“Moving in Data”: The Open Data Gaze as a form of Municipal Statecraft in the Entrepreneurial City

by

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Abstract

Globally speaking, data-driven urbanism is on the rise. As data becomes more readily available and important in contemporary economies, municipal governments are adopting new ways of managing and planning cities. By transforming themselves via urban data, cities can position themselves to be economically competitive, embedded in global networks, and increasingly connected to their citizens. Edmonton is a city that has reacted to these global trends and adopted smart city policies and data-driven processes. By implementing initiatives such as the *Smart City Strategy* (2017) and the *Open City Policy* (2015), and creating the Open Data Program, Edmonton has capitalized on this digital shift and positioned itself to use data and technology to promote and manage growth.

This research set out to address the following question: how has data-driven urbanism unfolded in Edmonton, Alberta? It addresses this question using a multi-method qualitative research approach which included key informant interviews, policy document analysis, and a case study of the Open Data Program. To analyze data-driven urbanism in Edmonton scholarly literature on data-driven urbanism, entrepreneurial urbanism and the data gaze was applied.

Through researching data-driven urbanism in Edmonton, the thesis developed an original concept: the open data gaze. The open data gaze describes the discourses, infrastructures and practices at work in Open Data Program, and how they work together to apply and expand the data gaze. The thesis concludes with an exploration of the open data gaze in relation to literature consulted. This exploration addresses how the open data gaze acts as an exemplar of municipal statecraft. As a form of municipal statecraft, the open data gaze is applied towards entrepreneurial ends. The City

of Edmonton uses the open data gaze as a process for transforming Edmonton into a data-driven city. This transformation is predicated on the desire to become an entrepreneurial city. Ultimately, the thesis concludes that the open data gaze can be understood as a process by which data-driven urbanism in Edmonton is entrepreneurialized.

Preface

This thesis is an original work by Hannah Graham. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name “Putting Data-Driven Urbanism in its Place”, Pro00097885 August 14, 2020. The research was funded by a Social Sciences and Humanities Research Council Insight Grant (SSHRC Reference#: 435-2019-1137).

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All significant milestones and moments in my life have never been a solitary endeavor. These moments are made up of a network of places, family and friends, peers, and mentors. This research and thesis are of course no exception, and could not have been done without the support and encouragement of those close to me.

I would like to start by thanking my parents whose endless love and support always got me through the best and worst times. I do not think I can describe just one thing I am thankful for, but thank you for listening to my thoughts and ideas, thank you for the Sunday dinners, and thank you for always showing me you were proud of me. Thank you also to my brother Carson who always called to check in and see how I was, and to my brother Jack who shares my love of data and would engage in many 'data-driven' conversations. I of course also want to thank the rest of my family who always offered their support, asked me how my thesis was going, and listened to me talk about the research.

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As I completed my degree during the pandemic lockdowns, I spent a significant amount of time in my apartment. That is why I would like to thank my roommate Maddy for constantly being

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This research would not have been possible without the assistance of those who participated in the research. Thank you particularly to the Open Data team at the City of Edmonton whose openness (for lack of a better word) and willingness to work with and help me ensured this project was possible.

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Chapter One – Introduction

Cities are supposedly being transformed by data-driven policies, decision making and technologies. According to techno-enthusiasts the urban "data-revolution" (Kitchin, 2014a) has led to the emergence of so-called smart cities – technologically inclined cities that use digital data in everyday decision-making to improve urban governance and livability (Kitchin, 2019; Rose, 2020). The City of Edmonton has declared itself a 'smart city', enacting a variety of data-centric policies, directives and initiatives to deliver on this label, and provide solutions to current issues related to population health, urban sustainability and economic competitiveness (City of Edmonton, 2017a). This thesis examines how this phenomenon of 'data-driven urbanism' is understood, facilitated and experienced in Edmonton.

1.1 The 'Actually-Existing' Smart City: Edmonton Alberta

There is an extensive body of literature surrounding the smart city (Rose, 2020; see also section 2.2). Geographers, in particular, have described the smart city in all its varieties as a generalized form of urban transformation (Kitchin, 2019; Rose, 2020; McGuirk et. al., 2021; Kitchin, Lauriault & McArdle, 2017). While understanding this generalized process is important, there are increasing calls to do empirical case study work focused on the 'actually-existing' smart city (Rose, 2020; Kitchin, Lauriault & McArdle, 2017). Studying the so-called 'actually-existing' smart city allows for the in-depth exploration of the people, processes and spaces behind these data-driven transformations. The connection between data and the smart city will be explored in depth throughout the thesis. The production of urban data is central to nearly all definitions of the smart city – the place where data-driven urbanism occurs. Data-driven urbanism is then the process that has built, and runs throughout, the smart city. Rob Kitchin (2017), for example, refers to data-driven urbanism as 'the mode of production' of the smart city: it is what fuels and drives the establishment of smart cities. I have come to conceptualize the smart city as a place where data-driven urbanism occurs. Data-driven urbanism is, then, the process that has built and animates the smart city.

Edmonton is an ideal site to study the actually-existing smart city, providing an opportunity to delve deeper into the processes of data-driven urbanism. As early as 2010, when the City of

Edmonton applied for and won IBM's Smarter Cities Challenge, Edmonton has identified itself as a smart city (City of Edmonton, n.d.-a; IBM, 2011). In 2010, Edmonton was the fourth municipality globally (third in Canada) to create an Open Data Catalogue, has since "grown to include a wide variety of datasets and visualizations, making data related to roadways maintenance, locations of schools, varieties of trees, municipal elections data, aggregate municipal census data and much more available to the public" (City of Edmonton. n.d.-b). The Open Data Program is the City of Edmonton's flagship smart cities initiative, a vital component of Edmonton's smart city identity, and is crucial to processes of data-driven urbanism in the city.

1.2 Research Question and Objectives

This thesis examines Edmonton as an 'actually-existing' smart city. In particular, it focuses on the production and management of open data, one process that has come to define Edmonton as a smart city. The thesis addresses a short, albeit complex question: how has data-driven urbanism unfolded in Edmonton, Alberta?

To answer this question, this research set out to do the following:

1. define the key features which characterize Edmonton as a smart city;
2. describe the discourses that have structured data-driven urbanism in Edmonton;
3. identify and describe the infrastructures and practices that make possible the production, management and utilization of open data;
4. critically evaluate the spaces that are produced by and through these forms of data-driven urbanism.

I addressed the question above using a multi-method qualitative approach, which resulted in the development of an original concept: the Open Data Gaze. The research objectives were met primarily through the development of this concept, which describes the primary process of data-driven urbanism in Edmonton. The open data gaze is based on David Beer's (2019) theory of the data gaze, which describes how data is imagined, deployed and realized within the data analytics industry. The open data gaze is an extension of this theory, and defines the discourses, infrastructures and practices surrounding open data in Edmonton. The open data gaze acts as an

exemplar of municipal statecraft – the intentional and proactive efforts taken by governments to manage the municipal state in contemporary cities. Because of the intentional policy effort taken by the City of Edmonton to establish the Open Data program, coupled with the infrastructures and practices that support its proliferation in the city – it is clear that the open data gaze is an active process of municipal statecraft. This is important because municipal statecraft is a key component of contemporary entrepreneurial urbanism, where cities are actively defining and generating their own economic success. Given this, this thesis argues that the open data gaze can be understood as a process which makes data-driven urbanism in Edmonton entrepreneurial. A detailed description of how the research question was answered is included in the following section.

1.3 Thesis Overview

The overall structure of this thesis is outlined below.

Chapter Two - Background: Geographies of Data-Driven and Entrepreneurial Urbanism

Chapter two is a literature review of relevant scholarship on data-driven urbanism including smart cities and urban data. The section on data-driven urbanism includes an exploration of the literature on smart cities, a definition of urban data, descriptions of the main forms of urban data used in cities (big data and open data), and an examination of the critical understandings of urban data. Entrepreneurial urbanism is then defined and described – including an exploration of municipal statecraft and how smart city policies are an exemplar of these entrepreneurial practices. The chapter contents are framed as the geographies of data-driven and entrepreneurial urbanism, and therefore highlight the spatial underpinnings of these processes.

Chapter Three - Analytical Framework: The Data Gaze

Chapter three introduces the main theory that the thesis utilizes: the data gaze. The data gaze is a theory introduced by David Beer (2019) and characterizes the discourses, infrastructures and practices that surround the data analytic industry. This chapter details the data gaze framework, as well as the key spatialities and temporalities that are woven throughout. The data gaze theory is applied throughout the thesis, and this chapter provides an underlying foundation for its use.

Chapter Four - Methodology: Unpacking Data-Driven Urbanism in Edmonton

Chapter five includes a description of the multi-method qualitative approach that the research undertook. First it describes the methods of the key informant interviews, including an exploration of podcast interview methodology and a definition of the 'modified framework method' I undertook for data analysis. Second it details the policy document analysis of several City of Edmonton policy and strategy documents on smart city and data-driven initiatives. Lastly the case study of the Open Data Program in Edmonton is described, which includes an ethnography and in-depth interviews.

Chapter Five - Results: The Open Data Gaze

Chapter five includes the results of the thesis research, which culminated in the development of the open data gaze. The results chapter includes an exploration of Edmonton as a smart city, and then details the open data gaze. The open data gaze is comprised of the discourses, infrastructures and practices that operate within the Open Data Program in Edmonton.

Chapter Six - Discussion: The Entrepreneurial Open Data Gaze

Following the results chapter and introduction of the open data gaze, chapter six discusses the results in reference to the theory and literature previously established throughout the thesis. In doing so it answers the research question 'how is data-driven urbanism understood and applied in Edmonton' by undertaking an exploration of the entrepreneurial open data gaze.

The thesis additionally includes an introductory and concluding chapter, as well as appendices and a reference list.

Chapter Two – Background: Geographies of Data-Driven and Entrepreneurial Urbanism

2.1. Introduction

Globally speaking, data-driven urbanism is increasingly being operationalized in cities. As data becomes more readily available and important in contemporary economies (Beer, 2019; Kitchin et al. 2017) governments are adopting new ways of governing in response. Municipal governments especially have become well placed to adopt data-driven decision-making and smart city policies in this regard (McGuirk et al. 2021; Luque-Ayala et al. 2015). By using urban data, cities can position themselves to be economically competitive, embedded in global networks, and increasingly connected to their citizens (Barns, 2016; McGuirk et al. 2021; Chang et al. 2021). Edmonton is a city that has reacted to these global trends and adopted smart city policies and data-driven governance styles. This thesis endeavors to understand how Edmonton sees, understands and applies data-driven urbanism, therefore it is first crucial to define data-driven urbanism.

Cities are increasingly using urban data, often in real-time, in order to perform governmental functions, facilitate decision making and enhance service delivery (Kitchin, 2017). This form of urbanism is spurred on by a desire to compete economically, as governments see data as a strategic tool to enhance their own economic status (Barns, 2016). The literature on data-driven urbanism is made up of two main bodies of work: the smart city and urban data. Data-driven urbanism can be defined as the "mode of production" for smart cities, and therefore understanding the smart city will provide a useful backdrop for examining this phenomenon (Kitchin, 2017, p. 44). Data-driven urbanism is ran on and by urban data, so the second body of scholarship examined will be urban data – its definition, use in cities, and critical understandings.

In addition to data-driven urbanism I propose including another concept to examine in tandem: entrepreneurial urbanism. Recent scholarship on entrepreneurial urbanism describes how contemporary cities use smart city policies and data-driven processes as a way of taking more interventionist roles in urban governance and the economy through municipal statecraft. Entrepreneurial urbanism is a key way to understand the motivations and intentions behind data-

driven urbanism and determine the ways in which municipal governments work to facilitate economic growth. Including the geographies of entrepreneurial urbanism alongside data-driven urbanism will provide a useful foundation for critically understanding data-driven urbanism in Edmonton.

2.2. The Smart City

Cities all over the world are becoming 'smart', utilizing physical and virtual infrastructures to transform the urban experience. Smart cities, constituted by different styles of data-driven governance, are multiplying in part due to the uncertain futures that climate change and a tumultuous economic environment are presenting (Shelton et al., 2015; Kitchin, 2017). Despite their intentions, these 'futurist' solutions can be critiqued, as big data, algorithms and modeling may not be able to properly address these uncertainties (Haraway, 2016; Kitchin, 2017). Smart cities run on urban data. In the smart city, the functioning of urban processes and infrastructures and the flow of data are intricately linked, and one does not operate without the other. In any close examination of data-driven urbanism, the smart city is a key backdrop.

Smart cities, as both "a policy idea and a planning practice, [have] emerged at the forefront of global urban policy discussions" (Chang et al., 2021, p. 560). Why is this so? Cities have always adapted to technologies as they come along, whether that be automobiles, the printing press, radio, manufacturing plants, or really any number of technologies that have come to define urban growth (Green, 2019; Mattern, 2017; Clark, 2020). So what differentiates a smart city? Why are we now defining cities as smart, and creating significant policy efforts to implement them? The short answer is big data. Big data is categorized by its volume, and while municipal governments have used data in various forms for a long time – they are now able to use such a mass of data that they can build their cities in more efficient and effective ways (Batty, 2017). Society is becoming ever more urban, and cities in turn are needing to adopt new ways to manage and govern. Smart cities have arisen to act as an important governance tool in reconfiguring the city for the collection and use of urban data (Kitchin, 2017).

Smart cities can be defined, most simply, as cities that incorporate information communications technology (ICT) into urban infrastructures and services (Green, 2019; Kitchin, 2019; Amirian &

Basiri, 2017). By weaving digital sensors and technologies into the fabric of the city, cities can generate big data (Kitchin, 2017) that can be harnessed to guide decision making and improve governmental service delivery (Gupta et al., 2015; Green, 2019). Kitchin (2019) describes three ways that smart cities are currently understood. First, smart cities are cities that are 'managed computationally' by embedding digital instrumentation into the infrastructure of the city to provide data for managing the city (Kitchin, 2019). What is stressed here in these understandings is the importance of "continuous streams of data" gathered from physically embedded sensors and technological tools so that the city can more efficiently and effectively provide services to their citizens (Kitchin, 2019, p. 775; Rose, 2020; Shelton et. al., 2015). The second understanding of smart cities stems from the use of ICT to strategically produce 'smarter' workers, entrepreneurship and greater economic development (Kitchin, 2019). Lastly, the smart city is understood as a place that prioritizes democracy, citizen-centered innovation, participation, and transparent governance (Kitchin, 2019). While these three understandings often co-exist, cities may choose to prioritize one over the others to fit with their own goals and governmental ambitions (Kitchin, 2019). Each understanding of the smart city is united in that they depend upon embedding technological tools within the city's infrastructure. Either way, smart city technology is understood to advance urban governance in some way, and thus has become an increasingly powerful governmental tool in its own right.

Governments collect data in numerous ways, either by traditional methods such as surveying and data collection by employees, by buying data from corporations or other governmental bodies, or now, by automated collection using sensors and digital instrumentation (Kitchin, 2014a). The most powerful data collecting method here is likely the automated collection from sensors embedded in the city, which is why smart cities have become such a prevalent policy goal (Kitchin, 2014a). With more instrumentation – comes more data, with more data comes more decision making power. As will be discussed in the following section, data is becoming more and more important for cities. This "need for data to flow unimpeded is at the heart of the idea of the smart city", and it is almost as if to have data, you need to have a smart city (Rose, 2020, p. 522). Data-driven urbanism then, is what works behind the scenes of the smart city – using the data collected to better manage the city.

