sharing of the legal rights to data or data itself (Wernick et al., 2020); sharing via contracts or by collective agreements (GovLab, 2017; Micheli et al., 2022); or sharing via limited liability companies or cooperatives (Scholz, 2016; Pentland, A., & Hardjono, 2020). Potentially, data trusts could deliver a range of services: from data storage to data sharing for charitable purposes to commercial data reuse. However, the initial promise of data trusts was never realized, perhaps because regulatory intervention may be required to persuade technology companies to share the data they collect. Academic researchers have offered largely critical accounts of data trusts, saying they compel individuals to share even more personal data with commercial companies (Artyushina, 2020; Austin and Lie, 2021). Yet, the data trust idea continues to attract policymakers around the world and has contributed to the emergence of the professional class of data stewards (Artyushina, 2020a, 2021b). Since 2021, training programs for data stewards have been piloted at the New York State University's GovLab and Harvard's Berkman Klein Center. Since 2021, in Canada, federal government has begun appointing departmental data stewards, hoping to standardize data governance approaches across the services and create cross-departmental data pools.

As a form of data sharing, data trusts have been piloted in Canada, the EU, the United States, and Australia. In the Canadian Province of Ontario, Ontario Health Data Hub was created by the 2020 provincial Emergency Act and helped researchers get access to health and personal data of COVID-19 patients during the pandemic. Since 2021, the Government of Ontario has been working on establishing the Data Authority, a data hub that will store and help safely reuse public data for commercial and other purposes. In the European Union, the Trusts project (stands for Trusted Secure Data Sharing Space) promises to deliver a secure data sharing infrastructure and data governance frameworks to make public and commercial data available for commercial purposes. In the US, a range of data trust initiatives aimed at reusing the data of school children, hospital patients, and small businesses were trialed and ended due to the lack of financial means (e.g., the recently shut down Silicon Valley Regional Data Trust). In 2020, Australia passed a law that allows the work of professional "digital intermediaries" that would help obtain and reuse business data (ACCC, 2020).

Data cooperatives or data commons, the final type of data-sharing initiatives, are a relatively new and understudied phenomenon. The European Commission has made data cooperatives a staple of the pan-European data strategy (Data Governance Act, 2020). The new

legal landscape envisions data cooperatives as key players in the EU's emerging digital market; citizens, public institutions, and commercial companies are expected to donate their data to licensed data cooperatives that will oversee responsible reuse of this data for economic and societal benefits. The legal and organizational structures for these data governance actors are not defined yet, and the vocabulary around these initiatives is still developing. For example, data cooperatives are sometimes called platform cooperatives or data trusts. While some experts argue that data cooperatives should be collectively owned and governed (Calzada, 2021), others call for the state-run data commons (Open Future, 2022).

One example of a data cooperative that I analyze in this thesis is SalusCoop based in Barcelona. The cooperative was launched in 2022 by two former employees of Francesca Bria, and it manages the health data of Barcelonians. The goal of the cooperative is to license data to the European research organizations; currently, the data access is free to the researchers but the cooperative plans to introduce fees as soon as they get enough clients. The data governance model is a collective decision-making around data, though individual data donators can choose which organizations they prefer to share their data with. The Driver's Seat Collective is another example of a data cooperative, based in the US. Created by the drivers working for the platforms (e.g., Uber, Lift), the cooperative initially pooled drivers' data to help them negotiate better work conditions with the employer. Currently, the cooperative makes profits by licensing drivers' data to the US city administrations.

2.6. Conceptualizing New Forms of Data Governance as Asset Governance

As I mentioned earlier, the vocabulary for novel data-governance initiatives is still developing, and sometimes practitioners use these terms interchangeably (e.g., data cooperatives and data commons). In my dissertation, I conceptualize these emerging types of data governance as forms of *asset governance*, a concept that I develop from assetization theory (Birch & Muniesa, 2020). The policy trend toward data reuse has brought new aspirations, promising to make public services more efficient and redistribute the value produced in the data economy by breaking private and government data silos. What unites all these embryonic initiatives is that they seek to extract some form of benefit from personal data, be it a monetary return (e.g., economic rent) or some downstream social benefits that come from data reuse. Although private data governance is mostly extractive (Birch et al., 2020), other forms of asset governance

promise collective or public benefits. In the empirical chapters of this thesis, I analyze asset governance as an integral part of Sidewalk Labs' and the City of Barcelona's smart city initiatives. In this section, I first synthesize several strands of literature on public, private, and collective data governance and explain the reasons for using asset governance as an analytical lens.

Academic research has already paid attention to the governance of data by the private sector. Srnicek (2017) analyzes the history of technology monopolies and shows how they transitioned from niche businesses (e.g., Google used to be a search engine company and Amazon sold books online) to data monopolies. Digital personal data brings revenues to these companies through targeted advertising and profiling individuals for insurance, credit, and security purposes. For example, Pasquale (2015), Zuboff (2019), Cohen (2019), and Waldman (2022) explore the erosion of privacy brought on by these extractive data practices. Information asymmetry is key to the technology monopolies' business models; it translates into power asymmetry as the data allows them to manipulate the markets as well as their own workers, clients, and partners (Rosenblat, 2018; West, 2019; Mazzucatto et al., 2021). Researchers have shown how digitization of healthcare, education, and agriculture has led to the privatization of public services and goods, by data controllers (Hoeyer, 2019; Komljenovic, 2020; Fraser, 2019). Through the often non-voluntary exposure to digital surveillance, various aspects of individuals' private lives have been subjected to commercialization. For example, children, subjected to digital tracking from early age, learn to accept continuous monitoring by technology companies; similarly, fitness- and health- trackers help normalize digital surveillance and submit their users to the beauty and health standards promoted by developers of these technologies. These trends have been variously conceptualized by scholars; e.g., through the notions of quantified self (Lupton, 2016), datafied society (Hintz et al., 2018), algorithmic society (Schuilenburg & Peeters, 2021), and platform society (Van Dijck et al., 2018).

Since most of the studies of private data governance discuss the commodification of human experiences, it is not surprising that they expect digital personal data to function as a commodity (often without dwelling on the definition of the term "commodity"). The notion of commodity, however, does not capture rentier political economic logics that are implicated in the processes of data access, valuation, and reuse; in turn, these logics have important ramifications for the political and social processes transformed by the digitization. Indeed, assetization

research shows that digital personal data mostly exists in the form of a private asset that generates economic rents for large digital technology companies (Birch et al., 2020, 2021; Prainsack, 2020; Sadowski, 2019, 2020b). Epistemologically, there exist significant differences between the notions of commodity and asset. The commodity exemplifies an economic logic of supply and demand: when the product is sought after, its value rises; it can have an end owner, someone who has purchased it. On the other hand, asset valuations need not have anything to do with the consumers, they often reflect financial fluctuations in stock markets or bond markets; control over the asset, not ownership is what generates revenues, which can then be capitalized and can lead to a significant capital gains when sold. As an example, billion-dollar company Uber does not own the fleet of cars it operates; consumers who purchase modern smartphones do not own the software they run on. Some researchers argue that this trend is the end of ownership (Perzanowski & Schultz, 2016; Tusikov, 2019c). The value of data assets depends on the projective valuations and the expectations of future revenues held by particular investors. Amazon was unprofitable for almost two decades yet had no problem getting access to investor money as the company was expected to become a monopoly in the online trade. In this rentier economy (Birch et al., 2019, 2020), innovation and the production of consumer-facing products and services are not what generates the most significant returns; instead, technology companies focus on ensuring that their share values are secured and protected. Characteristically, the political economy of data assets entails financialization, extractivism, and monopoly control. Srnicek (2017), Prainsack (2019b), and Fourcade & Kluttz (2020) argue that data monopolies are able to extract economic rents from every participant of the data economy because they managed to turn their businesses into essential infrastructure.

Scholars have studied the initiatives where data is framed as a public asset (e.g., Hoeyer, 2016; Krutzinna & Floridi, 2019; Cheung, 2020). In recent years, government agencies have begun reusing the data they collect and actively partnering with other publicly funded bodies to use data for the social benefit. Generally, these newly established data pools have been used to improve public services, or for taxation and security reasons. Northern European countries have been especially successful in establishing "digital welfare state" with the implementation of centralized repositories for all data collected about the citizens and high public trust in the ability of the state to govern this data responsibly (Tupasela et al., 2019; Jørgensen, 2020; Wimmer et al., 2020). In healthcare, the has been a steep rise in a number of collaborations, in which

medical offices and hospitals share data with commercial companies and research organizations, and technology companies share health and lifestyle date with the medical researchers (e.g., the partnership of NHS and DeepMind and Apple's ResearchKit platform). This trend toward the reuse of patient data prompted some scholars to introduce the notion of "data donation" (Prainsack & Buyx, 2011; Hummel et al., 2019).

Researchers argue that citizens voluntarily sharing their data for the research or other socially beneficial purposes may indicate a step toward a more democratic data economy. Some scholars have been critical of these data governance initiatives as they lack clear understanding of what public interests in data may constitute, tend to intensify digital surveillance, and make data available to the commercial companies indefinitely (Hoeyer, 2019; Cheung, 2020). Another issue is both economic and technical: the infrastructure required for the data reuse is privately controlled and commercial companies often seek to recoup their investments by imposing high licensing fees on the public data (Vezyridis & Timmons, 2021; Collington, 2022).

As a general trend, data valuation critically depends on the digital and physical infrastructure that supports the existence of that data; even when data is reused for the nonmonetary purposes, technology monopolies are best placed to benefit from these transactions through acquiring more data or exploring new markets (Whittaker, 2021; Fraser, 2019). The European Commission (2020a) has unveiled its own vision for public data governance as it considers mandating the business-to-government data sharing. Another European data governance proposal, the European Commission's Data Governance Strategy (2020b) envisions data reuse for both social and commercial purposes, as Europe is preparing to launch niche markets of personal and non-personal data in the areas ranging from financing to health data (Artyushina, 2020b; Health Data Space, 2021). For these purposes, the EU funds the development of physical and digital infrastructure that would store and share data independently from Big Tech (e.g., the GAIA-X project).

Nascent academic literature explores the experiments around collective forms of data governance. The terms "data commons" and "data cooperatives" have often been used interchangeably to describe the initiatives where individuals pool their data together and govern it collectively (Scholz, 2016; Pentland & Hardjono, 2020; Calzada, 2021). These experiments have been met with excitement by many researchers and policymakers who see the bottom-up data governance initiatives as a way to protect collective interests in data. One ongoing project of

this type is a data cooperative created by the British Uber and Ola drivers who use the data about their rides and salaries to collectively bargain with the employers (Lomas, 2021a). Critics, however, pointed out that self-management of data can hardly mitigate any of the harms brought on by Big Tech, yet pushes data subjects to share even more data about themselves (Lehtiniemi & Kortesniemi, 2017; Micheli et al., 2020; Artyushina, 2021b).

One way to conceptualize these data-governance experiments is to employ the governing knowledge commons framework (GKC) (Frischmann et al., 2014, 2023). The notion of the knowledge commons existed long before GKC, but this framework offers some useful analytical tools to study intangibles as they exist in contemporary economy. The GKC framework draws on and adapts Elinor Ostrom's institutional analysis and development (IAD) theory for natural resource commons (Crawford & Ostrom, 1995). In GKC, collectively developed rules are the key attribute of the knowledge commons (Frischmann et al., 2019). The unit of analysis for this framework are shared resources, values, controversies, governance strategies, rules-in-use, and legal institutions that affect or uphold the commons. Scholars have productively employed the GKC framework to examine ethical and privacy dilemmas faced by those who seek to establish data commons in smart cities and elsewhere (Madison, 2020, 2023), as well as the legitimacy issues raised by the extractive data practices of technology monopolies (Sanfilippo et al., 2021). My own research focuses on Sidewalk Labs' and DECODE's data governance policies and different ways that the collective governance of data and smart city infrastructure was envisioned in these projects; both smart cities can be seen as data commons that were not implemented for different reasons (Artyushina, 2023).

Regardless of whether data is seen as a private, public, or collective asset, realization of monetary or nonmonetary value remains key for the data governance practitioners. In bringing these diverse strands of literature together, I conceptualize data governance initiatives as the forms of asset governance. In the following empirical chapters, I explore the techno-economic frameworks implicated in the data governance strategies in Sidewalk Toronto and Barcelona's DECODE initiative. Analytically, I focus on data assets as the implicated in processes of social and technological change and a focal point where economic, social and political orders are being co-produced.

"Privacy is the least of our concerns," pointedly argues Komljenovic (2021) when analyzing the assetization of post-graduate education. In this thesis, I argue that the different

forms of (data) asset governance under the smart city initiatives has ramifications that go beyond those currently discussed in the literature. In data-driven cities, for example, public resources and public spaces may be transformed in ways that do not afford many forms of collective action (Artyushina, 2023). Yet data asset governance can also bring positive social and technological changes to cities. An integral part of this process, and one that is deeply implicated in the negative or positive outcome, is the "affective" dimensions of asset governance that takes places in projects where public servants and activists seek to deploy data for the socially beneficial purposes. These novel forms of affective engagement with data and the visions of the future they produce can help shape the professional field of data governance toward less extractive and more equitable practices.

2.7. What is Affective Data Governance?

STS researchers have been increasingly interested in the ways in which affect shapes how science and technology are viewed and experienced in society. Kerr and Garforth (2015) argue that we witness an "affective turn" in STS where "embodiment, care and affective interactions" have become the focus of empirical studies that explore the ethics and epistemic practices of science (e.g., Pickersgill, 2012; Fitzgerald, 2013; Myers, 2015), doctor-patient relations (e.g., Leem, 2016; Swallow & Hillman, 2019; Glabau, 2022) and citizen science (e.g., Lorimer, 2008; Bloomfield & Doolin, 2011; Kenens et al., 2022). Similarly, Puig De la Bellacasa (2011) points to the many ways in which care, expressed through various forms of attachments and commitments, shapes the production of scientific knowledge and medical practices.

When introducing the notion of affective data governance, I recognize that the term "affect" comes as part of a significant theoretical debate across social sciences (Gregg & Seigworth, 2010; Anderson, 2014; Plamper, 2015; White, 2017). Specifically, some scholars insist on drawing a sharp distinction between affect and emotion. Affect is broadly defined as a non-discursive intensity within the body; emotion, on the other hand, is socially produced and culturally circulated (Massumi, 1995; Thrift, 2007; Oikkonen, 2017). STS researchers have offered various critiques of this distinction:

> It is a mistake to remove pre-conscious visceral perception from its usual and habitual world/brain/body/mind contexts, and to artificially freeze and isolate affect as a separate element from the dynamically integrated sequences in which these things normally

> operate. No easy distinction can be made between visceral and cultural meaning-making, and why should we make one – what is the advantage?' (Wetherell, 2012, p. 67).

Kathleen Steward conceptualizes human emotions as "ordinary affects," the events that are both public and intimate, a staple that connects the singularity of thoughts and actions into a continuity of the human experience:

> Ordinary affects are public feelings that begin and end in broad circulation, but they're also the stuff that seemingly intimate lives are made of. They give circuits and flows the forms of a life. They can be experienced as a pleasure and a shock, as an empty pause or a dragging undertow, as a sensibility that snaps into place or a pro-found disorientation. They can be funny, perturbing, or traumatic. Rooted not in fixed conditions of possibility but in the actual lines of potential that a something coming together calls to mind and sets in motion, they can be seen as both the pressure points of events or banalities suffered and the trajectories that forces might take if they were to go unchecked. (Steward, 2007, p. 2)

Anderson (2014) contends that affective life is imbued with representations and, therefore, does not exist in isolation from multiple social and cultural contexts. Leem (2016) and Swalow & Hillman (2019) examine the management of patients' emotions in the clinical context, where medical practitioners deploy elaborate socio-technical apparatuses to mitigate and, occasionally, leverage patients' fears and anxieties to achieve desired medical outcomes. Part of the fast-growing body of research on patient advocacies, Lindén (2021) explores the role of affect in patients' groups that engage in biomedical research. She coins the term "moving evidence" to explain how material evidence travels in time and space and how it is created to trigger certain emotional responses. Lingel and Jaber (2022) explore the inter-personal, socio-material nature of affect in their study of the polygraph. As a piece of technology, the polygraph is unable to achieve its main purpose: telling the truth from deceit. Instead, the polygraph operates as a socio-technical assemblage that brings together a machine, a subject, and an examiner. Both the machine and the examiner assume the roles of neutral and objective judges of affect, while the test taker is positioned as emotional and subjective. Affect here is something to be traced and reconstructed through the combined effort of the polygraph and its interpreter.

Myers and Dumit (2011) introduced the notion of "responsivity" to account for the agency distributed across bodies and material environments, and it specifically addresses affective relations between bodies. Myers further defines responsivity as the ability "to move with and be moved by" other bodies (Myers, 2012, p. 177). The idea of responsivity draws on the feminist theory, specifically, the concepts of affective labor (Hardt, 1999), emotion work (Hochschild, 1979), and care work (Federici, 2012). While the concept of affective labor refers to the often-invisible, unpaid work carried by women in households, the notions of emotion work and care work refer to the low-paid workers such as nurses and childcare providers. Combining the affective and the practical aspects of care work is essential for Myers' understanding of responsivity. In her study of protein modelling practices, Myers shows that emotional attachments push biologists to make enormous efforts to care for their research subjects, instruments, and experiments.

STS scholars have offered the concept of "entanglements" to explain how affective relations in the laboratory help produce scientific knowledge (Latimer & Miele, 2013; Fitzgerald, 2013; Kerr & Garforth, 2015). These studies build on the vast body of classical STS research that has challenged a vision of science as devoid of passion and subjective interests (Haraway, 1988) and examined the role of emotions such as love (Latour, 1996) and wonder (Daston & Park, 1998) in science and technology. The notion of "atmospheres" is another popular term in the STS studies of affect, which is defined as an assemblage of "human bodies, discursive bodies, non-human bodies" (Anderson, 2009, p. 80). Atmospheres are incredibly hard to operationalize, they are collective situations that may be perceived by actors as a place of joy and comfort or vice versa (Calkins, 2021). Atmospheres are impersonal in terms that they emerge from collective encounters, but they are often felt as deeply personal (Anderson, 2009).

The widely cited work of Ahmed (2004a) and Pedwell (2014) on the cultural circulation of emotions further challenges the distinction between affect and emotion. Ahmed introduces the concept of "affective economies" as she studies the circulation of affect in communities and describes this process as similar to the circulation of capital:

> In such affective economies, emotions do things, and they align individuals with communities — or bodily space with social space — through the very intensity of their attachments. Rather than seeing emotions as psychological dispositions, we need to consider how they work, in concrete and particular ways, to mediate the

> relationship between the psychic and the social, and between the individual and the collective. In particular, I will show how emotions work by sticking figures together (adherence), a sticking that creates the very effect of a collective (coherence), with reference to the figures of the asylum seeker and the international terrorist. My economic model of emotions suggests that while emotions do not positively reside in a subject or figure, they still work to bind subjects together. Indeed, to put it more strongly, the nonresidence of emotions is what makes them "binding." (Ahmed, 2004b, p. 119)

Pedwell (2014) offered the notion of "affective relations" to examine the various ways in which empathy has been mobilised to push for collective action. Among her case studies are the political actions that support neoliberal economic projects, mobilization against social injustice, as well as resistance and reconciliation in the postcolonial regions and contexts. Pedwell's central idea is that, as a form of affect, empathy translates rather well in the international contexts and travels across multiple social and political groups.

My concept of affective data governance aims to put in conversation the concept of asset economy (Birch & Muniesa, 2020; Birch & Ward, 2022), namely the studies of data rentiership (Birch et al., 2020, 2021), and affective economy (Ahmed, 2004a, b) through highlighting the role of affective relations in the governance of data. I argue that non-discursive affective intensities and socially shaped emotions are often inseparable in the collective dynamics of technoscientific phenomena. **Accordingly, I define affective data governance as a type of affective economy in which emotional engagements with data and algorithms create new social relations.** My empirical analysis of the two smart city initiatives (Chapters IV, V) examines how the two economies co-exist and, at times, run counter one another and how affective data governance may form the basis for political action. Two important illustrations here are the citizen movement against Sidewalk Toronto and the IT professionals' political activism in Barcelona. In both cases, the citizens' perceived emotional connection with personal data led to the origin of new collective social and political identities.

While the STS studies of affect provide an important starting point for my own research, my focus on collective affective dynamics extends the analysis to affective relations with data assets. Many STS studies have shown how the materiality of technologies impact their perceptions by users. For instance, Oudshoorn (2015) examines how implantable cardioverter defibrillators have been anthropomorphised by their users. Meskus (2015) analyzes the

emotional experiences in women undergoing infertility treatment as they attribute agency to embryos and hormonal treatments. Assets have agency, too. Braun (2020) shows how "stubborn" natural assets, namely wheat seeds, may resist assetization and how much elaborate work goes into keeping them in this economic condition. Similarly, Wiel (2019) explores technoscientific work of turning human embryos into a commercial asset. As I show below, the materiality of data assets has played an important role in the origin of affective data governance.

In the interviews for the Sidewalk Toronto case, my respondents often spoke of their affective relations with personal data, which they perceived as personal property, products of their labour, or part of their public persona. The evocative rhetoric of public data ownership was pronounced in the Barcelona case, in which the city administration's smart city initiative had been discursively linked with the anti-eviction movement. My respondents' affective engagements with data, often perceived as immaterial and invisible, appear to be significantly different than their largely grim perceptions of the smart city assets, existing or proposed. Several study participants experienced fear and repulsion toward facial recognition sensors deployed in the streets of Toronto and shared with me their concerns about the "changing ambience" in the city. The STS notion of atmospheres proved to be similarly inspiring when I was seeking to understand the charged exchanges between citizens and Sidewalk Labs' employees the at Sidewalk Labs' roundtables. Many respondents spoke with me about the feeling of alienation they experienced at the company's public engagement events. On the other hand, the meetings of #BlockSidewalk group were described by all interviewees as joyful collective experiences that translated into the feelings of belonging and participating in the life of one's community. Similarly, in Barcelona, the origin of Ada Colau's political party "In common" stems from the citizen movement against the city's handling of the public resources, including public investments in the private smart city projects. Spanish respondents shared how an activist Colau was elected due to the large support from the city's IT professionals, who considered the smart city paradigm to be a path toward a more efficient and equitable data and city governance. Like my Canadian respondents, Barcelonians were gravely concerned about the private governance of smart city assets, including the city's existing data-collecting city infrastructure. They perceived the existing private smart cities as evidence of corruption.

The word "governance" in the notion of affective data governance also deserves some discussion here. By governance of science and technology I understand policies and regulatory

frameworks that engage multiple non-state actors and citizens, an operation that involves collective decision-making about technoscience (Felt et al., 2008). STS scholarship shows that affect plays central role in the governance of technoscientific objects, ranging from city infrastructure to nanotechnology to genetically modified animals.

The governance of city infrastructure presents a prime example of affective governance. As Knox (2017, p. 375) convincingly argues, "politics … is neither prior to nor determined by material structures, but emerges and is reworked through affective engagements with the material arrangements of the worlds in which people live." Michael (2020) coined the term "affective infrastructuring" in his study of "fatbergs", the water-cleaning devices in London. Michael shows how the fatbergs have been affectively enacted various stakeholders, and how this process simultaneously performs the sewerage infrastructure and its public audiences. Londoners became aware of the fatbergs not through direct interaction with them, but in terms of the threats they supposedly posed to certain spokespersons. Engagement with the city infrastructure, Michael argues, is always indirect and affective.

Hetherington and Jalbert (2023) explore the affective engagements with city infrastructure in their study of Montreal's Big Flush controversy. In 2015, Montreal's administration announced planned maintenance works on the city's sewage pipes, during several weeks the city's waste would have to be disposed in St. Lawrence River. Once the renovation plan was announced, the opposition party of Quebec called it disastrous and pointed to some potential epidemiological and environmental issues it might cause. A heated public controversy over the Big Flush ensued but was soon forgotten; the maintenance works went as planned and Montrealers never noticed them. The governance of city infrastructure, the researchers conclude, is necessary affective and political:

> Non-events like the Big Flush are as much produced by the careful management of perception as they are by well-planned technical interventions. We call that work 'affective maintenance' here, to underline the careful work that goes into managing infrastructural temporality and the complex relations that hold an infrastructure and its public in place. Had the Big Flush erupted into the scandal that, for a brief period, it seemed it might, Montreal might have found itself seriously reconsidering the way that it dealt with its waste, changing its politicians, its infrastructure, and its relation to the river that surrounds it. But instead, deft affective maintenance allowed the process to go ahead uneventfully, and for

> the pipes, waters, and municipal bureaucracy to recede once more from view. (Hetherington & Jalbert, 2023, p. 176)

It is not just the governance of material infrastructure that involves affective governance. Various tangible and intangible technoscientific objects rely on the management of perceptions to support their existence. For instance, the study by Oikkinen (2017) argues that the governance of infectious disease epidemics requires rigorous management of affective and emotional responses to them. In her research, the Zika epidemic demonstrates that affect plays key role in the emergence and development of technoscientific phenomena. Bloomfield and Doolin (2010) make similar argument in their study of the public controversy over transgenic cows in New Zealand, where the dominant framing of the project as a potential cure for multiple sclerosis was supported and contested by various stakeholders who had emotionally engaged with the subject of the study. STS studies of the trans-fat labeling (Schleifer, 2012) and advertising for the nanotechnology projects (Campbell et al., 2015) similarly point to the importance of affective governance in technoscientific phenomena.

This discussion about affective relations with data assets allows me to reflect on other manifestations of affective asset governance, for example the cases in which internet users claim to have had romantic relationships with chatbots that were thwarted by software updates (Chow, 2023) or the all-too-human tendency to anthropomorphize and befriend the algorithms (Tarnoff, 2023). Governance of these assets has become a complicated affair as multiple interests collide here: the companies' rents depend on the users' abilities to actively engage with proprietary software while being constrained to the roles ascribed by the vendor (e.g., the role of a data subject), while the users may be willing to assume other social roles in their affective engagements with data and algorithms or claim their ownership of the said products.

The asset is fundamentally a social entity, it depends on the actors calculating their future revenues and weighing possible options (Birch, 2023). As such, assetization can be destructive and exploitative since turning bodies, spaces, and knowledge into tradable commodities may lead to the chilling effects on human rights (Wernick & Artyushina, 2023). But it is not just the logic of capitalization that directs assetization processes. Birch and Ward (2022) discuss class struggle as a type of social relations with or around the asset. Recent studies of de-assetization provide some useful illustrations here (Juárez, 2023; Stokes-Ramos, 2023). For example, in their research

on the practices of de-assetization in pharmaceutical industry, Bourgeron & Geiger (2022) show how patient advocacy groups contest certain patent practices in courts as abusive toward patients.

A form of asset governance, affective data governance challenges some of our assumptions about assetization. First, it shows that the rational, calculated governance of the asset (Birch, 2023) requires affective labor, i.e., intentional management of emotions of the asset's audiences. Second, it shows that assetization is not a linear, one-direction processes, the social lives of assets and their audiences can lead to the many new social relations. To paraphrase Ahmed (2004b), imagining an affective asset governance would mean exploring the ways the assets have been performed and enacted in non-commercial ways. These affective engagements may co-exist with asset economies or run counter them. As an illustration, Mattern (2019) explores the origin of the 5G deniers' movement and points to the lack of productive social relations between the creators and the receivers of this technology.

2.8. Conclusion

The aim of this chapter was to explore the political economy of data governance as it marks a transition from online spaces to digitalized and automated cities. As other parties beyond Big Tech begin accumulating and reusing digital personal data, they devise novel governance frameworks that produce monetary and social value from data (e.g., data trusts, data cooperatives). This chapter examines and synthetizes academic debates on the existing and emerging approaches to data access, valuation, and governance. This research has been informed by the field of science and technology studies (STS) and the fields of smart city scholarship and critical data studies.

In this dissertation research, I examine the governance of personal data in two smart city initiatives: Sidewalk Toronto and City of Barcelona's DECODE. I understand governance as a range of rules, standards, and organizational mechanisms pertaining to the development and control of science and technology (Irwin, 2008, p. 584). I also apply this concept to the various forms of self-governance (Barry, 2001) and the modes of thought that guide the actors involved in the process of science and technology governance (Jasanoff & Kim, 2015).

Researching data governance in smart cities from an STS perspective means subjecting the very categories of data, smart city, and governance to empirical examination. I have adopted a case study approach to analyze the views of data governance practitioners, civic leaders, and

policymakers on what constitutes the public good in smart cities and how the interests of privacy can be balanced against the public and commercial interests. Emphasizing the local knowledge and practices, I consider Sidewalk Toronto and Barcelona's DECODE to be the sites of social change where technological, social, and political orders simultaneously shape one another.

In the field of STS, a body of assetization research has explored the political economy of digital personal data (Birch et al., 2020, 2021; Birch & Bronson, 2022). The assetization theory (Birch, 2020a; Birch & Muniesa, 2020) emphasizes three trends in the contemporary, technoscientific capitalism: (a) the growing role of science and technology in the functioning of industries and markets; (b) the advent of an asset-driven economy, where economic rents have become a predominant way of generating revenues; and (c) the defining role of expectations and imageries of the future on the assetization processes (e.g., what is expected to bring profits in the future may have a high value in the present).

The dominant model of data governance online favors a small number of technology companies that have established de-facto data monopolies (Srnicek, 2017; Zuboff, 2019; Cohen, 2019). Yet, data governance in the physical spaces (e.g., biometric collection, digital infrastructure, internet of things [IoT]) presents a more nuanced picture. Increasingly, various public and private actors have begun to see value in reusing personal data they accumulate. Among these interested parties are governments, law enforcement agencies, civic actors, and businesses of various scale (European Commission, 2018; Meijer, 2018; Mercille, 2021; Micheli, 2022). I theorize the emerging forms of data governance as forms of *asset governance*, a concept that I have developed from the assetization theory (Birch & Muniesa, 2020). The policy trend toward data reuse has brought new aspirations, promising to make public services more efficient and redistribute the value produced in the data economy by breaking private and government data silos. What unites all these embryonic initiatives is that they seek to extract rent from data, be it economic rent or some downstream social benefits that come from data reuse. Although private data governance is mostly extractive (Birch et al., 2020), other forms of asset governance promise collective or public benefits. In my empirical chapters, I explore asset governance as an integral part of the smart city policies in Sidewalk Labs' and the City of Barcelona's smart city initiatives.

CHAPTER III: RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

This chapter addresses the research design and methodology of my dissertation study. I employed a comparative case study approach to examine the policy objectives and socio-technical arrangements for two smart-city initiatives: Sidewalk Lab's project in Toronto, Canada, and the City of Barcelona's smart city initiative DECODE. These two projects complement each other as case studies. Both Sidewalk Toronto and Barcelona's DECODE were designed as public-private partnerships and promised to give the public the rights to data. The two projects also offer a useful comparison in approaches to data governance in smart cities. While Sidewalk Labs prioritized the economic value of data, the municipality of Barcelona aimed to govern data as a public and common good. Both projects had been widely publicized, were shut down before completion, and significant project documentation for analysis. I use these two initiatives to explore the different forms of assetization of personal data in smart cities. My comparative case study draws on the methods of observation, document analysis, and semi-structured interviews.

In addition to the usual obstacles a doctoral student faces (e.g., learning to craft academic texts and limited funding to support one's fieldwork abroad), I had to deal with unexpected issues caused by the COVID-19 pandemic. Among these unforeseen circumstances were travel restrictions imposed by the governments of Canada and Spain, which prompted me to conduct most of the interviews remotely, and the deaths of two family members, which impaired my ability to work for a period of time.

This chapter is structured as follows: in the section 3.2, I explain the choice of a case study method and highlight the comparative angle of my analysis. In the section 3.3, I introduce the two cases and explain why I have chosen them. In the section 3.4, I summarize the advantages of and barriers to elite interviewing. Section 3.5 addresses the observation phase of the project; section 3.6 discusses some ethical considerations of the study; and section 3.7 describes the document analysis, coding, and analytical tools that I used. Throughout the chapter, I discuss the changes I made to carry out my research activities remotely.

3.2. Why a Comparative Case Study?

My dissertation research focuses on three forms of data governance increasingly found in rapidly digitized cities: personal data as a private asset, public good, and commons. Conceptually, this study draws on the assetization theory (Birch, 2020; Birch & Muniesa, 2020), which offers a useful and multifaceted apparatus designed to explore the socially contingent processes through which tangible and intangible things are turned into tradable resources. Conceptualizing the governance of digital personal data as a socio-technical practice (Birch et al., 2020, p. 469; Helgesson & Lee, 2017, p. 533), I explore the objectives, expectations, and technologies underpinning smart city initiatives in Toronto and Barcelona as social actors sought to realize the monetary and social value from data.

Prominent smart city scholar Rob Kitchin (2014, 2022) urges social researchers to conduct more case studies to counter the prevalent policy discourse that depicts a technology-centered private smart city as the universal future for all cities. In a similar vein, Igor Calzada (2018, 2020) argues that the field of smart city research should use a cross-national case studies approach, as municipalities worldwide introduce new policies guided by the concept of citizen-centered smart cities.

Yin (1994, p.13) has produced the definitive explanation of case study method in social research, and he defines the case study as an "empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not really evident." The case study method is applicable when the research questions concern the values and motivations of individuals, the subject of the study is contemporary (not historical), and the researcher has no ability to affect the subject or its environment.

The case study method is a powerful tool to examine collective experiences and traumas, where individual perceptions reflect certain social, political, and cultural contexts. I have chosen the case study method as it is well equipped to answer the "why" and "how" questions, especially as my research draws on the interviewees' accounts of fast-evolving contemporary events:

> The essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and

> with what result. (Schramm, 1971, as cited in Ebneyamini, 2018, p. 2)

When analyzing a smart city initiative, a researcher deals with emerging technologies, their changing valuations, and anticipated threats to individual and collective rights. As a research tool, the case study method can be employed to investigate the issues around human-technology interaction. A case study has been designated as a core method in my primary research field, science and technology studies (STS), where it is employed to understand the co-production of technoscience and society (Pinch & Bijker, 1984; Latour & Woolgar, 1986).

According to Eisenhardt (1989, p. 532), the logic of sampling in a case study is significantly different from sampling in quantitative research. In a case study, the choice of theory often predetermines the choice of cases, and the goal of the study may be to illustrate, extend, or challenge the chosen theory. Assetization theory (Birch et al., 2020, 2022) frames contemporary data economies as exploitative since it seeks to extract economic rents from personal data. In an data-driven economy, personal data as diverse as digital face prints, licence plates, and online search histories are open for commercial exploitation. While many existing smart city projects reflect key features of an data-driven economy and allow technology companies to extract value from publicly controlled data (Sadowski, 2020, 2021), some initiatives frame personal data as a public good or commons and seek to extract nonmonetary social value from it (Kitchin, 2022; Lorinc, 2022). To capture the social practices that turn data assets into collectively and publicly beneficial resources, I explore three forms of asset governance in the smart city: the governance of data as a private asset (Birch et al., 2020, 2021; Pozner & Weyl, 2018; Srnicek, 2017); public good (Hoyer, 2019; Starkbaum & Felt, 2019; Prainsack, 2019a); and commons (Morozov & Bria, 2018; Frischmann et al., 2014; Frischmann et al., 2023; Artyushina, 2023). The choice of cases for this dissertation study was my attempt to sample all three types of data assets.

3.3. The Two Cases

Academic research on smart cities is highly relevant in both scientific and policy contexts as urban spaces have been largely seen as the “next frontier of the digital innovation” (G20 Global Smart Cities Alliance, 2020; UN Habitat, 2021), and the governance of personal data captured in the city spaces challenges existing legal systems (Scassa, 2020; Scassa et al., 2022). Both Sidewalk Toronto and Barcelona have drawn international attention as self-proclaimed

"exemplary" smart cities. Both projects promised a sweeping digital transformations of the public spaces; envisioned legitimate data reuse for commercial, public, and collective purposes; and put forward civic-oriented data governance proposals.

In 2017, Alphabet's subsidiary Sidewalk Labs proposed to build a new digitally driven neighborhood in downtown Toronto, at the foot of Parliament Street (Figure 4.1.). The first press release envisioned Sidewalk Toronto/Quayside as a place where digital technology tackles key issues of urban growth:

> Sidewalk Labs and Waterfront Toronto announced today "Sidewalk Toronto," their joint effort to design a new kind of mixed-use, complete community on Toronto's Eastern Waterfront. Sidewalk Toronto will combine forward-thinking urban design and new digital technology to create people-centered neighborhoods that achieve precedent-setting levels of sustainability, affordability, mobility, and economic opportunity. (Waterfront Toronto, 2017)

The smart city project existed for two and a half years and got into the media spotlight as "Google's first smart city" and the "world's first neighborhood built from the internet up" (McGillivray & McLaughlin, 2017; Sauter, 2018). Among some of the technologies that Sidewalk Labs proposed were centralized systems for emergency services, self-driving shuttles, flexible and data-driven public spaces, algorithmic planning, and data-driven park and recreation management. The digital and physical infrastructure of the smart city would be powered by Alphabet's technologies, with some parts of it owned by the company and its subsidiaries and the rest sold back to the Canadian government at a market value. To support these urban innovations, Sidewalk Labs put forward a series of policy proposals: for example, an entity called the Urban Data Trust would govern the data collected in the smart city and seek ways to generate value from it (Artyushina, 2020; Austin & Lie, 2021). Several other trust-like entities would govern the public spaces, transportation, and greenery in the smart city, with the aim to make them automated and financially self-sufficient (Artyushina, 2022). However, data ownership and control in the smart city were rather controversial (Flynn & Valverde, 2019; Goodman & Powles, 2019). While some types of digital personal data collected in the smart city were deemed as becoming Sidewalk Labs' commercial assets, other data assets were expected to benefit the public through data licensing and open data arrangements. In other words, the data in this project was seen as both private and public goods.

In 2020, Sidewalk Labs pulled out of the agreement with its public partner in Canada, Waterfront Toronto, citing financial uncertainty brought on by the COVID-19 pandemic. Although the project was shut down, its central concepts continue to inspire new technological products. As an example, the company's vision for the data-driven planning (Artyushina, 2021) was implemented in a form of marketable software by the startup called Replica; Replica is owned by Sidewalk Labs.

Because of the scale and ambition of Sidewalk Toronto, finding a comparable case proved to be a challenging task. Most functional smart city initiatives are limited in scope (e.g., a project for collecting excessive rainwater in a few neighborhoods in Rotterdam) and rely on existing urban infrastructure retrofitted with data-collecting devices (e.g., the network of CCTV cameras in central London). Other smart city projects, which promised to create a data-driven urban space from the ground up, have either failed or not yet been completed. Among the prime examples are Songdo in South Korea, Masdar in the United Arab Emirates, Neom in Saudi Arabia, and the 100 smart cities initiative in India.

In 2015, the new socialist mayor of Barcelona, Ada Colau, invited a technology expert Francesca Bria to rebrand Barcelona as a smart city. Bria's smart city initiative followed the earlier digitization efforts of the municipal administration, specifically the "green city" and the "self-sufficient city" initiatives. The previous smart city visions were heavily criticized for their efforts to attract international investment, often at the expense of the local economy and housing affordability. Colau did not want Barcelona's smart city to become yet another brand that city officials use to promote the city in the global ratings. Instead, she wanted the actual jobs, technology products, and profits. That was the vision of the smart city implemented in the City of Barcelona by technology expert Francesca Bria in a project she called DECODE (Decentralized Citizen-Owned Data Ecosystem). Bria devised an ambitious plan to put the city's entire digital infrastructure under government control, press technology companies into storing digital personal data in the public servers, use data licensing to support the municipal budget, and launch the city's first health data commons (Bria, 2016; Morozov & Bria, 2018; March & Ribera-Fumaz, 2016).

A ubiquitous network of sensors would collect data about the city transportation and human behavior in the public spaces, open for both commercial and social innovation. For the first time in history, Barcelonians could access and download all their medical information

through one digital hub. Bria's landmark project, an open government platform called DECIDIM, helped city residents participate in the municipal affairs remotely and often in real time. Three concepts were central to Bria's work: her vision of data as a public infrastructure, her definition of data/digital sovereignty as a form of power in the 21st century, and the concept of digital rights that grew out of Barcelona's collaboration with other smart city initiatives. Unfortunately, Colau lost the next elections and had to make certain political choices to regain her position as mayor. One of these decisions was the abandonment of the smart city agenda. Even unfinished, Bria's vision of the public and collective governance of data has had a lasting impact on Barcelona's later smart city developments, and the concept of digital rights that she introduced has informed new governance frameworks for the digitization initiatives at the city and global levels (Cardullo et al., 2019; Kitchin, 2021; Cities Coalition, 2022).

The nature of the two cases shaped my choice of methods in this dissertation study. Both smart city initiatives happened in the recent past and mostly existed in the form of plans, media reports, and continuously revised proposals. As a result, my three key methods in this research were observation, interviews, and document analysis.

3.4. Observation at the Public Engagement Events

According to the Canadian Panel on Research Ethics, article 2.3. (TCPS 2, 2022), ethics review is not required when observation is conducted in public places and where a) it does not involve intervention staged by the researcher or direct interaction with them; b) individuals present in the public meetings do not have any reasonable expectations of privacy; and c) any dissemination of results does not include identification of specific individuals. All three conditions have been met in this study. The "public roundtables" conducted by Sidewalk Labs' were public meetings, and they were recorded by the company; videos from these events are in the public domain (available on YouTube). Meetings of the Digital Strategy Advisory Panel were public, reporters from all major Canadian media outlets were present there, and the panel's written reports were posted online. Similarly, the #BlockSidewalk meetings were public and they were extensively covered in the local press. My role at these events was that of an audience member and a passive observer. The photographs that I have included in the dissertation have been digitally altered to blur the faces and all other identifying traits (e.g., tattoos, original hairstyle, etc.).

I began researching Sidewalk Toronto in 2018 through observation at the public engagement events conducted by Sidewalk Labs in Toronto. The first event called "public roundtable" was held in March 2018. The roundtables ran through 2018 and 2019 at various premium business centers in downtown Toronto. These were not roundtables in any conventional sense. During the first thirty minutes, seated audience was listening to various speakers who were presented as Sidewalk Labs and Waterfront Toronto and employees, and the next half hour was structured around some interactive activities, like imagining a perfect city and leaving post-it notes for the company on a bulletin board. Sidewalk Labs' programming was tight and provided limited ways to engage with the project or project employees. After each meeting, I took detailed notes, and I complemented this data through analysis of the video footage that Sidewalk Labs posted online.

As several scholars who researched these public engagement events pointed out (Haggart, 2020; Wood, 2020; Chantry, 2022), the roundtables did not provide much information about the project. The company employees avoided mentioning the company's plans for digital data and did not disclose Sidewalk Labs' business model. Instead, the meetings centered on noncontroversial aspects of the project, such as affordable housing, energy savings, and timber wood modular construction. Some researchers argue that these events were meant to deflect public attention from the actual threats posed by the smart city—digital tracking and privatization of the policymaking in Toronto (Clement, 2020; Carr & Hesse, 2020). Sidewalk Labs' promotional materials mentioned multiple public engagement events. However, most of these events targeted an audience of certain age or were invitation-only. For instance, three of the company's most publicized events were the YMCA–Sidewalk Labs summer camp, which accepted children of ages 9–12; the fellowship program, which only accepted individuals of ages 19–24; and the citizen panel, where the company randomly sent invites to the households across Toronto. Haggart (2020, p. 44) called the company's attempts at public engagement the "Potemkin consultations."

In August 2018, I gave a talk at the annual meeting of the Society for Social Studies of Science (4S) in Sydney, Australia. After the presentation, a member of the audience came up to me and we had a brief conversation about the surveillance aspects of Sidewalk Lab's project. The person told me they were recently appointed to the Digital Strategy Advisory Panel (DSAP), a consulting body that Waterfront Toronto set up to help review Sidewalk Labs' proposal; they

asked if I wanted to observe the panel's public meetings. I was quite surprised that I had never heard about the DSAP before. The panel meetings were public and took place at the Waterfront Toronto office on 5 Front Street, in downtown Toronto. Yet Waterfront Toronto did not publicize them, and the easiest way to find information about the next meeting was to be invited by a panel member. I arrived back in Toronto and found out that, together with several other researchers who studied Sidewalk Toronto, I was included in the panel listserv.

The DSAP meetings became a real breakthrough for my study. The panel was staffed with well-known Canadian lawyers as well as experts in privacy, data governance, antitrust policies, and digital surveillance. The panelists provided in-depth analyses of the privacy, policy, and equity issues raised by Sidewalk Toronto. For example, one member raised issues with the company's plans to reuse personal data collected in the smart city for commercial purposes; another member scrutinized the privacy and data governance documents issued by Sidewalk Labs; another member reviewed the company's planning vision and pointed out some immense equality issues it raised; and yet another member analyzed the potential impact of the smart city on the economy of Ontario. Each DSAP meeting was a lively debate between the experts and the representatives of Sidewalk Labs and Waterfront Toronto (please see the empirical chapters for more detail).

Unlike Sidewalk Labs' roundtables, the DSAP meetings were very instructional to me, as a researcher who had just started studying smart cities. These events were also visibly challenging for the Sidewalk Labs–Waterfront Toronto partnership, which had publicized very few details about the project's technologies and agreements (Goodman, 2019; Clement, 2020). The DSAP members sought to discuss potential harms of the smart city to privacy and human rights in Toronto, the parties' contractual obligations, and specific technologies that Sidewalk Labs was experimenting with. The panelists were given access to the project documentation and technology prototypes that were never released to the public. While the DSAP members were not authorized to disclose this information, their public discussions provided some clues as to where the project was headed.

The panel existed up until May 2020 and assembled every two to three months. Members of the public, like myself, were not allowed to ask questions or make any remarks during the meetings. The meetings themselves were recorded by Waterfront Toronto for undisclosed purposes. The DSAP meetings helped clarify for me some complex technical, legal, and political

aspects of Sidewalk Labs' proposal; they also became an important mechanism for identifying potential interviewees for my project. At the panel, I also established contact with the activists who would later form the #BlockSidewalk movement and several journalists who covered the smart city project for *The Globe and Mail* and *Toronto Star*.

As part of my research fieldwork on the Sidewalk Toronto case, I attended public meetings of the #BlockSidewalk citizen group until its dissolution in 2020 (please see Chapter IV for empirical data). That was a unique opportunity to observe how concerned residents of the Waterfront neighborhood, members of the Toronto City Council who represented them and leaders of the local grassroots organizations united around the key figure of Bianca Wylie.

Due to the COVID-19 pandemic, I could not observe smart city events held by the municipality of Barcelona. My fieldtrip to Barcelona was scheduled for the Summer 2020, yet both Canada and Spain closed their borders in response to the pandemic. Instead, I conducted interviewees with the Spanish respondents remotely and complemented this data with document analysis.

3.5. Interviewing the Canadian and Spanish Elites

Litting (2009, pp. 90–101) pointed out the lack of clear definitions for the term "elite" in social research. In Germany, she said, a member of the elite necessarily occupies a high social position and, presumably, is more knowledgeable than the lay public, while in Anglo-American studies, all individuals who hold leadership positions in companies, public institutions, unions, and judiciary are considered the elite. Some scholars (Bogner & Menz, 2009, p. 44) define elites as individuals who possess unique knowledge in their respective fields, thus equating the notions of "elite" and "experts." According to Litting (2009, p. 103), this translates into the limitation of sampling techniques: there are no existing pools of elites or experts available for each particular study.

Before approaching potential study participants with interview requests, I reviewed the methodological literature on elite interviewing (Litting, 2009; Harvey, 2011; Mikecz, 2012; Bogner et al., 2018; Ma et al., 2021). Members of the political, business, and social elite groups can be difficult to access in social research (Mikecz, 2012, p. 483). While locating elites is relatively easy due to their high public visibility, they often have the means and power to limit interactions with other members of society:

> For many qualitative investigators, one of the most pressing research concerns lies in gaining access. The researcher's success in this regards will have a significant effect on the nature and quality of the data collected. . . and, ultimately, on the trustworthiness of the findings. (Shenton & Hayter, 2004, pp. 223–231)

Since I was preparing to interview the Canadian and Spanish-Catalan politicians,[10] government officials, and technology professionals involved in two well-publicized smart city initiatives, I expected access to interviewees to be a major issue in this study. However, as I will explain in this section, the circumstances of my fieldwork were so unusual that people who normally might not respond to an email from a doctoral student, had agreed to give me in-depth interviews.

Enrolling an "elite" member as a research participant may be difficult, but getting their direct perspective on a subject can be even more challenging. An elite interviewee may have professional or personal reasons to engage in reputation management and decide to share with the researcher a statement prepared by their public relations team. Moreover, the quality of interview data may be significantly affected by the circumstances of the meeting and surrounding environment. For instance, a company employee may be less comfortable sharing sensitive information about their job while in the office. Elite interviews also prove challenging in terms of the researcher's positioning: interviewees can end up dominating the interview or patronize the researcher.

Research design literature offers various strategies to gain access to and build trust with the elite interviewees. Ostrander (1995) suggested that elite interviews take place at public places, where the researcher may familiarize themselves with the environment and the interviewee can get comfortable. Ma et al. (2021) rely on the intelligence and erudition of business elites to co-create theoretical concepts with them. McNulty and Pettigrew (1999) argue that business leaders often lack people with whom to discuss the challenges they face, meaning that explaining the purpose and research design of the study may help them open up to the researcher. Dexter (2006) define an elite interview as one in which the interviewees is encouraged to lead in the conversation and where their account of the situation is prioritized.

[10] Interviewees from Barcelona predominantly identify as Catalan. The region of Catalonia has long been struggling for the political and budgetary independence from Spain. See Casey (2021) for the most recent discussion about the Catalan separatist movement.

To identify my sample population, I relied on the publicly available sources of information and the snowballing technique. First, I compiled a list of individuals who spoke about Sidewalk Toronto and Barcelona's smart city initiative in the media, or were discursively connected with these projects (in academic articles, official reports, press releases, media publications, and social media posts). I would then ask each interviewee to suggest another person, familiar with the smart city projects, who might be interested in speaking with me.

Several factors were helpful as I began approaching individuals with interview requests. First, active mobilization against Sidewalk Labs' smart city united a number of Canadians, from residents of the Waterfront neighborhood in Toronto through business elites to members of the Parliament. Moreover, the public controversy around the project drew attention from international privacy scholars, technology professionals, journalists, and digital rights activists. It was relatively easy to connect with all these people, once I had explained the purpose of my research. The public engagement events organized by Sidewalk Labs in Toronto, meetings of Waterfront Toronto's Digital Strategy Advisory Panel and the events organized by the #BlockSidewalk movement all provided ample opportunities to identify potential respondents.

Between 2018 and 2020, I attended about a dozen public events related to Toronto's smart city project. I was present in person at the public events held in Toronto and I virtually attended those held across Canada. I used these events as an opportunity to compile a list of people who had advocated the project, publicly spoke against it, or been involved in it in various professional capacities (e.g., public officials who'd reviewed the project on behalf of the Canadian government, company employees, and paid consultants). When interviewing them, Sidewalk Labs' employees were rather restrained in sharing information about the project or disclosing their personal attitudes toward it, but other interviewees often got emotional when speaking about the potential privacy, policy, and human rights impacts of the smart city.

Second, in 2020, I received an ethics approval from the York University Ethics Review Board and began approaching potential interviewees with formal interview requests. The pandemic made contacting and interviewing some individuals easier than expected. Since both international and local travel were restricted for almost two years, I sent out 50 emails with Zoom meeting requests to government officials and technology professionals who worked in the fields related to data governance and smart cities, specifically I approached 36 people in relation to Sidewalk Toronto and 14 regarding Barcelona's smart city. Most of the meeting requests were

accepted, and 37 interviewees agreed to be interviewed and recorded (25 and 12 per case, respectively, see Table 3.1. for details).

Third, since 2019, I have participated remotely (as a presenter or member of the audience) in two dozen academic workshops thematically related to smart cities, data governance, and digitalization of public services. These online events provided many opportunities to connect with international networks of data governance practitioners and policymakers. For example, in 2020, I was a co-panelist with several digital rights activists from Barcelona's initiative the *Cities Coalition for Digital Rights*, members of the European Parliament, data governance officials from the City of Seattle, and leaders of the Privacy International. These connections were very helpful when it came to approaching potential interviewees, because shared knowledge helps researchers engage respondents in a more open dialogue and can directly impact the nature of interview data (Liu, 2018).

Fourth, I actively engaged in the public debate about Sidewalk Toronto through academic publications and social media. Mikecz (2012) claimed that "knowledgeability" of the researcher, understood in this context as awareness of the events that concern one's respondents, can be immensely helpful in gaining access to elites. Early in the recruitment process, I found out that a "cold contact" would more likely agree to a meeting if they had received my publications as an email attachment. Once my research article about Sidewalk Labs' data trust proposal (Artyushina, 2020a) came out, I received numerous emails from government officials and technology entrepreneurs who wanted to learn more about the company's data governance proposal and the potential of data trusts in public data governance. A few months later, I wrote an article about the European Union's novel data governance policies (Artyushina, 2020b). This second paper led to a few consulting positions within the Canadian and European public sector organizations, which helped me better understand key challenges that the public officials faced when dealing with the smart city projects; in these policy advising roles, I also learned about the changing policy landscape, where the public sector organizations sought to reinvent themselves as data stewards.

Fifth, I have been doing some consulting work for the federal and municipal government in relation to smart cities. In October 2019, the Information and Communications Technology Council of Canada invited me to help review finalists of the second round of the Smart City Challenge led by Canada's Ministry of Infrastructure. Two months later, I was invited to join the

Advisory Board that would help the City of Toronto review Sidewalk Labs' proposal. In August 2020, an employee of the City of Toronto reached out to me: they were looking to hire a permanent policy analyst.

Sixth, as I have been researching emerging data governance frameworks, Canadian and international technology companies often approach me as they seek to promote their products. I do not advertise any products, but I use these opportunities to learn more about the latest industry trends.

Interviewing people from Barcelona posed some difficulties related to geographic and language barriers. Since I could not travel to Barcelona in person, I contacted several academic researchers who studied Barcelona's smart city initiative, people who were publicly linked to the project, and current and former employees of the city administration. Some of them agreed to an interview; others connected me with their peers who were familiar with the smart city initiative and felt more comfortable speaking English. Three entrepreneurs whom I interviewed as part of the Canadian fieldwork offered to introduce me to their Catalan business partners. Both city officials and entrepreneurs I spoke to were fluent in English and ready to talk about Barcelona's projects. On the other hand, access to the Catalan/Spanish lawyers proved to be challenging due to the double language barrier. I was not able to read legal documents unless they had been translated into English, and they believed they did not speak English confidently enough to agree to the research interview. To ensure my interview data was accurate and nothing was lost in translation, I did some fact-checking via publicly accessible sources and used conventional document analysis to triangulate the interview data. Over the years, the municipality of Barcelona has released and posted online ample documentation detailing each iteration of the smart city initiative; the city administration has been actively collaborating with academic researchers who published studies on Barcelona's approach to civic engagement, digital economy, connectivity, and digital sovereignty (e.g., March & Ribera-Fumaz, 2016; Calzada, 2018, 2020).