2.3. Urban Data

2.3.1. Introduction

Urban data is the lifeblood of data-driven urbanism, and capitalizing on its use is how municipal governments have ushered in this new urban formation. Critically examining the role of urban data in the rise of smart cities, and the ever increasing influence of data-driven urbanism, is key to understanding cities and how they are responding to contemporary societal issues. Urban data has become a "key input for understanding city life, solving urban problems, formulating policy and plans, guiding operational governance, modelling possible futures and tackling a diverse set of other futures" (Kitchin, 2017, p. 44). Despite their rather ubiquitous influence in urban settings, there is still much that is unknown about urban data. Questions such as how and for whom urban data is produced are still relatively unexplored, as well as its influence in governments and organizations (Kitchin et al. 2017).

A growing scholarship has begun to question the influence of data in cities. Falling under the umbrella of 'critical data studies' this scholarship "[takes] the politics and praxes of data as its central concern" (Kitchin & Lauriault, 2018), emphasizing the need to go beyond studying data in a strictly technical sense. This section examines urban data, and its creation and use in the smart city. Here big and open data are the primary types of urban data used in governance. Urban big data and open data can themselves be theorized as socio-technical, material and political.

2.3.2 Defining Urban Data

At the heart of the smart city is its most fundamental component: urban data. Generally, data are the 'raw' elements abstracted from the world (Kitchin, 2014a). These elements display the world in categorical, measurable, representational, and implicit ways, and as such make up the most basic constituents of our knowledge (Kitchin, 2014a). With the unending desire to 'know' our world, data of various kinds have been used for centuries across many disciplines and settings. In urban settings, for example, data have been widely used by governments, planners and engineers, amongst others, to interpret and manage cities (Shelton et al. 2015). Despite their historical use, the rise of ubiquitous computing has changed the nature of data (Kitchin, 2014a). Now, powerful

computers can generate, process, display and analyze data with ease, leading to the widespread use and voluminous presence of data in our modern world (Kitchin, 2014a). Alongside businesses and organizations, cities have endeavored to utilize this expansion of data availability. Termed 'urban data', data about cities have transformed modern governance, actively changing the ways cities are understood and regulated. Data initiatives such as dashboards (interfaces that display data visualizations), open data archives (databases available for public use and redistribution) and participatory mapping (citizens input spatial data into a mapping platform) are some tools cities have used to capitalize on urban data (Kitchin, 2014a). Urban data range from small to big in nature, consisting of spatial, participatory, and sensed data which are frequently 'open' (Kitchin, 2014a).

2.3.2.1. Big Data

When we talk about contemporary uses of data, and how it is used within cities, it is not to say that data is new. Data has existed in many forms for a long time, but with increased computational power data can now be leveraged to even greater extents (Batty, 2017; Kitchin, 2014a). Big data are defined using a number of characteristics, among them are: volume, velocity, variety, exhaustivity, resolution, relationality and flexibility (defined in table 2.1). Of these, Kitchin and McArdle (2016) identify exhaustivity and velocity as the traits that distinguish big data from other forms, meaning the key qualifiers of big data are that they attempt to capture a population of *n=all*, in near-real or real-time (Kitchin, 2014b; Kitchin & McArdle, 2016). Big data are particularly important to data-driven urbanism, as the rise of smart cities has co-occurred with the rise of big data (Taylor & Richter, 2015). Big data allows large amounts of information on cities to be captured instantaneously and used for decision-making and urban services. With increasingly large amounts of data comes the need for tools to make sense of all this data – largely encompassed within the world of urban analytics (Batty, 2019). Urban analytics is seen as a "fast emerging … core set of tools employed to deal with problems of big data" in an urban setting (Batty, 2019, p. 403). Within urban analytics are a suite of tools, including data analytics, urban science, city operating systems and data infrastructures, as detailed in table 2.2 (Kitchin, 2017; Kitchin, 2014a).

Table 2.1

Characteristics of big data (Kitchin, 2014b; Kitchin & McArdle, 2016)

Characteristics of Big Data	**Definition**
Volume	Huge or enormous quantities of data.
Velocity	Data is produced in approximately real-time.
Variety	Multitude of data types including structured, unstructured, temporal and spatial.
Exhaustivity	Data are not sampled, and instead an entire population or system is collected (n=all).
Resolution	Data are fine-grained and detailed.
Relationality	Data allow for the conjoining of multiple datasets.
Flexibility	Data allow for changes in size and categories (fields).

Table 2.2.

Examples with definitions of urban analytic tools

Term	**Definition**
Data analytics	Tools and processes for gaining insights from datasets, including pattern recognition, visualization, statistics, and predictions and simulations (Kitchin, 2017; Beer, 2019).
Urban science	A form of science meant to study human behaviour in cities and determine general laws and theories that can apply to cities' behaviours and functioning (Batty, 2019). Urban science is sometimes accompanied by computational modelling that explains urban processes (Batty, 2019; Kitchin, 2017).
City operating systems	Rooms that monitor city functions via cameras, data streams and other computational monitoring devices (Kitchin, 2017).
Data infrastructures	Institutional, physical and digital apparatuses that allow for data storage, release and use (Kitchin, 2014a).

Many terms have been used to describe this influx of data use. Among them, terms such as data deluge, and the data revolution are some of the most common (Kitchin et al. 2017). These terms speak to the way data has taken over our cities and our governance strategies. Referring to how urban areas are administered and managed, urban governance has far reaching influence over the allocation of social and material resources in cities, and the organization of political power (Avis, 2016). The potentials of big data in urban governance, including aspects of design, planning, administration and management, are 'manifold' (Taylor & Richter, 2015). The great potential of

data to make cities organizable, manageable and efficient, has led to its widespread use. In fact, in 2011 data generation was projected to rise by 40% each year, denoting its continued importance in contemporary society (Manyika et al., 2011).

Increased use of big data in cities, in conjunction with algorithmic data mining and pattern detection, has led to the emergence of real-time urban governance (Kitchin 2014a). Automated data generation and processing is occurring via sensors that work with little human attention and these sensor technologies are typically embedded in the physical environment of cities or on the bodies of citizens themselves (Batty, 2017). Taking full advantage of this automatic data collection involves compiling data into analytic hubs such as open data portals or city dashboards (Kitchin, 2014a). The collection and analysis of data in real-time contributes towards "closing the gap between data and insight", an effect that has been called 'immediation', producing accelerated forms of real-time knowledge production (Beer, 2019, p. 48). Essentially, if data can be utilized in real-time, decision-makers can better project and anticipate future outcomes (Beer, 2019). Ultimately, this utilization of data in real-time for urban governance reflects an overarching desire to make cities hyper-efficient. The desire to make a city hyper-efficient raises some questions: why do we want our cities to be so efficient, and, is this just a new means of social control? It also calls into question whether cities are being made so efficient that they will start to lose their character, or 'cityness' (de Waal, 2017). Mattern (2014, p. 3) even laments that "we seem ready to translate *our* messy city into *my* efficient city" (emphasis in original).

2.3.2.2. Open Data

Thus far, I have defined urban data, and showed that many different types of urban data exist – with varying purposes and uses. The type of urban data examined in this thesis is open data, data that is "free to use, reuse and redistribute" (Kitchin, 2014a, p. 50). For governments, open data are a way to be more transparent, pursue participatory data collection from citizens, and make governance efficient, making them a key form of urban data (Kitchin, 2014; Mattern, 2014). This freely available data has become very popular among governments worldwide, with 85 local and national governments adopting the Open Data Charter Principles since 2015 (ODC, n.d.). Stemming out of the Right to Information movement, and as an often used tool of open government, open data is presented as data that can lead to transparency, participation, and

accountability in government (Kitchin, 2014a; Landemore, 2020; Barns, 2016). This type of urban data is particularly important in Edmonton, one of the world leaders in open data (City of Edmonton, 2017b). Because this thesis aims to understand the spatial arrangements of open data in Edmonton, it is first crucial to further define open data and then detail some of its uses in cities.

Open data is generally defined as data that can be freely used, reused and redistributed by anyone (Open Knowledge Foundation, n.d.; Kitchin, 2014a). Predicated on the idea of 'openness', open data has very little restrictions imposed on it – at most, requiring attribution (Open Knowledge Foundation, n.d.-a). Open data must also be machine readable, meaning that it is formatted in a way that it can be automatically processed by a computer (Barns, 2016; Open Knowledge Foundation, n.d.). While there are a variety of interpretations of 'openness' and what it means to be 'open', open data itself is quite clearly defined. It must be open to anyone to use or redistribute without restriction, and it must be provided in a technically open format where machines are able to process it. Open data is most often provided as open government data, and the terms are frequently used interchangeably, the only difference being the specifics of 'government' (Barns, 2016). Open government data is when governments (national, local or otherwise) release their data to the public, in a free, machine-readable format (Barns, 2016). It can also be seen as "a philosophy – and increasingly a set of policies – that promotes transparency, accountability and value creation by making government data available to all" (OECD, n.d.). The importance of open data in this way, lies not in its technical definition, but as a tool that can promote the ideas of open government.

Open government aims to make government more accessible to the general public, through transparency, participation, and accountability (City of Edmonton, n.d-b.; Barns, 2016; OECD, n.d.). Transparency is making governmental information available to the public, participation engages citizens in governmental processes, and accountability allows the public to scrutinize and call upon the government to justify their actions (Barns, 2016). Governments purporting to follow and implement these open government principles typically do so by creating open data programs (Landemore, 2020). This more "limited goal of 'open data'" does not necessarily embody these open government principles, and sometimes focus more on either "improved

efficiency of government and service delivery" or, the ability of open data to be used as an economic tool (Landemore, 2020, p. 15; Barns, 2016). So "while the arguments for open data were originally framed around the values of open government", open data has become increasingly linked to "software entrepreneurship and value generation" (Barns, 2016, p.3). This notion of open data being used for entrepreneurship and the economic growth of cities will be discussed in more detail in section 2.4. For now, it is mainly important to note the origins of open data through open government principles, and that cities often present open data as a way to fulfill these principles, and create more 'open' cities.

2.3.2.3. Data Dashboards

An illustrative example of big and open data usage in cities is city dashboards – graphic digital interfaces that display data visualizations of city performance metrics and patterns (Kitchin & McArdle, 2017). These dashboards use different types of data to create maps, charts, icons and models to show how a city is 'performing' in certain areas such as transportation, health or design (Kitchin & McArdle, 2017; City of Edmonton, n.d.-c). For example, the City of Edmonton has a COVID-19 Dashboard displaying all of the relevant COVID-19 data for the city, as shown in figure 2.1. The City of Edmonton also has a Citizen Dashboard that records key metrics for the most recent City Plan, as shown in figure 2.2 and 2.3. City dashboards such as the Citizen Dashboard have often used data collected with 'traditional' methods, utilizing small data to display urban measurements, but are increasingly turning towards big data usage, as exemplified by the COVID-19 Dashboard (Kitchin & McArdle, 2017).

Figure 2.1

City of Edmonton COVID-19 Dashboard (City of Edmonton, 2021)

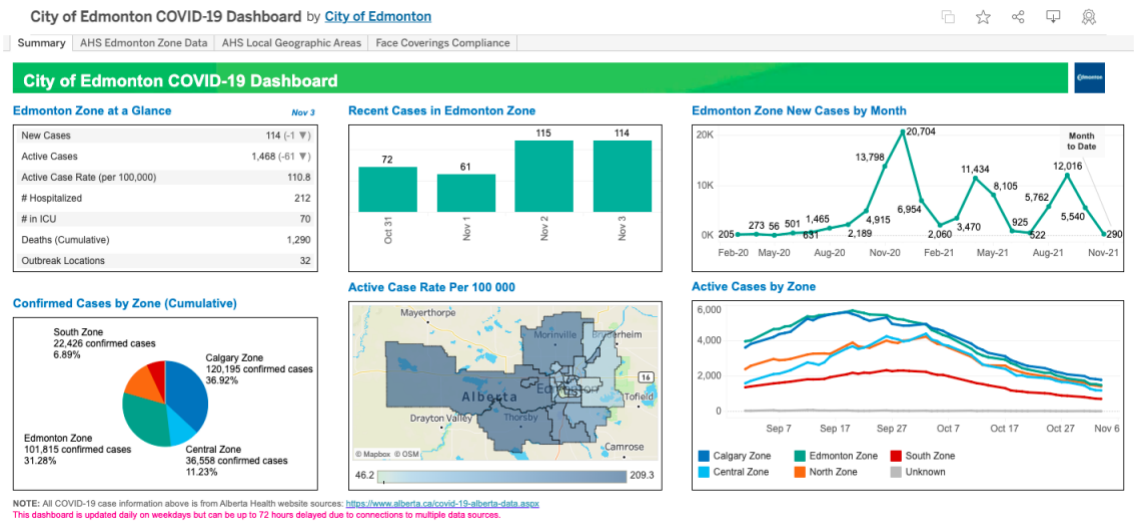


Figure 2.2.

City of Edmonton Citizen Dashboard (City of Edmonton, n.d.-c)

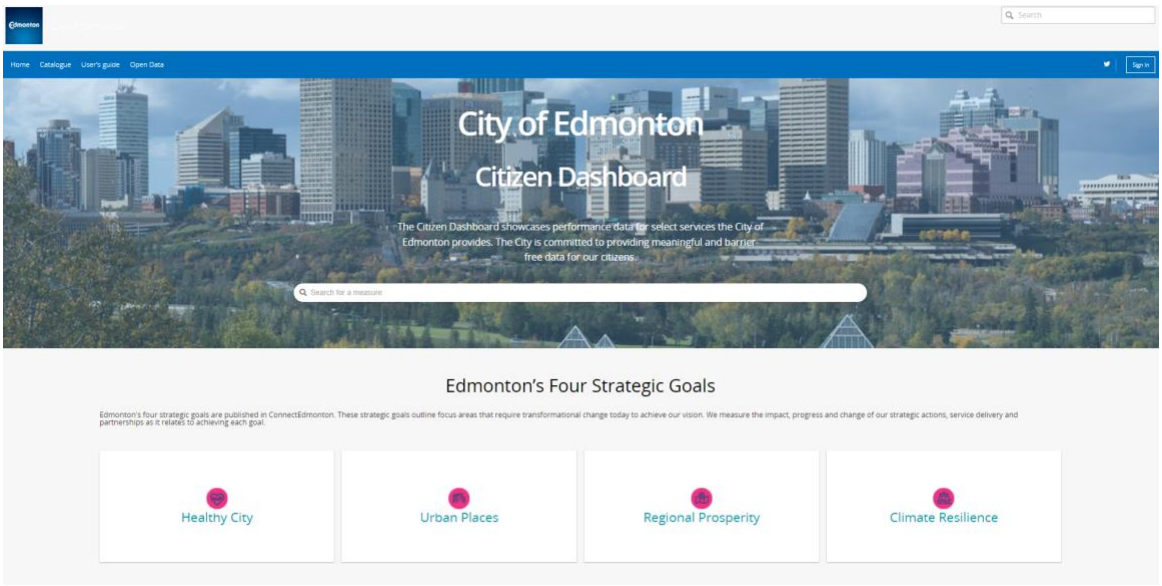
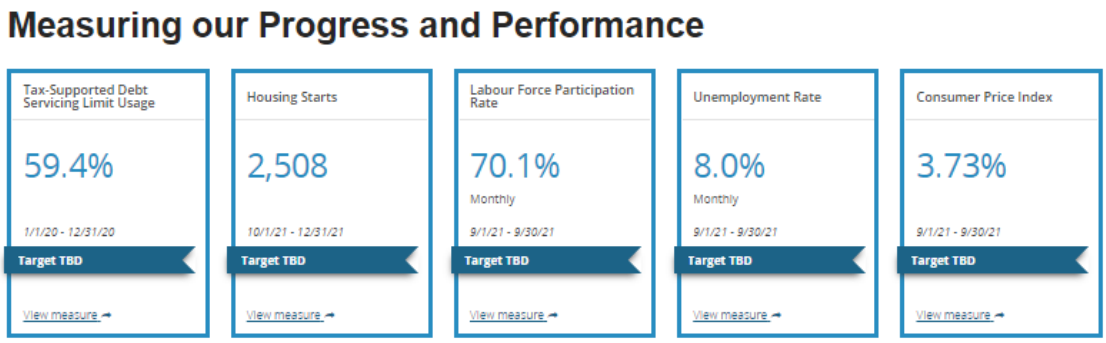


Figure 2.3

Regional Prosperity Dashboard Metrics (City of Edmonton, n.d.-d)



Dashboards are a visual format used to make data available to the public to view and use, effectively making the data displayed 'open' (Kitchin, 2014a). By abstracting urban phenomena as a set of indicators, dashboards present a vision and sense of what a city is at a given time. These abstractions and displays of the city are typically presented as neutral and objective tools of urban governance (Kitchin, Lauriault & McArdle, 2017). A critical study of urban data, presented using tools such as dashboards, is meant to show that data are in fact *not* neutral and instead contain inherent values, politics and biases (Kitchin, Lauriault & McArdle, 2017). The following section will describe how urban data are evaluated as non-neutral in three key ways.