In 2020, my dissertation study received a formal authorization from the Office of Research Ethics at York University. Between 2020 and 2021, I undertook 37 semi-structured interviews with Canadian and Spanish public officials, data governance professionals, and privacy/digital rights activists (see Table 3.1.).

Interviewees (occupation)	Sidewalk Toronto (25)	Barcelona (12)
Privacy/Data Governance Experts	9	2
Government officials	7	6
Politicians	2	1
Citizens/activists	7	0
Academic researchers	0	3

Table 3.1. Types of interviewees by case study

3.6. Conducting Semi-Structured Interviews Remotely

Engward et al. (2022) praise remote interviewing as a way to rapidly recruit interviewees. Yet, they remind researchers that the practices of ethical scientific study do not automatically translate into the virtual space. Technology-mediated communication may prompt a researcher to be less sensitive to the needs and vulnerabilities of the interviewees. As an example, Matzner and Ochs (2019) highlight the differences in the perception of the remote interview among researchers and participants. While a researcher may find the format of an online interview convenient, interviewees may be concerned about privacy and security issues associated with the use of video conferencing software. Engwald et al. (2022) offer practical steps to make a remote interview as comfortable as possible for interviewees. These steps include engaging a research participant in small talk before the interview, proactively using the consent form to give the interviewees more control over the interview process, signposting the stages of the interview, and including many open-ended questions.

The method of in-depth semi-structured interview has been widely applied across social sciences (Kvale, 1994; King et al., 2019; Peters & Halcomb, 2014). Many strategies are available to build rapport with the interviewees; for example, through an elaborate self-introduction,

providing a detailed information about the benefits of the study, amending the demographic section of an interview to the format that suits the interviewee, and providing them with a leeway if they are not willing to answer certain questions. Furthermore, it is advised that the researcher asks questions in plain language or the language the interviewee understands (e.g., some research participants respond positively to the use of professional jargon they are familiar with). Semi-structured interview questions should not lead an interviewee toward a specific answer (Peters & Halcomb, 2014).

Unfortunately, some of the strategies that help build connection with a interviewee during an in-person meeting do not apply to a remote interview. For instance, if a company CEO agrees to a 30 minute videoconferencing session, there may not be enough time for a warm-up talk. Similarly, a digital environment limits opportunities for the researcher's self-presentation.

First, I found out that having an informal online meeting or a brief phone conversation with a potential interviewee helped recruit them for an interview. Preparatory activities, like picking an alias, proved to be an enjoyable activity and effective strategy to alleviate the interviewees' anxieties before the interview. I have noticed that the sense of control over the information they had shared made study participants feel comfortable and relaxed, and the interviews became longer and richer in detail.

Second, highlighting the political and societal effects of the study helped me get access to some high-profile government officials and civic actors in Canada and Spain. In Canada, the interviewees demonstrated a heightened sense of social responsibility, showing that they were willing to participate in an academic study that served the public interest. Similarly, the Catalan/Spanish participants told me they felt certain responsibility in representing Barcelona before international audiences.

Third, having a continuous online presence helped me extend the list of the study participants and establish close contacts with some of them despite the geographical barriers. In a polarized political climate, one's social media activity helps research participants establish the researcher's academic and political agenda. Quite often, interviewees would tell me they "knew me" because they followed me on Twitter.

Fourth, digital ethnography methods can be very useful in studying virtual and semi-virtual communities (Pink, 2015; Pink et al., 2016). For example, the #BlockSidewalk movement that began in Toronto soon became largely virtual as many individuals from across the world

joined in the fight against the smart city project. While I have not conducted a computerized analysis of the online posts, they provided me with important contextual data and helped position the digital personas who fought against Sidewalk Toronto within the real-life context.

Interviewees in the age group 50+ often shared nostalgia for their university years. Apparently, many of today's politicians and smart city engineers considered academic careers. Across all categories of interviewees nts, my status as an academic researcher was often enough to make a person want to talk to me. All but one participant agreed to including interview excerpts in my publications; most of the interviewees wanted to be pseudonymized.

3.7. Key Ethical Considerations of the Study

Maintaining the safety of the study participants has been my key concern throughout this study. While protecting privacy and confidentiality of research participants is a standard requirement for research projects guided by the institutional ethics review boards in Canada, my study posed additional challenges in this regard. Throughout the project, strained relationships existed between Sidewalk Labs, grassroots organizations that protested the project, certain Canadian politicians, and the company's public partners. To address the tensions, Sidewalk Labs engaged in aggressive lobbying,[11] invested in a multi-year public relations campaign, and threatened several people who publicly spoke against the project with legal action. The company's insensitivity toward a healthy public debate elicited different reactions from the interviewees. While some people feared that Sidewalk Labs might retaliate against them personally, others felt compelled to amplify their messaging about the actual and potential harms of the smart city. In this charged political climate, nearly every interview regarding the project became highly sensitive. For some study participants, it took several months to find the courage to agree to a formal interview after we had an informal meeting; others asked me to take notes instead of using a recorder during the interview. Notably, members of civil organizations felt more anxious and vulnerable to the company compared to all other categories of interviewees.

Compared to Sidewalk Toronto, my research on the Barcelona case was not intense or stressful. To the best of my knowledge, none of my Catalan/Spanish interviewees were in any political, professional, or personal circumstances that could restrain them from speaking with me

[11] Investigative reporters found out that Sidewalk Labs lobbied all three levels of the Canadian government, from the City of Toronto to federal ministers, through official and unofficial channels (Deschamps, 2019; O'Kane, 2022a)

freely. None of them felt the need to hide the fact that they spoke to me, although I have chosen to pseudonymize their interviews. However, there were other challenges: first, I had to rely on my interviewees' accounts as a primary source of information. Second, I had to navigate interpersonal tension between a few interviewees, which necessitated double-checking their accounts. Third, the technology community in Barcelona is quite small, and I had to take additional steps to protect my interviewees' confidentiality. A major limitation of my Spanish fieldwork is that some interviewees might have given me too polished a vision of Barcelona's smart city initiatives. I relied on document analysis to address the limitations of my interview data.

3.8. Coding and Data Analysis

My analysis drew on the fieldwork notes (observation data from the smart city events), 38 semi-structured interviews, and some 4,000 pages of publicly accessible documents issued in relation to the smart city initiatives by Sidewalk Labs, Canadian regulators, the municipality of Barcelona, the Cities Coalition for Digital Rights, academic researchers, and civic actors. I complemented these sources through analysis of the media coverage of the smart city projects by local and international media outlets. I used AI-driven computational linguistic software *Otter AI*, to transcribe and code the interviews that I had collected. Otter AI automatically turns audio into a text and provides some built-in tools to edit, comment, and analyze the transcript. Initially, I would have a text with some comments on the margins, then I would add another layer of comments, with the secondary codes.

I coded the interview transcripts and documents following a descriptive approach (Saldaña, 2013), to inductively provide an overview of key themes and concepts. First, I would highlight in the text and comment on the sections that contain various conceptualizations of the terms "data," "data asset," "smart city," "data economy," "digital economy," "digital technology," and "technology." The more nuanced part of the coding was tracing the diverging notions of the economic value of data, public good, and different accounts of the histories of Sidewalk Labs' and Barcelona's initiatives. Second, I grouped the first-level codes under new categories, using the assetizaton theory and my research questions as analytical framework (Chun Tie et al., 2019). The third step was to use these second-level codes to examine the data governance strategies employed in my two case studies; I came up with a specific set of codes

for the emotional attitudes towards the smart city initiatives that the interviewees had shared (e.g., the thrill of experiment, embodied discomfort, ambition, fear of exclusion). I also reflected on the resulting codes and the contexts they bring about, such as lack of expertise in procurement at the level of municipal government and inconsistent definitions of privacy. One major issue with the studies of data governance and smart cities is that there are no established vocabularies in both fields, and different groups of interviewees often use the same terms in a different sense, or came up with their own notions. For instance, there are multiple legal and quasi-legal definitions of data; while some interviewees used the terms "data economy" and "digital economy" interchangeably, others emphasized the conceptual or practical differences between them; the same effects I observed with the "digital" and "data" rights. Similarly, there were some differences between the smart city vocabularies employed by the Catalan/Spanish interviewees and their Canadian peers. European interviewees emphasized the role of the public in the smart city initiative and often rooted their concepts in the political theory of socialism. For instance, the concept of "data cooperative," popular in the Barcelona tech scene, was perceived as alien by Canadian interviewees. Please refer to the Table 3.2, for the specific codes I employed in this study.

Research questions	First-level codes	Second-level codes
Social, economic, and political frameworks that drive data governance in smart cities	Data, dataset, personal data, anonymized data, deidentified data, digital technology, technology, aggregated data, urban data, open data, social innovation, socialism, value, democratic, federalism, provincial governance, public-private partnership, utility, competition, Canadian economy, data sharing,	Data assets, assetization, assetized, rent-seeking, social assets, public assets, neoliberalism, financial capitalism, market-driven, profit-driven, commons, collective interests, governance, stakeholders; shareholders, democracy, community, socialism, public, accountability

	Catalan independence, automated, communitarianism, cooperative	
Various ways to define the public interest and key objectives of the smart-city governance	Pilot, data reuse, data donation regulations, public good, public interests, procurement, open procurement, public engagement, data rights, digital rights, citizens, citizen panel, engagement, data sovereignty, digital sovereignty, transparency, collective, European Union, economic prosperity, innovation, competitive, utility, power, artificial intelligence, voice, future	Public purpose, public good, utility, economic prosperity, marginalized communities, economic profits, competition
Emotional attitudes toward the smart city initiatives	Whimsical, exciting, playing around, challenge, opportunities, open government, open governance, uncomfortable, unclear, confusing, erosion, rights, violated, digital panopticon, explore, automated reason, update, efficient, successful, resist	Playful attitudes, creativity, innovation, digitization, open government, fear, embodied reactions, invasive technologies, surveillance

Table 3.2. Codes extracted from the interview data and document analysis

3.9. Conclusion

In the research design and methods chapter, I explained the choice of the method of comparative case study for this dissertation research; strategies I used to gain access to the interviewees; techniques employed to protect the privacy and comfort of the study participants during remote interviewing; and key ethical challenges of this study. Additionally, I provided the total number of interviews I collected, categorization of the study participants by occupation, and explained the coding and data analysis.

Several factors were helpful as I began approaching individuals with interview requests. First, active mobilization against Sidewalk Labs' smart city united a number of Canadians, from the residents of the Waterfront neighborhood in Toronto to the business elites to the members of the Parliament. Moreover, the public controversy around the project drew attention from the international privacy scholars, technology professionals, journalists, and digital rights activists. It was relatively easy to connect with all these people, as I had explained the purpose of my research. The public engagement events organized by Sidewalk Labs in Toronto, meetings of Waterfront Toronto's Digital Strategy Advisory Panel, and the events organized by the #BlockSidewalk movement all provided ample opportunities to meet potential interviewees in person and establish contacts before approaching them formally with an interview request. The role of in-person communication in building trust and rapport with interviewees is highlighted by textbooks on qualitative interviewing (King, 2019). Interviewing the study participants from Barcelona posed some difficulties related to geographic and language barriers. Since I could not travel to Barcelona in person, I contacted several academic researchers who studied Barcelona's smart city initiative, people who were publicly linked to the project, and current and former employees of the city administration. Some of them agreed to an interview; others connected me with their peers who were familiar with the smart city initiative and were fluent in English. Three entrepreneurs whom I interviewed as part of the Canadian fieldwork offered to introduce me to their Catalan business partners. Both city officials and entrepreneurs I spoke to were fluent in English and ready to talk about Barcelona's projects. On the other hand, access to the Catalan/Spanish lawyers proved to be challenging due to the double language barrier. I was not able to read legal documents unless they have been translated into English, and they believed

they did not speak English confidently enough to agree to the research interview. To ensure my interview data was correct and nothing was lost in translation, I did some fact-checking via publicly accessible sources and used conventional document analysis to triangulate the interview data.

CHAPTER IV. SIDEWALK TORONTO/QUAYSIDE

4.1. Introduction

Sidewalk Toronto/Quayside was an experiment in data governance and urban planning (Robinson & Coutts, 2019; Lorinc, 2022; Haggart & Spicer, 2022). Over the two and a half years of its existence, the smart city project was at the center of successive controversies relating to its proprietary approach to data and city governance (Balsillie, 2018; Wylie, 2019; Filion et al., 2023). The company devised some innovative instruments of governance and management in data and city infrastructure (Scassa, 2020; Artyushina, 2022) and envisioned the Toronto development as the first in a series of Alphabet's urban ventures (O'Kane, 2022a). However, the Sidewalk Toronto partnership collapsed as parties failed to balance conflicting interests in data governance and the company's plans for data commercialization did not withstand public criticism (Wylie, 2020; Austen, 2020).

In this chapter, I draw on the empirical data collected in Toronto to address my research questions regarding the social and political frameworks that underpin data governance strategies in smart cities, visions of the public interest that drive smart city governance, and the role of novel legal and technical definitions of data in decision-making around smart cities. My aim in this chapter is to examine how Sidewalk Labs configured their smart city project: operating in a loosely regulated area, the company invented novel quasi-legal definitions of data to facilitate a private ordering (Wernick, 2021, pp.71-72) of the data framings and its governance in Sidewalk Toronto. In the absence of legal framework that could put some limits to the company's plans, Canadian public officials did not establish a clear understanding of the public stakes in this project, largely because they lacked the policy tools necessary to address the privacy and governance risks associated with Sidewalk Toronto. A controversy about the lack of public interest in this project was one of the reasons that led to the public backlash against the smart city.

I approach this empirical material through the lens of assetization theory (Birch, 2020; Birch & Muniesa, 2020) and explore the particular form of (data) asset governance that manifested in the Sidewalk Toronto project, which led to contestation in defense of the public

interest. I conceptualize Sidewalk Labs' proposals for the governance of data in the proposed smart city as *private* asset governance and investigate its socio-technical configurations and implications. Furthermore, my analysis inductively highlights another, under-explored aspect of data governance: the affective forms of data governance.

The chapter is organized as follows. Section 4.1. provides an overview of the project's timeline. Section 4.2. scrutinizes Sidewalk Labs' proposal for data governance through the lens of assetization theory. Section 4.3. explores the company's idea of data-driven planning in the smart city. Section 4.4. addresses the company's vision for the public, private, and collective interests in the smart city. Section 4.5. analyzes the moral economy of data governance through the analysis of the public opposition to Sidewalk Toronto. The conclusion reflects on the three forms of asset governance in smart cities (public, private, and commons) and outlines some perspectives for the study of affective decision-making around data governance.

4.2. The Origin and Timeline of the Sidewalk Toronto Partnership

Quayside is a 12-acre parcel of land on the eastside of Toronto's waterfront, situated at the foot of Parliament Street (Figure 4.1.). Since 2001, the public corporation Waterfront Toronto has been overseeing the development of public land along Lake Ontario (Flynn & Valverde, 2019). The usual mandate of the corporation includes the development of affordable and luxury housing, public spaces, and roads. Over the two decades of its existence, Waterfront Toronto has transformed derelict industrial lands into new neighborhoods, public beaches, and waterfront parks. Waterfront Toronto was created by the federal, provincial, and municipal governments, and it typically helped develop land that had been under mixed public ownership. Quayside, however, is owned by Waterfront Toronto and it was proposed for a different type of development in 2017: ae "smart city" built around digital technologies (Sauter, 2018; Carr & Hesse, 2020; Morgan & Webb, 2020).

In March 2017, Waterfront Toronto issued a request for proposals to find an "innovation and funding partner" to develop Quayside. On October 17, 2017, the Alphabet-owned company Sidewalk Labs was announced as the winning bidder for the project, and a partnership called "Sidewalk Toronto" was officially launched (Flynn & Valverde, 2019; Goodman & Powles,

2019).[12] The company's proposal for the smart city was called "Vision" (2017), and it promised to achieve unprecedented levels of energy efficiency, housing affordability, mobility, and economic opportunity through combining Alphabet's technology with "human-centered" planning.

Figure 4.1. Aerial view of the 12-acre Quayside, provided by Waterfront Toronto. (Image source: https://www.waterfrontoronto.ca/our-projects/quayside)

Over the next 18 months, Sidewalk Labs worked on its Master Innovation and Development Plan and ran a citizen engagement campaign. The campaign was largely considered unsuccessful, primarily because the company avoided talking about the technological aspects of the proposal and did not provide any channels for public feedback (Clement, 2020; Chantry, 2022). As many researchers argue (Robinson, 2019; Haggart, 2020; Lorinc, 2020), public controversy over the project had its roots in these failed citizen consultations, especially because the company did not share its plans for data collected in the smart city.

Some of the extensive media coverage portrayed Sidewalk Toronto as an example of technological and urban innovation (The Economist, 2018; Doctoroff, 2018). Yet in Canada, much of the discourse was critical from the beginning. A Canadian open governance advocate,

[12] Sidewalk Labs and Waterfront Toronto entered into the first Framework Agreement on October 16, 2017, and created a limited partnership called Sidewalk Toronto, registered in British Columbia. The partnership mailing address is that of Google LLC.

Bianca Wylie, became a vocal critic of the project and argued that Sidewalk Toronto did not serve the public interest (Wylie, 2017; Bliss, 2018). In 2019, Wylie teamed up with several other activists to launch a group called #BlockSidewalk (Vincent, 2019). Prominent Canadian enterprises and technology experts publicly expressed their concerns about the project, which they saw as a privacy threat to citizens and a lost opportunity for the Canadian technology sector (Balsillie, 2018; O'Shea, 2018; Lorinc, 2019; Reddekopp, 2019).

A study participant reflected on the role of political factors in the creation of Sidewalk Toronto:

> The politicians are the ones that, a lot of their staffers are getting jobs, and there's regulatory capture and, and the political parties get benefits in those relationships. So, there's a lot of reasons for politicians to move fast, but that doesn't make it right. They give them smart cities, they let them mess around on election day, but they mess up. There's a lot of people who think I'll scratch your back, you scratch mine. I think the citizens lose, so citizens and civic leaders have to stand up just like they did in Sidewalk Toronto. (Interviewee 8)

It is important to consider the legal context this project had operated in. Canadian legislation is complex as it consists of the federal, provincial, and municipal-level laws. Yet when it comes to privacy and data protection, Canada was not prepared to the smart city proposal of the level of Sidewalk Toronto. The 2000 Personal Information Protection and Electronic Documents Act (PIPEDA) provided little protection to digital data created through mass and real-time data collection and said nothing about data reuse and data analytics. Similarly, the laws of the Province of Ontario and the City of Toronto had nothing to say about data reuse and were not prepared for the ambitious visions for the digitalized city infrastructure proposed by Sidewalk Labs. Moreover, in the call for proposals, Waterfront Toronto explicitly looked for a partner who would create new governance policies for the smart city. Julie Cohen (2017) argues that platform companies do not enter markets, they replace them by proactively shaping law and creating new economic institutions that favor their business interests. This was the strategy of Sidewalk Labs in this smart city project (Artyushina, 2020a; Austin & Lie, 2021).

Here is how one of the study participants explained the Canadian legal landscape in relation to Sidewalk Toronto:

> I mean, in the Canadian context, it's important to acknowledge the legal context in which that was happening. Every, every stakeholder involved, from civil society to Sidewalk Labs themselves to the three levels of government and Waterfront Toronto, all acknowledged that the legislative structure that we have to protect data and privacy in Ontario and in Canada, was not up to the task of, you know, putting up the appropriate safeguards in the context of a smart city, where, again, we're talking about sensors embedded at the level of the infrastructure that are going to have, you know, ongoing impacts on daily life of those who live, work, and play in that neighborhood. So, everyone agreed that the, the legal structures that we currently have, were inadequate. (Interviewee 2)

In June 2019, Sidewalk Labs released its 1,500-page Master Innovation and Development Plan (MIDP, 2019), which detailed the company's plans for Quayside and requested 180 acres of additional land in the Port Lands nearby, which is jointly owned by the city and the provincial government. The MIDP caused an even more heated controversy than the failed citizen engagement campaign. Activist Bianca Wylie was concerned about the privatization of city governance in the project (Wylie, 2020); developer Juli Di Lorenzo raised issues with the fact that Quayside was to be sold for less than its market value (Bozikovic, 2019); and the leadership of the Waterfront Toronto corporation was concerned that Sidewalk Labs had requested land that was under mixed public ownership, which required approval from the municipality and the provincial government (O'Kane, 2022b). Some of the negative coverage of the MIDP in the Canadian press was caused by the leaked Yellow Book, an internal document that revealed the company's plans to request taxation power in the smart city and monetize nearly all public services provided within its confines (Cardozo & O'Kane, 2019). On October 31, 2019, the board of directors of Waterfront Toronto voted to accept the deal with Sidewalk Labs, but to limit its scale to the 12-acre Quayside. In May 2020, the company shut down the project, citing the economic uncertainty brought on by the COVID-19 pandemic.

In 2019, Canadian Civil Liberties Association (CCLA) sued the three levels of government over the deal with Sidewalk Labs. Here is how a study participant explained the ramifications of this lawsuit:

> Did the lawsuit help? We hope so. Yeah, I think you heard that when Sidewalk Labs left, it was "Oh, dear COVID. Now, we have to go away." Yeah. But what led to that decision was, you know, years of pushback from grassroots, a year of us trying to get them into court and then stalling. We were actually at the point where they were going to have to, you know, where we were going to get a court date. And there was going to have a discovery process where information that, you know, had not been released to the public might possibly go public, okay? And we never quite got to that point, because they walked. (Interviewee 24)

In the next section of this chapter, I analyze Alphabet/Sidewalk Labs' data governance proposals for the smart city and show how they reflect a *private* form of asset governance, entailing a specific logic and socio-technical implications.

4.3. From Data Governance to Asset Governance: Sidewalk Labs' Data Trust Proposal

Researchers who study the political economy of data assets (Birch et al., 2020; Birch et al., 2022) emphasize two imperatives (Sadowski, 2020a, 2020b) that manifest in the business models of technology companies: unlimited data accumulation and control over users and business partners. These imperatives present in the form of enclosure of personal data that has turned Big Tech firms into the large data holders (Birch, 2020; Whittaker, 2021), creating information asymmetries that companies can exploit to underpay their workers and manipulate the markets they have created (Rosenblat, 2016; Dubal, 2023), hidden forms of consumer and vendor taxation (Mazzucato, 2018; DOJ, 2023), monopoly ownership of the digital and physical infrastructure (Gekker & Hind, 2019; Bast et al., 2022; Lehdonvirta, 2022), and the capacity to avoid regulations pertinent to regular vendors (Srnicek, 2016; Cohen, 2019; West, 2019).

Alphabet/Sidewalk Labs' proposal in Toronto reflected nearly all of these practices: from the secrecy around the project (Goodman & Powles, 2019; O'Kane, 2019) to data hoarding (Muzaffar, 2018; Galang, 2018) to the monopolization of digital and physical infrastructure in the project (Goodman & Powles, 2019; Artyushina, 2022) to avoiding the regulations that apply to developers and technology providers in Canada (Tusikov, 2020; Carr & Hesse, 2020). These practices are underpinned by the logics and practices of data assetization (Birch et al., 2020,

2021), understood as novel regimes of control and ownership that allow for seamless dispossession of personal information and rights from data subjects. As I argue in this chapter, turning data collected in the smart city into the company's commercial asset was key to Sidewalk Labs' smart city project.

Central to Sidewalk Labs' data governance strategy was a novel institution called the Urban Data Trust, proposed in their 2019 MIDP, which was tasked with the double role of regulating the reuse of digital data and generating revenues from it. Initial public reception to the data trust idea in Canada was lukewarm: some researchers criticized it as an attempt to bypass the Canadian privacy legislation (McDonald, 2019; Austin & Lie, 2021). Canadian data governance expert Teresa Scassa (2020) criticized Sidewalk Labs' data trust proposal for failing to account for the competing interests in data reuse; she emphasized that the company's proposal failed to address the issues of privacy, data access, sharing, monopoly on digital infrastructure, and data localization.

Based on my analysis of Sidewalk Labs' urban data trust proposal (Artyushina, 2020, 2023), I argue that Sidewalk Labs' Urban Data Trust was designed to extract value from data by making it easier for private actors to collect, reuse, and monetize it. The trust was designed to assetize data through five interconnected processes: introducing new legal definitions for data, retrofitting city infrastructure with digital tracking devices, creating the regime of self-certification for data collectors, accumulating the data collected in the smart city in one physical location, and establishing intellectual property (IP)-intensive data sharing agreements.

The first glimpse into Sidewalk Labs' data-driven city was provided in the company's winning bid called "Vision" (2017). The 400-page document mentioned such technologies as self-driving shuttles, robot couriers, automated underground garbage disposals, and smart grids. All these devices would run on and replenish the smart city's data repository. The vast network of sensors would connect urban infrastructure to the internet and the data would become available to the company's partners and the public:

> The physical and digital layers will connect via sensors to generate a shared repository of data on the neighbourhood that is critical not only for day-to-day operations but also for public agencies and third parties working to improve services—empowering people to build solutions faster than is possible in cities today. (Vision, 2017, p. 18)

An "exemplary urban living lab," the smart city was expected to become a cluster of technological and urban innovation:

> As a secondary anchor, Sidewalk will work with local institutions such as the University of Toronto and Ryerson University to establish an urban innovation institute, bringing together academia, industry, government, and entrepreneurs to address the growth challenges facing cities. This applied research institute can create a talent pipeline and a real-time knowledge-exchange with pioneering companies, just as Stanford does with digital startups in Silicon Valley, and Cornell Tech does with engineers in New York. (Vision, 2017, p. 31)

When discussing Sidewalk Toronto, some scholars argue that conflict around data was unavoidable, because the city and Alphabet/Sidewalk Labs had incompatible interests in data:

> For the city, being smart is about functioning better and attracting tech plaudits. For the technology company, the smart city is a way to capture the value of data flows—either by directly monetizing behavioral insights or by using those insights to design or acquire services—and then realizing the network effects and monopoly rents that have characterized information technology platforms. (Goodman & Powles, 2019, p. 457)

To get at the socio-technical implications of these data governance arrangements, it is important to understand the main social actors in this narrative. Crucially, neither partner had significant experience in data governance. Sidewalk Labs LLC was launched by the co-founder of Alphabet, Eric Schmidt, in 2015 and promoted itself as an "urban innovation firm," yet it did not have a portfolio of previous projects to draw on. According to Canadian journalist Josh O'Kane (2022a), who documented the story of Sidewalk Toronto in a book *Sideways: The City Google Couldn't Buy,* Sidewalk Labs was one of several "moonshots" created by Schmidt. These companies, financed by Alphabet, were not meant to be successful or profitable in a foreseeable future; instead, they have been used by the company to explore new markets. The only project Sidewalk Labs had completed prior to Sidewalk Toronto was the controversial LinkNYC, a network of advertising-supported Wi-Fi kiosks erected by Mayor Bloomberg on the streets of

New York City. Publicly funded LinkNYC promised to provide free high-speed internet connection to underprivileged residents, yet the kiosks were concentrated in Manhattan. A major scandal erupted when local journalists found out that the kiosks copied data from the devices connected to them and covertly recorded video and audio footage of the streets (Kofman, 2018; Lampen, 2019).