2.3.3. Critical Understandings of Urban Data

There is a fairly substantial body of literature on critical understandings of urban data – detailing it as non-neutral, and embedded with social and political values that impact our world. This section will detail three main ways in which urban data is understood critically: namely, how urban data is socio-technical, material and political.

2.3.3.1. Urban Data is Socio-Technical

One of the main critical understandings of urban data is that it is socio-technical, meaning it is both more-than technical itself, and exists within socio-technical systems. Many critical data studies approach data as socio-technical, as opposed to strictly digital and technical (Thatcher &

Dalton, 2017). By doing this urban data is examined not from a "common-sense, essentialist position" but instead as an object embedded within socio-technical structures and systems (Kitchin et al., 2017, p. 4). These socio-technical systems represent the infrastructures, politics, values, actors, and economies involved in creating and sustaining technical objects including code, platforms, interfaces and of course, data (Kitchin, 2017). When data is examined critically from a socio-technical perspective, the data itself can be looked at as more-than-technical, where there is intentionality and social values embedded into the data itself. Looking at data socio-technically also involves looking at the system of social actors that urban data exists within. This section will examine both of these areas of study, showing how urban data has come to be known critically as socio-technical.

A more-than technical interpretation of urban data is exemplified by Thatcher and Dalton's (2017) analysis of data provenance – a feature of urban data typically left 'underexplored'. Data provenance typically refers to the documented origin and history of that data, ranging from the technical source of the data, to the assumptions and biases that went into their collection (Thatcher & Dalton, 2017). A more-than technical approach to data provenance necessitates that provenance includes not only the technicalities of data collection, but the intentionality as well (Thatcher & Dalton, 2017). Data provenance is what typically determines the trustworthiness of data, ensuring the data is clean of technical issues and social biases (Kitchin, 2014a). The recording of biases and limitations in data provenance is particularly important with urban data which are meant for public decision making and citizen use. Since data are meant to represent the 'truth' of a situation, they must be trustworthy on technical, social and political bases (Thatcher & Dalton, 2017). If not recorded in the provenance, those working with urban data in a public sphere may consider data trustworthy as long as it is technically credible.

These inherent more-than technical assumptions that go into the collection of urban data affect their distribution and limit their usage. Offenhuber (2017) utilizes the term 'data friction' in a discussion of urban data proxies as a way to illustrate the importance of evaluating social biases in data. Data friction refers to the efforts required to utilize data in more than one context (Offenhuber, 2017). For example, the urban data proxy of using radiance values from remotely sensed atmospheric imaging to indicate urban population, carries significant amount data friction

given the extent of socioeconomic assumptions required to equate light to human presence (Offenhuber, 2017). Data friction is more-than technical, requiring the recognition of social factors among technical ones when using urban data for more than one purpose.

One of the best examples of urban data as sociotechnical can be found in Gillian Rose's (2020) exploration of sociality in smart cities. Rose takes a deep dive into the different socialities at work in one 'actually-existing' smart city: Milton Keynes, United Kingdom. What is most interesting about this paper is how data and technology can be seen as working within a socio-technical system. Rose characterizes the 'smartness' of smart cities to be achieved through using data to improve urban governance, and highlights the networks of interconnected actors working to achieve this goal. Because smart cities "convene a variety of actors to achieve a wide range of aims and affects", the social part of social-technical becomes very important (Rose, 2020, p. 513). Urban data does not work on its own – it is created, put into motion and used by various groups of people, in different ways and for a diversity of purposes. Rose identified three main forms of sociality at work while interacting with data and technology: sociological, neoliberal and cybernetic, each with a varying degree of connection to data, or the 'technical' component of socio-technical.

The sociological branch of sociality in a smart city refers to the social structures that build social groups, and the relations between them (Rose, 2020). The building of these social groupings creates some 'structural divisions' between groups, in the case of a smart city between the technology or 'tech' people, and 'real' people (Rose, 2020). By creating disparate social groups of those who create the data and technology, and those who are supposed to benefit from that technology, there is less of a connection between data and 'the social'. Data in this way is almost purely technical, and only seen as a tool within a social system.

Another type of sociality found in smart cities is neoliberal (Rose, 2020). With neoliberal sociality, groups are autonomous, self-directed entities that aim to self-improve (Rose, 2020). They act in conjunction and in relation to urban data and technology. In this form of sociality there is more connection between the social and the technical, as social groups act in relation to each other and to technology.

The last form of sociality found in smart cities is cybernetic, a "sociality constituted by the flow of data" (Rose, 2020, p. 522). This is the most socio-technical of the three forms of sociality as data is what makes up the sociality, moving from the social and technical simply being relational, to being interconnected. Rose states that there is a "need for data to flow unimpeded is at the heart of the smart city", which a cybernetic sociality achieves (Rose, 2020, p. 522). By having this increased connectedness between people and technology, data is able to 'flow' smoothly and freely through the smart city. The three forms of sociality that run through the smart city – sociological, neoliberal and cybernetic - work together to constitute socio-technical networks in the city, and together make up the socio-technicality of urban data.

2.3.3.2. Urban Data is Material

It is clear that our world is becoming more and more technological, programmed, and digital. Because of this it is tempting to think that the world is therefore becoming more 'virtual' – with computation creating a world of appearances. Data is often placed in this virtual realm, as something that is immaterial and only affects the world as a point of mediation between people and this 'non-existent' sphere of virtuality (Straube, 2017). How can this be so? How can data not 'actually' exist, and yet still have an effect on the people using the data? This question cannot really be answered – data cannot have an effect on the world if it only exists in a virtual, immaterial realm. This, then, requires looking at data as *material*. Looking at data as material is not a novel examination, and has been looked at by numerous critical data studies scholars.

The materiality of data can be understood in two ways. First, data themselves are material - whether by the magnetic atoms stored and then transmitted electromagnetically, or by the physical infrastructures enabling their generation and use (Bates et al. 2016). Secondly, socio-political and cultural values are materialized in data (Bates et al. 2016). Both of these materialities are important when evaluating urban data, as the physical material properties are rapidly changing the fabric of cities (Kitchin, 2014a), and urban values are manifesting themselves within the data. Straube (2017), alternatively, looks at the ways in which data has its own inherent materiality – beyond that of a socio-material mediator of human values. For him, data is "materially constituted by processes that 'take place' beyond human perception" (Straube,

2017, p. 157), and by only considering data "in regards to their effects on society" (Straube, 2017, p. 156), we would be limiting data's agency, and not adequately acknowledging its complexity.

Meaning can also materialize within urban data as it 'journeys' through sites of data practices and governance, changing form as it moves through different socio-material contexts (Bates et al. 2016). These sites of data practice and governance are part of a larger 'assemblage', representing the diverse material and discursive framings of urban data production and use (Bates, 2017; Kitchin, 2017; Lauriault, 2017). A socio-material assemblage includes the material aspects of data (interfaces and hardware) as well as its social framing such as knowledge bases, governance strategies or systems of thought (Kitchin, 2017). This assemblage thinking that situates urban data, supports the idea of "materiality as a gathering, an assemblage, or a coming together" (Wilson, 2011, p. 858). Urban data are material because social meaning materializes within them, and they exist within a wider material world.

2.3.3.3. Urban Data is Political

Finally, urban data have come to be understood as non-neutral because they are political in the classic sense of the term. Urban data generation, analysis and use are always motivated by intentions and work as strong regulatory and management tools in urban governance (Kitchin et al. 2017). Ultimately urban data serve a given political interest and are crafted to fit within a certain agenda. In an analysis of crime data, Scassa (2017) identifies the numerous ways in which urban data are 'crafted' to fit within political agendas. Crime data generation typically depends on the police officer who records the data, and the personal and institutional biases they carry (Scassa, 2017). Crime data is also only released and made open to the public if they fit a particular crime narrative, such as police effectiveness or 'oppositional social justice' (Scassa, 2017). More generally, the open data movement was not politically neutral to begin with, occurring in significant part because of efforts from businesses (Kitchin, 2014a). Urban data are carefully manipulated to serve particular political interests and are controlled by a small proportion of people. This manipulation and control of urban data are being challenged in political movements, particularly Indigenous groups advocating for 'data sovereignty'. Indigenous data sovereignty refers to the rights of Indigenous Peoples to control their own data,

contributing to their rights for self-governance (FNIGC, 2019). In looking at data sovereignty, and urban data more broadly, it is key to note that "government data is generated for the purposes of governance" (Kitchin, 2014a, p. 63). In this way, the politics of urban data are never neutral, and always collected and used for the purpose of managing populations.

2.3.4. Conclusion

This section has examined smart cities, how they operate via data-driven urbanism, and the centrality of urban data in these processes. This understanding functions as one backdrop for this thesis, showing how smart cities seek to harness the potential of urban data in order to manage cities more effectively. These 'digitally-mediated cities' are becoming more and more common, so it is important to understand how they work, as well as their motivations and goals (Rose, 2017). Even though cities are using data to govern more transparently and efficiently, data still carries social and political values, and are not the neutral, technical tool their proponents claim them to be. In this way, there are a multitude of priorities and agendas running through the smart city that are vital to examine, and not take the promises of data and the smart city at face value.

2.4. Entrepreneurial Urbanism

2.4.1. Introduction

This section will take a step back from data-driven urbanism and contextualize it within broader priorities and motivations for municipal governments. I propose examining entrepreneurial urbanism as a key context and driver of data-driven urbanism. While it is clear that urban data is important to contemporary cities and a vital component of data-driven urbanism, it is important to understand *why*. Why are municipal governments using urban data as a strategic tool? Why are they building smart cities to accommodate the use of urban data? There are many differing reasons given from governments, and many different critiques leveled at cities for employing their use. Some of the main critiques of smart cities and urban data include: enabling technocratic decision-making in governments (Green, 2019), heightening surveillance and privacy concerns (Luque-Ayala et. al., 2015), furthering control of citizens (Ruppert, 2017), contributing to the "neoliberalization of urban life" (Rose, 2020, p. 525), and acting as an economic tool for entrepreneurial urbanism (Clark, 2020). The latter is the critique this thesis

will engage with, by looking at how smart cities and open data are strategically used by municipal governments to further their economic performance.

Using the 'interpretive frame' of 'entrepreneurial urbanism' we can see why cities have an economic interest in urban data policies, and how these manifest, materially within cities (McGuirk et al., 2021). Entrepreneurial urbanism refers to a form of urban governance in which the city acts as an economic engine and attractor of capital primarily, and a provisioner of public services secondarily (McGuirk et al., 2021). In recent years there has been substantial research examining how smart city policies act as a significant contributor to entrepreneurial urbanism, and how the concept of smart cities is in fact born out of these entrepreneurial interests (Chang et al., 2021; McGuirk et al., 2021; Barns, 2016; Lauermann, 2018). This section will first describe entrepreneurial urbanism, and then unpack at how contemporary cities use municipal statecraft to become active agents in entrepreneurial efforts. After defining municipal statecraft this section examines how smart cities exemplify the proactive efforts to implement entrepreneurial urbanism through municipal statecraft.

2.4.2. Defining Entrepreneurial Urbanism

Entrepreneurial urbanism, introduced by geographer David Harvey in 1989 as urban entrepreneurialism, describes a form of urban governance that "condition[s] the city as a lure for hypermobile capital investment, human capital, and tourist flows" (McGuirk et. al., 2021, p. 1732). Harvey himself noted a shift in municipal governance from one of managerialism, where municipalities are managed bureaucratically and gain external funding from other governmental bodies, to one of entrepreneurialism, where cities actively pursue their own economic growth (Harvey, 1989; Lauermann, 2017). In this way, cities shift their goals from providing services to their citizens, and instead prioritize economic growth (Phelps & Miao, 2019). Urban entrepreneurialism has equaled, if not overtaken, urban managerialism in most municipalities globally, with cities now focused on "public-private partnerships, municipal real estate speculation, and a political economy of place rather than territory" (Lauermann, 2017; Lauermann, 2018; p. 206). Also key to urban entrepreneurialism is the idea of inter-urban competition, that is, municipalities competing for capital (workers and resources) to gain economic advantages (Harvey, 1989).

Harvey offers four strategies that municipalities can use to compete in "the advanced capitalist world": using local advantages for production and consumption activities, developing new mass consumption activities, increasing command and control functions, and redistributing surpluses (Harvey, 1989, p. 8; Phelps & Miao, 2019). To increase competitive advantages municipalities can first exploit their local advantages for the production of goods and services (Harvey, 1989). This can include having access to certain resources, locations or technologies, and then capitalizing on these specific local features to enhance economic outputs (Harvey, 1989). Second, municipalities can increase consumption activities through things like tourism, arts and culture, mass attractions, or urban spectacles (Harvey, 1989; Lauermann, 2018). This can "improve [cities'] competitive position with respect to the spatial division of consumption, attracting investors to the city because of certain consumer features (Harvey, 1989, p. 9). The most difficult strategy for entrepreneurial urbanism is to increase the command and control functions of a city in key industries such as banking, government, media, and travel (Harvey, 1989). By centralizing these key activities, cities can secure a significant amount of political and economic power, therefore making them internationally competitive (Harvey, 1989). Lastly, cities can redistribute their surpluses from other departments and services that are no longer important to the economic activities within the city (Harvey, 1989). By engaging in these four activities, cities play a more active part in their economic successes, and can become internationally competitive.

2.4.3. Municipal Statecraft

Statecraft can be broadly defined as the "skillful management of state affairs" (Oxford Dictionary, 2011), and therefore municipal statecraft would be the skillful management of *municipal* state affairs. There are two important things to consider here: first, the idea of the city as a state. A city is a state, it has borders, internal governance and an established power system (Jessop, 2016). Municipalities are often seen as not having as much power as other 'state' levels, but their operational prerogative impacts citizens on the day-to-day perhaps more so than any other governmental jurisdiction, or state. A second important idea is that municipalities exercise 'skillful management'. Skillful carries a connotation of being more effort than just management,

and therefore it is important to note that statecraft is a very intentional and curated process. Municipal statecraft can also be defined as the process behind "the construction, deconstruction and reconstruction of the urban state", in essence the entirety of "local practices that shape cities and the lives of their residents" (Cirolia & Harber, 2021, p. 3). Either by the skillful management or the construction and deconstruction of municipal states, municipal statecraft is an active and overarching force on municipal life. With both definitions we see how municipal statecraft acts as a much more invested governmental approach, which is why it is increasingly being identified as an interventionist tool used within the context of entrepreneurial urbanism.