A Canadian public corporation, Waterfront Toronto was created in 2001 by the federal, provincial, and municipal governments to help revitalize the city's industrial waterfront (Flynn & Valverde, 2019). While the corporation had a portfolio of successful developments in Toronto, none of them had to do with digital technology. Moreover, Waterfront Toronto had no policies for the governance of data and/or digital technologies and had no authority to set such policies (Carbone, 2018). Yet it was Waterfront Toronto that entered into the agreement with Sidewalk Labs (Figure 2.4). In the request for proposals, Waterfront Toronto expressed hopes that the developer of Quayside would act as a *policy* and funding partner for the project. Sidewalk Labs did exactly that: they proposed a data governance policy centered on the institution called the Urban Data Trust.

Figure 4.2. Prime Minister Justin Trudeau, Ontario Premier Kathleen Wynne, and City Mayor John Tory at the launch of Sidewalk Toronto, October 17, 2017. (Image credits: Patrick Morrell/CBC)

Here is how one of the interviewees described the role of Waterfront Toronto in the deal with Sidewalk Labs:

> Examine the Waterfront Toronto legislation and it will very explicitly say that Waterfront Toronto is NOT an agent of any level of government. Waterfront also indemnifies the three levels of government. No level of government was required to sign off on the Framework Agreement or the PDA. The only role three levels of government would have had was to offer regulatory approvals such as code compliance, public works compliance but even then, it appears in the MIDP that the proponent wanted their own "regulatory regime" as in forteen months, no formal applications were made to the City of Toronto with required supporting documentation. Very important to note is that Waterfront Toronto, while being a corporation has no shareholder. (Interviewee 10)

The first mention of the project's experimental data governance regime can be found in the Plan Development Agreement (2018: 47), which mentions "an independent data trust with representation by both data subjects and citizens more generally." The aim of the trust was to "carry a fiduciary responsibility to serve and balance data subject and public interest within a framework that treats privacy from both a public as well as a private good perspective." Further details about the data trust came several months later in Sidewalk Labs' Digital Governance Proposal (2018). In this document, the trust received its first name, Civic Data Trust, and was defined as an independent entity to manage and make publicly accessible all data that could reasonably be considered a public asset, and to devise a set of rules that would apply to all entities operating in Quayside, including Sidewalk Labs (Digital Governance Proposal, 2018, p. 10).

In legal practice, the trust is a "legal instrument that appoints a steward (trustee) to manage an asset for a purpose—such as conservation of land or maximizing value—on behalf of a beneficiary or beneficiaries who own the asset" (McDonald, 2018). Data trusts operate as the stewards that manage data or the rights to data (Wernick et al., 2020). An asset management tool, data trusts can serve various purposes: from seeing data as a share in profits (Capgemini France, 2019; Ruttan, 2019) to those aiming to protect data rights through the fiduciary law (Delacroix & Lawrence, 2018; Wylie & McDonald, 2018).

Despite the citizen-centric and public-interest rhetoric, the Urban Data Trust was a way for Sidewalk Labs to position itself as controlling both the data flows and the smart city infrastructure that produces them. The first step in the process of turning data into the company's assets was to introduce new legal definitions for data collected in the physical confines of Quayside. Sidewalk Labs proposed to use the term "urban data" for all anonymized data collected in the public and semi-private spaces in the smart city (Digital Governance Proposal, 2018, p. 14). According to the project documentation, urban data could be reasonably considered a public asset and enclosed within the framework of the data trust to be shared and reused under different legal arrangements. Urban data should not be confused with "conventional data," which was Sidewalk Labs' name for all personally identifiable information that should not be entrusted to a data steward (Digital Governance Proposal, 2018, p. 10).

In the 2019 Master Innovation and Development Plan (MIDP), Sidewalk Labs renamed the Civic Data Trust as the Urban Data Trust and detailed its functions as a quasi-legal

instrument that legitimized private data governance in the smart city. The document explained that the Urban Data Trust would act as a guardian for data that should be exempted from Canada's privacy legislation, that is all data collected on the premises of the smart city. The MIDP was also a response to critics who noted that Canadian law did not see the public as a beneficiary of a legal trust (Tusikov, 2019; Valverde, 2019): the company explained that the Urban Data Trust was not meant to be a trust in any legal sense.

The Urban Data Trust would entrench Alphabet/Sidewalk Labs' position as data collectors and data controllers/ by creating an exemption within an exemption: while all data collected in the smart city would be managed by the trust, personal and personally identifiable data was protected as the data collectors' private assets. Personally identifiable data was renamed "transactional data" and defined as the information collected by "applications and web services with the subject's consent" (MIDP, 2019, pp. 385, 445). In this iteration of the company's proposal, personal and personally identifiable data would be managed by the trust but protected as the intellectual property of the data collectors. The company insisted that the datasets compiled by their proprietary algorithms automatically become the company's ownership and can only be licensed out. The concept of urban data in the Master Innovation and Development Plan (MIDP, 2019, p. 377) was updated to include some information collected in private spaces: urban data was defined as information "gathered in the city's physical environment, including the public realm, publicly accessible spaces, and even some private buildings." Urban data was classified into four categories: personal information, deidentified data, aggregate data, and non-personal data. All these types of data would be managed by the trust and placed in the public domain (MIDP, 2019, p. 417). Only personal information is protected by PIPEDA.

A second step toward turning data into an asset in the smart city was the modification of the urban environment around real-time data collection. In this respect, Sidewalk Toronto would resemble the highly criticized South Korean smart city project Songdo, where every surface was equipped to collect video and audio footage and other types of data (Halpern et al., 2013; Greenfield, 2013). Sidewalk Labs planned to act as a developer of all data-driven infrastructure in the project and also set its own building and zoning requirements (Goodman & Powles, 2019, p. 45). Sensors embedded in the city infrastructure would ensure unlimited and uninterrupted data collection across Quayside. A third step was to create the "biggest urban data repository that ever existed": the Urban Data Trust would store the data on its servers, prepare it for potential

buyers, and share it via customized APIs. Coupled with the data trust, the internet-enabled city infrastructure would support uninterrupted flow of data 24/7. As showcased in Sidewalk Labs' project "Old Toronto," the company has instruments to merge real-time and historical data in the most creative ways (Curiosity, 2020)[13].

Certification was the fourth step in the process of data assetization. Certified by the trust, businesses would be authorized to access the data collected by Sidewalk Labs, install their own sensors, or rent them from the company. To make the process even more convenient for data collectors, the trust would allow for self-certification. A company would be allowed to self-certify if it requested data for limited purposes or if the risks of privacy breach were low. Any company that wished to collect data in the smart city would be required to get approval from the Urban Data Trust. This would be done through a self-assessment form, devised by Sidewalk Labs:

> Sidewalk Labs proposes that entities, both public and private, seeking to collect or use urban data complete an RDU Assessment—an in-depth review outlining the purpose of the digital proposal, the type of urban data it aims to collect, its potential impact on the community, and its risks and benefits. This step would also apply to entities proposing to use urban data collected by an existing device for a new purpose. RDU Assessments would be conducted during the design phase, prior to urban data collection or use. (MIDP, Vol 2, Ch. 5, p. 429)

The final step in the process of data assetization would be to protect access to data using contractual law. The Master Innovation and Development Plan explains: "The Urban Data Trust entity would enter into contracts with all entities, institutions, and organizations that are approved to collect or use urban data in the IDEA District. The contracts ("urban data agreements") could be similar to data sharing agreements or data license agreements and include parameters that govern the collection, disclosure, storage, security, analysis, use, and destruction of urban data" (MIDP, 2019, Vol. 2, Ch.5, p. 421). The trust would review and approve an application and profits from the sale of the data would be shared between the company, the city, and the trust (Digital Governance Proposal, 2018, p. 25).

[13] The Old Toronto project was an interactive map, where one could see some historical photos of the city's streets and buildings. The project was meant to show the connection between the future and the past in the city, and how Sidewalk Labs' products can help citizens meaningfully engage with Toronto.

For the Urban Data Trust, designed with the dual goal of regulating data collection and generating value from it, there was a delicate balance to strike: to protect citizens' privacy, it aimed to keep data collection to a minimum and provide citizens with the ability to opt out; to ensure the data attracted economic profits, the trust needed a sizable data repository and real-time data collection. Through the five-step process of turning data into data assets, the trust would achieve three goals: unlimited and uninterrupted data collection on the smart city premises, control over the data-gathering devices, and regulation of the data collection and reuse through legal instruments (i.e., intellectual property, licensing, and contractual agreements). What was not articulated in Sidewalk Labs' documents was that enclosure of the data collected in Quayside in the data trust framework meant limiting individual residents' rights to the data collected about them, and it effectively eliminated ways to opt out of the data collection.

Bianca Wylie pointed out that Sidewalk Labs' discussion of the data trust had sidelined the question of whether citizens should be tracked in public spaces in the first place (Rattan, 2018). Indeed, as smart city researchers observe, obtaining consent to digital surveillance in the public spaces is a tricky question with smart cities (Edwards, 2016). In 2019, Sidewalk Labs sought to solve this issue by introducing its "consent through signage" principle (Lu, 2019). The signage system would inform citizens about the type of data collected in a particular public space and help them make an informed decision about whether to stay under the gaze of the cameras or retract consent by leaving the premises. Natasha Tusikov (2020) notes that gaining consent through signage is an innovative approach to data collection in public spaces, yet it might introduce new forms of segregation: between the people who can afford/tolerate being recorded and those who will effectively lose access to certain parts of the city. Sean McDonald (2018, n.p.) emphasizes the fact that Sidewalk Labs was looking to create a precedent where certain types of data would be legally defined as the company's assets simply because the data had been collected in the smart city: "Proposing that Toronto should base ownership determinations on the urbanity of a data set is a departure from Canadian data ownership law and a precedent that, if approved, could extend far beyond this project."

It is important to note that Sidewalk Labs' vision of private ordering in data went much farther than even regular forms of private ordering through IP and licensing (Wernick et al., 2021, pp. 71-72), as the company wanted to control each and every instance of data collection,

processing, certification, and commercialization. It wanted regulatory, state-like powers in these processes:

> Those founding documents, in setting up a partnership, rather than engaging a vendor, this organizational arrangement was giving that sibling of Google an excessive responsibility, not just for developing technologies, but for also shaping the policies that we're going to cover, the technologies that they themselves were creating. Despite the altruistic framing, you know, sustainable and affordable, the ultimate motive of a for-profit company is profit. And that's not right or wrong. They have a fiduciary and legal duty to their shareholders, of course. So, the legal structure of the business mitigated against giving away control of data governance. And that was what we were concerned was happening as a function of these agreements. (Interviewee 6)

It is still not clear how serious Sidewalk Labs was about its data governance ideas. According to some of my interviewees, the 2018 data trust documentation was put together hastily by a recent law school graduate. They further note that several Sidewalk Labs employees pitched to Sidewalk Labs' CEO Dan Doctoroff more legally nuanced and technologically sophisticated ideas on how to ensure the data collected in the smart city was governed in a responsible manner, yet these pitches were never responded to. The many changes made to the data governance proposals over the course of several months suggest that the company was struggling with the concept of the data trust, partly because an independent institution in control of data could potentially limit the company's ability to set and control contractual terms for data access and reuse.

Detailing the public interest impacts of the data trust was arguably the weakest part of Sidewalk Labs' data governance proposals. In all iterations of the data trust idea, the public was portrayed as the primary beneficiary of the trust who would be fairly compensated for their data inputs. However, the company never specified how this compensation could be implemented: through direct payments or indirectly via taxes, new products, and services? Some commentators wondered whether all residents of Toronto or the province of Ontario should be compensated under the data trust reuse scheme (Ruttan, 2019). Other project critics raised doubts that the public interest could be defined in monetary terms (Leszczynski, 2020; Mattern, 2020). In all of its versions, Sidewalk Labs' data trust proposal raised concerns about digital surveillance and the

privatization of data and public services in the smart city (O'Shea, 2018; Sauter, 2018; Lorinc, 2020). Reviewing Sidewalk Labs project, Information and Privacy Commissioner of Ontario, Brian Beamish cautioned that new legal definitions of data and governance institutions proposed by Sidewalk Labs did not conform to Canadian law. He further proposed to update the existing legislation to respond to the issues raised by smart cities:

> The Provincial Government mush modernize our laws to ensure that privacy protective, transparent, accountable, and ethical data practices are at the forefront of all smart city projects. (Information and Privacy Commissioner of Ontario, 2019)

4.4. Urban Infrastructure as an Asset: Data-Driven Planning in Sidewalk Toronto

In the previous section, I examined Urban Data Trust, the key concept of Sidewalk Labs' data governance strategy. In this section, I analyze the notion of data-driven urban planning, another important aspect of Sidewalk Labs' proposal for smart city governance. Sidewalk Labs sought to use data-driven planning to futureproof the city against multiple economic, social, and environmental challenges; they claimed that, using data modelling, city spaces and buildings could be swiftly repurposed to accommodate the changing needs of the population. My argument here is that, through the creative merging of digital and urban policies, Sidewalk Labs aimed to turn the city's spaces, infrastructure, and services into sources of economic rents.

Data assets owe their existence to and remain deeply embedded in the digital infrastructure established by major technology companies (Prainsack, 2020; Birch & Bronson, 2022). Imbued with the logic of rent-seeking, private data governance means that data assets are being collected in specific ways, marketed, and used as leverage by businesses who seek to dominate markets (Birch et al., 2020, 2021). Mazzucato et al. (2021, p. 29) take this argument further and show that platform governance is essentially a behavioral problem: once the biggest players stop behaving in extractive and anticompetitive ways, other technology companies will have an opportunity to work with data responsibly. My research indicates that the smart city in Toronto reflects Alphabet's approach to data and city infrastructure, which was similar to other company's failed infrastructural projects, including Google Fiber in Kansas (Alizadeh et al., 2017) and Google's campus in Berlin (O'Sullivan, 2018). In these projects, Alphabet promised to deliver cutting-age innovations, namely high-speed internet and green urban technologies,

while requesting free access to the city's facilities, lax regulations, and tax breaks. In Toronto, reimagining the city through the lens of data assets led to contestation because the company's vision for data and city governance did not satisfy the residents and local government. Canadian journalist John Lorinc who wrote *Dream States*, a book on the policy implementations of smart city visions, notes that the public scrutiny helped Canadian civic leaders, technology experts, and citizens understand the risks posed by Sidewalk Toronto:

> In Toronto, public response to Sidewalk's plans was less explicitly reactive, in the sense that the backlash—from civil liberties activists, tech-sceptics and some city officials—coalesced well before the company was able to build anything. What's more, the public and media scrutiny of Sidewalk Labs' far-reaching proposal set in motion—at least temporarily—a discussion about the governance of smart city systems and the potential for function creep, as well as concerns about privacy and the monetization of data gathered from people moving through urban spaces. (Lorinc, 2022, p. 187)

Researchers who have studied the emergence of data assets in the areas of agriculture, health, and education (e.g., Komljenovic, 2020; Vezyridis & Timmons, 2021; Fraser, 2022) emphasize three major trends in this process: 1) data is turned into assets through the use of proprietary infrastructure that mediates data access and sharing; 2) data is protected through the instruments of legal ownership and control; and 3) even in public-interest projects, the pursuit of revenues often trumps all other objectives. Understanding the role of the material nature of digital data and the infrastructure that sustains its existence contributes to our understanding of the nature of data assets. Similar to how the monopoly positions of Alphabet and Amazon have been strengthened by these companies taking control of the digital and material infrastructure that produces, analyzes, and stores data (e.g., APIs and data storages), Alphabet sought to establish itself as the largest provider and gatekeeper of data and technology when it entered the market of smart cities.

Across the multiple documents, Sidewalk Labs envisioned itself as the sole developer of the smart city. There are conflicting reports on how the company's request was perceived by Waterfront Toronto and the local government. Canadian journalist Josh O'Kane (2022a) cited Waterfront Toronto's former vice president Kristina Verner when he wrote that the public corporation was aware of the company's plans and made it clear they were unrealistic. Two of

my interviewees, whose professional roles made them aware of the internal dynamics of the Sidewalk Toronto partnership, claimed that Sidewalk Labs received provisional approval to oversee the development from Waterfront Toronto. Other academic sources corroborate this empirical evidence (e.g., Goodman & Powles, 2019).

Facing public backlash over their plans for data (Muzaffar, 2018; O'Shea, 2018), the company devised more sophisticated means of control over the smart city, for instance, through embedding data-driven technology in the city planning. The planning tool, called "outcome-based code," first appears in Sidewalk Labs' bid for Quayside, where it promises to achieve the market value of property and land:

> This new system will reward good performance, while enabling buildings to adapt to market demand for mixed-use environments. It is Sidewalk's belief that outcome-based codes, coupled with sensor technology, can help to realize more sustainable, flexible, high-performing buildings at lower costs. (Vision, 2017, p. 120)

Designed to replace state zoning requirements and building codes (e.g., requirement not to build a chemical plant in a residential neighborhood in Toronto), Sidewalk Labs' data-driven code would allow the company to continuously redevelop the smart city. Specifically, the outcome-based code would allow the company to swiftly repurpose lands, buildings, and public spaces in response to changes in their market value. Simplified building requirements would blur the line between residential and non-residential spaces to ensure all city assets generated revenues for the company:

> For example, single-use zoning regulations that separate residential and non-residential uses were intended to protect the public from industrial hazards. But an "outcome-based building code" system with real-time sensors that monitor for nuisances, such as noise, could enable neighbourhoods to incorporate light production uses into residential buildings, creating more vibrant streets and greater economic opportunities while still ensuring safety. (MIDP, 2019, Vol 2, p. 21)

Retrofitting urban infrastructure with data-capturing devices was a necessary condition for the outcome-based code to work. The sensors would collect real-time data on how the city spaces and infrastructure were being used by the residents and would monitor environmental

data about the quality of air, water, light conditions, noise, and energy use. The company would employ this data to allow for placemaking experiments, like versatile marketplaces and removable canopies for the outdoor spaces.

Sidewalk Labs' data-driven tool was meant to achieve much more than deregulate city planning: it put the company that controls the data in the position of regulator. In a community created and run by data, the outcome-based code becomes a form of social ordering (Katzenbach & Ulbricht, 2019). In Sidewalk Labs' smart city, data would have been used to control the residents:

> As an alternative to traditional regulation, Sidewalk envisions a future in which cities use outcome-based code to govern the built environment. This represents a new set of simplified, highly responsive rules that focus more on monitoring outputs than broadly regulating inputs. With embedded sensing for real-time monitoring and automated regulation, this new code will reward positive behaviors and penalize negative ones, all while recognizing the value residents and visitors increasingly place on having a variety of uses within one neighbourhood. (Vision, 2017, p. 139)

Reflecting on the ramifications of the outcome-based code, digital media theorist Evgeniy Morozov argues that the long-term goal of Sidewalk Labs was to stifle all forms of grassroot activity in the city:

> Even neoliberal luminaries such as Friedrich Hayek and Wilhelm Röpke allowed for some non-market forms of social organisation in the urban domain. They saw planning – as opposed to market signals – as a practical necessity imposed by the physical limitations of urban spaces: there was no other cheap way of operating infrastructure, building streets, avoiding congestion. For Alphabet, these constraints are no more: ubiquitous and continuous data flows can finally replace government rules with market signals. (Morozov, 2017)

4.5. Collective Asset Governance: Balancing the Private, Public, and Collective Interests in the Smart City

In the mixed-use smart city Sidewalk Toronto, Sidewalk Labs was preparing to balance the interests of residents and businesses by asking companies to conduct self-assessments that would measure the impacts of their solutions on the quality of life in the smart city. Residents

were invited to provide feedback on the outcome-based code to Sidewalk Labs in the form of "user reports." What is evident in the proposal is that, in a data-driven, continuously redeveloped city, residents lose opportunities to build horizontal networks and organize around the issues of collective concern (Artyushina, 2023).

In this section, I conceptualize Sidewalk Labs' proposals for the governance of data and infrastructure in the smart city as private asset governance. Researchers have been studying data that exists in the form of a private asset (Srnicek, 2017; Birch et al., 2020, 2021; Prainsack, 2020; Sadowski, 2020a,b), public asset (Hoyer, 2019; Prainsack, 2019a,b; Starkbaum & Felt, 2019), and commons (Morozov & Bria, 2018; Frischmann et al., 2023; Artyushina, 2023). Commercial logics do not always permeate the governance of assets, yet these studies show that, in public-interest projects, assetization often leads to the commercialization of public goods and services. The key difference between these three forms of asset governance – as theorized in Chapter 2 – is the way they define personal data and who controls the rights to this data. First, private governance entails the treatment of data as a commercial asset and its enclosure within certain legal regimes. Second, public governance entails defining data as a public good, which gives government agencies the mandate to protect the public interest. Finally, collective governance (Artyushina, 2020, 2022; Morozov & Bria, 2018; Wu et al., 2021) entails governing data as knowledge commons (Frischmann et al., 2014; Sanfilippo et al., 2018)—a collective resource that can stimulate innovation. Of course, these are analytical categories. In practice, boundaries between these forms of asset governance are often muddied.

While the notion of public interest was largely eliminated from the proposal, Sidewalk Labs envisioned collective governance in the smart city assets. The company suggested establishment of five new bodies of collective governance (MIDP, 2019, Vol. 0): the Urban Data Trust (UDT), the Waterfront Housing Trust (WHT), the Open Space Alliance (OSA), the Waterfront Transportation Management Association (WTMA), and the Public Administrator (PA). I discussed the UDT in previous sections of this chapter, and in this section, I focus on the four remaining governance entities.

The company shared an ambitious housing affordability plan. In the plan, 2,500 housing units would be built in the smart city, with at least 40% of them sold or leased below the market price; 20% of the units would comprise affordable rentals, including 5% "deep affordable" (the average for a one-bedroom unit in Ontario is $1,202 per month according to Canada Mortgage

and Housing Corporation) (Donovan, 2018). The Waterfront Housing Trust (WHT) would oversee all real estate in Sidewalk Toronto, assemble funding from a variety of private and public sources, and direct it toward below-market housing in the smart city (MIDP, 2019, Vol. 2, p. 284). Mayor of Toronto John Tory praised the proposal as addressing the city's most pressing issue: access to affordable housing (Donovan, 2018, n.p.). Members of the public who attended Sidewalk Labs' presentation of the housing affordability plan were surprised: the prototype units were almost half the size of regular housing in Toronto. The company never specified the financial mechanisms that could help the WHT make the units cheaper, and never responded to criticism about their sizes. Critics of the smart city proposal, like city planner Jennifer Keesmaat, were skeptical of the planning side of the proposal and argued that the market approach to housing would not solve the problem of housing affordability in Toronto:

> Sidewalk's proposal describes a life story in which a couple moves into a unit, and as their equity grows and their family expands, they acquire the smaller unit next door and knock out the wall to create a bigger home. In theory, such units can grow and shrink as needed. But if these units follow the pattern of sub-divided houses in neighborhoods, that means adjacent units will, over time, become larger, expensive units that house fewer people per square foot. A unit mix presented as diverse at the outset will gradually transform into fewer, larger, even super-sized units. Density and affordability will suffer. (Keesmaat, 2019, n.p.)

The Open Spaces Alliance (OSA) was another trust-like body proposed by Sidewalk Labs, and it was designed to oversee public parks, streets, and recreation zones (MIDP, 2019, Vol. 2, p. 184). The company reconceptualized public spaces as "flexible outdoor spaces" that would be governed and co-financed by a range of sources through the mechanisms of the OSA (MIDP, 2019, Vol. 2, p. 123). Using the data collected by Sidewalk Labs, the OSA would help residents and developers identify "open space assets" and create new opportunities for recreation and commerce. The OSA would not retain full-time municipal workers to tend the public spaces in the smart city; instead, this work would be conducted by volunteers and contract workers with the use of interactive maps and algorithms (MIDP, 2019, Vol. 2, p. 186). Sidewalk Labs partnered with two Canadian nonprofit organizations to develop a prototype of the CommonSpace app, through which residents could report problems to the company and temporary workers would get instructions on how to fix them:

> This app could use image recognition to help identify plants as well as pest and disease issues, making it easier for people to keep the garden in a state of good repair without specialized landscaping knowledge. The OSA could agree to instruct their maintenance workers to use the app as part of a pilot. (MIDP, 2019, Vol. 2, p. 191)

Traffic management is another pervasive issue in Toronto. Not surprisingly, it was an important part of the partnership's plan to modernize the city (MIDP, 2019, Vol. 2, Ch. 1, 5). The Waterfront Transportation Management Association (WTMA) was the fourth governance entity proposed by Sidewalk Labs. It would coordinate the transportation systems in the smart city and employ data to encourage residents to use the roads and highways more efficiently:

> A new public entity tasked with coordinating the entire mobility network – can manage traffic congestion at the curb by using real-time space allocation and pricing to encourage people to choose alternative modes at busy times. (MIDP, 2019, Vol. 2, p. 367).

Local public officials met the company's proposal for a new transportation authority without much enthusiasm. For instance, city councilor Gord Perks pointed to the fact that the WTMA would not be accountable to the citizens: "Over my dead body. Accountability to the public is greatly harmed [. . .] This would further cement that distance between people that elect governments and the decisions that they make" (Spurr, 2019). Canadian journalist John Lorinc similarly pointed to the lack of public oversight over the proposed governance body:

> The proposed WTMA illustrates the point: within the Sidewalk development zones, this body would take over management of traffic, signals, curbsides, price-setting for rides and parking, mobility subscriptions, technology procurement, the operation of Sidewalk's "dynamic pavement" and flexible streets, and coordination with companies providing navigation apps. Financed by fees generated by these activities on a cost-recovery basis, the WTMA would report to the proposed public administrator, which, Sidewalk officials say, may or may not be Waterfront Toronto. Where the public connects to this formidable entity is anybody's guess. (Lorinc, 2019, n.p.)

The Public Administrator (PA) was a fifth governance entity proposed by Sidewalk Labs for its smart city, and it was expected to become a key intermediary between the company and state regulators. When announcing the deal with Waterfront Toronto, Alphabet chairman Eric Schmidt noted that Sidewalk Toronto would possibly need "substantial forbearances from existing laws and regulations" (Hook, 2017). Indeed, with the outcome-based code and other planning innovations in place, Sidewalk Labs would need to communicate regularly with the Canadian environmental authorities and other public bodies. The PA would help update Canada's legislation in response to the demands of the project (MIDP, 2019, Vol. 3, p. 70).

The idea of the PA faced criticism from Canadian experts. In an open letter to the Waterfront Toronto trustees, Information and Privacy Commissioner of Ontario Brian Beamish expressed concerns about the PA delivering public services that fall within the mandate of the municipal government while not being subject to the same access to information and privacy legislation (Information and Privacy Commissioner of Ontario, 2019). Similarly, urban planning scholar and advisor to Waterfront Toronto Pamela Robinson called for more government oversight in the smart city project to ensure commercial interests did not override the public interest (Robinson, 2019).

4.6. Affective Data Governance: Citizen Engagement in Sidewalk Toronto

As I have shown in the previous sections of this chapter, Sidewalk Labs' technological and urban policies were aimed at entrenching the company's position as an entity controlling the development, services, and regulations of the smart city. Through the outcome-based code and the trust-like governance institutions, Sidewalk Labs effectively disenfranchised the residents from any rights to the smart city, i.e., the right to participate in the municipal governance, the right to privacy, and the right to equitable city policies. Smart city researcher Shannon Mattern argues that Sidewalk Labs' extractive data practices were incompatible with traditional forms of participatory design in urban planning: "The old tools of participatory design, like the survey and the map, have little value where automated data extraction feeds directly into algorithmic urban engineering" (Mattern, 2020). Urban studies scholars Hesse and Carr (2020) argue that Sidewalk Toronto was an exercise in the "post-political governance," i.e., the privatization of state institutions and functions.

One aspect continuously brought up in all interviews was how mistaken both Sidewalk Labs and the Canadian government were in thinking that the question of data governance does not interest the public:

> Citizens care about this stuff more than the government gives them credit for. Like, I think the general view in the government is, you know, smart city data exchange protocols is not a sexy thing that gets people re-elected. But when you put it in the context of Sidewalk Labs, it was everyone cared, right? Like it was all the rage in it. (Interviewee 29)

In this section, I analyze the argumentation employed by the citizens who protested Sidewalk Toronto, the experts who advised Waterfront Toronto on this project, and the government officials who publicly expressed their criticism of the smart city or quietly worked to stop it from happening. The focus of my analysis is on the moral economy of asset governance (Ouma, 2020; Birch, 2023), as it was shaped during the Sidewalk Toronto controversy. I conceptualize the ways citizens and policymakers approached data governance in Sidewalk Toronto as a type of affective economy (Ahmed, 2004b). In this study, I understand affective data governance as collective engagements with data and algorithms that challenge the existing dynamics of data assets by creating new social and political groups.

As outlined in the Chapter 2, in business practices and policy discourses, digital data is seen as a means to objectively describe reality and exercise control over it (e.g., Kitchin, 2014; boyd & Crawford, 2016). These attitudes may become especially harmful in the governance of smart cities, where public officials often attempt to fix complex social and economic matters by deploying digital tracking technologies or privatizing public services (Green, 2019; Mattern, 2015, 2021). In Chapter II, I provided a detailed discussion of the many failed or purely tokenistic attempts at citizen engagement in the past and existing smart city initiatives; and the citizens themselves seem to be unwilling to take part in these consultations. Yet this is not what I have seen in my own study. In both cases, city residents had opinions about the digital technologies being developed in their cities, actively participated in the public consultations, and even self-organized against the initiatives they did not approve of . While the citizens in the Sidewalk Toronto case organized to educate themselves on the technological matters that the company wanted to hide from them, Barcelonians organized to continue the work of Francesca

Bria after she had left the municipality. In both cases, the interviewees perceived data governance through the ethical lens, often investing personally in the smart city project or the fight against it. This is how one of the interviewees described their journey from a curious bystander to an activist protesting Sidewalk Toronto:

> In planning in general, even before we talk about smart cities, like, like this idea of being objective in urban planning is a huge, is a huge issue. When Sidewalk Labs came around, they said, you know, I remember, Rohit Aggarwala said: "We've learned from the past." Rohit was the head of urban policies at Sidewalk or whatever. And that was good to hear. But, I mean, to cut to the chase, as time went on, I became more and more skeptical because I saw that, you know, they weren't actually living up to the promises that they were making. They weren't being as public as they were being. And I started attending events. Waterfront Toronto, they had Digital Strategy Advisory Panel. So, I started attending some of those events, I started writing about it, I joined a group, first called the Toronto Open Smart Cities forum, out of Ryerson. Then I joined #BlockSidewalk. (Interviewee 5)

In an interview, another study participant reflected on why it was important to organize against harmful smart city technologies and the companies that produce them:

> If people want to fight, you know, the fight against, like, you know, Microsoft and IBM, good. That's, that's a worthy kind of cause, because we do need to reform tech procurement. And that's like, really, really important. And it does have serious consequences. So, smart cities do have a lot of negative kind of connotations, because they do exacerbate, you know, social, economic kind of inequities in society. You can even make the case of smart cities, you know, you know, are being damaging to kind of a social justice, as well. (Interviewee 7)

Unlike Sidewalk Labs, whose digital proposal envisioned data as a quick fix to the biggest social issues faced by cities[14] and a way to generate revenues, interviewees often spoke of data governance in terms of excitement, utility, morality, and power. Is this technology fun to tackle? Does it make my life easier? Is this ethical to share this data with insurance companies or advertisers? Who is in charge in my city? These were the questions that the study participants

[14] E.g., congestion and traffic, see Vision, 2017 and MIDP, 2019

asked themselves when thinking of smart cities during our interviews. The questions of what types of data have been collected about them and which city services get digitalized were emotionally deep and value-driven for residents. Interviewees' views of Sidewalk Toronto appeared to be closely related to particular visions of their own future and a perceived lack of good scenarios for this future (Prainsack, 2023). This notion of a specifically moral economy led to contestation and active attempts to de-assetize the smart city (Austen, 2020; Bourgeron & Geiger, 2022).

For the municipalities, the ascendance of smart cities reflects a broader shift from government-controlled planning to multistakeholder governance of urban infrastructure, which involves a mix of public, private, and civic actors (Barns et al., 2017; Valverde & Flynn, 2020). Unlike other forms of development that require public consultations and are bound by state regulations, smart city projects are often run by public-private partnerships and are subject to legal exemptions (Voorwinden, 2021; Datta, 2015). City residents are often excluded from the planning and development of smart cities, and even when public consultations are being conducted, the people who participate in them may not be the ones whose everyday lives and livelihoods will be affected the most (Vanolo, 2016; Datta, 2018). Cardullo and Kitchin (2019) employed Arnstein's concept of the ladder of citizen participation to analyze participatory aspects of smart city initiatives implemented in the European Union. They argue that most of these projects manifest the technocratic or tokenistic approaches to the public engagement in smart cities. Similarly, Hollands (2008, 2015) argues that smart city projects often seek to substitute municipal governance for private governance while simultaneously eroding traditional forms of policymaking.

Mattern (2014) and Gabrys (2016) highlight important structural transformations in practices of citizenship, as city residents are being perceived as "human sensors" whose primary function is to feed digital systems with their information to keep smart cities running. Scholars and practicing urbanists have been promoting the concept of the "smart citizen" as a way to humanize the technocratic visions of the city offered by technology companies (Hill, 2013; Calzada, 2018). This approach invites citizens to create their own technologies or use existing ones to improve their living environments, including through fablabs and living labs (Townsend, 2013; Zandbergen & Uitermark, 2020).

Adjacent to this one is the discourse of public empowerment in the smart city that centers on residents' "digital rights" (Cardullo et al., 2019; Kitchin, 2021, 2022). The notion of "digital" or "informational rights" has been informed by the concept of the "right to the city" coined by Henry Lefebvre, which is widely regarded as analytical framework in urban planning (Shaw & Graham, 2017). Lefebvre (Butler, 2012) saw the city as a space being co-created by planners and residents, where the interests of those living in the city take precedence over the interests of capital or government. Digital rights activists (e.g., Cities Coalition for Digital Rights) urge citizens and municipal governments to politicize smart cities and make them the focus of democratic deliberations (Morozov & Bria, 2018; Kitchin, 2021, 2022; Calzada, 2018). Some researchers argue that the human-rights-based approach (HRBA) to the governance of smart cities could help alleviate issues brought about by public-private partnerships in smart cities and ensure that citizens' rights are respected (Kemper Reuter, 2019; Wernick & Artyushina, 2023).

My empirical study of Sidewalk Toronto falls within the recent stream of studies of "actually existing smart cities" (Shelton et al., 2015; Calzada, 2018, 2020). As the public interest was being sidelined in Sidewalk Labs' proposal, the company's vision was being challenged by activists, privacy and planning experts, and, eventually, the government officials who were tasked with the mission of assessing and helping to implement the project. It is through the lens of their own affective relations with data that study participants formed their opinion of Sidewalk Toronto:

> I would say many existing smart cities are "accidental" smart cities. We wanted to change that, and the projects we worked on were exciting, even whimsical. When Mississauga got its own public network, we realized we could use this data to improve the emergency services, to run experimental AI projects, to make intersections safer and more accessible. (Interviewee 3, 2020)

The questions of data governance have been admittedly obscure to those of the interviewees whose occupations are not in the area of technology, and the critical attitudes toward Sidewalk Labs' proposal often had to do with the disturbed sense of comfort of living in Toronto:

> No, I can't say I know the MIDP well. Um, data was always a major concern. But it's not my area, I usually defer to other people

> who have this, this relevant expertise. Reading it made me feel deeply uncomfortable. Do we want to live in a surveillant city? (Interviewee 11, 2020)

Other research participants were concerned that many trusted experts who could provide their opinions on the data governance aspects of Sidewalk Labs' smart city were engaged by the company as paid consultants or employees:

> There was this boosterism and a number of Toronto urban types, you know, planners and civic leaders, supported it. There were things like, you know, like a supportive letter that a bunch of people signed. I was like, okay, this is weird. Some of these people actually worked for Sidewalk Labs, and others were sort of consultants. There was a feeling this was all very murky. There was this, this kind of sensibility from these Torontonians, who were the boosters, that seemed like it was coming from Sidewalk's communications playbook. (Interviewee 1)

Sidewalk Labs had volunteered to host citizen engagement events on behalf of the Sidewalk Toronto partnership (Murakami Wood, 2020; Chantry, 2022). The first public roundtable was held in March 2018; admission was limited, as the company stopped giving out electronic tickets three hours after the announcement. The second roundtable took place in May 2018 and its organization was surprisingly negligent. Sidewalk Labs unexpectedly changed the venue several hours before the event. At the roundtable, a Sidewalk Labs employee who represented the software division informed the audience that he had been hired a few days before and had yet to familiarize himself with the project. Sidewalk Labs' events were roundtables in name only: for the first half of the meeting (30 minutes) the seated audience listened to company employees speaking from the stage; the second half comprised break-out groups moderated by Sidewalk Labs staff or hired facilitators, where visitors were asked to "dream about an ideal city" and write down their ideas on the provided worksheets. Sidewalk Labs' programming left little room for the audience to ask questions or otherwise engage with the company staff. Adding to the strange ambience of these events was the behavior of administrative workers. At the second roundtable, a person who worked at the registration desk anxiously explained to me that Sidewalk Labs was not collecting my personal data and that the event was not recorded. I had not asked any of these questions, but apparently somebody else had. More than once I observed the

facilitators quickly distanced themselves from the project by explaining they were working for a local company and that Sidewalk Labs had simply subcontracted them for a single event. Toward the end of 2018, the audience at the roundtables was so scarce that the company had to use its own employees to fill in the room. It was easy to spot Sidewalk Labs' staff in the audience, because sometimes they would forget to take off their badges; on one occasion, I was seated next to two Sidewalk Labs' employees who joked about having to pose as citizens at the public engagement events. Apparently, this was done to prevent visitors and journalists from taking pictures of the empty chairs (Figure 4.3.).

As far as I could tell, the people who participated in the public roundtables were mostly in the 30–50 age group and were well educated: lawyers, technology professionals, academics, businessmen. Some of them resided in Toronto, while others traveled from other cities in Ontario, drawn by curiosity. About a quarter of the room seemed to be occupied by elderly Torontonians.

Figure 4.3. Sidewalk Labs' second roundtable, May 2018. (Image source: author)[15]

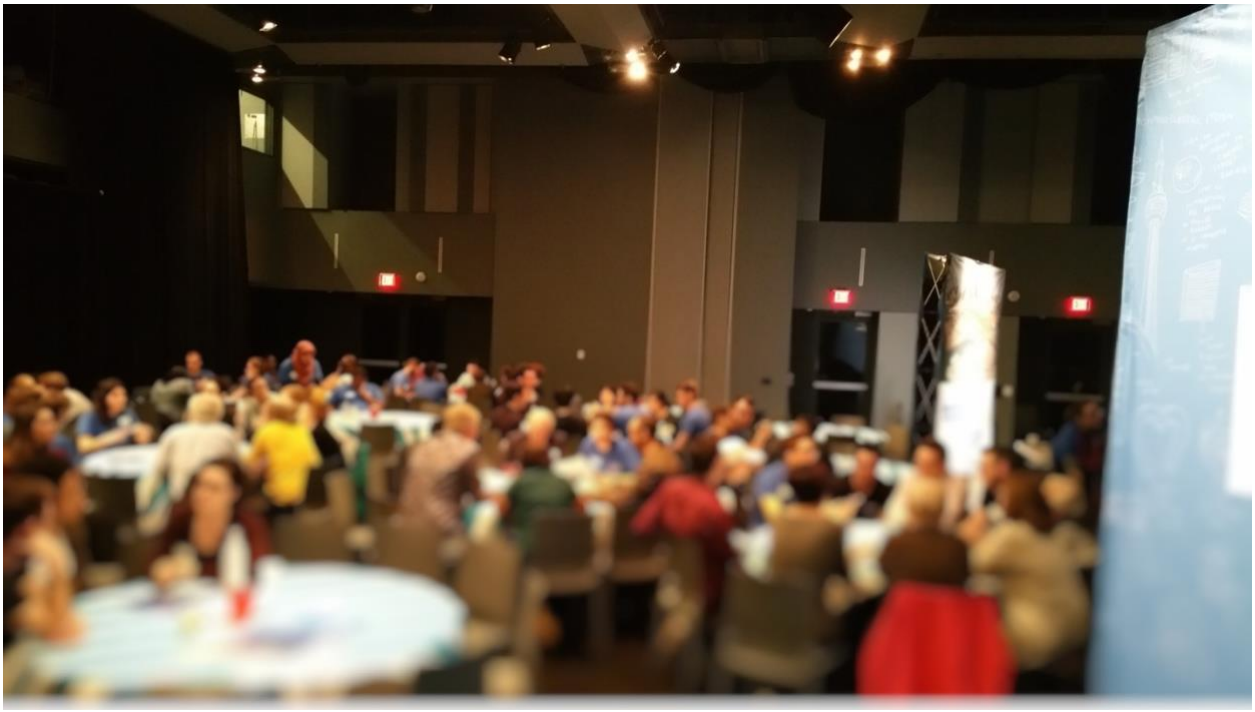

Figure 4.4. Sidewalk Labs' second roundtable, May 2018. (Image source: author)

[15] The photos have been blurred to protect the privacy of individuals, who attended Sidewalk Labs' public engagement events.

Figure 4.5. Sidewalk Labs' first roundtable. (Image source: author)

Visibly present at the roundtables were the activists gathered around Bianca Wylie and Toronto city councilors Joe Cressy and Paula Fletcher. While the activists were skeptical about the project from its inception, the views of the councilors may have shifted over the course of the project. The Sidewalk Toronto leadership personally invited the councilors to attend their public engagement events, hoping they would embrace the project. Yet as the public controversy over Sidewalk Toronto unfolded, both Cressy and Fletcher started asking the questions that worried their constituents, questions about the company's plans for data. For example, at the second roundtable that Sidewalk Labs held in May 2018, Mr. Cressy was introduced by the event host as a "special guest." Mr. Cressy raised from his seat in the audience and said that he was pleased to receive an invitation to this event and saw the smart city initiative as an exciting project. Mr. Cressy's secretary attended the third roundtable as his representative, as was pointed out by event facilitators, who draw the audience's attention to the councilor's interest in the project. In December 2018, Mr. Cressy was appointed by the mayor of Toronto as a board member of Waterfront Toronto. Days after this appointment, he published an op-ed in the Spacing Magazine that explained his stance toward the smart city project:

> Has the project been controversial? You bet. Some of what Sidewalk Labs has shown so far is the first of its kind and scale in Toronto and Canada. A new approach of combining urban planning with more detailed data raises issues of privacy in the context of neighbourhood development that we in Toronto have not ever had a public conversation about before. Let's have and lead that conversation. I vow to see that the public's interests are thoroughly protected as we review all aspects of the proposal for Quayside. Jane Jacobs used to say that communities have a right to say `no' to things that are going to harm them, but a responsibility to say `yes' to things that will help. That's how I'll approach the Sidewalk Labs debate. (Cressy, 2018)

Mr. Cressy left politics in 2019 due to personal reasons, but his legacy lives on. While still a member of the Toronto City Council, he pressed for public consultations on the smart city governance; under his guidance, the city staff began working on the Digital Infrastructure Plan (DIP), the guidelines for public officials willing to partner with technology vendors (Reddekopp, 2019).

City councilor Paula Fletcher expressed her concerns about the project already in February 2018. As documented by the media reports from one of the City Hall meetings, she said:

> I am worried about their sales pitch, which is: 'We're the future, things are so wonderful,'" said Councillor Paula Fletcher. "This is our waterfront, and we have some pretty clear plans and requirements for it. … They're acting a bit like they are the government and that their plans will be the final decision. That's what has people worried. (Anonen, 2018)

Ms. Fletcher also attended Sidewalk Labs' roundtables but abstained from endorsing the project. Ms. Fletcher, however, was very active at the citizen-organized #BlockSidewalk's meetings. For instance, in February 2020, Ms. Fletcher was one of the key figures at the #BlockSidewalk's town hall, where she said her constituents saw the project as harmful to the city.

As documented in my fieldwork notes, the first and second roundtables were met with great enthusiasm, as many attendees were excited about Alphabet starting an ambitious project in Toronto. Several of my interviewees would recall these first months of the project and how

excited they were about “Google putting Toronto on the map” as an economic hub and a tourist attraction. Gradually, interest in the project faded and many individuals whom I continued to see at Sidewalk Toronto events expressed frustration with the smart city project. By the end of 2018, the leadership of Sidewalk Labs had stopped participating in the roundtables and the atmosphere became charged, with audience members raising their voices at the presenters and accusing them of lying and obfuscating. Sidewalk Labs continued with various citizen engagement activities until the project’s cancelation in 2020, namely the invitation-only citizen panels, youth camps, and internships; notably, most of these initiatives targeted individuals under 25 years of age (Haggart, 2020).

The Digital Strategy Advisory Panel (DSAP) was an expert group appointed in 2018 by Waterfront Toronto to help assess the technological aspects of Sidewalk Toronto. The panel comprised 15 high-profile Canadian experts in privacy, cybersecurity, urban planning, and intellectual property. At the beginning of each event, several members of the panel would acknowledge a conflict of interest, as they worked as paid consultants to Sidewalk Labs. Despite this favorable makeup, the panel found itself in opposition to the smart city project. During the public meetings of the DSAP, panelists questioned the company’s proposals for data governance and demanded access to the intellectual property and procurement agreements between Sidewalk Labs and Waterfront Toronto. The panelists regularly voiced concerns about the company sole-sourcing the project and designing the smart city to be reliant on Alphabet’s technologies.

In 2018, two members of the panel stepped down in protest at the lack of cooperation on the part of Sidewalk Labs and Waterfront Toronto. The interviewees explained to me that the resignations happened after Sidewalk Labs canceled the presentation of technology prototypes to the panel and secretly sought to draft data licensing agreements for the smart city. I have confirmed this information using the information in the public domain; for instance, a former DSAP member, Saadia Muzaffar (2018), mentioned the IP and licensing deals Sidewalk Labs was forging around the smart city in her resignation letter. Here is how one of the DSAP members explained their dissatisfaction with the work of the panel:

> I joined that [panel] because I wanted to talk about the data question. And I feel like we talked about every question, except THE QUESTION. And I got, you know, two thirds of the way through, I just kind of got disillusioned because it became clear that we weren't going to talk about data. We weren't going to talk about data

> architectures and value capture and like IP and things that actually were going on. Instead, we're going to talk about garbage robots and tunnels. It was funny watching them pare back what they wanted to control versus what they were prepared to license, or like hardware people in. It was a software defined network. And it was the qual amount. So other than the layer on which data, data is standardized, and the interface of how data comes in and out of the network, they were prepared to give up everything else. That should tell us everything we need to know. (Interviewee 25)

There are reasons to assume that Waterfront Toronto was not happy with the work of the DSAP. The first two meetings I attended, in the fall of 2018, were barely advertised and the administrative staff were visibly surprised that members of the public were present. The meetings were usually held in a boardroom of the Waterfront Toronto offices on Front Street in Toronto, and the public was warned that Waterfront Toronto was recording the meetings for internal purposes. In 2019, Waterfront Toronto announced they wanted to add several new members to the DSAP and closed the meetings to the public. As my interviewees informed me, Waterfront Toronto also demanded that all members of the DSAP sign nondisclosure agreements.

At each meeting, a Waterfront Toronto employee collected the panelists' comments for Sidewalk Labs. The company never responded to them. Despite all efforts on the part of the Sidewalk Toronto partnership to keep the work of the DSAP private, it was often featured in the press. Additionally, over the course of the project, the panel issued several reports providing insightful analyses of the company's controversial proposals (DSAP, 2019; Bickis, 2019).

As Sidewalk Toronto was increasingly being planned behind closed doors, public distrust in the project grew. Some activists and journalists felt that a public-good project was being given away by Waterfront Toronto (Wylie, 2018; Lorinc, 2019). Eventually, individuals from different professional backgrounds began discussing the smart city initiative in terms of the lost national interests (Balsillie, 2018; Rattan, 2018; Zarum, 2020). In 2019, several activists formed a citizen group called #BlockSidewalk that aimed to stop the project (Vincent, 2019). Existing both online and in the form of regular in-person meetings, #BlockSidewalk quickly became a hub for anyone who wanted to get updates about the developments in Sidewalk Toronto. When Sidewalk Labs released its 1,500-page Master Innovation and Development Plan, #BlockSidewalk held workshops to help city residents understand the planning and technical aspects of the proposal.

My research on the #BlockSidewalk group relied on observation at the group's meetings, analysis of the publicly available data, and interviews. As documented in my fieldwork notes and interview data, the founding member of the #BlockSidewalk group, open government advocate Bianca Wylie built relationships with researchers, local civic groups, and the Cities Coalition for Digital Rights. The concept of digital sovereignty, promoted by the Cities Coalition for Digital Rights, significantly informed the group's political stance and actions, with the citizens fighting for data localization and stronger public involvement in the project. The everyday activities of the group were run by Toronto activists Thorben Wieditz and JJ Fueser, whose experience in organizing helped unite several other grassroots movements around #BlockSidewalk. Namely, #BlockSidewalk received public support from several Canadian advocacy groups, including ACORN, JobsforAll, and the Friends of Canadian Broadcasting. The growing recognition of Sidewalk Toronto as a national threat brought to the group some support from local and federal politicians. Canadian politicians Joe Cressy, Charlie Angus, and Paula Fletcher publicly supported the #BlockSidewalk campaign against Sidewalk Labs. Furthermore, Angus brought the group's questions to an April 2019 hearing of the Ethics Committee of the House of Parliament of Canada, at which Dan Doctoroff testified. Toronto city councilor Gord Perks, who also attended some of the events organized by #BlockSidewalk, publicly raised issues with the governance of the smart city project.

The ambience of the #BlockSidewalk events could not be more different from that of Sidewalk Labs' roundtables. Energetic and passionate people addressed the audience as they spoke about Toronto and, by extension, Toronto's smart city as an equitable place. Sidewalk Labs' plans for data were at the center of all discussions: what kind of digital surveillance are we talking about? What kind of data does Alphabet plan to collect in Sidewalk Toronto? Many discussants wondered if Sidewalk Toronto was a "development play," an attempt by an American corporation to purchase public lands at a low price. The audience at the #BlockSidewalk meetings largely intersected with the audience at Sidewalk Labs' roundtables. Members of the group often volunteered to help other attendees get a better understanding of the project. For instance, the lawyers and planning experts helped with presentations at the meeting aimed at addressing the questions that Sidewalk Labs did not want to respond to.

Both at these meetings and in the interviews, members of the group expressed their passion about the governance of data and smart cities. This often related to questions of ethics

and morality. For example, a study participant who attended the #BlockSidewalk meetings, once described Alphabet's data governance practices as being as morally dubious as "organ trafficking":

> You know, we wanted to keep an open mind to the idea that there is a potential to leverage technology to really make better living spaces for humans. But, you know, this comes with a healthy degree of skepticism and concerns about things like technological solutionism, and about the tendency of political leaders to get dazzled by all things new and shiny that come with the word innovation attached. And some of Google's actions, they are crime in all but name, like, like organ trafficking. From the outset of the project, as I said, we had concerns. And, from a legal point of view, some of those concerns were grounded in, actually, the founding documents of the agreement. (Interview 2)

In the interviews, Sidewalk Toronto was often described in terms of the power struggle: "Waterfront Toronto got subsumed by Sidewalk Labs"; "the government needs to put controls and make sure commercial interests do not override the public interest." Notably, few interviewees had clear visions of the future. For the activists, primary goal was to get the federal and provincial government to intervene and break up the Sidewalk Toronto partnership. In the interviews, however, Canadian public officials and businesspeople often shared a sense of inevitability that global technology companies will dominate our public spaces and services, and that it was just a question of who gets there first:

> You know, what happened with Facebook and Cambridge Analytica in the last election? We are…Twenty five years from now, when we wake up in a world where literally every piece of information, like literally every piece of infrastructure will generate information. And literally every piece of information from the city will be owned by a private interest? I don't know exactly what the repercussions of that are, but I don't think they're good. (Interviewee 12)

Some public officials, however, offered a vision for how to make the data economy useful without compromising citizens' privacy. In utilitarian terms, these interviews envision the Canadian government becoming a steward for citizens' data. For example, here is how one of the study participants explained it:

> From the municipal perspective, you know, it's important for people to understand that data is being used all the time, for the public good. Cities are essentially data. In 2015, there was a project in Toronto called the Bloor Street Bike Lane project, it was adding bike lanes along a very busy corridor, through the middle of the city. Yeah, quite a controversial project. Toronto tends to polarize around sort of, you know, if you're a cyclist or a driver, so people were quite divided about it. The pilot helped inform the public opinion and make sure that people have good information, so they could make informed decisions about whether it was having a positive or negative impact. We partnered with a technology company [Name], their technology was used to track, you know, protests, pedestrian volumes, cyclists, traffic times, all of this sort of, you know, travel along the corridor. (Interviewee 15, 2021)

Consequently, there has been a major push behind the professionalization of data stewardship in Canada at the level of the federal government through the creation of chief data officer positions and unified data governance standards for public services. This is how a federal employee explained it:

> The other big thing in Canada happened three years ago, all our departments started naming Chief Data Officers. That's been a game changer, because we have always had Chief Information Officers, which sometimes were Chief Information Technology Officers, they really weren't the data, they were more about technology. But now we have those CDOs in there, and the CDOs have all gotten together and started to work together. There's a co-counsel and aligning of the standards. We have different parts of the government working together to solve data problems. Some of our departments will steward data for other departments in the future, so that we don't all have to do the same thing. (Interviewee 18, 2022)

There were also voices for establishing an independent data steward for personal data of Canadians, modelled on the public broadcaster BBC in the United Kingdom:

> Well, I think it creates the potential that these technologies become instruments of public good, again, to other institutions that that focus on public good, whether it's, you know, they are not pure market. The telcos were originally, you know, a public corporation, before they got privatized. Water treatment and wastewater treatment and streetlights are public goods, and libraries. So, you know, because data has so much public good characteristics, would it be ok

> to keep this business model of appropriating public and private goods for other person's private gain? What could change that is a keeper of the public good, kind of like the public broadcaster in the UK There was a time when they didn't have the BBC. (Interviewee 4)

4.7. Conclusion

The analysis presented in this chapter was based on documentary analysis, research interviews, and public materials from public engagement events organized by Sidewalk Labs, sessions of the Digital Strategy Advisory Panel that advised Waterfront Toronto on this project, and meetings of the citizen-led #BlockSidewalk group that protested the development.

The voluminous documentation released by Sidewalk Labs solely and jointly with its public partner Waterfront Toronto detailed various aspects of urban innovation (e.g., convertible timber wood buildings and flexible outdoor spaces), and, for the most part, ignored the technological aspects of the proposal (Goodman & Powles, 2019; Wood, 2020). The documentation I analyzed included: Sidewalk Labs' 2017 winning bid for Quayside, 2018, 2019 Sidewalk Toronto partnership agreements, and the 2019 Master Innovation and Development Plan.