While Harvey's framework is fairly extensive, recent literature has expanded upon it, incorporating municipal statecraft frameworks which detail the more 'interventionist' roles municipalities themselves play in entrepreneurial urbanism (Lauermann, 2018). Entrepreneurial urbanism is often seen as reactionary to the larger economic and political landscape, but there are often more purposeful efforts behind this type of urban governance (Lauermann, 2018; McGurik et al., 2021). Lauermann (2018) highlights recent scholarship that has outlined a much more active role on the part of cities, where they perform acts of municipal statecraft in order to create entrepreneurial cities (Parnell & Pieterse, 2010; Shin & Kim, 2015; McCann, 2013; March & Ribera-Fumaz, 2014; Allen & Cochrane, 2010). Lauermann (2018) synthesizes this literature and offers three actions of municipal statecraft operating in contemporary entrepreneurial cities: (1) diversifying investment and policy portfolios, (2) utilizing experimentation rather than speculation, and (3) engaging in inter-urban cooperation in addition to competition. This framework of modern municipal statecraft is particularly useful for analyzing smart cities, as they are a proactive policy effort, rather than a reactive one (McGurik et al, 2021). This section will first outline Lauermann's (2018) framework of municipal statecraft in entrepreneurial cities, and then describe how this may be exemplified within the smart city with data-driven urbanism.

2.4.3.1. Municipal Statecraft in Entrepreneurial Cities

There are three main actions of municipal statecraft in entrepreneurial cities: diversified portfolios, experimentation vs. speculation and inter-urban diplomacy (Lauermann, 2018). These three actions of statecraft position the municipality as an active intervenor in the city's economy and entrepreneurial efforts, even going so far as to position the municipality as the entrepreneur

in entrepreneurial urbanism (Lauermann, 2018). If the "'entrepreneur' of the entrepreneurial city is a municipal government", "this means investing public funds with simultaneous objectives of achieving public policy goals and expanding public revenue" (Lauermann, 2018, p. 211). Lauermann's (2018) municipal statecraft framework presents three ways in which municipalities achieve these goals, and act as 'the entrepreneur.'

First, municipalities must diversify their investment and policy proposals beyond development (Lauermann, 2018). Instead of primarily focusing on real-estate and attracting investments in land development – cities must also engage in other activities that will expand their economic output (Lauermann, 2018). There are a diverse set of stakeholders who bring in certain agendas, which cities must consider, and capitalize on (Lauermann, 2018). This diversification can include 'mega-events' such as the Olympics, or "promising agendas like urban regeneration, sustainable design, world class place branding or smart city management" (Lauermann, 2018, p. 214). By engaging these stakeholders and diversifying their portfolios, municipalities can attract significant more economic investment. Cities are no longer tied to development and real-estate for growth, but instead a vast quantity of industries.

The second action of statecraft in Lauermann's (2018) framework is moving from speculation to experimentation. Urban entrepreneurial projects were typically formulated and evaluated based on whether or not they could yield a return on investment. Speculation, therefore, as a "mechanism for conventional entrepreneurial urbanism" determined if an effort was worth it based on if it contributed to the economic growth of the city (Lauermann, 2018, p. 214). Contemporary entrepreneurial urbanism, however, carries a lot more freedom through experimentation. Cities now engage more in 'policy experiments' where they do not require an economic return on investment, and instead create their own criteria of success and failure. This shift to experimentation positions the city "as a sort of 'urban laboratory'" where "municipal states experiment with various governance practices" (Lauermann, 2018, p. 214). Similar to diversifying their investment and policy portfolios, municipalities engage in policy experiments on a variety of ideas such as smart, resilient, or cultural design and planning (Lauermann, 2018). Even though cities have shifted to experimental policies that may not require an economic return on investment, they are still trying to achieve certain goals and ambitions (Lauermann, 2018).

Experimentation therefore has not entirely replaced speculation, and economic success is still a major goal of municipalities – it is simply being defined differently, and by the municipalities themselves (Lauermann, 2018). If municipalities have the freedom to experiment, and define their own goals, different forms of economic success and growth may arise.

The last part of Lauermann's framework describes how municipalities engage in inter-urban cooperation as well as inter-urban competition. This inter-urban diplomacy is the final action of municipal statecraft occurring in contemporary entrepreneurial cities (Lauermann, 2018). Inter-urban diplomacy includes cooperating with other municipalities in order to "build on entrepreneurial practices like ranking/benchmarking, participating in competitions for symbolic status or hosting events, or providing incentives for industries to relocate" (Lauermann, 2018, p. 216). This cooperation among municipalities, somewhat paradoxically, allows them to compete with each other more effectively, and once again, achieve economic growth (Lauermann, 2018). By doing these activities an 'imagined urban hierarchy' is formed, which municipalities can use to attract investment (Lauermann, 2018). Where Harvey's urban entrepreneurialism focused primarily on geographies of competition, contemporary cities operate in a slightly greyer area – mixing cooperation and competition (Lauermann, 2018). This inter-urban diplomacy again, positions the municipality in an interventionist role and casts them as the 'entrepreneur', actively building the economic activities in their city. To summarize, between diversifying their investment and policy portfolios, focusing on experimentation rather than speculation, and participating in inter-urban diplomacy – cities are intervening in and facilitating entrepreneurial urbanism.

2.4.3.2. The Place of "Smartness" in Entrepreneurial Urbanism

With the increasing interventionist strategies being implemented by municipal states to advance their economic status comes an opportunity: the smart city. Smart cities act as a key way that municipalities can engage in proactive municipal statecraft in the context of entrepreneurial urbanism. One key piece of work in this area is covered in McGuirk et al. (2021), where they present the smart city as one of the two main entry points for contemporary entrepreneurial urbanism. In comparison to the reactionary entrepreneurialism of the 2008 Global Financial Crisis, smart cities are a proactive formulation of entrepreneurial urbanism (McGuirk et. al.,

2021). Similarly engaging in municipal statecraft, cities enacting smart city policies are actively devising economic, political and social agendas (McGuirk et. al., 2021). Smart cities are an example of Lauermann's municipal statecraft framework because they are policy efforts that aim to increase the economic growth of cities through diversification, experimentation and inter-urban diplomacy. Smart city policies are proactively put in place by cities, first constructing the policy, and then implementing the technology and infrastructure. They are then by definition, interventionist practices, where municipalities can craft their identity and economic status. McGuirk et al. (2021) demonstrate this by showing that municipalities engaged in smart city policies enact entrepreneurial urbanism through extrospective efforts of creating the space necessary to build smart cities, and by introspectively changing municipal operations to fit the smart city agenda (McGuirk et al., 2021, p. 1739). Both of these efforts move municipalities from being reactive, to participating in proactive forms of municipal statecraft.

Municipalities enact urban entrepreneurialism through smart city policies extrospectively in three key ways (McGuirk et. al., 2021). First, municipalities make public-private partnerships an integral part of smart city policies (McGuirk et al., 2021). For smart cities to exist, partnerships are needed with technology companies, academic institutions, developers and other organizations, and therefore municipalities must seek out and form these partnerships (McGuirk et al., 2021). By doing so, municipalities are proactively forming an economic network centred around smart city technologies (McGuirk et al., 2021). Second, municipalities implementing smart city policies take part in the policy experiments outlined by Lauermann (McGuirk et al., 2021). As technology, innovation and start-up culture become more interwoven throughout cities, experimental policy efforts are growing to create "smart urban economies" (McGuirk et al., 2021, p. 1737). In implementing smart city policies, municipalities are actively transforming themselves to be testbeds and sites of experimentation (McGuirk et al., 2021). Lastly, municipalities craft smart city discourses in order to lend authority and legitimacy to their efforts (McGuirk et al., 2021). A "key externally-facing activit[y] of entrepreneurial municipal statecraft is constituting supportive policies behind the idea of the smart city and its agenda" (McGuirk et al., 2021, p. 1739). The external activities of building public-private partnerships, engaging in experimental policy, and crafting smart city discourses are all examples of how smart cities use municipal statecraft to engage in entrepreneurial urbanism.

Another part of the smart city's efforts in urban entrepreneurialism lies within the municipal state itself (McGuirk et al., 2021). Introspectively, municipalities make efforts to reconfigure their internal processes to fit their smart city agendas, collaborate with other municipalities, and ensure the municipality is agile. To start, municipalities create an internal culture that is supportive of smart urbanism (McGuirk et al., 2021). This can be done by creating smart city strategies that are representative of the municipality's attitudes as a whole, thereby crafting their idea of what a smart city is around the current state of the municipality, or by actively changing dispositions in favour of smart city agendas (McGuirk et al., 2021). Either way,

> this introspective facet of entrepreneurial municipal statecraft – reworking municipal dispositions, institutional forms and capabilities – is a constitutive practice that actively contributes to the realisation of the smart city both as a political project and a material reality (McGuirk et al., 2021, p. 1741).

Additionally, cities engage in inter-municipal collaboration by sharing ideas and expertise, as well as resources (McGuirk et al., 2021). Because smart city technology is more transient than other forms of municipal infrastructure, cities can more easily cooperate with one another and create governmental networks (McGuirk et al., 2021). Finally, cities must remain open-ended, agile and willing to change with the evolving industry that is technology and innovation (McGuirk et al., 2021). Technology can change rapidly, and therefore cities focused on using technology must also have this ability, despite risk-averse bureaucracy that often exists within cities (McGuirk et al., 2021). These introspective instances of municipal statecraft again show how smart city policy efforts actively institute urban entrepreneurialism.

2.4.4. Conclusion

Cities are now capitalizing on their power and focusing on the "role of local elites and municipal officials in shaping new entrepreneurial agendas" (Lauermann, 2018, p. 218). Municipalities are increasingly proactive in shaping their economic activities and growth, moving from managerial governance styles, to entrepreneurial ones. Even further, municipalities are no longer enacting entrepreneurial urbanism because they are reacting to certain socio-political landscapes, but instead actively shaping in order to facilitate economic growth. While there are many critiques of

the smart city being a vessel for capitalistic ventures and facilitating an entrepreneurial state, there is less literature on how the municipal state fosters these processes (McGuirk et al. 2021). To shed more light on this idea, this section first defined entrepreneurial urbanism as an urban governance style that prioritizes economic growth, and then showed how contemporary cities are pursuing forms of municipal statecraft in order to further control their economic growth. To conclude, this section looked at the smart city's role in entrepreneurial urbanism, and how this acts as an exemplar for municipal statecraft.

2.4 Conclusion

Data-driven urbanism is becoming an increasingly used tool of municipal governments to enhance their economic prowess and become more entrepreneurial. Within the landscape of the smart city, data-driven urbanism is powered by urban data – which aims to improve decision making, increase transparency and connect citizens to government. Cities are increasingly using and investing in big and open data to achieve a wide variety of goals, mainly to grow their economies and become globally competitive. By employing interventionist strategies of municipal statecraft, cities are turning more and more to smart cities in order to accomplish their goals. By creating smart city policies and using urban data – cities have established data-driven governance styles as a key form of managing the municipal state. This chapter has aimed to describe the geographies of data-driven and entrepreneurial urbanism, where the use of urban data in cities is underpinned by the drive to facilitate economic growth. If municipalities can proactively build smart cities by using urban data and as a strategic resource, they can then grow economically and facilitate entrepreneurial urbanism on their own terms. These geographies of data-driven and entrepreneurial urbanism is crucially important in this thesis, as we largely see them at play in Edmonton, Alberta – an 'actually-existing' smart city. But how can we analyze the actual production of urban data? This question is addressed in the chapter that follows.

Chapter Three – Analytical Framework: The Data Gaze

3.1. Introduction

The central framework this research will utilize to analyze data production is the data gaze, a theory developed by David Beer in his book *The Data Gaze* (2019). Influenced by Foucault's *The Birth of the Clinic* (2003), Beer puts Foucault's ideas on the medical gaze to work in the data analytics industry (Beer, 2019). Building on the visual metaphor of 'the gaze', the data gaze describes "how data are seen and how we can come to be seen unendingly, through data" (Beer, 2019, p.11). The conception and influence of data through this gaze are explored through the visions, infrastructures and practices that make up the data analytic industry. The visions of the data gaze are identifiable through a data imaginary – the discourses and rationalities present in and characteristic of the data analytics industry (Beer, 2019). Infrastructures of the data gaze can be found in 'codified clinic', the 'analytical space' where the data gaze is deployed (Beer, 2019). The practices can then be understood as the work and 'diagnostic eye' of the data analysts and engineers (Beer, 2019).

In addition, the data gaze contains several spatial and temporal concepts which will be referenced throughout the thesis, including: futurity, translation and expansion. The data gaze carries with it a spatiality and a temporality (Beer, 2019). The data gaze does not just look on its subjects, but builds upon them in space-time (Beer, 2019). The data gaze sets its sights upon the future, and translates its intents through space. In addition, the data gaze "seeks expansion" (Beer, 2019, p. 127). By expanding more and more, the data gaze furthers its reach, influence and power and we come to "*see data* and [be] *seen by data* with greater frequency" (Beer, 2019, p. 134, emphasis in original). These theoretical points can be all understood as aligned with Foucault's "speaking eye" (2003). The data gaze has a 'speaking eye' as it both sees data through an imaginary, and creates (or speaks) the spaces and times the data gaze can operate within.

3.2. The Data Gaze Framework

3.2.1. Introduction

The three 'focal points' of visions, infrastructures and practices together make up the analytical framework of the data gaze. Intertwined within the analytical framework is the idea that the data gaze is both material and discursive. By "weaving the dreams of the data imaginary with the practices and structures of the data gaze" "material outcomes occur" (Beer, 2019, p. 128). The discursive elements of the data imaginary influence and intertwine with the materiality of the codified clinic, making the gaze both discursive and material. This section will describe the data gaze as an analytical framework and by doing this identify how the data gaze is both material and discursive.

3.2.2. Visions: The Data Imaginary

The data imaginary is the primary mechanism by which the data gaze operates. The data imaginary acts as "the data gaze's diamond tip, used for cutting, chipping, tearing and opening the spaces into which it can expand" (Beer, 2019, p.15). This evocative metaphor discloses how the data gaze opens up ways of seeing and doing; but what is the data imaginary exactly? The data imaginary refers to how people understand and envision data, and further how data comes to be conceptualized, or imagined, in a social world (Beer, 2019). A data imaginary, however, is more than a "common set of understandings"; it is "cultivated and fostered" by parties interested in the existence and proliferation of data-driven practices (Beer, 2019, p. 19). By examining marketing materials from a sample of large data analytic companies, Beer outlines a data imaginary where data analytics are seen to be speedy, accessible, revealing, panoramic, prophetic and smart (2019). This imaginary reveals the machinations of the broader data analytics industry, and is what opens up the spaces in which data analytics can operate within. The data gaze is therefore "rooted in this data imaginary" where the imaginary "creates the space, purpose and desire for the analytics and for the data gaze" (Beer, 2019, p. 33).

3.2.3. Infrastructures: The Codified Clinic

The space that the data imaginary opens up for the data gaze to be deployed in is what Beer labels 'the codified clinic' (2019). The codified clinic is to data analysts what the medical clinic

is to doctors – both require this space to work and the space itself influences the type of work to be done (Beer, 2019). The clinic makes possible "a domain of clear visibility … to the gaze" where the gaze can look upon this space and deploy itself within it (Foucault, 2003, p. 128; Beer, 2019). An important distinction between Foucault's medical clinic and Beer's codified clinic lies in their relationship to materiality. The medical clinic is a corporeal, physical space where doctors *gaze* upon their patients, whereas the codified clinic is more nebulous and transient in its deployment, where data can be *gazed* upon outside of a confined space (Beer, 2019). United though, is how the clinical spaces are imperative to the operation and deployment of the gaze.