I approached this data through the lens of assetization theory and explored the particular logic that manifested in the project that led to contestation over the public interest in the smart city. I conceptualized Sidewalk Labs' proposals for the governance of data in the smart city as forms of private asset governance. I showed that the company used the proposals for collective governance in data and smart city infrastructure to deflect the public attention from its extractive economic practices. Central to Sidewalk Labs' vision of the smart city was the concept of Urban Data Trust that would help turn personal data into data assets through connecting city infrastructure to the internet, storing data in the trust's servers, establishing the process of self-certification for data collectors, and by using contractual agreements to lease out data. Data itself, in this context, becomes as a matter of politics, with its legal, digital, and physical characteristics being shaped and challenged by the conflicting parties.

Finally, my analysis highlights another, under-explored aspect of data governance: the phenomenon of affective data governance. Contrary to the popular portrayal of data governance as a technical matter that requires citizens to be educated about, the governance of personal data in Sidewalk Toronto witnessed a great deal of public engagement. Not only did citizens show

interest in these matters, their vision of data governance as a subset of city administration that needs to be open to contestation provides a refreshing perspective on the governance of urban technologies. For both activists and citizens protesting the project, data governance was imbued with the affective, value-laden context: through personal involvement with smart city technologies, embodied discomfort, attitudes toward the power relations in the city, etc. As my research data shows, these visions of data governance, dismissed by Sidewalk Labs, had great relevance for the public officials who made the decisions about the fate of the project.

CHAPTER V. BARCELONA'S SMART CITY

5.1. Introduction

The City of Barcelona began using the smart city label in 2011. Like many other European cities, Barcelona applied for the European Union's Horizon smart cities grant[16]; across the world, municipalities pursued smart city branding to help attract private capital and foreign investment (Hollands, 2008, 2015; Vanolo, 2016). As a branding strategy, the "smart city" followed the city administration's policy visions of Barcelona as a "green," "self-sufficient," and "intelligent" city (March & Ribera-Fumaz, 2016). In these early years, the municipality entered into multiple public–private partnerships with developers and technology companies that helped rejuvenate the city, opening fablabs and innovation centers, and the massive gentrification brought on by these developments (Ferrer, 2017; March & Ribera-Fumaz, 2018).

This technocratic and gentrified vision of the city, chosen by the political leadership, was in contrast with the political and economic situation in the city, where the financial crisis and record-high unemployment had left many families unhoused and facing destitution. It was in this climate that the data governance expert Francesca Bria proposed her own vision of Barcelona's smart city: she framed digital personal data as a public good and proposed some practical steps toward achieving common governance in data and smart city assets. It was Bria who made Barcelona a symbol of the global smart city movement (Vincent, 2019).

In this chapter, I analyze the smart city initiative that was implemented in Barcelona between 2015 and 2019 and compare it with Sidewalk Labs' data governance proposals. Sidewalk Toronto was conceived as a corporate smart city with some elements of data commons, tightly integrated with Alphabet's other products and services. Barcelona's smart city vision was created by local municipal officials who envisioned a data-driven welfare state. Both these initiatives put forward new proposals for data commons, struggled to balance profitability against the public interest, and failed because of unexpected political pressure.

[16] Horizon Europe is the EU's funding programme for research and innovation, with the current budget of €95.5 billion. Since the early 2000s and to this day, the Horizon grants and its predecessors have been supporting the municipalities' smart city initiatives that aimed to tackle environmental issues and city governance. Please visit the Horizon programme's website for more information: https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/horizon-europe_en.

The chapter is structured in the following way. Section 5.1 provides a historical overview of Barcelona's smart city, including its origins, changing political objectives, and funding arrangements. Section 5.2 examines Francesca Bria's intellectual contributions to the development of Barcelona's smart city project and the global smart city discourse. Section 5.3 examines the practical implementations of Bria's ideas: DECODE, DECIDIM, and Sentilo. Section 5.4 juxtaposes the two smart city initiatives to explore various forms of asset governance that were trialed there. The conclusion summarizes my analysis of Barcelona's smart city project and provides some reflection on the comparative analysis of the two cases.

5.2. The Origin and Timeline of Barcelona's Smart City

Up until 2015, the City of Barcelona's track record as a smart city was fairly typical among the municipalities that employ creative branding strategies to attract investments and forge partnerships with technology companies (Kitchin, 2015; Datta, 2015; Green, 2019; Joo, 2023). As a promotion strategy, the "smart city" replaced the visions of Barcelona as a "green," "intelligent," and "self-sufficient" city (March & Rubera Fumaz, 2016). With the smart city, however, Barcelona decided to set a high bar and become a trendsetter for the global smart city movement:

> All the cities in the world want to be the protagonist of [the smart transformation], and Barcelona, the city where Cerdà invented and implemented modern urbanism, has the chance of converting this need for change into the economic engine for the creation of wealth and welfare for its citizens. The new smart cities across the world offer an unique opportunity to apply solutions in which Barcelona can be the laboratory and leader at the same time (Ajuntament de Barcelona, 2012, pp. 2-3).

In 2011, the municipality launched the world's biggest smart city conference, the Smart City Expo. Running annually since then, the Smart City Expo functions as a prestigious exhibition where vendors present their latest technologies and a marketplace for the businesses and public actors seeking to purchase data-driven solutions. The newly elected liberal mayor, Xavier Trias, made Barcelona's smart city ambitions central to his economic policies, as he initiated a complete overhaul of the city's departments and functions:

> After the celebrated Barcelona Olympic Model (Busquets, 2006; Marshall, 2004) and a decade of attempting to transform Barcelona into a knowledge city, [the] new mayor (selected in May 2011) decided to turn Barcelona into a world benchmark for the Smart City. According to its deputy mayor, Barcelona has to become the platform for innovation in the century of cities, to become a Smart City based on the principles of efficiency, quality of life and social equity. This has already implied the reshuffling of the whole planning and economic strategy of the city towards this goal. Indeed, the first step taken by Barcelona City Council (BCC) was to merge the planning and infrastructure, housing, environment and ICT departments into a single department called Urban Habitat. (March and Rubera Fumaz, 2016, p.818)

Underlying Trias's smart city vision was the intention to employ public–private partnerships to integrate data-driven technologies into the city's architecture, services, and planning. He and his team aimed to make Barcelona energy-efficient and environmentally friendly and create new white-collar jobs (Habitat Urbà, 2013). As indicated in the interviews, the idea to adopt the smart city branding also came as part of Barcelona's continuous attempts at European integration, often seen as a way toward political independence from Spain. The European Union's Horizon grants supported development and business opportunities in European cities that wished to pursue smart city initiatives:

> In 2011, the City Council of Barcelona launched a new IT strategy to encompass a global transformational plan aimed at introducing the use of new technologies in an innovative way in order to improve the overall operation and management of the city, fostering economic growth and strengthening citizens' welfare. This strategy was strongly aligned with the targets of the Horizon 2020, the European Union's strategy to improve its growth model for the next decade, and create a more sustainable, smart and inclusive path for development. (Ferrer, 2017)

During Trias's term (2011-2015), Barcelona entered multiple public–private partnerships to turn the underdeveloped industrial area of the Poblenou neighborhood into an innovation district called 22@Barcelona (also known as 22@ and Districte de la innovació) (Charnock & Ribera-Fumaz, 2011). Since 2014, 22@Barcelona has hosted the city's open data portal, fab lab

and persuaded IBM and Cisco to open their Spanish offices there. Interviewees describe this policy vision as technocratic and entrepreneurial:

> They created this vision of the city as, as, as being like the internet, the networks, infrastructure, and the network flows. There are flows of data between the environment and so on, but at the end of the day this is about promoting startups putting sensors and organizing interoperability. I mean, that was what they wanted to develop. (Interviewee 16, 2021)

Through multiple other public–private partnerships, Barcelona built an automated irrigation system for the city's green spaces, which promised to save the city $555,000 in irrigation costs (Laursen, 2014). The data-driven irrigation system is still in operation and contains 187 data-collecting points that provide real-time data about the humidity, air quality, and soil in the city.

Another project, the public smart city platform Sentilo was a joint venture between the city of Barcelona and nine other European cities, funded by the European Commission's grant (European Commission, 2014). The municipality gave permits to the technology companies to install data-collecting sensors across the city, under the condition that the data would be available through Sentilo. For instance, the company Worldsensing piloted a parking application, Fastprk, that ran on 100 parking sensors installed in the 22@ district. Once the trial was over, the municipality implemented its own smart sensors and launched the city-run parking application L'apparkB. Despite these technological developments, interviewees indicated that the mayor's smart city vision did not receive much public support. Gentrification and privatization of the public lands and property that accompanied these initiative made some Barcelonians questions whether the smart city was serving the public good:

> I mean, the first thing that said was: we need to build a city operative system. Cisco was the main partner back then, they created some smart city protocols that were implemented in other cities. They built it later, that's another story. But, again, from 2011 to 2015, it was a very orthodox smart city approach, take it or leave it. [That was] a smart city with a twist of citizens, empowered citizens, with a very liberal tokenist understanding of the citizen empowerment. It was completely a smart city, but they didn't want you to call it a smart city because they were seeing that it was not

> cool. I remember they, they, had this initiative that still existed, but it was dying. (Interviewee 23, 2021)

A study by Bacici et al. (2013) indicated that Barcelona's first attempt at developing a smart city engaged a popular concept of the "knowledge economy," an economic and planning strategy that prioritizes entrepreneurship and white-collar jobs as the main drivers of economy. Notably, the smart city initiatives centered around the concept of knowledge economy are not rare. For instance, Datta (2013) described similar trends in the Indian smart city initiatives, which she criticizes as "developmentalist" as they sometimes prioritize the interest of economic integration in the global economy over immediate needs of their own population.

Unfortunately, these attempts at economic rejuvenation of the city did not immediately bring economic prosperity to Barcelona's residents. Between the high volumes of tourists, fast-growing unemployment rates, and rapid gentrification, the citizens felt like their city was being taken away from them. Moreover, as a result of the 2008 global financial crisis, Spain experienced significant and ongoing economic problems between 2008 and 2014 (Wagner, 2014). A deep recession triggered record-high unemployment, and many Spanish households lost their homes as they were unable to pay their mortgages (Royo, 2020):

> By 2013, according to government figures, 12.6 million people were at risk of poverty or social exclusion. The unemployment rate peaked that same year at 27 per cent, with youth unemployment then at 57 per cent, while real wages were in the midst of a decline of 6.1 per cent between 2010 and 2014. But the politics of the crisis were ever more intensely focused on housing issues after 2009. While the banking system was rescued by the state, homeowners in Spain were put under extreme duress—a problem exacerbated by the idiosyncrasies of Spanish law. (Charnock & Ribera-Fumaz, p. 192)

Barcelona was hit particularly hard. In 2015, the year of mayoral elections, interviewees recalled that local families squatted in the offices of 22@Barcelona and empty business centers across the city. Nearly every day, citizens rallied in front of City Hall, protesting evictions and austerity measures. It was in this political-economic climate that an activist, Ada Colau (Kassam, 2015), won the mayoral elections, promising to solve Barcelona's housing crisis and build a smart city run by the citizens. And technology expert Francesca Bria was recruited to oversee Colau's ambitious smart city program. Analyzing the radical shift in Barcelona's smart city

policies, de Hoop et al. (2018) hail Colau's victory as a historical transformation, where market-oriented political leadership, with its vision of corporate smart cities, was replaced by the political leadership that originated in local social movements and grassroots democracy. Here is how one of the study participants describes it:

> There was a moment where in three, four, six, or seven places around town court officers and policemen were arresting somebody from the anti-eviction movement. They would sit in front of the door [of their house], not then allowing people to pass. Many people thought that because they lost their house, they were a failure. The citizens were pressing for a new law, anti-eviction law. That was a very strong movement, and the most visible person in that movement was Ada Colau. She was part of the left coalition when she participated in the mayor's election. She presented in 2015, with this left coalition, doing the same protests at @22 [business center]. And within this coalition, there were people with technological background, people coming from alternative tech movements and techno politics. (Interviewee 30)

5.3. Francesca Bria's Vision of Data as a Public Good

Francesca Bria arrived in Barcelona with a solid track record on citizen-centered data governance initiatives. In the 1990s, she was an activist in the European open-source movement and participated in the EU hacker community. An Italian national, Bria spent a significant part of her life in the United Kingdom, where she earned a master's degree in digital economy from Birkbeck, University of London, and a Ph.D. in Innovation and Entrepreneurship from Imperial College, London. While she was still a doctoral student, Bria was invited to join several expert panels that were advising the European Union on such matters as the digital economy, participatory democracy, and free access to knowledge. The panel included members from Brazil, specifically former Brazilian minister of culture Gilberto Gil, who experimented with open software licenses in Brazil and wanted to democratize access to knowledge. These Brazilian members made a big impression on Bria (Bria, 2023), and these Brazilian initiatives would have a long-lasting effect on Bria's vision of democracy and smart cities. In the widely cited report "Rethinking the Smart City", which Bria co-authored with Evgeny Morozov, Bria pointed to the leading role of land developers in smart city initiatives and analyzed the controversial Brazilian social investment bonds scheme:

> The Bank of Brazil issues bonds to be auctioned off to developers to regenerate part of the city. The bonds ("CEPACs," short for "certificates for additional construction potential") provide legal and fiscal incentives entitling developers to build additional density in the area, while revenues from bond sales are invested back into housing, roads and other infrastructure in the same redevelopment zone. Cities have been using these strategies to unlock land value for private investors, while capturing some of this value back. CEPACs were widely traded and became a solid investment vehicle for pension funds and real estate, resulting in a huge increase in land prices and gentrification which slowly expelled the local population from their neighbourhoods. (Morozov & Bria 2018, p. 13.)

After completing her doctoral studies, Bria joined the British innovation agency Nesta, where she spent eight years as a project lead. Bria's biggest project at Nesta was D-CENT, which stands for Decentralized Citizens Engagement Technologies. The initiative was piloted in several European cities (including Barcelona) from 2013 to 2016 and had been funded by the European Union. D-CENT comprised a set of technological solutions that allowed citizens to follow the work of their municipality, vote on the municipal budget, and even be reimbursed through blockchain technologies: "Since 2013, D-CENT has run large-scale pilots in Spain, Iceland and Finland to test and develop the tools in practice. These pilots have been involving thousands of citizens across Europe in municipal decision-making, policy and budgeting processes" (D-CENT Project, 2016). Bria realized that conventional, technocratic approach to data governance was deeply flawed, as citizens were eager to engage with the new technologies:

When activist Ada Colau, who represented the evicted Barcelonians, formed the party Barcelona en Comú (which translates into English as "Barcelona in Common"), she invited Francesca Bria to advise her on the digital aspects of her political platform. Bria was already familiar with the smart city initiatives run by the previous leadership of the city, and she was drawn to the citizen-centered, activist nature of Barcelona en Comú. Colau's message was straightforward: Barcelona is full of highly educated people, many of them with an IT background, and they are looking for jobs. It therefore made sense to develop a smart city that serves the citizens and is owned by them. In 2015, Colau won the mayoral elections and appointed Francesca Bria as the Chief Digital Technology and Innovation Officer of the City of Barcelona.

During her tenure in the municipality of Barcelona, Bria continued thinking about how to make technology vendors and developers provide a share of profits to the citizens. She devised a financial scheme where the companies that deploy smart city solutions in the streets of Barcelona were mandated to store the data they collected in public servers (sometimes referred to as a "data trust" by my interviewees) and pay for access to it. Bria posited that digital personal data, the most valuable asset in the contemporary economy, should belong to the citizens. She called this a "data sovereignty" policy (European Commission, 2020c). Connected to the concept of data sovereignty was Bria's vision of data as a public good (Bria, 2019). Bria compared personal data to the local water sources and believed that, just like with the water infrastructure, smart city technologies should be governed by the municipality, and profits should go directly to the municipal funds:

> Cities can become laboratories for democracy and sustainability. They can run smart, data-intensive, algorithmic public transportation, housing, health, and education – all based on a logic of solidarity, social cooperation, and collective rights. (Bria, 2018)

Here is how one of the interviewees described Bria's citizen-centered approach to smart cities:

> This was done in a very kind of post, post-worker manner, [indistinct words] rally, that kind of stuff, but municipality had the strategy, had the controls. They talked about technological humanism. Yes, technological humanism means making the smart city more citizens friendly. I mean, it is introducing…. In a nutshell, technological humanism or whether you refer to different managers means that you can keep the business models of big tech, but have a little bit of ethics. (Interviewee 34)

Colau and Bria initiated a large-scale transformation of the city's operations centered on reconfiguring data as a public good. The project which was later called DECODE (standing for the Decentralized Citizen-Owned Digital Ecosystems) began with a technological platform for open governance. Central to Bria's vision of the smart city was a technological platform called DECIDIM (translates as "we decide"), a fully developed version of D-CENT. In 2018, Bria explained her smart city vision to *Wired* magazine:

> "We are reversing the smart city paradigm. Instead of starting from technology and extracting all the data we can before thinking about how to use it, we started aligning the tech agenda with the agenda of the city." (Graham, 2018, n.p.)

DECIDIM (n.d.) was created as an open government platform for the residents of Barcelona; it employed an interface that resembled social media to get citizens engaged in municipal matters. All matters of concern were put to a vote in the system, which also acted as a platform for the citizens to chat and connect with one another and the municipal workers (Figure 5.1.). For instance, citizens would be consulted prior to the municipality entering a public–private partnership with any smart city vendor. Barcelonians had a say in the decisions regarding the types of data collected in public spaces. After that, when a decision regarding a particular smart city technology reached the stage of budget consultations, Barcelonians would be able to decide in real time whether the project benefitted the city or not. This transparency and real-time engagement, Bria posited, brought on a new era of transparency in participatory democracy.

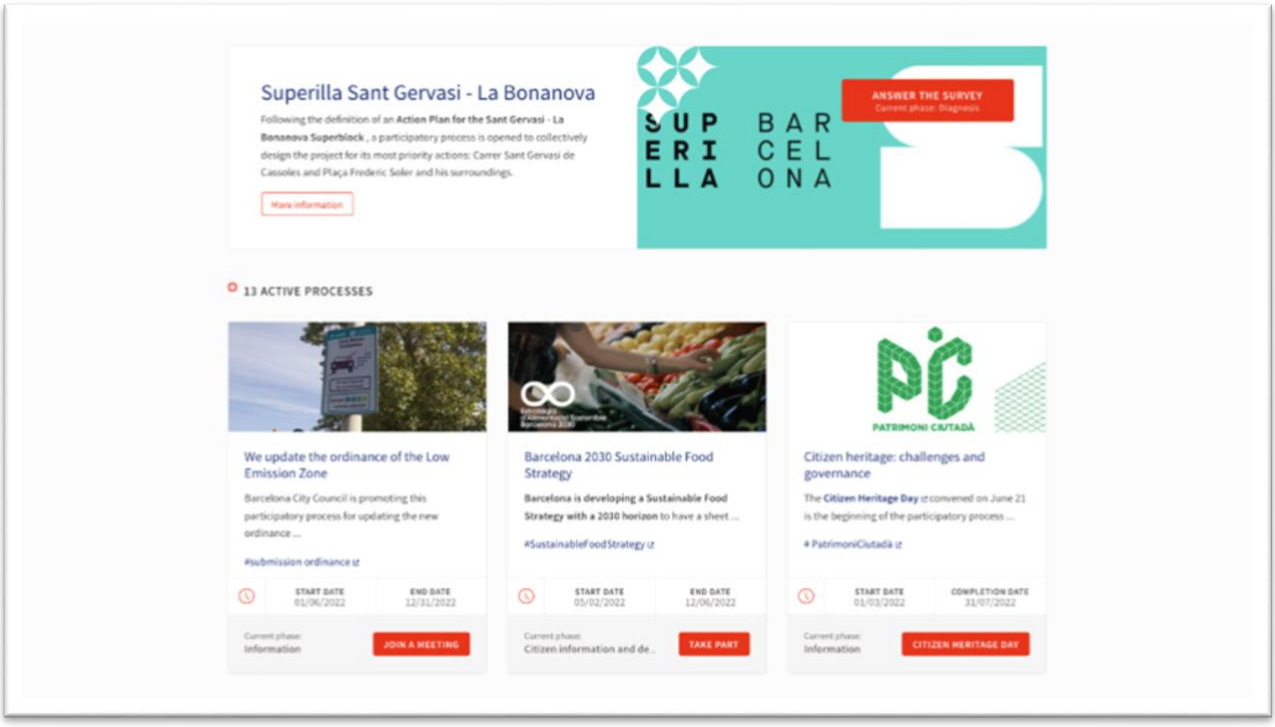

Figure 5.1. Voting processes on DECIDIM. (Image source: decidim.org)

In 2018, Bria reported that 40,000 Barcelona residents had participated in DECIDIM, and many municipal proposals were coming directly from the citizens:

> We are experimenting with a hybrid of online and offline participatory democracy. We used Decidim to create the government agenda — over 70 per cent of the proposals come directly from citizens. Over 40,000 citizens proposed these policies. And many more citizens were engaged in offline collective assemblies and consultations. (Graham, 2018, n.p.)

Bria thought of DECIDIM as the first of Barcelona's digital platforms. Inspired by Obama's Blue Button initiative, she initiated the digitalization of the city's entire healthcare system. For the first time, Barcelonians had a chance to access and download all their medical data through a single digital portal. Bria's shared with her team an idea that Barcelonians would eventually want to donate their personal data for scientific or charitable purposes and might even be reimbursed for these contributions via blockchain technologies:

> She wanted it to be on Blockchain. That's politics, all [European] governments were implementing blockchain systems. It just had to be on Blockchain. She thought that, in time, this could develop into a system where Barcelonians donate their data to research organizations, and they get some financial benefits through these decentralized platforms. (Interviewee 35)

One interviewee pointed out that Bria was inspired by the privacy-by-design approach introduced by the Canadian privacy expert Anna Cavoukian:

> They talk about this, this, thing privacy by design, I guess when you're trying to design things in order to keep data on the… under control and ownership of citizens and public administration and externalization that tries to create a different way of understanding technology in the smart city. (Interviewee 29)

The years of 2015–2017 were also a time of political disturbance in Barcelona. As Spain implemented the politics of austerity, some political leaders in Barcelona wondered whether the region of Catalonia (of which Barcelona is the capital) should gain independence and join the European Union on its own terms. Interviewees suggested that Bria's vision of Barcelona's data

sovereignty was heavily impacted by this political-economic context: as Barcelona struggled for political independence, independence from technological corporations seemed like a logical next step. This political undertone of Bria's smart city vision may have been the reason why it was soon abandoned by the City of Barcelona.

Bria herself indirectly confirmed the political roots of her technological proposals. Here is how Bria described Colau's first steps as mayor in an article on data sovereignty:

> The first example is Barcelona City Council. After the large mobilization of the 15M Movement, the anti-eviction housing activist Ada Colau leading the mortgage victim platform became the mayor of Barcelona, representing the main opposition against a political and economic elite who precipitated Spain into a deep financial and social crisis leaving hundreds of thousands of families without a home. The new coalition led by Colau, crowdfunded and organized through a collaborative platform that aggregates policy input from thousands of citizens. Soon after taking office, they started a series of social reforms. In particular, they started to crack down on illegal tourism, challenging home rental websites, in the attempt to improve the life of 31,000 Spanish families without housing. The council froze new licenses for hotels and other tourist accommodation, and promised to fine firms like Airbnb and Booking.com if they market apartments without being on the local tourism register. Barcelona then provided these companies the possibility to negotiate 80% of the penalty if they give the empty apartments to the Social Emergency Housing Consortium to be allocated to social rent for 3 years. (Bria, 2016)

In 2019, en Comú lost the next mayoral election to the pro-independence Catalonian party. Colau and Bria were set to leave office, but something unexpected happened. Colau's candidacy was supported by several pro-Spain parties, which also participated in the election. As a leader of this joint political coalition, Colau was re-elected. At the same time, Spanish law enforcement apprehended the leaders of Catalonian independence, putting 12 people on trial for treason. Violent protests erupted in Barcelona as citizens poured onto the streets in a show of solidarity with the arrested Catalonian politicians and government officials (BBC News, 2019).

On social media, Bria welcomed Colau's reelection. But the new political climate did not favor Bria's work, specifically her vision of data sovereignty achieved through citizen-centered smart cities. Upon her return to power, Colau initiated a complete overhaul of her political platform and sidelined the smart city agenda. While Bria did not make a public exit from Colau's

team, that same year, her projects were quietly shut down. Bria reoriented her team to work on DECODE independently from the municipality of Barcelona. She also became the director of a new Italian National Innovation Fund.

When I started researching Barcelona's case study, I was surprised to learn that only DECIDIM remained functional after Bria's departure from the City of Barcelona. Currently, Bria and her team are working to promote DECIDIM across the European Union. I have established that, as of 2023, Barcelona, Madrid, and Helsinki have been using DECIDIM, although the City of Helsinki implemented the platform on a smaller scale, only for budgeting deliberations. According to the website of DECIDIM, the platform has been deployed by some 30 countries. However, I have no information as to whether these have been trial projects, limited deployments, or full-scale implementations.

Reflecting on her time in Barcelona, Bria regretted that her data sovereignty vision has not become a pan-European perspective and that the EU's technological policies remain fragmentary:

> There were, of course, failures. While we managed to scale projects like Decidim, we didn't manage to achieve a common pan-European initiative on technological sovereignty, linking political, economic, and geopolitical dimensions in a coherent way. There's still no coherent vision of a digital industrial policy that could liberate even half of the stack that Europe needs, not to mention its entirety. In our defense, we also had very little money; 5 million Euro—this was Decode's budget, spread across many partners in the project—is not so much given the ambitions. (Bria, 2023, n.p.)

5.4. DECODE: Barcelona's Visions of the Smart City as Commons

Bria's ambitions did not stop at transforming Barcelona's participatory democracy. She envisioned data sovereignty as a way to curtail surveillance capitalism by putting municipalities and individual data subjects in charge of data governance processes (Bria, 2019). In 2018, the City of Barcelona released a document called *Ethical and Responsible Data Management: Barcelona Data Commons* (Barcelona Data Commons, 2018). In this document, Bria formulated key points of the city's vision of data sovereignty: (1) putting citizens in control of personal data by strengthening the municipal ownership of data; (2) understanding data as urban infrastructure, similar to the provision of water and energy; (3) treating data as a common asset that could be

reused for the purposes of social and economic innovation; (4) protecting the privacy of the residents of Barcelona. The document also outlined specific steps the municipality was planning to take to implement these principles: appointing a new data protection officer in the municipality of Barcelona who would help implement the GDPR, updating the existing open data portal with the data collected through the existing and coming smart city infrastructure and previously sealed public records, and bringing more transparency to the municipal decision-making processes through DECIDIM.

Bria was convinced that the city administrations were best placed to oversee data governance in smart cities:

> There is a crisis of trust. Governments need to reshape their relationships with citizens, and cities are closer to the citizens. Cities also run data-intensive, algorithmic processes: transport, public housing, healthcare, education. This is the level at which a lot of services are run, and so cities can experiment with alternatives. It's the same reason why there was the smart city boom — cities have this capacity. (Graham, 2018)

Bria realized that public ownership and control over the digital and physical infrastructure in the smart city was important to achieving her vision of data sovereignty. In 2016, she received a European Union Horizon 2020 grant for the project called DECODE (Decentralized Citizen-Owned Data Ecosystems). DECODE promised to develop privacy-oriented, open-source technologies for decentralized data governance and identity management. Creation of new digital credentials promised to give the residents of Barcelona some level of control over the data collected about them in the city spaces.