Within the codified clinic are an assemblage of analytical spaces. Analytical spaces refer to the configurations of infrastructure that "[afford] the spatial and temporal dimensions of the gaze" (Beer, 2019, p. 57). Infrastructure in the data gaze refers largely to software infrastructures, as they are the main tools of the data analytic industry. While not material in the sense of a boxed in corporeal space, there is still a materiality here that the data gaze becomes entangled with (Beer, 2019). This materiality lends some authority to the data gaze, as the gaze is not just operating in an imagined space, but a real material one (Beer, 2019). The imagined space (via the data imaginary) opens up the analytical spaces for data analysts to work in, thereby legitimizing and authenticating the data gaze (Beer, 2019). Here we see the important relational element between the imaginary and the codified clinic. The data imaginary justifies the need for the infrastructures in the analytical spaces, but without the infrastructures the imaginary does not carry the authority it needs for expansion (Beer, 2019). It is then only by working together in which the data gaze can operate. To summarize this idea, Beer emphasizes that

> the data gaze needs a space in which it can be exercised – the gaze is tied closely into the analytical space. … The data gaze cannot operate outside of data infrastructures: it is afforded by those infrastructures, their functionality and their direction of development. Those infrastructures are also a product of how the data gaze is imagined and what future possibilities it is seen to hold (2019, p. 89).

The codified clinic is where the data gaze is able to operate. It is similarly the space that offers the data gaze expansion, not limited by the bounds of physical space.

3.2.4. Practices: The Diagnostic Eye

If the codified clinic is the space in which the data gaze can be performed, how does that gaze get performed? Largely, it is the data analysts and engineers (or, data practitioners) who perform the data gaze (Beer, 2019). Even though many data-driven and computational processes can be automated and performed without a person at all, there is still a need for people to facilitate these processes, and further facilitate the data gaze. Beer puts forward the notion that the data practitioners "cast a *diagnostic eye*" on data – handling, using and presenting data, the object so key to the data gaze (2019, p. 99). The diagnostic eye looks upon and 'treats' data, whether by identifying the patterns within data, finding value and visualizing the data for consumers – or, by building and operating the software platforms that house the data (Beer, 2019). Beer distinguishes two kinds of data practitioners: the data analyst and the data engineer (2019). This distinction is important in Beer's work, as they both cast a slightly different diagnostic eye within the data gaze. Data analysts are more concerned with data itself, interpreting and finding value within the data, whereas data engineers are more concerned with the infrastructures that facilitate the use of data (Beer, 2019). If the analyst's role is to find patterns within and decipher data, the engineer's role is to make that process as easy and error-free as possible (Beer, 2019). The "focus of the data engineer" then, is to ensure the "smooth transportation of data to the analyst's eye" (Beer, 2019, p. 112). This eye however, is crucial in both roles – one seeing the big picture story the data is presenting, and the other seeing the technicalities that make data work.

Both the data analysts and data engineers are tasked with seeing data, and casting the diagnostic eye on data in order to facilitate the data gaze. As facilitators of the data gaze there are two important, interconnected considerations for the data practitioners: their position as embodied actors within the data gaze, and their role in ensuring the expansion of the gaze. To return to the notion that the data imaginary opens up the spaces so that the data gaze can expand, there then needs to be someone who occupies those spaces and expands the data gaze. This is where the data practitioners act as embodied actors – they both embody the data imaginary, and are embodied within the spaces of the codified clinic (Beer, 2019). Of course, there is a relational aspect here where "the data imaginary mixes with practice and is embodied in these actors", and the actors in turn influence the data imaginary (Beer, 2019, p. 101). A key role of the data

practitioners is to translate the data imaginary (Beer, 2019). If the data imaginary is what opens up the analytical spaces for the data gaze, the data practitioners translate that imaginary through the spaces, to the data itself. Through this "act of translation … the data gaze is both diagnostic and prescriptive" – the data practitioners see, or diagnose the promised data imaginary and then apply those to data themselves and send them out to the world (Beer, 2019, p. 104). By releasing the translated data – the data gaze has an ability to expand. As the codified clinic is not bound by physical space, neither are the data practitioners. Their translation of the data imaginary spreads through the codified clinic and beyond – making the "dreams" of the data imaginary into something "real" and "tangible" (Beer, 2019, p. 122). The data practitioners are the vessel by which an imagined space turns into a material one, and therefore are the vessel by which the data gaze can work and expand.

3.3. Spatiality and Temporality in the Data Gaze

There are many spatial and temporal concepts that Beer (2019) utilizes in *The Data Gaze.* Ultimately, the data gaze exists and expands through space and time, so it is important to look at some of the key spatial and temporal concepts used. In general, spatialities span the physical and virtual worlds, constituting the spaces that surround us. Time additionally surrounds and influences the social world, and is an important concept to consider alongside space. Spatiality and temporality work together in order to form the world. Space does not exist outside of time, and vice versa.

This chapter has already touched on the main spatial concept of the analytical space as a space crucial to the conceptual framework of the data gaze. This section will aim to explore the spatial and temporal concepts slightly more tangential to the gaze, or those important to consider but not vital to its conceptual framework. These additional spatial and temporal concepts include: futurity, translation and expansion. In defining these concepts, I will draw from some supplemental geographical and critical data studies literature in order to further understand the ideas.

3.3.1 Futurity

The future is a very important temporality in the data gaze. The data imaginary itself is "founded upon an ability to grasp the future and use it in the present" (Beer, 2019, p. 27). 'Grasping' the future through the data imaginary can be seen as a type of 'folding' where the data imaginary has the ability to 'fold' time and use it in the present. The past can be folded to 'touch' the present, or the future can be brought into the present in an anticipatory fashion (Shields, 2013). This temporal aspect of folding is particularly important for data, which depends on being able to analyze the past and present, as well as be prophetic to the future (Beer, 2019). Key to utilizing data is being able to anticipate the future, and represent it in current data analysis (Beer, 2019). Being able to fold the future into the present by being anticipatory of upcoming phenomena, greatly enhances the efficiency and productiveness of data analytics (Beer, 2019).

The data gaze accepts a concept of the future where data analytics can both see and achieve certain futures (Beer, 2019). Data analytics are used to predict or see the future, and therefore influence what the future may be (Beer, 2019). This is a sort of 'politics of anticipation' whereby data analytics see given futures based on who is doing the data analysis, and why (Beer, 2019). By being able to anticipate what will happen, the data analytics industry can also dictate the best ways to respond to that imagined future. Data analytics therefore do not just "enable[e] future sight, they also bring those desired futures into existence" (Beer, 2019, p. 29). The future is an important concept in the data gaze because the data gaze has the ability to anticipate and create the future.

3.3.2. Translation

Translation is a concept that is mentioned throughout *The Data Gaze* (2019). While not central to the data gaze – the data analysts are often referenced as being data intermediaries, a concept central to translation (Beer, 2019). Translation via intermediaries is very applicable to data, where meaning is added to data through intermediaries in space (White, 2017; Beer, 2019), or data act as intermediaries for various social processes (Straube, 2017). Meaning is added to data sequentially through intermediaries in space, where these intermediaries instill meaning and discourse into the data and the material practices surrounding them (White, 2017). Translation refers to how data comes to be 'entangled' with urban discourse and values (White, 2017). For

Beer (2019), intermediaries are those which are "locating value, narrating and then attaching meanings to that data" (p. 16). Translation is important as it is the process that changes data, and as such continually changes the spaces and relations for which it is a part of.

In addition to attaching meaning to data, data analysts work to make data understandable – further translating the data to those consuming it (Beer, 2019). Data analysts work to make data clear and digestible in visual or narrative forms, and distribute it through space for consumption. Data analysts are also tasked with "finding the interesting patterns and translating them for others to use" (Beer, 2019, p. 103). While the data gaze does not necessarily use translation in the traditional sense of bringing something into a network by being 'interested' in that network, it is still an important spatial concept that runs throughout (Murdoch, 2006). The data analysts are responsible for translating data through the spatial infrastructure of the data gaze, either adding meaning to it as an intermediary or translating it for broader use (Beer, 2019).

3.3.3. Expansion

A final important spatial concept for the data gaze is expansion. The gaze itself seeks expansion, aiming to grow and distribute itself through space (Beer, 2019). A key element to expanding the gaze is that it has the ability to watch, or oversee itself (Beer, 2019). The data imaginary opens up the analytical space for the data gaze, and allows the data analysts to practice their diagnostic eye (Beer, 2019). Because of this interconnectedness, the data gaze is constantly watching itself, and by doing so

> the data gaze expands its reach, increases the data accumulated and further embeds data-led thinking into decision making, knowledge and into ideals of the way the world should run. (Beer, 2019, p. 127).

Because the data gaze reaches into the world past data, it is facilitating its own expansion. If the data gaze gains the authority it needs through the imaginary, material infrastructures and practices, the data analytics industry will continue to grow, and the data gaze can expand (Beer, 2019). In addition, the data gaze is not limited by physical space so its expansion is not bound

and therefore can continue indefinitely (Beer, 2019). Expansion is a vital feature of the data gaze, and is ultimately its main purpose and goal.

3.4. Conclusion

Beer's framework of the data gaze provides a very adept way to look at and understand data. Working through the visions, infrastructures and practices of the data analytics industry, the data gaze is almost 'all-seeing' as it sees nearly all aspects of data-driven systems. It is a strong analytical framework to use when analyzing data-driven processes as it can provide an overarching view of the system in question. By utilizing some crucial spatial and temporal concepts the data gaze also details how it manifests itself in space and time. The data gaze allows for you to look at the relationality between the elements – how do the visions impact the infrastructures, or the practices? How does the imaginary open up the spaces for the data gaze, and how do practitioners embody those imaginaries? The data gaze ultimately seeks to understand data in its entirety, looking at how data is seen, structured and practiced.

Chapter Four – Methodology: Understanding Data-Driven Urbanism in Edmonton

4.1. Introduction

The literature on smart cities, data-driven urbanism and open data often include calls to do empirical case study research, and study the 'actually-existing' smart city (Kitchin et. al., 2017; Lauriault, 2017; Rose 2020). The research presented in this thesis explored one 'actually-existing' smart city: Edmonton. The research employed a qualitative, multimethod approach to gain a thorough understanding of data-driven urbanism in Edmonton. The methods utilized included: semi-structured interviews with key informants, discourse analysis of policy documents, and an ethnographic case study. By using these three methods this research aims to achieve 'triangulation', furthering the veracity, integrity and depth of the research (Ritchie et. al., 2003). While triangulation does not necessarily 'verify' the findings of qualitative research, it does provide the "security" of "giving a fuller picture of the phenomena" (Ritchie et. al., 2003, p. 44). Using a multimethod qualitative approach gave a detailed picture of data-driven urbanism in Edmonton.

4.2. Semi-Structured Key Informant Interviews

The first method employed in this research was semi-structured key informant interviews. The purpose of these interviews was to understand Edmonton's place as a smart city – its development, priorities and status. Participants were recruited from a pool of governmental, private sector, and non-profit experts in smart city and data-driven initiatives. The interviews were also released publicly as a podcast titled*: Smart City Stories*.

4.2.1. Podcasting Methodology

Podcasting is increasingly being used as a research methodology. Urban planning researchers in particular have taken advantage of this emerging methodology (Rogers & Herbert, 2020; Rogers & Herbert, 2019). Podcasting is defined as a digital audio file that is available for download over the internet (Rogers & Herbert, 2020; Rogers & Herbert, 2019). As most academic research is only available through institutional access or by purchase, researchers are continually looking for ways to make their work more available and accessible (Rogers & Herbert, 2020; Rogers &

Herbert, 2019). Podcasting provides a way for researchers to make their research public, and present it in new and dynamic ways. Given this trend towards open and accessible research via podcasting, I made a selection of my interviews available to the public as a podcast called *Smart City Stories.* The podcast has a tagline of:

> Smart City Stories is a podcast looking at cities using technology and data to move towards the future, and become smart. Smart cities are becoming more and more common globally – and Alberta is no exception. Cities in the Alberta capital region have been working to transform themselves into smart cities for a number of years. The aim of this podcast is to reconstruct the stories behind these efforts through a series of interviews with key figures driving the strategies, policies and initiatives needed to make these cities smart.

The key informant interviews I conducted were uploaded to the *Putting Data-Driven Urbanism in its Place* website, including links to key initiatives, policies or documents mentioned in the interviews.

One important note when using podcasting methodology is that you are telling a story to the public through your research (Rogers & Herbert, 2020; Rogers & Herbert, 2019). Given this, it is an inherently political process where you dictate who are included or excluded, what you are saying, and how it is presented (Rogers & Herbert, 2020; Rogers & Herbert, 2019). The semi-structured interviews were uploaded largely unedited, at most cutting off the beginning or end where there may have been a quick end or mistake in the preamble. In this way I was not altering what the interviewees were saying in order to fit it into a larger story. The most political consideration for the podcast interviews was who was interviewed. Recruitment of interview participants was wide, but only five interviews were conducted. Many individuals involved with the origins of smart city and data-driven policies in Alberta had moved to other roles. Interviews conducted were a mix of government, private sector and non-profit representatives (see table 4.1), but did not span diverse ethnic or gendered backgrounds. In this way the Smart City Stories podcast presented a representative view of the smart city from professionals, but less diverse personnel.

Table 4.1.

Key informant organizations and job titles

Participant	Organization	Job Title
1	City of St. Albert	Former St. Albert Smart City and Innovation Manager and Director of the Alberta Smart City Alliance
2	IBI Group	Deputy Regional Director, Canada West
3	Health City	CEO
4	City of Edmonton	Manager, Data Science and Research
5	City of Edmonton	City Councillor

4.2.2. Data Collection

In total I conducted 5 interviews from September 2020 – February 2022. Interviews were conducted and recorded over Zoom, and ranged from 20-40 minutes in length. I contacted participants by email to request participation (see email script in Appendix A). The participants I interviewed can be found in table 4.1. Interviews were conducted using a guide with 5 questions, and some additional prompts (see Appendix B). There were some changes of program names based on who I was interviewing, but the questions themselves were the same for all participants. Participants were also provided the questions beforehand so that they could familiarize themselves and prepare answers if they wished. Because the interviews were semi-structured I asked probing and follow-up questions to the participants to supplement their answers, as well as to guide the interview into interesting areas.

4.2.3. Analysis

For the analysis of key informant interview data I used a modified version of the framework method (Gale et. al., 2013; Hackett & Strickland, 2018). The framework method is a popular approach to analyzing qualitative data, particularly in policy research (Gale et. al., 2013). The framework method is a type of thematic analysis which gives researchers a systematic, structured approach to analyzing qualitative data (Gale et. al., 2013; Hackett & Strickland, 2018). There are seven main stages to the framework method, which can be seen in table 4.2. I utilized stages 1-5

of this method, which will be detailed below, but did not chart my data into a framework matrix. I did not move on to stage 6 because after I had completed and applied my thematic framework the findings from the analysis were already clear, and did not need an additional level of interpretation.

Table 4.2.

Framework Method Procedure (Gale et. al., 2013; Hackett & Strickland, 2018)

Stage	**Action**	**Details**
1	Transcription	Transcribe interviews verbatim from audio recordings. Transcription also allows the researcher to be immersed in the data prior to analysis.
2	Familiarization with the interview	Become familiar with the interview by reviewing audio recordings, reading the transcripts, consulting notes from interview. While doing this stage take notes of significant topics that come up.
3	Coding	Read the transcript line-by-line and apply a descriptive label, or code. Inductive research applies open coding during this stage.
4	Developing a working thematic framework	After coding a few transcripts develop a set of codes to use for the rest of analysis. Include an 'other' code into sub-categories that can be later defined.
5	Applying the thematic framework, or indexing	After the working analytical framework has been developed, apply it or 'index' the rest of the transcripts using this framework.
6	Charting data into the framework matrix	Use a spreadsheet to chart data into a matrix. Data are summarized by category, and then compared across the transcripts. A summary of each code for each transcript will be added into the framework matrix.
7	Interpreting the Data	Develop the main themes from the data. This could include applying a theoretical framework, mapping connections, or generating typologies.

The framework method typically is used to analyze large quantities of textual qualitative data, which makes the summarizing of data into a framework matrix a useful tool for analysis. Because I was only analyzing five interview transcripts I made some adjustments to the general procedure of the framework method to better suit my dataset.

4.2.3.1. Modified Framework Method

I followed the first two steps of the framework method: transcription and familiarization quite faithfully. First I transcribed each interview. This involved using Microsoft Word's transcription function to do an initial transcription of the interview, and then cleaning up (finding errors and adding punctuation) and formatting the transcription myself by listening to the audio file. I listened to the audio once more following along with the transcript to ensure that there were no errors. The final transcription was a verbatim, word-for-word transcription that omitted only filler words and direct repetitive words, false starts were kept in. The primary unit of analysis was the content, and so how the person was speaking was less important than what they were saying (Gale et. al., 2013). The second stage of the framework method is familiarization (Hackett & Strickland, 2018). The components of this stage differs among the literature, but the primary goal in all instances is to prepare the researcher to be able to construct a thematic framework (Gale et al. 2013; Hackett & Strickland 2018; Ritchie et. al., 2003). To familiarize myself with the data I read through each transcript prior to coding it. While reading through the transcript I took notes on anything interesting, and potential codes to use.

Stage three of the framework method is coding. My approach to coding was an inductive one, where I used open coding to code "anything that might be relevant from as many perspectives as possible" (Gale et. al., 2013). Inductive research generates knowledge, theory and ideas from collected data, as compared to deductive research which tests a theory with predetermined criteria (Williams & Moser, 2019). It is important while doing inductive inquiry to remain as open and reflexive as possible – coding in ways that are unexpected and not just descriptive. To code the interviews I used NVIVO qualitative data analysis software in order to better organize and apply the codes (QSR International, n.d.). The open coding involved reading the transcript line-by-line, and applying a label that I felt was most relevant to the meaningful statements. During this stage of open coding I aimed to be as free and flexible as possible, and was not concerned with limiting the amount of codes I was applying. While using NVIVO codes applied to previous interviews are saved so that you can apply them in the same project. While this streamlines the process, I mostly tried to not pay attention to these previous code and only used them if I was already going to apply that same code. While open coding I ended up with 79 different codes across the five interviews.

The next step of analysis (stage four) was to create a thematic framework based on the open coding. To do this I wrote each code on Goodnotes software on a tablet. I organized the codes based on relationality and frequency, and then applied overarching theme labels. I also combined some codes with less frequency into one label so the thematic framework was clearer. In organizing the codes I created a base thematic framework, which can be found in Appendix C. Once the thematic framework was developed I moved on to stage 5: indexing. During indexing the thematic framework is applied to the dataset (Gale et. al., 2013; Hackett & Strickland, 2018). In NVIVO I created a new classification and added all the thematic framework codes into the software. I then went through the transcripts line-by-line again and applied codes from the thematic framework. Once I had indexed the codes I felt that enough base data analysis had been done, so I did not put the data into a framework matrix and instead moved on to interpret the data. The thematic framework created had the three themes that were later written up for analysis in section 5.2.

4.3. Discourse Analysis of Policy Documents

This research included a discourse analysis of City of Edmonton documents linked to smart cities and open data. By engaging this analysis the research was able to extract key themes that run throughout smart city and data-driven policy. The results from the discourse analysis are presented as a data imaginary (see section 5.3. in following chapter).

4.3.1. Mapping a Discourse

The analysis of policy documents employed a discourse analysis based on Michel Foucault's archeological method (Evans, 2015; Foucault, 1972). Utilizing this method allowed me to 'map a discourse' throughout the policy documents, extracting not only the main content of the policy documents, but situating them materially as documents that are produced by a given polity (Evans, 2015; Murdoch, 2006). In this way I was able to gain an understanding of not only *what* the policy documents were trying to convey, but *who* was trying to convey them. Foucault sees discourse, specifically discursive practices as "part and parcel of the exercise of power" (Murdoch, 2006, p. 4 Chapter 2). Discourse is not simply speech, but what allows or prohibits what is able to be said (Barad, 2003). Given this it is important to not just approach policy

documents as neutral and transparent writing, but as writing that is written by someone, for a specific purpose, within a social, cultural, political and economic system (Mayan, 2009). Because policy documents are written with certain intents, this research employed a Foucauldian discourse analysis to further get at those intents, and be able to uncover the interests behind data-driven urbanism in Edmonton.

4.3.2. Document Selection

The first step of the document analysis was to select the City of Edmonton policies and strategies for analysis. I created an inventory of all City of Edmonton policies and strategies that applied to smart cities, technology, innovation, and data. From this inventory I then selected the four policies that were formative in establishing Edmonton as a smart city, as well as those pertaining to the Open Data Program. These documents are shown in table 4.3. The chosen documents covered the year range from 2015-2017 and were therefore prior to the Smart Cities Challenge in 2019. Together they reflect the policy landscape that led to Edmonton declaring itself a 'smart city'.

Table 4.3.

City of Edmonton Smart City and Open Data Policy and Strategy Documents

Policy Document	**Year**	**Initiative**
Open City Policy	2015	Open Data
Open Data Strategy	2017	Open Data
Open City Initiative Refresh	2017	Open Data
Smart City Strategy	2017	Edmonton: Smart City

4.3.3. Analysis

After the documents were chosen, I read through the documents line-by-line and extracted 'meaningful statements'. Meaningful statements were a piece of text, or an image that had intention or value. Meaningful statements were extracted on the basis of if they were coming from a speaker trying to make a point or convince the readers of something, not simply what I

found interesting. Extracted statements included sentences, sets of sentences and images, totaling with 55 extracted statements.

After the meaningful statements were extracted, I analyzed the statements for three key components: objects, speaking position and concepts. A sample of the analysis of statements can be found in table 4.4. First, objects were defined as the point of reference (human or nonhuman) for the speaker (Foucault, 1972; Evans, 2015). Second, speaking position was analyzed with regard to who was speaking, from where and in relation to what object (Foucault, 1972; Evans, 2015). Finally concepts referred to anything central or foundational to the statement, and if multiple concepts were applied to one statement they were related or similar in some way (Foucault, 1972; Evans, 2015). This analysis was done for each meaningful statement extracted.

Table 4.4.

Sample of Statement Analysis for Objects, Speaking Positions and Concepts

Document	**Statement**	**Page**	**Objects**	**Speaking Positions**	**Concepts**
Smart City Strategy (2017)	A municipality that is resilient is adaptive, well-planned and flexible. It is one that understands threats and vulnerabilities and considers all the tools available to the Community in its plan for the future. It has diverse, planned adaptation processes that reduce vulnerabilities.	10	City of Edmonton	City of Edmonton from a prophetic position	Resilient, adaptive, planning
Smart City Strategy (2017	Edmonton's spirit of inclusion and innovation extends to our relationships with other communities and their partners to respond collectively to challenges and problems. As a smart city, Edmonton learns from and integrates aspects of other community building activities	22	Edmonton, a smart city; other communities and their partners	City of Edmonton (speaker); leadership position; but on an equal level with other communities	Spirit of inclusion and innovation; challenges and problems; community building; social ecosystem

	through membership in the larger social ecosystem.				
Open Data Strategy (2017)	Building upon these past accomplishments, this Open Data Strategy is a measurable action plan to enhance Edmonton's robust Open Data Program by increasing the volume and quality of free and accessible machine-readable data, creating opportunities for informed citizens to discuss innovative opportunities for growth and realizing the economic and social value of open data.	2	Edmonton, Open Data Strategy, citizens, data	Edmonton, from an accomplished position, but starting new action	Social and economic growth and value, voluminous and quality open and machine-readable data, innovation

After all the statements were analyzed I began to look for patterns across the statements and created a summary list of the primary objects, speaking positions and concepts. I also sorted each category of objects, speaking positions and concepts in order of abundance from the analysis. From these patterns I defined six themes that were then written up as the data imaginary in Edmonton in Chapter 5 (section 5.3).

4.4. Ethnographic Case Study: The Open Data Program

Within the landscape of data-driven urbanism in Edmonton one program rises above the rest: the Open Data Program. As mentioned in Chapter 1, the Open Data Program is the flagship program of smart city and technological initiatives in Edmonton. Because of its status and influence in Edmonton, it is an excellent "data gaze" to examine in the context of data-driven urbanism in Edmonton. Case studies examine 'bounded systems' and are an approach to understanding the complexity of a given system, or in this case program (Mayan, 2009). The case of the Open Data Program is situated within the larger landscape of Edmonton as a smart city, and acts as a stand out exemplar for data-driven urbanism. The case study consists of two methodological elements: an ethnography where I acted as a participant observer in the Open Data Program, and in-depth interviews with the staff of the program. By using two data collection methods I was able to gain a thorough understanding of the practices and perspectives associated with open data in Edmonton.

4.4.1. Ethnography

Ethnography aims to understand a system or group of people by being situated and immersed in their community (Ritchie et. al. 2003). The primary data collection method of ethnography is:

> participant observation in which the researcher joins the constituent study population or its organizational or community to record actions, interactions or events that occur. This not only allows the phenomena to be studied as they arise, but also offers the researcher the opportunity to gain additional insights through experiencing the phenomena for themselves (Ritchie et. al. 2003).

The main purpose of ethnography is to gain 'firsthand experience' in examining a social or cultural setting (Mayan, 2009). Ethnography was chosen for this research to gain a complete understanding of the Open Data Program. By using ethnographic field methods a more comprehensive picture of the Open Data Program, and the work of the open data analysts could be painted.

In the period of January 2021 – April 2021 I was embedded, as an intern, in the Open Data Program at the City of Edmonton. This period took place during the context of COVID-19, where the city had enacted work-from-home protocols. Because of this all observation was done digitally, on my personal computer, primarily through email and Google Meet. As a participant observer I acted as an 'Open Data Analyst' and worked approximately 12 hours a week. During this time I was assigned various tasks to complete and sat in on meetings with the Open Data Team. I was also given full access to the program's process documents, software, incoming and outgoing open data emails, and the chat of the Open Data Team. As a participant observer I recorded both my own work, as well observations on the practices of the Open Data Team. I often took up impromptu conversations with the Open Data Team to further complement my observations.

The fieldwork conducted primarily included:

- Attending regular meetings between the Open Data Team and various groups in and outside of the city.

- Contributing to and attending a presentation of the Open Data Program to the new department manager.
- Working on and observing the process of publishing datasets to the Open Data Portal.
- Monitoring the open data email account for correspondence from citizens, areas within the city and automatic emails from software surrounding the Open Data Portal .
- Reading process documents for the Open Data Program.

4.4.1.1. Field Notes

My field notes took an adapted structure from David Beer's *The Data Gaze* where I looked for the discourses, infrastructures and practices surrounding the Open Data Program. Simply put, I was looking at the ways people talk about data (discourse), software and hardware tools that are utilized (infrastructure), and how data is formed (practice). I used this language when I discussed with the Open Data Team what I would be observing so they were also aware of my intentions. Telling the Open Data Team what I was observing helped as one participant often invited me to meetings where they thought it would be interesting for me to "see how people talk about data", which they may not have done if I had not informed them of my process. At the end of each day of observing I also summarized my observations in either a paragraph or key bullet points. Approaching my field notes in this way was primarily in order to organize my thoughts, and have an intentional approach to observation. I will go further into the analysis of the field notes in the following section, but I did not analyze the field notes based on these categories.

I tried to take observational notes in as real time as possible, but often in meetings I needed to be more present, so I would summarize my observations as soon as possible afterwards. A benefit of working online through Google Meets was that it was easier to take notes as the meeting was going, as it was not necessarily obvious I was taking notes. Similarly, if I was working on a project I would either take notes as I went on during my own processes, or summarize what I did at the end of the work. I also took notes on process documents, emails and the Open Data Team chat group. I did not record verbatim from these textual sources, and instead put observations from them in the relevant categories of discourse, practice and infrastructure. These sources provided extra valuable observational data that I was privy to as a participant observer. My field notes were a very rich source of data because I took notes on all facets of the Open Data

Program. As someone who was able to work as, as well as observe the open data analysts I came to understand their work quite completely.

4.4.1.2. Analysis

Analysis of the field notes was completed after data analysis was done on the in-depth interviews. By doing this analysis after the interviews were analyzed I could better picture what was still missing from my analysis that could be supplemented with observational field notes. As I will go into depth further, the interviews more so covered the perspectives of the open data analysts, and how they felt about their work (see sections 4.4.2 and 5.5). The observational field notes did not have these first hand perspectives and instead were my perceptions of their work and who they were. Based on this I wanted to come up with a detailed understanding of *who* the open data analyst is based on the practices I observed. After I decided on this direction I read my field notes page by page and came up with several main categories. I then did some concept mapping to determine how they related to each other and was able to determine a full picture of the Open Data Program (see section 5.4). Once I had a foundational idea I went through the field notes again and placed anecdotes and information into a document with an outline. Finally I wrote up the results, supplementing the writing with quotes and images.

Ultimately the analysis of the field notes hinged on a familiarity with the dataset. Because I was embedded with the Open Data Program for four months I was very familiar with the field notes by the time it came to analyze them. Similarly by reading through the field notes after I had completed analysis on the interviews I was even more aware of what the data may uncover. However because I was so familiar with the dataset I needed to practice reflexivity while going through the dataset to limit confirmation bias. By going through the field notes a second time to fit the data into themes I was able to ensure I was not excluding any key datapoints. I also altered my outline and categories many times based on what the data was saying, versus what I potentially wanted it to say. This was another reason I did not use the categories of discourse, infrastructure and practice when analyzing the data as I did not want my analysis to simply reflect or confirm a theory I was interested in.

4.4.2. In-Depth Interviews

The second data collection method used for the Open Data case study was in-depth interviews with the open data and associated team members. Interviews were conducted to determine how the staff of the Open Data Program see and understand their own work. Interviews "provide an opportunity for detailed investigation of people's personal perspectives … and for very detailed subject coverage" (Ritchie et. al., 2003). By conducting in-depth interviews with participants involved with the Open Data Program I was able to gain rich insights into how they conceptualize their work and the program more generally.

4.4.2.1. Data Collection

In total I conducted five interviews over the span of May 2021 – June 2021. I performed the interviews after I had completed participant observation with the Open Data Program. Doing this gave me a better idea of who I wanted to contact for interviews, and allowed for a more conversational approach to the interviews. Before finishing participant observation, I informed participants that I would like to set up interviews, and then contacted them by email afterwards to set up interview times. The small number of interviews is largely due to the size of the Open Data Program. At the time of interviewing there were only three members of the Open Data Program, all of whom were interviewed. In addition, I interviewed a representative from the Internal Data Program and a privacy officer who consulted the Open Data Team on issues. Interviews were conducted and recorded over Zoom, and ranged from 40-60 minutes in length.

Interviews were conducted using a guide with 13 questions, and some additional prompts (see Appendix D). There were some changes of program names based on who I was interviewing, but the questions themselves were the same for all participants. I began the interview by informing participants that I was looking to understand what they do, and how they think about what they do. Because some of the questions would duplicate what I had observed while embedded with them, I reaffirmed that I had observed some of the questions but I was looking to get their perspectives. This initial qualifier for the interview set the stage and gave the participants more information on what I was trying to learn from the interview. My first set of questions mainly included specific questions about the Open Data Program and the participants' work, and then I concluded the interview with a set of questions about openness and smart cities more generally.