The official website presents DECODE (n.p.) as "a response to people's concerns about a loss of control over their personal information on the internet. The ability to access, control and use personal data has become a means by which internet companies can drive profits." Bria's project was creating a framework for democratizing the processes of data governance and putting the personal data collected in smart cities into communal use:

> DECODE will explore how to build a data-centric digital economy where data that is generated and gathered by citizens, the Internet of Things (IoT), and sensor networks is available for broader communal use, with appropriate privacy protections. As a result, innovators, startups, NGOs, cooperatives, and local communities can

> take advantage of that data to build apps and services that respond to their needs and those of the wider community. (DECODE, n.p.)

The first step toward the implementation of DECODE was to retrofit the city infrastructure with data collecting devices (e.g., street cameras, motion sensors, air-quality sensors). The City of Barcelona partnered with several other municipalities to launch Sentilo, a public smart city infrastructure that gathered and stored the data streams coming directly from the residents and automatically generated by the digitalized urban infrastructure. The residents in several neighborhoods of Barcelona received packs of air quality sensors from the municipality and used the Sentilo application to upload the data they captured to the Sentilo dashboard. Other sensors mounted to light poles and the façades of the buildings across the city gathered data about energy use and the movement of people and vehicles in real time.

The architecture of the publicly funded project Sentilo, including its sensors, servers, data sharing, and visualization technologies, was the backbone of Francesca Bria's DECODE (Figure 3.5.). Once fed into Sentilo, the data from various smart city devices became public property, the property of the City of Barcelona. It was then employed to create digital maps of the city spaces and services to serve the needs of citizens, businesses, and researchers. As part of their work on Sentilo, the municipalities of Barcelona and Amsterdam created registries of all smart city devices deployed in the cities. While Sentilo was jointly developed by several European municipalities, the terms of data sharing agreements between them and the existence thereof are unknown to me.

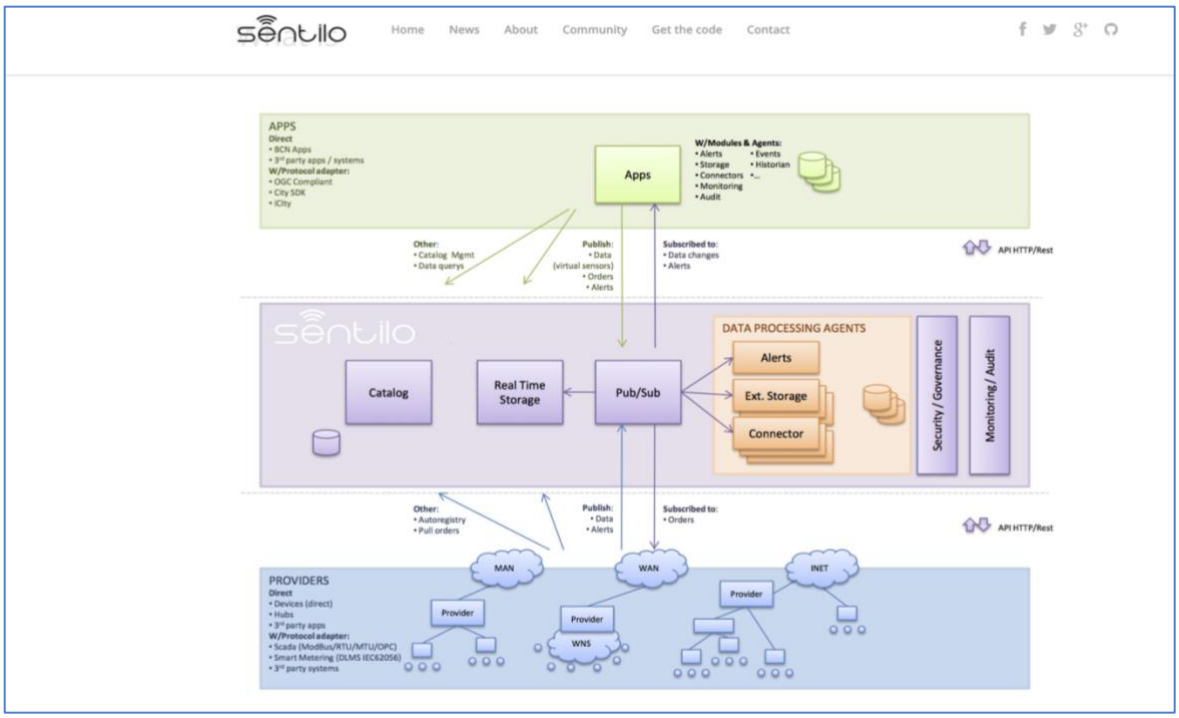

Figure 5.2. Architecture of the Sentilo public smart city project (image source: https://www.sentilo.io/wordpress/).

Here is how one of the interviewees explained the need to create the public infrastructure for smart cities:

> Now we look at the internet, as an infrastructure element, the internet has been developed entirely in the private interest. Right? And, you know, we can second guess how we got there, whether that was right or not, but we did. That's where we are. But now the internet is coming to the city, right? So the internet of cities is the next internet. And the physical world is about to get connected to the internet. And in my view, the Internet of cities needs to be architected. And whether you think of that as in a technology framing or in a public policy framing, it needs to be architected in a way that creates a distinction between infrastructure that should be managed in the public interest, and infrastructure that should be managed in the private interest. (Interview 31)

The City of Barcelona was working on another smart city interface for the reuse of personal data. This dashboard was planned to be integrated with the architecture of DECIDIM and the newly created digital credentials for all Barcelonians. When a Barcelona resident logged into their DECIDIM account, they could access their data collected from a variety of sources:

personal data, public records, health data from their fitness trackers, etc. Bria argued that this one-stop shop for data could help Barcelonians gain an understanding of what types of data were being collected about them in the smart city and use this data in socially beneficial ways, for instance, donating it for medical research. Bria envisioned the creation of a data-sharing platform and marketplace for data, where the residents of Barcelona would be reimbursed for data donations through blockchain technologies. Bria explained:

> [There is a] DECODE wallet that manages people's decryption keys, with an interface that lets you select that you want to give your transport data to the city, because you know that they can improve public transport with it—but you don't want to give that kind of private data to an insurance company or an advertiser. (Graham, 2018)

The DECODE initiative was never fully implemented. Together with Bria's other projects, it was shut down in 2019. Some of its elements, however, became part of Barcelona's smart city landscape. The 180 cameras and movement sensors installed by the Sentilo project have been repurposed by academic researchers and startups based at Barcelona's innovation district 22@. The City of Barcelona employed these sensors to create a municipal parking app for smartphones, which is still operational.

The work of turning DECIDIM into a data-sharing platform for personal data was left unfinished, and yet it gave rise to a new version of a data commons in Barcelona. During her short tenure, Bria's team managed to digitalize the city's healthcare system, giving the residents an option to access and download their medical records. In 2020, two of Bria's former employees decided to build a health data commons, inspired by the citizens' interest in data sharing. The Salus Coop (n.p.) began its work in 2021 as a privately funded blockchain platform that connected Barcelonians with research organizations that sought access to the health data of European residents. The project team experimented with different business models for this initiative. Originally, it was designed as a data cooperative, which means it would be collectively managed by the citizens of Barcelona. Currently, Salus Coop is called a "data collaborative" and is seeking to devise a financial model where research organizations pay for data access. The founders explained that, potentially, Salus Coop may be able to reimburse Barcelonians for their data in the form of blockchain payments.

5.5. Affective Data Governance and Barcelona's Smart Citizens

In 2018, smart city researcher Igor Calzada praised Bria's work in Barcelona as the first European citizen-centered smart city initiative. Similarly, Trencher (2019) argued that, under Bria's leadership, Barcelona presents an exemplary "bottom-up" smart city, where citizens took on a role of decision-makers and data was employed to tackle the issues of collective concern. It is through engaging the citizens in the matters of data governance that the smart city becomes data commons:

> Barcelona is experimenting with socializing previously collected data via sensors operated by citizens, with the city taking the lead in aggregating and acting upon such data to promote new co-operative approaches that solve common urban issues, such as tackling noise levels and improving air quality. The plan is to keep this common data infrastructure open to local companies, co-operative platforms, and social organizations, allowing them to build data-driven services and create long-term public value. (Calzada, 2018, n.p.)

Another study (Capdevila & Zarlenga, 2015) paints a more nuanced picture of Barcelona's smart city as having changed over time, and being made up of several smart city initiatives, some of them planned and some emerging from grassroots activities of the citizens. They discuss Barcelona's Smart Citizen project as an example of a citizen-led smart city project:

> The Smart Citizen project serves as an illustrative example of how a grassroots initiative can be gradually adopted by citizens and by public institutions. The Smart Citizen project has been developed by some of the members of the Fab Lab Barcelona. The goal is to allow individuals to easily collect and share data about different environmental variables such as the measure of the air composition (CO and NO2), temperature, light intensity, sound levels, and humidity (Smart Citizen n.d.). This project is an open-source (open hardware and open software) environmental monitoring platform that consists of an Arduino-compatible hardware, a data visualization web API, and a mobile app. Once the device is set up, it is able to stream the measures by the different sensors over a Wi-Fi connection and share the data over internet in real time. The obtained open data can be freely used by public or private actors to develop applications or services. For instance, data on air quality can be used to create local maps of humidity, air quality or sound levels in order to report

> to local city governments or to raise awareness of issues that matter to the local community. (Capdevila & Zarlenga, 2015, p. 11)

Interviewees indicated that Bria's smart city initiative was very popular in Barcelona, and Bria fast became an internationally recognized data-governance expert. Both her own reputation and the reputation of Barcelona's smart city were associated with the citizen-centered data governance initiatives, a viable alternative to the commercial data economy promoted by technology monopolies (see Chapter 4). Bria's ideas also gained support among the city's bursting academic community, paving the way for several research studies and educational initiatives aimed at preparing the first generation of local smart city experts. The level of public support Bria enjoyed is best illustrated by her health data hub project (sometimes called a "data trust" by interviewees).[17] Before initiating the digitalization of citizens' health and medical records, Bria's team surveyed the city population; the study showed some 80% support of the project. After Bria's departure, her former employees conducted another survey, and, once again, the majority of Barcelonians indicated their interest in the data reuse, hoping to contribute their information for scientific and charitable purposes. With this support, the health data cooperative Salus Coop was launched.

Unlike the study participants in Toronto, interviewees showed in-depth professional knowledge of the data governance aspects of Barcelona's smart city initiative. Yet, when asked about Bria's smart city vision, they expressed the same affective attitudes toward data governance that I documented in Sidewalk Toronto case. For the people who worked with Bria, it was important that her vision reflected the local concepts of social justice, cooperative living and collectivism, and that the smart city was primarily a means to address the corruption, unemployment and housing crisis. Unlike the previous iteration of Barcelona's smart city, developed under the liberal mayor, DECODE was perceived as a welcome development. Some aspects of Bria's vision, however, were not received well. According to a few interviewees, the public liked the idea of data dividends, payments for data. Yet, some of the DECODE employees expressed concerns about Bria's idea to integrate DECIDIM with cryptocurrencies; they thought of it as a controversial attempt to monetize digital personal data. Bria's unsuccessful attempts to

[17] As outlined in Chapter 4, the data trusts are usually NGOs or private entities that steward one's data on their behalf. In the case of Barcelona's health data hub, the municipality acted as a trustee.

secure funding for DECODE also contributed to the project's demise, since the municipality struggled to cover the costs of the public smart city. While the limitations of my fieldwork only allowed me to carry out a limited number of interviews with people in Barcelona, the interviews I did with experts demonstrated striking similarities in the practices of affective data governance with the professionals I interviewed in Toronto. Just like in Toronto, for Barcelonians the smart city has never been just about data; instead, data governance in the project presents as a set of complex political and social processes that evoke strong emotional responses in both members of the public and amongst experts.

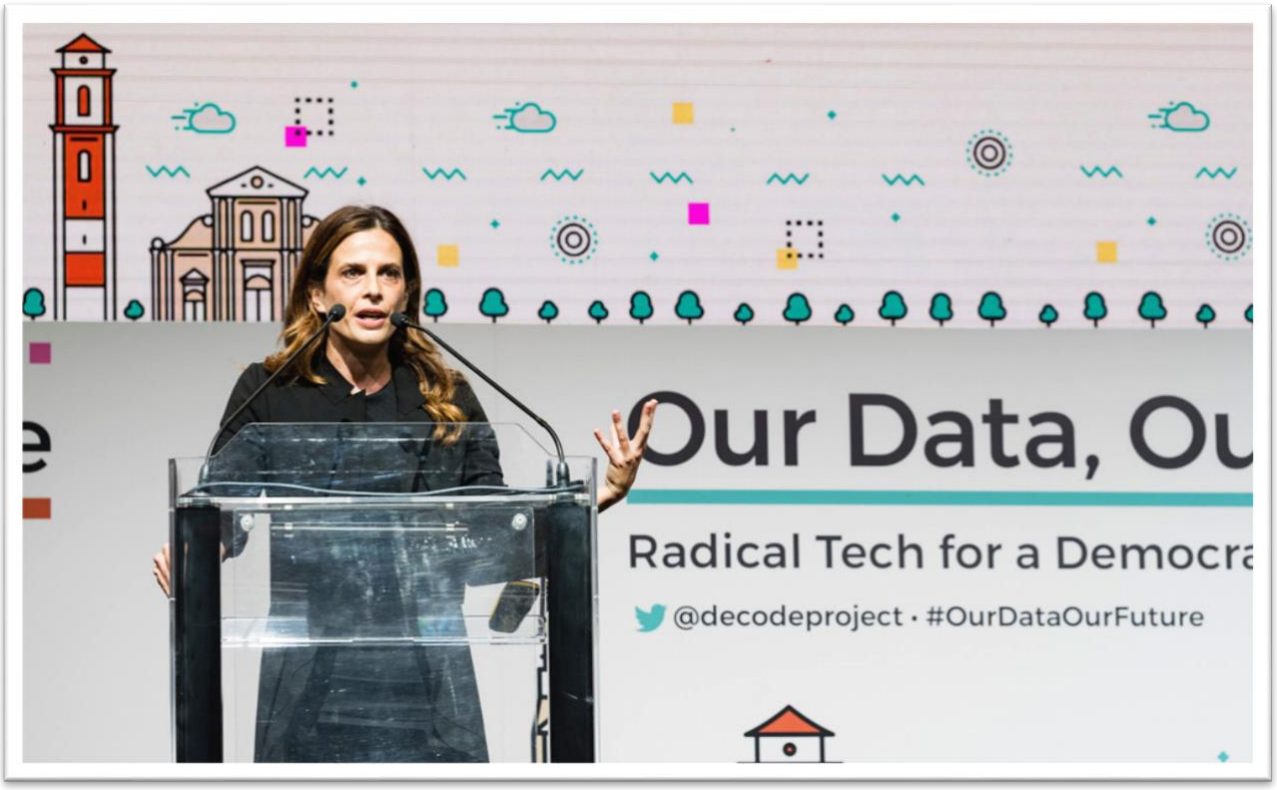

Figure 5.3. Francesca Bria launches DECODE, 2017. (Image source: Andrea Guermani)

5.6. The Many Facets of Assetization: Comparing Data Governance in Sidewalk Toronto and Barcelona's Smart City Initiative

In terms of empirical research, both Sidewalk Toronto and Barcelona present challenges to researchers, as the projects were shut down while still works in progress. In terms of research material, both of my case studies exist in the form of multiple draft proposals. In the case of

Sidewalk Toronto, I analyzed Sidewalk Labs' winning bid for the 12-acre Quayside, materials presented at Sidewalk Labs' public engagement events, framework agreements, and the MIDP. I complemented document analysis with observation at public events held by Sidewalk Labs and Waterfront Toronto and 25 expert interviews with the politicians, government officials, activists, and technology professionals involved in the project. In the case of Barcelona's smart city, I examined the official documentation released by the municipality since 2011 (when Barcelona began using the smart city branding in its official communications) and local and international media reports on the project. I complemented this documentary and media data with 12 expert interviews with the current and former employees of the City of Barcelona, legal experts, and technology professionals involved in the project.

Unfortunately, my fieldwork in Barcelona was affected by the COVID-19 pandemic. Due to the travel restrictions imposed by Barcelona and Canada in 2020–2021, I was unable to travel to Barcelona during the time that I was carrying out my research fieldwork. Instead, I conducted all interviews related to the Barcelona case study via videoconferencing software. The size of the interview sample is another issue with the second case. After Francesca Bria's departure and once Ada Colau had reoriented her political platform away from the smart city initiative, there were not many current employees in the City of Barcelona I could interview. To widen my pool of interviewees, I approached several former employees of the city administration and other smart city projects of Bria's, local data governance experts, and researchers who studied the smart city project.

The goal of my dissertation study has been to examine Sidewalk Labs' and the City of Barcelona's smart city initiatives as sites of enduring tensions between the public, private, and collective governance of digital personal data. Sidewalk Toronto and DECODE represent two contrasting, yet complementary, case studies of data governance strategies in smart cities. I conceptualize these strategies as three forms of asset governance: private governance (Birch et al., 2020, 2021; Pozner & Weyl, 2018; Srnicek, 2017), public governance (Hoyer, 2019; Prainsack, 2019a; Starkbaum & Felt, 2019), and commons governance (Artyushina, 2020, 2023; Frischmann et al., 2023; Morozov & Bria, 2018). The key difference between these three forms of asset governance is the way they define personal data and who controls the rights to it. First, private asset governance entails the treatment of data as a commercial asset and its enclosure within certain legal regimes. Second, public asset governance entails defining data as a public

good, which gives government agencies the mandate to protect the public interest in data, as this interest is seen by a particular administration. Finally, data commons in smart cities entails governing personal information as a knowledge commons—a collective resource that can stimulate innovation and bring about positive social outcomes.

Table 5.1. presents a comparative analysis of Sidewalk Toronto and DECODE through the lens of assetization theory (Birch, 2020; Birch & Muniesa, 2020). I would argue that the political-economic logic of data assets made it particularly difficult for both initiatives to balance the interest of profit with public and collective considerations. While Sidewalk Labs sought to protect the data and smart city infrastructure in Sidewalk Toronto as private assets (at times framed as a commons), the DECODE project aimed to achieve public ownership of data and smart city infrastructure while using the framework of a data commons to extract monetary and nonmonetary value from data.

My argument is that Sidewalk Labs aimed to gain control over the data collected in the smart city by reconfiguring it as both a private asset and a common asset. The company devised several quasi-legal instruments that, if implemented, could make the data captured in the geographical confines of Sidewalk Toronto exempt from Canadian data protection legislation (McDonald, 2019). For example, the concepts of "urban data" and "transactional data" were introduced to make sure personal data collected by Alphabet and its affiliated companies in the smart city would remain under the data collectors' full control (Artyushina, 2020). Another idea introduced by Sidewalk Labs was the collective governance of smart city infrastructure through trust-like entities (e.g., Urban Data Trust, Waterfront Housing Trust, Open Spaces Alliance, etc.). While the idea of implementing collective governance in the smart city infrastructure sounded progressive, in fact, it can be seen as a strategy aimed at assetizing the city's assets and replacing the municipal governance with private governance disguised as commons (Artyushina, 2023).

Type of Data Governance	**Sidewalk Toronto**	**DECODE**	**Key Social/Economic Issues Smart Cities Aimed to Solve**	**Legal/Technological Solutions**

Private Asset	X		Housing Affordability Mobility Environmental Issues	Data-Driven Planning
Public Asset		X	Housing Affordability Mobility Environmental Issues	DECIDIM
Commons	X	X	Governance of Smart City Infrastructure	Private or Public Ownership

Table 5.1. Data Governance Strategies in Sidewalk Toronto and DECODE

Barcelona's smart city reconfigured data as a public good and commons. Bria sought to secure public control over data assets through these interconnected measures: public voting on municipal issues through the public blockchain platform DECIDIM, public ownership of the smart city infrastructure called Sentilo (e.g., sensors and servers), transparency on municipal decision-making through open data portals, and public profits from data licensing. The data commons was seen as a way to generate monetary and nonmonetary value from data. Integrated with Sentilo through the system of digital credentials, DECIDIM was meant to become a data sharing hub for citizens to access and reuse personal data collected through public services and by the smart city infrastructure. Bria envisioned that if DECIDIM became a popular marketplace for personal data, blockchain technologies could be employed to reimburse residents for their data inputs.

The political-economic roots of the two projects were different. Alphabet was looking to dominate the smart city market while testing out its new technologies. Barcelona's smart city was created by the local municipality and informed by the city's social agenda. The issues the two smart cities tried to solve were the same: the extractive data economy, local housing crises,

and governance issues brought on by the ascendance of smart city technologies in cities. At the first glance, there are significant similarities between the projects: both proposed collective governance in the smart city infrastructure, sought to extract value from personal data, and promoted data reuse. Underlying the data governance struggles of Barcelona and DECODE was the recognition that data and data-driven technologies require large amounts of funding for upkeep, yet they are hard to monetize. The way technology corporations like Alphabet generate revenues is through the monopolization of various marketplaces, where the company can benefit from network effects. Turning data and smart city infrastructure into revenue sources turned out to be challenging for both Sidewalk Labs and the City of Barcelona.

There are, as well, differences in the forms of data/asset governance in the two smart city projects. While private data assets entail further privatization of the smart city infrastructure that sustains data access and reuse, public data governance could help maintain a healthy balance between the interests of profit, public and collective interests. Bria's idea of the publicly funded smart city infrastructure may have great potential if we think of the future of smart cities.

As two interviewees indicated, both projects had a hard time retaining employees as the idea of financial reimbursement for the data was articulated by the respective project leadership. The stigma attached to data reuse is so significant that one interviewee compared data governance done by Facebook to organ trafficking. Both projects were met with some political pressure: While Sidewalk Toronto fell victim to Sidewalk Labs' failed public engagement campaign, DECODE failed to secure continued support from local politicians and funding from the European Union.

5.7. Conclusion

This dissertation research is a comparative study of Sidewalk Toronto/Quayside and Barcelona's DECODE project. The overall aim of this thesis is to explore two smart city initiatives as sites of the complex interplay between public, private, and collective interests in data governance. These initiatives represent two contrasting yet complementary cases of data governance. Sidewalk Toronto envisioned data as a private asset whose existence was sustained by the collectively governed smart city infrastructure, and DECODE framed data as a public good whose operations were supported by the collectively governed smart city infrastructure. Both smart city initiatives collapsed under external pressure: public controversy in the case of

Sidewalk Toronto and the changing political agenda of the local city administration in the case of Barcelona. As I explain in the following chapter (the dissertation's conclusion), both projects provide important lessons for policymakers seeking to implement smart cities, and both of them give rise to novel data governance initiatives.

In this dissertation, I explore the governance of digital personal data in smart cities through the political-economic lens. Specifically, I draw on the assetization theory (Birch, 2020; Birch & Muniesa, 2020) to conceptualize key data governance regimes in smart cities (private, public, and commons data governance) as forms of "asset governance." The key difference between these forms of asset governance is the way they define personal data and who controls the rights to this data. First, private asset governance entails the treatment of data as a commercial asset and its enclosure within certain legal regimes (Birch et al., 2020; Cohen, 2017, 2019; Srnicek, 2016). Second, public asset governance entails defining data as a public good, which gives government agencies the mandate to protect the public interest in ways suitable for the current political administration (Hoyer, 2019; Prainsack, 2019; Starkbaum & Felt, 2019). Finally, asset governance as a commons (Artyushina, 2020, 2023; Morozov & Bria, 2018; Wu et al., 2021) entails governing personal data in an institutionalized collective manner (Frischmann et al., 2014; Frischmann et al., 2023).

It is worth noting that asset governance is an analytical construction. In practice, smart city projects often conflate different types of asset governance, and the naming of these initiatives can be highly misleading. For instance, Sidewalk Labs' proposal for collective data governance was a strategy to legitimize private data governance in Sidewalk Toronto. In Barcelona, there are public good smart city projects such as Sentilo and private data commons like Salus Coop.

My argument is that Sidewalk Labs aimed to gain control over the data collected in the smart city by reconfiguring it as a private asset and commons. The company devised several quasi-legal instruments that, if implemented, could make the data captured in the geographical confines of Sidewalk Toronto exempt from Canadian data protection legislation (McDonald, 2019). For example, the concepts of "urban data" and "transactional data" were introduced to make sure personal data collected by Alphabet and its affiliated companies in the smart city would remain under the data collectors' full control (Artyushina, 2020). Another idea introduced by Sidewalk Labs was the collective governance of smart city infrastructure through trust-like

entities (e.g., Urban Data Trust, Waterfront Housing Trust, Open Spaces Alliance, etc.). While the idea of implementing collective governance in the smart city infrastructure sounded progressive, in fact, it was a strategy aimed at assetizing the city's assets and replacing the municipal governance with private governance disguised as a commons (Artyushina, 2023).

Barcelona's smart city reconfigured data as a public good and commons. Bria sought to secure public control over data assets through these interconnected measures: public voting on municipal issues through the public blockchain platform DECIDIM, public ownership of the smart city infrastructure called Sentilo (e.g., sensors and servers), transparency on municipal decision-making through the open data portals, and public profits from data licensing. The data commons was seen as a way to generate monetary and nonmonetary value from data. Integrated with Sentilo through the system of digital credentials, DECIDIM was meant to become a data sharing hub for citizens to access and reuse personal data collected through public services and by the smart city infrastructure. Bria envisioned that if DECIDIM became a popular marketplace for personal data, blockchain technologies could be employed to reimburse residents for their data inputs.

CHAPTER VI. CONCLUSION

This dissertation was an empirical investigation of the private, public, and commons governance of digital personal data in two smart city initiatives: Sidewalk Toronto/Quayside and the City of Barcelona's DECODE. Both initiatives gained international attention as testbeds for innovative solutions in the areas of data reuse and collective governance in the smart city infrastructure. Both initiatives collapsed under political contestation, and both initiatives offer valuable lessons for the municipalities willing to employ smart city solutions.

Between 2018 and 2021, I conducted a study of the two smart city projects, drawing on methods including observation, document analysis, and semi-structured interviews. I analyzed the smart city projects from a perspective of science and technology studies (STS), specifically through the lens of assetization theory. This analysis reveals three key insights. First, data governance in smart city initiatives can be theorized as a form of asset governance, since the political economic logics of assetization dominate in the data governance proposals for Sidewalk Toronto and DECODE. Second, both smart city initiatives aimed to generate value from digital personal data and failed to balance commercial interests with public and collective interests. Third, the policymakers and citizens engaged in these smart city initiatives displayed a variety of non-economic expectations and attitudes toward data, a phenomenon I conceptualize in the dissertation as "affective data governance."

In this final chapter, I summarize the dissertation by bringing together the academic discussions on assetization, data governance, and smart cities (Section 6.1). I then highlight the key empirical findings in relation to my research questions (Section 6.2). I also discuss the theoretical contribution of this investigation (Section 6.3) and outline its implications and possible future research directions (Section 6.4). Finally, I conclude with some policy recommendations for the municipal officials willing to implement smart city solutions and for the policymakers who are developing regulatory frameworks for these technologies (Section 6.5).

6.1. Summary of the Dissertation Research

In this dissertation, I sought to address three research questions brought on by the emerging practices of data governance in smart cities:

- What are the social, economic, and political frameworks that underpin public, private, and commons governance of data in smart cities?
- How do government, industry, and civic actors define the public interest in smart city governance?
- How do novel legal and technical definitions of digital personal data affect the decision making around smart cities?

In the theoretical chapter of this thesis (Chapter 2), I examined the literature on smart cities and data governance through the lens of science&technology studies (STS). I discussed how the central concepts of STS (i.e., the co-construction of science and technology and situated knowledges) directed my research focus to the practices through which conflicting notions of data are discursively produced and reified. I employed the assetization framework to bridge the previously disconnected academic discourses on smart cities and data governance. This literature review revealed that more literature is needed on the political economic nature of data governance and its detrimental effects on the social outcomes of smart city projects. I also argued that the existing literature on data assets may shed light on the extractive data practices and the erosion of public interest in publicly funded data governance initiatives. Specifically, the body of assetization research demonstrates that public interest projects often come to serve commercial interests through the deployment of proprietary digital and physical infrastructure.

The policy trend toward data reuse has brought new aspirations, promising to make public services more efficient and redistribute the value produced in the data economy by breaking private and government data silos. While the vocabulary for these emerging data governance strategies is still developing (e.g., data trusts, data cooperatives), I proposed to theorize them as forms of asset governance. All these initiatives are united in seeking to extract rent from data, be it economic rent or some downstream social benefits that come from data reuse. Although private data governance is mostly exploitative, other forms of asset governance promise to bring public or collective benefits. In Sidewalk Toronto and Barcelona's smart city, the proposals for the Urban Data Trust and the municipal data commons DECODE promised to redistribute the value produced in the data economy by reusing digital personal data for socially

beneficial purposes. Yet, the extractive logics of data assets and external political pressure thwarted both initiatives and led to their collapse.

In the methods chapter (chapter three), I outlined my methodological and analytical approaches in working with the two empirical case studies. I also reflected on my experience conducting fieldwork remotely. Specifically, I explained the techniques I used to ensure that the study participants felt comfortable while being interviewed via videoconferencing software. I employed a comparative case study approach to examine the policy objectives and socioeconomic and technical arrangements for Sidewalk Lab's project in Toronto, Canada, and for the City of Barcelona's DECODE. I chose these two projects because they complemented each other methodologically. Both smart city initiatives aimed to generate monetary and nonmonetary value from digital personal data, advanced a vision of data as commons, and sought monopoly control over the physical infrastructure of the smart city. Both initiatives were shut down before completion and left abundant project documentation. Yet, they differed significantly in the ways they approached the rights to the data collected in the smart city: while Sidewalk Labs sought legal rights to control personal data collected in the smart city as a commercial asset, the municipality of Barcelona framed data as a public good and commons.

I conducted observation, document analysis, and semi-structured interviews with the experts and government officials involved in the two projects. Between 2018 and 2020, I undertook observation at the public roundtables organized by Sidewalk Labs, meetings of the Digital Strategy Advisory Panel (DSAP) appointed by Waterfront Toronto to advise on this project, and meetings and rallies of the #BlockSidewalk citizen group that protested the smart city project. Sidewalk Labs released hundreds of pages of project documentation; I analyzed the ones that directly addressed the governance of data and smart city infrastructure in the project (e.g., RFP submission, MIDP, 2018 Framework Agreement). I complemented this qualitative data with 25 interviews with leading experts in the fields of data governance and privacy, public officials who were involved in the assessment and decision making around Sidewalk Toronto, and citizens who organized against the project. My fieldwork in Barcelona was affected by the COVID-19 pandemic. For this case, I relied on document analysis and remote interviewing. Between 2015 and 2019, the City of Barcelona and its CTO Francesca Bria personally published several documents that detailed the city's plans for the municipal governance platform DECODE, the public smart city infrastructure Sentilo, and the data sharing platform that would

later become a health data commons. While the municipality of Barcelona drastically reduced the staff working on its smart city vision in 2019, I managed to conduct 12 interviews with current and former employees of the municipality, data governance experts, and academic researchers who studied the smart city project when it still existed.

In the empirical chapter that presents my data and analysis of Sidewalk Toronto (chapter four), I first reviewed the fast-growing literature on the failed smart city project. An initiative of large scale and ambition, Sidewalk Toronto was an experiment in the areas of data governance and urban planning. Multiple studies addressed the issues of secrecy, failed citizen engagement, and privatization of city governance in the project. Fewer studies addressed Sidewalk Labs' data governance proposal. In this chapter, I analyzed the company's plans for digital personal data and showed how the extractive logic of assetization permeated the urban planning proposals of the company. I argued that Sidewalk Labs' Urban Data Trust was designed to extract economic rents from data by making it easier for private actors to collect, reuse, and monetize it. The trust was designed to assetize data through five interconnected processes: introducing new legal definitions for data, retrofitting city infrastructure with digital tracking devices, creating a self-certification regime for data collectors, gathering the data collected in the smart city in one physical location, and establishing intellectual property (IP)-intensive data sharing agreements. I then analyzed the notion of data-driven urban planning. I argued that through the creative merging of digital and urban policies, Sidewalk Labs aimed to turn the city's spaces, infrastructure, and services into sources of economic rents.

The last section of the chapter discussed Sidewalk Labs' proposal for collective governance in the smart city infrastructure. My analysis showed that the trust-like entities proposed by Sidewalk Labs were not commons in any sense but rather quasi-legal instruments of financialization for city assets. Moreover, in a data-driven, continuously redeveloped city, residents would lose opportunities to build horizontal networks and organize around issues of collective concern. In this chapter, I showed that the underlying goal of Sidewalk Labs' smart city project was to establish the company in a role tantamount to that of Alphabet in the digital space: as an entity controlling the data, the markets of smart city technologies, and the governance of these technologies. This chapter also discussed affective data governance. In the section presenting data on the citizen opposition to Sidewalk Toronto, I showed that the technical and legal issues of data governance were incomprehensible for many of my interviewees.

Instead, their expectations and attitudes toward the project were normative in nature. For example, Sidewalk Toronto was expected to make the city less comfortable to spend time in – hostile, even. The involvement of public officials with the data governance initiatives implemented in Toronto was also rather personal. While Sidewalk Toronto may have been perceived as an invasion of the city space, other data governance initiatives, especially the ones developed by local civic groups, were perceived through the lens of personal involvement and enthusiasm. As a general trend, the interviewees articulated their attitudes toward data governance in smart cities in terms of excitement, utility, morality, and power.

In the empirical chapter that details my fieldwork and data on Barcelona's smart city (chapter five), I first reviewed the literature on the subject. Surprisingly, few sources offer a periodization of Barcelona's smart city initiatives, and even fewer discuss the factors that led to the collapse of Francesca Bria's ambitious project. I explained that my analysis focused on Bria's version of the smart city that was implemented through municipal policies between 2015 and 2019. In several official documents, Bria explain her vision of data as a public good. She sought to secure public control over data assets through the interconnected measures of public voting on municipal issues through the public blockchain platform DECIDIM, public ownership of the smart city infrastructure Sentilo (e.g., sensors and servers), transparency on municipal decision making through open data portals, and public profits from data licensing. Additionally, a data sharing hub for personal data (data commons) was seen as a way to generate monetary and nonmonetary value from Barcelonians' personal data. Bria envisioned that when DECIDIM became a popular marketplace for personal data, blockchain technologies could be employed to reimburse residents for their data inputs. The motive of economic gain pervades Bria's proposals as she looked for ways to ensure that citizens were reimbursed for the data collected about them by the smart city sensors. Economic considerations also played a role as Bria tried to find ways to fund the public smart city infrastructure she helped install in Barcelona.

Just like for the citizens of Toronto, the smart city initiative was a deeply personal matter for Barcelonians. Here, too, there were instances of affective data governance. Bria's closest ally, socialist mayor Ada Colau, made the smart city agenda central to her political platform. Barcelona's smart city initiative was perceived by citizens as a digital welfare state, an opportunity to use technology for the benefit of the citizens. According to city records, Barcelonians actively engaged with DECIDIM by reporting their concerns and voting on the city

budget, and they participated in the work of Sentilo by voluntarily submitting the data they collected to the system. After Bria's departure, several of her employees found private funding to build the local health data commons Salus Coop on the basis of the abandoned data sharing hub. According to the study participants, many Barcelonians were excited about the health data hub and signed off to share their medical and health data. While the early smart city initiatives in Barcelona (developed between 2011 and 2015) were described by citizens as a "land grab" and "data grab," Bria's projects were met with excitement. Even after the shutdown of Bria's smart city initiative, Barcelonians still recognized the smart city technologies developed in the city as a means to better their political, economic, and social life. In this chapter, I also provided a comparative analysis of the two cases. While Sidewalk Labs prioritized the economic value of data, the municipality of Barcelona aimed to govern data as a public good and commons. While Sidewalk Labs proposed a data trust, with the main function of securing the company's control over data, Barcelona proposed an open government platform and a data sharing hub for personal data to help citizens manage their data traces.

6.2. Key Empirical Findings of the Study

I now turn my focus to the key findings answering the research questions outlined in the introduction. These research questions were formulated around three concerns: the political economic frameworks that drive data governance in smart cities, the visions of public interest, and the decision-making around data.

6.2.1. Socio-Technical Frameworks that Underpin Public, Private, and Commons Governance of Data in Smart Cities

What are the social, economic, and political frameworks that underpin public, private, and commons governance of data in smart cities? To answer this question, I traced the discourses on innovation, economic benefits, and data sovereignty that had profound impacts on shaping each smart city project. For instance, Sidewalk Labs envisioned the smart city in Toronto as a testbed for Alphabet technologies, which is why the company's proposals often spoke of precedent-setting technologies and business opportunities. In contrast, Barcelona's smart city reflected the social and economic contexts of its origin – rising unemployment and homelessness. I argued that different legal and quasi-legal concepts of data and smart city

infrastructure that each project put forward. I showed that Sidewalk Toronto proposed new legal definitions for data collected in the smart city and sought to ensure that the company had full control over this data. The municipality of Barcelona proposed the concepts of data sovereignty and public digital infrastructure and sought to ensure public control over the data and data collecting devices in the smart city. Both Sidewalk Toronto and DECODE proposed the reimagining of the smart city as a commons through collective ownership and control. However, in the first case, this proposal was meant to deflect attention from Sidewalk Labs' attempt to gain monopoly control over the data and the smart city infrastructure in the smart city. I argued that Sidewalk Labs' proposal was underpinned with a vision of data as a commercial asset, whereas Barcelona's proposal framed data as a public good and commons.

6.2.2 Public Interest in Smart City Governance

How do government, industry, and civic actors define the public interest in smart city governance? In answering this question, I illustrated the key differences in the governance strategies of the two projects, which stemmed from different conceptualizations of data assets.

Both smart city projects responded to the specific needs of their respective communities. For fast-growing Toronto, these needs were economic ambitions, unaffordable housing prices, traffic, and environmental challenges. For Barcelona, the key issues were democratic governance, unemployment, unaffordable housing, and political independence from Spain. The projects formulated their objectives differently: while Sidewalk Labs spoke of cutting-edge technologies, new white-collar jobs, and environmentally friendly buildings, the municipality of Barcelona worked to make government operations more transparent and sought to redistribute the economic value generated by the smart city technologies. The notion of the public interest disappeared from Sidewalk Labs' proposal, replaced by the private governance of data and data-driven planning. I argued that the company's vision of the data-driven city effectively eliminated all collective forms of social life in Sidewalk Toronto. In contrast, Barcelona's smart city, running on public data, was seen as a way for Barcelonians to collectively benefit from the publicly owned smart city infrastructure and the data it collected by making city operations democratically accountable, supporting the municipal budget, and donating data for beneficial purposes (e.g., for financial reimbursement).

6.2.3. Novel Legal and Technical Definitions of Digital Personal Data

How do novel legal and technical definitions of digital personal data affect the decision making around smart cities? Both smart city initiatives devised some novel legal and quasi-legal concepts of data. The designers of Sidewalk Toronto proposed notions such as "urban data," "transactional data," "conventional data," and "aggregated data." I show that, coupled with concepts such as "urban data trust" and "outcome-based code," these definitions of data were meant to create a legal precedent for the data collected in the geographical confines of the smart city to be exempt from Canadian data protection law. Under the leadership of Francesca Bria, the City of Barcelona also proposed some new visions of data, including "citizen's data," "data sovereignty," and "data owned by citizens." The idea behind these concepts was that the information collected about citizens in the smart city should be under their control. Coupled with the publicly owned smart city infrastructure, these concepts were meant to reverse the conventional technocratic smart city paradigm, where proprietary smart city devices and the data they collect belong to commercial companies. When reflecting on the two failed smart city initiatives, public officials in both Canada and Spain felt uncertain. In Canada, the Sidewalk Labs project prompted several government agencies to rethink their approach to data governance and the procurement of data-driven technologies. However, when asked about the future or for good examples of smart city initiatives, Canadian officials expressed pessimism. They could hardly imagine a future where smart cities do not turn into surveillance machines; yet they believed in civic applications of data, of which the Canadian tech scene has several good examples. In Barcelona, the pessimism is caused by the failure of Bria's promising smart city vision, though some Barcelonians expressed hope that some of Bria's ideas will be implemented by future political leadership.

6.3. Key Theoretical Contributions

This dissertation broadens the theoretical and analytical perspectives of science and technology studies (Birch, 2020; Birch et al., 2021, 2021; Sadowski & Bendor, 2018; Sadowski, 2020) through crosspollination with the fields of smart city research (Kitchin, 2014; Mattern, 2015; Green, 2019), critical data studies (boyd & Crawford, 2012; Noble, 2018), and surveillance studies (Lyon, 2015; Monahan & Wood, 2018). At the same time, it extends the smart city scholarship into the realm of data governance by emphasizing the critical role of data

assets in shaping smart city projects. Central contribution of this dissertation is the application of assetization theory to studies of data governance in smart cities.

As outlined in Chapter II, assetization theory has proved to be very useful in the studies of data governance as a technoscientific phenomenon. I further developed the notion of affective data governance to account for the social aspects of assetization. The concept of affective data governance draws on the STS studies of affect as I argue that embodied affective intensities and discursive, socially shaped emotions are often inseparable in the dynamics of technoscientific phenomena. A collective experience, affective data governance refers to the instances of affective engagement with data that lead to the emergence of new social and political formations. For instance, in the empirical chapters of this thesis (Chapters IV and V), I analyze negative emotional responses to Sidewalk Labs' smart city that had pushed citizens to form the #BlockSidewalk citizen group; similarly, in Barcelona, collective dissatisfaction with private smart cities led to the election of an activist-mayor Ada Colau. As I am approaching data assets through an STS lens, my analysis has been acutely sensitive to the material dynamics of assetization. Study participants appeared to have been emotionally attached to personal data, which they considered to be one's property, form of labor, or a part of the public persona. Other manifestations of affective data governance, predominantly negative ones, had to do with the visible and perceptible data assets, smart cities.

In this section, I outline three interrelated contributions in relation to the existing theoretical perspectives referenced in the previous chapters.

6.3.1. Asset Governance

In the field of STS, an emerging body of research aims to understand the emergence and transformation of things into assets. STS scholars have used this assetization lens to explore the political economy of digital data, including personal data, health data, and internet user data (e.g., Beauvisage & Mellet, 2020; Prainsack, 2020; Vezyridis & Timmons, 2021; Ebeling, 2021; Geiger & Gross, 2021; Komljenovic, 2021; Rikap & Lundvall, 2022; Birch & Bronson, 2022). Assetization theory (Birch, 2020a; Birch & Muniesa, 2020) emphasizes three trends in contemporary technoscientific capitalism: the growing role of science and technology in the functioning of industries and markets; the advent of an asset-driven economy, where economic rents have become a predominant way of generating revenues; and the defining role of

expectations and imaginaries of the future on assetization processes (e.g., what is expected to bring profits in the future may have a high value in the present). A range of empirical studies have employed assetization theory to examine digital personal data and the attempts of various actors to generate monetary and nonmonetary value from them. These studies highlight three important trends: first, the assetization of data is a socio-technical process; second, data is turned into a valuable, tradable resource through costly digital infrastructure controlled by a small number of actors; and third, even when data are configured as a public or collective asset, the pursuit of economic rents often overrides all other interests.

I theorized public, private, and commons data governance as forms of asset governance. By bringing this STS perspective to smart city research, I showed why the attempts to build responsible smart cities failed, as the creators in both Sidewalk Toronto and Barcelona imbued data assets with mutually exclusive goals of generating financial profits and serving the public interest. I further employed an STS lens to examine the socio-material and technological aspects of Sidewalk Toronto and Barcelona's smart city, showing how the implementation of certain types of physical infrastructure can derail the original plans for data reuse for socially beneficial purposes.

6.3.2. Actually Existing Smart Cities

Smart city technologies have been rapidly adopted by the public and private actors across the globe, shifting the boundaries between the public and the private governance in cities and challenging privacy and autonomy of the city residents (Edwards, 2016; Artyushina & Wernick, 2021; Allen, 2022). In the field of smart city studies, the call to study "actually existing smart cities" (Shelton et.al., 2015; Wiig, 2018) reflects the fact that the top-down, technocratic visions of the smart city promoted by technology companies are being actively challenged by multiple actors on the ground. In recent years, a growing number of smart city scholars (Kitchin, 2015, 2022; Calzada, 2020) called for a case study approach to studies of smart cities and for more attention to the political aspects of smart city governance. Responding to these calls, this dissertation employed a comparative case study approach to examine Sidewalk Toronto and Barcelona's smart city. The Canadian case study is valuable for many reasons: first, there are few studies of Canadian smart city projects (Valverde & Flynn, 2020; Spicer et al., 2021); second, it was a smart city developed in Canada by the global technology corporation Alphabet;

and third, the project collapsed as citizens protested it. The case of Barcelona illustrates many dynamics endemic to European smart cities (e.g., the 2011 smart city initiative) but also reflects the unique social, political, and cultural contexts of the rebel Catalan region of Spain (e.g., the concept of data sovereignty was inspired by the struggle for political independence from Spain). When compared, these rich case studies showed surprisingly similar trends regarding the attempts at data commercialization and the vision of the smart city as commons. My study showed that it was the political logic of data assetization that caused so many issues in both initiatives.

6.3.3. Affective Data Governance

STS scholars have increasingly turned to the studies of the role of affect in technoscientific phenomena. Kerr and Garforth (2015) argue that we witness an "affective turn" in STS where "embodiment, care and affective interactions" have become the focus of empirical studies that explore the ethics and epistemic practices of science (e.g., Pickersgill, 2012; Fitzgerald, 2013; Myers, 2015), doctor-patient relations (e.g., Leem, 2016; Swallow & Hillman, 2019; Glabau, 2022) and citizen science (e.g., Lorimer, 2008; Bloomfield & Doolin, 2011; Kenens et al., 2022). The governance of city infrastructure presents a prime example of affective governance. As Knox (2017, p. 375) convincingly argues, "politics … is neither prior to nor determined by material structures, but emerges and is reworked through affective engagements with the material arrangements of the worlds in which people live." Michael (2020) coined the term "affective infrastructuring" in his study of "fatbergs", the water-cleaning devices in London. Michael shows how the fatbergs have been affectively enacted by various stakeholders, and how this process simultaneously performs the sewerage infrastructure and its public audiences. Londoners became aware of the fatbergs not through direct interaction with them, but in terms of the threats they supposedly posed to certain spokespersons. Engagement with the city infrastructure, Michael argues, is always indirect and affective.

My concept of affective data governance aims to put in conversation the concept of asset economy (Birch & Muniesa, 2020; Birch & Ward, 2022), namely the studies of data rentiership (Birch et al., 2020, 2021), and affective economy (Ahmed, 2004a, b) by capturing the role of affective relations with and around data. I define affective data governance as a type of affective economy (Ahmed, 2004b) in which emotional engagements with data and algorithms create new

social relations. Two important illustrations here are the citizen movement against Sidewalk Toronto and the IT professionals' political activism in Barcelona. In both cases, citizens' perceived emotional connection with personal data led to the origin of new collective social and political identities, i.e., citizens against Sidewalk Labs or Barcelonians against the corporations.

6.4. Possibilities and Future Research Directions

Theoretical and practical implications of data assets, affective data governance, and digital governance emerged as major areas in this project and possible directions for my future research. First, assetization theory portrays the political economy of data assets as reflecting a rent-seeking nature of technoscientific capitalism; that is why, in this dissertation, I explored data governance in smart cities as yet another iteration of extractive practices of technology monopolies. I believe that a notion of affective data governance may be useful in the studies of assetization as we seek to unpack the wide-ranging societal implications of this transformation. If the assetization of nearly every aspect of our lives is inevitable, what social and political roles would it ascribe to the human actors? What forms of resistance and self-determination are still available to us? The socio-material nature of data assets and the affordances it provides for affective engagement is another important avenue of my research, which spans the fields of STS, political economy, and the studies of affect.

"Digital governance" was a recurrent theme in my interviews with privacy and data governance experts who pointed out that the value of data depended on the control and ownership of the digital and physical infrastructure for data access, storage, and sharing. They urged me to speak about digital governance (i.e., the governance of the devices) instead of data governance. This argument was corroborated by my own research data, which showed that both Sidewalk Labs' and Francesca Bria's team in the City of Barcelona paid critical attention to the aspects of ownership and control over the smart city infrastructure, which defined who would receive the financial value of the data. I would like to extend my research to studies of digital governance and specifically look at the political economy of data sharing and storage (e.g., Lehdonvirta, 2022).

6.5. Policy Recommendations

A growing number of studies address the main lessons for policymakers from Sidewalk Toronto (e.g., Tusikov, 2020; Carr & Hesse, 2020; Haggart & Spicer, 2022). There is a growing

understanding that we need to take data governance in smart cities seriously, and when doing so we should balance a variety of competing interests, including rights to privacy, data access, and data reuse (Scassa, 2020; Wernick & Artyushina, 2023). Furthermore, the planning of smart cities requires public engagement (Wood, 2020; Nelischer, 2022), and public-private partnerships bring a lack of transparency to the development of smart cities (Valverde & Flynn, 2020).

Both Sidewalk Toronto and Barcelona are rich examples of smart city development. Despite the fact that both projects were canceled before their completion, the data governance approaches they proposed continue to inspire data governance initiatives and policies around the world. The concept of "data trust" has become a staple of the European Union's data governance policy that encourages data reuse across the public and private sectors (EU), and several costly public data trusts have been launched in the United States (e.g., the Silicon Valley Data Trust). After the departure of Sidewalk Labs, the Province of Ontario launched a public health data trust to help researchers of COVID-19. The City of Toronto is working on the Digital Infrastructure Plan (DIP, n.p.), a set of guidelines for city services that seek to procure smart city technologies. Francesca Bria's vision of the smart city has been foundational for the work of the Cities Coalition for Digital Rights, an organization that helps cities develop smart city solutions that address local needs. Her work also inspired the European Union's initiative for 100 climate-neutral and smart cities and the UN-Habitat People-Centered Smart Cities Program.

I propose the following policy recommendations that draw on the comparative analysis of the two case studies. These recommendations primarily address the municipalities seeking to develop smart cities and the regulators aiming to ensure that these developments do not override the public interest and do not impinge on the citizens' fundamental rights.

1. Municipalities have a capacity to act as the guardians of the public interest and as privacy gatekeepers in smart city projects. Indeed, city administrations are familiar with the issues faced by local communities, have experience with citizen engagement, and are democratically accountable. Putting municipalities in charge of smart city development was a central idea of Francesca Bria's DECODE project. Barcelona's smart city initiative proved that municipalities are in a good position to develop public smart city infrastructure and enter into public-private partnerships that are beneficial to the city and its citizens. Yet, to make it work, city administrations require new regulatory powers and substantial funding. This last requirement

is especially relevant in North America, where cities often have limited powers and even more limited funding (Green, 2019).

2. Data governance needs to be professionalized. According to study participants, a key reason why Sidewalk Labs managed to gain an upper hand in the smart city project was because its public partner Waterfront Toronto did not have professional experience in matters of data governance (Artyushina, 2023). The same can be said about the municipality of Toronto, which had experts in planning and economic revitalization but not data governance; therefore, city procurement contracts would often overlook issues of privacy and data reuse. It must be noted that all three levels of government involved in Sidewalk Toronto have taken steps to train their staff in matters of data governance. The federal government has been appointing Chief Data Officers across all departments with the purpose of creating common data pools; the Province of Ontario appointed a Special Advisor on Data Authority and launched the Ontario Health Data Council; and the City of Toronto conducted a public consultation on smart city development and began working on guidelines for public sector workers procuring smart city technologies.

3. Smart city solutions must respond to local needs (Artyushina & Wernick, 2021). The failure of Sidewalk Toronto proves the central argument of smart city scholarship that the generic, one-size-fits-all approach to the development of smart cities does not work. Meanwhile, the public support for Bria's smart city initiative shows that the municipality was headed in the right direction with the technologies it was using. Recent studies (Spicer et al., 2021; Sengupta & Sengupta, 2022) show that community-driven smart city initiatives have much better potential in locating the issues that need to be addressed and in deploying technological solutions that can actually benefit residents.

4. Smart cities need to be politicized (Kitchin, 2021, 2022). It is important to critically reassess the smart city paradigm that portrays data as the most objective and reliable instrument of policymaking. Good policies should precede any data governance initiatives. As this study demonstrated, data-driven city governance runs the risk of the commercial interests overriding the interests of the citizens. It is also important not to conflate the public interest with the interests of individual citizens and communities: arguably, this was a flaw in Barcelona's smart city project. As research on state surveillance compellingly argues, governments seek to employ the means of commercial surveillance as a governance tool. This convergence of public and private surveillance is especially dangerous in the case of smart city initiatives, where

residents have no option of escaping digital surveillance in the streets. To mitigate this risk, it is important to make smart cities the object of democratic deliberation and ensure that the people who design and deploy them are accountable to the people who will live in these smart cities.

5. Data reuse needs to be regulated (Artyushina, 2021a, 2021b). As I showed in this thesis, data rentiership (Birch et al., 2020) in the existing data economy stems from the fact that technology companies have legal and technical abilities to reuse the data they collect for legitimate purposes (e.g., when user data are collected as part of the service agreement with the online platforms). Putting limits on data reuse and requesting that data are destroyed after a certain amount of time could help implement the principle of purpose limitation first introduced in the GDPR in relation to data governance. The contracts could also encourage data sharing on the part of the businesses for public purposes (Mercille, 2021; Micheli, 2022). For instance, Bria's smart city initiative proposed contracts that would limit data reuse and require smart city vendors to store all the data they collected in public servers in Barcelona. Business-to-government data sharing is also a staple of the recent European data regulations (European Commission, 2020a).

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APPENDICES

Appendix 1. Project Documentation Analyzed for Both Case Studies

Sidewalk Toronto:

Sidewalk Labs winning bid of Quayside ("Vision")

Master Innovation Development Plan (MIDP)

2018 Framework Agreement between Waterfront Toronto and Sidewalk Labs

2018 Plan Development Agreement between Waterfront Toronto and Sidewalk Labs

2019 Plan Development Agreement between Waterfront Toronto and Sidewalk Labs

2018 Sidewalk Lab's Digital Governance Proposal

Sidewalk Labs' 2018 Privacy Framework

2018, 2019 Official reports issued by the Digital Strategy Advisory Panel (DSAP)

DECODE:

2012 Mesura de Govern MES: l'estratègia TIC del'Ajuntament de Barcelona al servei de la ciutat i delsciutadans

2013 Habitat Urbà (2013) Habitat Urbà. Ajuntament de Barcelona

2018 Ethical and Responsible Data Management: Barcelona Data Commons. Barcelona Municipal Data Office

2018-2020 Deliverables. DECODE Project

Appendix 2. Interview Guide

1. Please briefly outline your role in/in relation to Sidewalk Toronto.
2. How did you learn about Sidewalk Toronto? Did your perception of the project change over the course of the project?
3. Which part(s) of the proposal you were most interested/familiar with? In your opinion, how did the project compare to other development/smart city proposals?
4. What can you say about the role of the three levels of government in this project?
5. Can you think of any positive examples of smart cities in Canada and abroad?
6. How well, in your opinion, Canada's data protection legislation protects citizens' information? What are the main challenges brought about by the smart cities?
7. What is the best way to ensure citizen participation in smart cities?