Because the interviews were semi-structured I asked probing and follow-up questions to the participants to supplement their answers, as well as guide the interview into interesting areas.

4.4.2.2. Analysis

The analysis of interview data followed the same modified framework approach as detailed in section 4.2.3 The key differences are as follows:

- While open coding I had 150 different codes across the five interviews.
- Used physical sticky notes to sort codes instead of digitally to create a thematic framework.
- Data interpretation by creating code summaries.

After open coding I needed to sort the 150 codes into a thematic framework. To do this I wrote each code onto a sticky note with the number of occurrences in the data set (Hackett & Strickland, 2018). I then sorted the codes based on relationality, and then sorted them in order of frequency. After I visually saw the groups I began to apply overarching theme labels, and combined codes with small frequencies into a single code. This created my base thematic framework, which can be found in Appendix E. After this I moved on to indexing and data interpretation.

My main procedure of interpretation was to write code summaries for all of the codes. For this I looked at the data within each code, defined it using the data, and picked 2-4 key quotes that applied to the code. The most important consideration in this step was to ensure I was using the data to define the codes, not my preconceptions about the concepts. By doing this I ensured that I was reflecting the participants' perspectives in the results, not my own. The final step was to define the key themes that came out of the interviews. By forming the thematic framework I had already established most themes for the research, and only had to make a few changes after the code summaries were written. The final step of analysis was to write the results, which can be found in section 5.5.

4.5. Additional Considerations

In addition to data collection and analysis there were some methodological considerations with this research. First I will detail the ethical considerations that were upheld while doing qualitative research with humans. Second, while writing the results I describe the stylistic choices I made, including tense and participant identifiers.

4.5.1. Ethics

This research was approved by the University of Alberta Research Ethics Board. Prior to each stage of research I reviewed with participants the contents of the informed consent forms, asked if they had any questions, and received their oral consent before beginning. I received signed informed consent forms from the participants as well. An important ethical consideration in my research was that the participants were from a small pool of professionals, and the Open Data Program was identified. Because of this participants could potentially be identified, which I informed each of them of prior to beginning research. For the key informant interviews participants were not anonymous since the interviews were disseminated publicly as podcasts. Participants were also informed of this and consent was given to make the interview publicly available. Informed consent forms for the research can be found in Appendix F, G and H.

4.5.2. Writing

While writing the results I made two stylistic choices. First, I referred to all case study participants as ‘open data analysts’ or simply ‘participants’. While this took out some description of the roles of the participants, it reduced the chances for them to be identified through the writing. Second, I chose to write some of my results in present tense. In APA Citation styles results are typically written in past tense, except when the results still hold true (APA, 2020). When writing the results I infused the Data Gaze analytical framework throughout, so I ended up describing an active process. Because of this it was more effective to write the data imaginary (section 5.3) and the infrastructures (section 5.4) results in present tense, as opposed to the traditional past tense. Results from the interviews (section 5.2 and 5.5) are written in past tense as they are describing a past event.

4.6 Conclusion

In summary, this research utilized a qualitative multimethod approach to studying data-driven urbanism in Edmonton. First it used a series of semi-structured key-informant interviews to understand the perspectives of key actors in the formation of Edmonton as a smart city. Second a discourse analysis was performed on key City of Edmonton smart city and data-driven policy documents. By employing discourse analysis techniques I was able to extract key themes from the policy documents, as well as understand the purposes and intents behind the documents. To conclude, a case study of the Open Data Program was examined, using ethnography and interviews to illuminate the practices and perspectives of those associated with open data in Edmonton. This multimethod approach gave a detailed overview and understanding of data-driven urbanism in Edmonton.

Chapter Five - Results: The Open Data Gaze

5.1. Introduction

This chapter mainly presents the results of 'the Open Data Gaze', following Beer's (2019) framework. Prior to presenting this theory, the chapter will characterize the landscape of the smart city in Edmonton in which the open data gaze persists. As the data gaze describes how data is imagined, deployed and realized (Beer, 2019), I will be looking at this precise concept for these results, just with open data. The first component of the open data gaze is its relationship to the data imaginary in Edmonton. The data imaginary in Edmonton is the envisioned capacity of open data and technology to create a future where the city is progressive, prepared, connected, responsible, inclusive and democratic. Importantly, the data imaginary cultivates a vision of a future city. The open data gaze, therefore, is driven by this future-vision and is always operating with that goal.

Following the description of the data imaginary and its relationship to open data, the results will look at how the open data gaze is deployed and realized. The key actor here is 'the Open Data Analyst' who works to facilitate and expand the open data gaze. From my experiences embedded with the Open Data Team, I address the question 'who is the open data analyst'? By exploring the processes of data publication, their connections with external groups and their relationship to the citizen, I explore, in depth, the role of this key actor. I also describe what I call the 'eye' of the open data analysts through presenting several themes that emerged through interviews with them. By looking at the 'eye' of the open data analysts we can see how they embody the open data gaze. The open data gaze therefore has three component parts that work together: the data imaginary which opens up the analytical space for the open data analysts to work within, the practices of the open data analysts, and their keen eye for and understanding of open data that helps to engender the open data gaze. The open data gaze is at work in the city of Edmonton, and these results will show how it is built, and how it operates.

5.2. Edmonton as a Smart City

Edmonton has declared itself a 'smart city' – enacting a variety of policies, strategies and programs to maintain its vision. Government, non-profit organizations and businesses have all

contributed to the goal of making Edmonton *smart*. By interviewing key informants involved in the creation and implementation of smart city initiatives, Edmonton as a smart city emerged. First there is a municipal advantage for the smart city where the city acts as a crucial space for enacting smart city initiatives. Second there is a living lab component to the smart city where it acts as a space of experimentation and problem-solving. Lastly, there is a distinct smart city market in operation founded on the desire to increase economic opportunities. Ultimately the city, and Edmonton more specifically, has a distinct geography that allows for the building of a smart city and the spread of technological initiatives.

5.2.1. The Municipal Advantage

Cities have a distinct advantage in the adoption of smart city technologies and polices. Whether due to the size or governance structure – the municipality seems to be the preferred place in which to implement smart initiatives. Municipalities can tap into a local network of experts, leverage their local advantages and gain enhanced city status. Together these factors contribute to the municipal advantage for implementing smart cities and systems.

A significant advantage to the municipalities is that it allows those working on smart city initiatives to connect and partner with a variety of different experts. The city of Edmonton itself has 73 lines of business that can contribute to smart city efforts (Knack). Smart city initiatives are a way to connect these diverse areas and 'break down silos'. On this idea Edmonton Councillor Andrew Knack said that he is now seeing

> that shift from where I think that idea of being a smart city and innovation was focused more within one department in the city, over the last few years it has really expanded into a citywide initiative.

By expanding the smart city initiative throughout the city there is a greater network for smart city initiatives to be built within. In addition to the City of Edmonton itself, there is increased connection and network building to the private sector, community or non-profit organizations, and citizens. The manager of data science at the city of Edmonton mentioned that they seek out a "willing partner, someone who's willing to step up and meet [them] halfway" before engaging in

a data science or analytics project (Andreychuk). Other organizations focus on centralizing specialities in order to have a diverse expert base in one spot.

Municipalities carry with them a distinct set of local advantages that allow for the implementation of smart city initiatives. Edmonton for example, is seen to have a few local advantages: it is entrepreneurial in nature, it is a 'young' and small enough city to allow for infrastructural changes. Councillor Knack speaks to the advantages of Edmonton citizens being entrepreneurial, saying that:

> what particularly works well in Edmonton is that we are, there does feel, and I think it's probably backed up in in stats that you know we're a more entrepreneurial city than a lot of other spots. And so there's that desire to create, there's that desire to transform things, and so because that culture exists within Edmontonians, I think it makes it even easier for us to want to do that as a city, which might not exist in every city.

This entrepreneurial nature works as a key local advantage for Edmonton, and has led to establishing a variety of programs – including the Open Data Program which is seen as "a shining light for the city" (Joseph). In addition – smaller and younger cities are understood to be more 'nimble' and allow for more and timelier infrastructural projects (Peters).

Lastly, smart city initiatives present a way for municipalities to enhance their status. Whether that is standing out within their country or globally – cities are understood to be a key space that allows for increasing stature. On the ability to increase municipal status through smart city initiatives Travis Peter spoke to a success they had where:

> in talking about the policies of the government of Alberta and Canada at the time, I think it was important to us that we leverage our strategy, we leverage our knowledge and our influence to be able to interface into those governments and be able to compel action, compel support to municipalities to be able to afford and be able to take the time to look at innovation as a business opportunity and to build a program such as the Smart Cities Challenge internationally that to be able to support our communities, then building an idea, roadmap to achieve that idea and then meeting the objectives that they set out in partnership, and very happy to see the government of Canada accepted our

recommendations and used them as a part of the policy to found the Smart Cities Challenge of Canada.

Municipalities are a key space in which to innovate, grow and change. Because they have a stronger ability to try new projects and take risks they can act as exemplars for other jurisdictions. Given this – enacting smart city initiatives can turn municipalities into 'living labs'.

5.2.2. Living Lab

A living lab is defined as an open innovation network that allows for the collaboration of initiatives and ideas within a given spatial context (Leminen, 2015). Living labs "bring together technology, people and businesses to deliver solutions for urban problems as 'a model of collaborative innovation' where multiple parties 'co-create solutions' (McGuirk et. al., 2021). This sort of experimental and fluid geography operates in Edmonton through the implementation of smart city initiatives. In the 'living lab' that participants see in Edmonton there are two key characteristics of smart city initiatives – they are problem driven and experimental. By rooting initiatives in 'real world' problems and being open to change through experimentation, participants understand smart city projects as those will have a tangible impact on the city and its citizens.

One concept that came up repeatedly throughout the interviews was that smart city initiatives are problem driven – meaning they are trying to solve or aid a real-world problem. City leadership and technologists 'don't have all the answers' so they use smart city initiatives in order to solve problems and find the answers. By rooting smart city initiatives in real world problems the city can make "informed decisions and then come up with more innovative solutions" (Knack). Being problem driven means addressing a real need for people living in cities, and ensuring that smart city or data analytic projects are not simply technologically interesting. The data science team at the City of Edmonton aims to be "content agnostic" where they "think of it like a barnacle that attaches itself on a ship … [they] don't like ever just do projects that [they] think are personally interesting … it all has to be rooted in a business need" (Andreychuk). Making projects problem-driven is a key consideration for all of the participants I interviewed. One participant spoke on how:

> the ethos or the philosophy of our area to ensure [is] that our work is rooted in real stuff. These are at the heart of the Smart City effort, cause what it can't be is a gravitation to the newest solution on the market, to the quote unquote sexy alternative, it can't be that – it has to be about people, and real issues that are impacting the success of a community, where data, innovation and tech can help (Peter)

To him, data and technology are there to help solve problems in the city, not be used simply because they are popular.

In relation to solving a problem, smart city initiatives are built around the idea of experimentation. Councillor Andre Knack said he tried to push to a more open and experimental environment where City of Edmonton staff and policymakers can try new innovative approaches, and even if failing they "tried something to make things more efficient or to provide a better service" (Knack). This culture of experimentation allows for a "mindset [where] you can try something out, see how it works and use that to be even more informed when you're making a more permanent decision" (Knack). Experimentation also carries with it the unknown and the chance for unpredictable results. On this note Kris Andreychuk mentioned that:

> innovation is very buzzy right now, but like real innovation is trying something that hasn't been tried before. So if you're if you're trying something that hasn't been tried before your level of certainty with what you can expect at the end lessens. So you know we approach projects with some degree of an idea of what we can expect at the other end, but there needs to be that flexibility in appreciating that it's not as, the result isn't completely reliable - sometimes you get a surprise and most often it's a you know, it's a positive surprise, but a lot of times projects don't work out. So there needs to be that flexibility with you know if we're going to try something new, we have to be comfortable with how unpredictable it all can be.

To combat this unpredictability with innovation his team works using a 'secret sauce' where they have a system of solving problems and using experimental methods. The secret sauce is described as:

> four aspects that that really set us apart and that our work is really, well it's based on a few tenets. So the first is that our work is … it's really problem oriented. So all of the work that we do is really based in a real world problem. All of our work is done with a partner, like with a willing partner, someone who's willing to step up and meet us halfway. There is a clarity concerning what or who will change as the result of our work together, and there has to be a you know, a level of comfort with the unpredictable results of innovation. So that's the secret sauce of our work, and really what sets us apart and you know has allowed us for the success that we've had over the past while.

By implementing a system where they can aim to solve real-world problems, while still being willing to change because of unpredicted results – data science initiatives are rooted in experimental practices.

By solving city problems through experimentation smart city initiatives enact this sort of living lab. Bruno Peters additionally suggested "this living lab environment [is one] where the private sector could come and participate and be part of that smart city environment", furthering the reach of the smart city beyond the government.

5.3.3. Smart City Market

Out of smart city initiatives has risen a sort of smart city market – there is increased connection between the private sector and municipal government in order to facilitate economic opportunity. Smart city initiatives present an opportunity to incorporate the private sector further into government strategies. There is this mixing of public and private that comes with imbedding technology and data into the city. One participant commented on this, saying:

> I would say in all smart cities is the opportunity for private sector to contribute and participate in the operation of the city, and still drive additional value, generate some revenue, make a profit and at the same time make a better city. (Peters)

This connection is as much as an advantage for private businesses who can provide their products and services, as it is to the municipality. The benefits for the municipality come from attracting businesses "into the community that are clean, that create jobs, that translate their investment into taxation and fuels our community and the programs and services that people enjoy" (Peter). By incorporating the private sector in smart city policy efforts it is then seen as an economic opportunity for the city.

Many smart city initiatives are started from an "economic development lens" (Knack) whereby they are seen as a way to attract investment and facilitate economic growth in the city. One example of using smart city technologies to drive economic growth comes from the non-profit organization Health Cities in Edmonton. Health Cities aims to "transform innovations from our health sector into solutions that have commercial application and global relevance" (Health Cities, n.d.). Reg Joseph, the CEO of Health Cities thinks technology and innovation are a way to develop a 'new health economy' or even "looking at how we diversify Edmonton's economy writ large" (Joseph). Stating Alberta, and by extension Edmonton

> is very much dependent on resource based aspects of the economy …, when we do have a ton of other strengths. And so how do we start adding those pieces to the overall economy to make our economy a little bit more resilient and diverse? (Joseph)

Smart city initiatives are seen as a way to bring in diverse economic opportunities to the city, and leverage local advantages beyond that of resources. Joseph also spoke on

> the opportunity there to look at these strengths and assets together, tied with data seemed like a real obvious opportunity where Edmonton could shine and build on from an economic development perspective. (Joseph)

The opportunity in Edmonton to use smart city technology and data took hold and resulted in many different polices, strategies and initiatives to transform Edmonton into a smart city.

5.3.4 Conclusion

Smart city initiatives in Edmonton are driven on a desire to capitalize on the advantages presented by municipalities, including the ability to tap into a network and use the local strengths of the municipality itself. By transforming the city into a 'living lab' smart city initiatives are given opportunity to try new and innovative things without the fear of failure and unpredictable results. Finally implementing technological initiatives opens up a smart city market for the private sector and the municipality to participate in equally. Presenting the economic advantages and opportunities provided by smart city technologies allowed for Edmonton to engage in different initiatives and potential get a 'return on investment'. This manifested most prominently in the Open Data Program, considered "a shining light" for the city, which will be explored throughout the rest of this chapter.

5.3. Visions: The Data Imaginary in Edmonton

5.3.1. Introduction

If you were to quickly examine the many polices and initiatives running throughout Edmonton you might observe that Edmonton is defined as many types of a city. Some say it is a big city, a sustainable city, or a healthy city, a safe city, or a winter city, a smart city, a global city, a resilient city, or an open city. Even if you were to consult the many documents of 'Innovation, Initiatives and Strategies' (City of Edmonton, n.d.-e), you would be confronted with a variety of different ideas and ways policymakers imagine Edmonton itself in relation to keywords such as resilience, winter and health. The section that follows reports findings from the analysis of policy documents linked to open data and smart city technology (see Chapter 4). This analysis asked what kind of data imaginary is constructed across these documents? A data imaginary encompasses how people understand, envision and imagine data (Beer, 2019). This analysis revealed how authors of key documents imagined open data and its potential.

5.3.1.1. City of Edmonton Documents on Smart Cities and Open Data

The data imaginary I will describe is constructed across four City of Edmonton Documents: *Open City Policy* (City of Edmonton, 2015), *Open Data Strategy* (City of Edmonton, 2017b), *Open City Initiative Refresh* (City of Edmonton, 2017c), and *Smart City Strategy* (City of Edmonton, 2017a). This set of policies and strategies aim to define Edmonton as both an open and a smart city, and guide the formation of various technological programs, most significantly: the Open Data Program. The *Open City Policy* (2015) is a policy that sets out the goal for Edmonton to become an open city, emphasizing the principles of "transparency, participation, collaboration, inclusiveness and innovation" (City of Edmonton, 2015, p. 1). Building on this policy, both the *Open Data Strategy* (2017) and the *Open City Initiative Refresh* (2017) establish a set of goals to apply this policy within the City. The *Open Data Strategy* (2017) is "a measurable action plan to enhance the City of Edmonton's robust Open Data Program by increasing the volume and quality of free and accessible machine-readable data" (City of Edmonton, 2017b, p. 2). The *Open Data Strategy* (2017) is predicated on the vision of being an 'open, smart and resilient city', and follows the principles of the *Open City Policy* (2015). It also defines three overarching goals of the Open Data Program: inspire citizens to use open data, empower citizens to make informed decisions and to support openness. The strategy concludes with a roadmap to implement the Open Data Strategy which includes goals and progress indicators across the six streams of: governance, citizen engagement, external partnerships, knowledge management, technical, and value realization.

The *Open City Initiative Refresh* (2017) aims to define the City of Edmonton's "way forward in open government" (p.3) and implement the *Open City Policy* (2015). Similar to the Open Data Strategy it is beholden to the Open City Principles, and sets out a framework for an open city with five goals. The Open City Framework can be found in figure 5.1 and includes the relational elements of foundations, open engagement, open data, open information, and open analytics. Citizens surround this framework to showcase the place of citizens within an open government. The final document in the analysis is the *Smart City Strategy* (2017). The *Smart City Strategy* is the most comprehensive document, spanning three main goals - resiliency, workability and livability - and nine interconnected streams. These streams are shown in figure 5.2; interestingly, these streams are hardly related to technology at all, instead focusing on more

wide-reaching concerns of the city such as infrastructure and health. Technology, instead, is centered reaching its way through these streams, making regular city operations and goals *smart*.

Figure 5.1.

Open City Framework found in the Open City Initiative Refresh (2017).

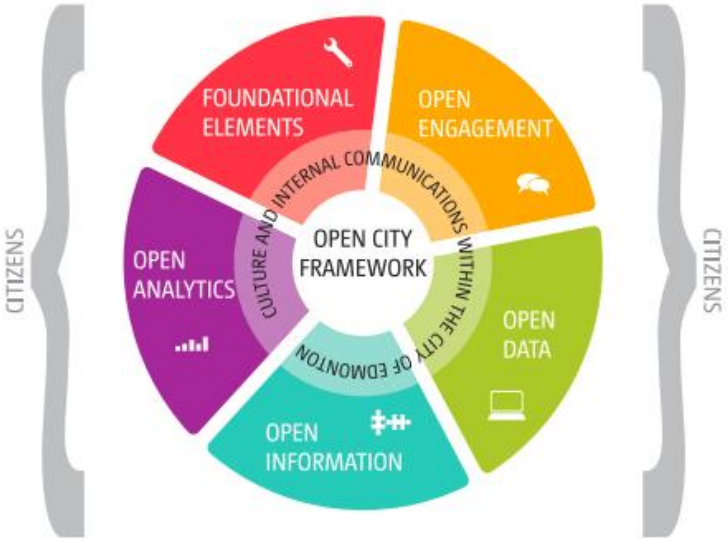


Figure 5.2.

Smart City Strategy (2017) *Goals and Streams*.

5.3.1.2. Unpacking the Data Imaginary in Edmonton

The discourse analysis utilized techniques drawn from Foucault (1972) (see also Evans, 2015). The approach consisted of reading through these policy documents and identifying significant statements. Then, these statements were analyzed for objects, speaking positions and concepts (see Chapter Four above). In this regard, the open data and technology focused policy documents centre around a small set of interconnected objects and one speaking position - the City of Edmonton as a corporate entity. The main object is Edmonton as a place in a variety of iterations. Edmonton is referred to as 'the city', as an open city, a smart city or a global city. By positioning itself as these different 'cities' the City of Edmonton is able to speak on a variety of issues, depending on which 'city' they are speaking to. Other key objects in this analysis include citizens, data and information, policies and programs, and community partners. Community partners refers to any partner organizations within the city, which can include non-governmental

organizations, academia, and most significantly - the private sector. Through the interactions of the City of Edmonton, as the main speaking position, and the objects spoken about, a data imaginary emerges characterized by several significant themes: namely, progressiveness, preparedness, connectedness, responsibility, inclusiveness and democracy.

Underpinning this data imaginary and its themes is a concern for the future. The future here is critically important. The data imaginary creates, or cultivates a pathway towards a certain future: the envisioned capacity of open data and technology to manifest a city that is progressive, prepared, connected, responsible, inclusive and democratic. In this sense the future is imagined, created and performed through open data and technology.

5.3.2. A Progressive City

Progressiveness can be seen as the main overarching theme of this imaginary. How does a city advance and move forward? The answer the policy documents give are in terms of data and technology. Data and technology are envisioned as tools that enable Edmonton to grow and change, therefore fulfilling the other thematic goals of being a prepared, connected, responsible, inclusive and democratic city. All of this together is seen to make the City of Edmonton *progressive*. For example, a progressive city is one that incorporates technology to foster a direct democracy with its citizens, or one that focuses on using data and machine learning to adequately prepare for climate emergencies. For the City of Edmonton, progressiveness is centered on two things: growth and change. To be a progressive city is to not 'stay the course' but to innovate, change and improve. According to one document, Edmonton "aspires to fulfill its role as a preeminent global city", requiring it to be "innovative, inclusive and engaged" (City of Edmonton, 2017b, p.2). Innovation here is intrinsically related to progression – how Edmonton can use data and technology to grow and change, on its way to having a prominent global presence.

5.3.2.1. Growth

The first component of this theme is growth. Policy documents claim that data and technology have the capacity to boost social and economic growth in the city. Throughout the policy documents this phrase 'social and economic growth' is frequently used, denoting the types of

'growth' the City of Edmonton is trying to achieve. In stating that "Edmonton creates opportunities for diverse input and participation by inviting citizens to play a larger role in shaping their community to enable social and economic growth" the Open Data Strategy (City of Edmonton, 2017b, p. 2) expresses the desire that citizens become more actively engaged in the growth of the city. Using data and information and leveraging technology are presented as a key way to drive innovation in the city. The Open Data Program, for example, explicitly aims to increase the volume of data available to open up these "innovative opportunities for growth" and unlock the "economic and social value of open data" (City of Edmonton, 2017b, p.2).

Despite emphasizing economic and social growth, these documents focus on the economic promises of open data and technology. The documents go only as far as stating that using these technologies can enhance livability or social well-being. The social values of open data and technology are not entirely missed of course, and do come up again especially in the themes of inclusivity and democracy – but the City of Edmonton does not extensively define or explore social growth. Given this, the type of growth the City of Edmonton prioritizes is economic growth. Using open data to create economic opportunities is seen as very important as "an effective open data program balances both the release of information as a public asset and the consumption of data as a strategic resource" (City of Edmonton, 2017b, p. 7). By 'resource-ifying' open data, the City of Edmonton positions it as a tool that can be used to advance the city forward economically, and further give that economic power to different groups such as citizens or the private sector. Because anyone can use and access open data, the economic opportunities that can be created by the city providing it, are shown to be endless (that is of course, if you use it).

What, then, becomes possible by using open data as a strategic resource? One key use of open data is developing commercial products and services, thereby commercializing data. Beyond this, open data can accelerate the growth of startups, incubator organizations, and emerging tech companies, as well as capitalize on individual talents. By leveraging the talents and knowledge of entrepreneurs the city can encourage future investment and diversify the economy. This economic growth has the potential to make "the city nationally and internationally competitive" (City of Edmonton, 2017a, p. 16), which is likely why it is a key goal of the Open Data Program.

Being a progressive city then incorporates a desire to enhance global status. To 'move up in the world' the City of Edmonton then proposes to use open data as a strategic resource to stimulate economic growth and drive innovation in the city.

5.3.2.2. Change

Essential to the idea of a progressive city is the notion of change. How does a city advance if it does not change? Change in these documents refers largely to evolution and creating a better future. In regards to evolution the City of Edmonton asks: how can things be done better, and how can things be done more efficiently? Because "the next frontier for governments is how to use data and analytics to make better evidence-based decisions" governmental practices must change to utilize these technologies (City of Edmonton, 2017a, p. 1). Utilizing this technology involves creativity, innovation and transformation. Finding new solutions to issues and challenges, as well as altering governmental structures, such as heightening citizen involvement, are forms of change, and, therefore, progression. The Open Data Program itself is conceived as something that evolves and changes on its own, based on citizen input and emerging trends in technology. In this regard, the Open Data Program aims to learn from other open government initiatives, employ innovative approaches, build new ways to share information, and increase the value of open data. This commitment to change and implementing new and innovative ideas is another crucial factor in how the City of Edmonton aims to be progressive.

Progressiveness is the overarching theme of the data imaginary in Edmonton, because it provides the main rationale for writing these policies and strategies in the first place. The City of Edmonton recognizes open data and technology as a way to move forward, to advance. These policies are then written to try to achieve the goal of advancing and progressing. The imaginary is cultivated around this idea that Edmonton will improve, will realize a better future in terms of growth, and open data is a tool to achieve that goal. The imaginary posits that Edmonton is progressive, and it embodies that by not only growing and changing using data and technology - but also by becoming prepared, connected, inclusive, responsible, and democratic.

5.3.3. A Prepared City

Along with being progressive and wanting to create a better future, the City of Edmonton also aims to be prepared for the future. The rationale is as follows: preparedness comes in many forms but it is largely about understanding the city's vulnerabilities and what threats it may face. By using data and technology the City of Edmonton can not only predict what may happen in the future, they can prepare for it. In this regard, data and technology hold the power to be able to decide, or even control the future. The future here is an uncertain one that Edmonton must be prepared for - one that has economic, environmental and has social ambiguities. The city evokes a future that is unclear and tumultuous – but by using data and smart city technology they can overcome, or conquer this future. The *Smart City Strategy* (2017) is the document that sets out how to combat this precarious future, suggesting that technology be utilized to build a future city that is resilient, workable and livable. "Building such a city takes foresight [and] planning" (City of Edmonton, 2017c, p. 3), which is where the power of data really comes in – you can use data to understand and foresee the future, then use technology to plan for it, and mold it into what you want it to be.

As stated above, "effective planning for the future" (City of Edmonton, 2017c, p. 13) involves the three goals of making the city resilient, workable and livable. By using technology to achieve these goals the City of Edmonton therefore better positions themselves in relation to the main 'threats' the future holds. Being workable largely revolves around ensuring the workforce in Edmonton is sustainable and can withstand economic downturn. By adding smart city technology into infrastructure, education and mobility, the City of Edmonton aims to make the city workable, and prepare for the issues that will affect the workers "of today and tomorrow" (City of Edmonton, 2017c, p. 13).

Making Edmonton livable means making the city healthy, community-oriented and environmentally conscious. Here again, the City of Edmonton is presenting a potential future where healthcare and environmental conditions are unstable, and remedying it with technology. With smart city technology the City of Edmonton can invest in healthcare and health innovation, or have better environmental footprint monitoring tools. Edmonton then goes from an unstable

city, to a livable one. The most important preparation the City of Edmonton must account for is the climate crisis. In preparing for this uncertainty, the city becomes resilient.

5.3.3.1. Resiliency

The City of Edmonton defines a resilient municipality as one that is "adaptive, well-planned and flexible" which "understands threats and vulnerabilities and considers all the tools available to the community in its plan for the future" (City of Edmonton, 2017a, p. 10). Resiliency and preparedness are almost synonyms then, revolving around knowing potential problems and then combating those in some way. While the City of Edmonton states that resiliency covers a wide range of potential threats, the one they are most concerned with is climate change. The City of Edmonton presents the negative impacts from climate change as an inevitable fate that they must prepare for. By using smart city technology Edmonton can create sustainable agriculture systems, become carbon-neutral, turn garbage into biofuels, or achieve any number of 'green' fixes. These technological initiatives are aimed at achieving sustainability that will enhance Edmonton's resiliency, allowing it to prepare for the imminent consequences of climate change.

In addition to climate resiliency, the City of Edmonton envisions resiliency in another interesting way, by focusing on open city and citizen initiatives. This is another way of creating a sustainable community, and being prepared for the future. By engaging with citizens through a variety of technological means, including open data, the City of Edmonton can also ensure that citizens are prepared. If citizens can use technology and open data, then they can be prepared themselves for the future. For the City of Edmonton, engaging citizens is a key way to ensure that the city is resilient and prepared for the future. In stating that, "Edmonton is a creative community of changemakers and social innovators" the City of Edmonton positions citizens as "engaged with their community and lead[ing] the charge for a better future" (City of Edmonton, 2017a, p. 7). In this way citizens can use open data and technology to create a better future, and the responsibility for preparedness is shared between them and the City of Edmonton.

In summary, to be prepared is to both see and create the future. The City of Edmonton is implementing open data and smart city initiatives to understand and pinpoint the uncertainties the city faces, as well as remedy those with technological fixes. Within this imaginary the City of

Edmonton evokes this uncertain and problematic future, and presents data and technology as a way to prepare for it, creating their own, more desirable future. The theme of preparedness positions the City of Edmonton to be able to "direct the growth of the community for generations to come" (City of Edmonton, 2017a, p. 3) by withstanding the threats they might face.

5.3.4. A Connected City

The next theme in this imaginary is connectedness. Along with being progressive and prepared, the City of Edmonton envisions a future city that is itself a network of social groups connected through technologies, and an 'open data ecosystem'. Through being connected through this ecosystem the City of Edmonton aims to foster collaboration with various groups within the city, and positions itself as a global leader in open data.

5.3.4.1. Ecosystem

The use of the term 'ecosystem' is an interesting one, and one that is often used in the data analytics industry (Beer, 2019). An ecosystem generally refers to all organisms and their interactions in a physical environment (Virginia & Wall, 2013). What then, is an 'open data ecosystem'? The City of Edmonton broadly defines an open data ecosystem as "a complex system of social, economic, political and technological networks" (City of Edmonton, 2017a, p. 1). An open data ecosystem co-creates value with partner organizations, is physically connected through broadband networks and transportation systems, and has local and global connections.

The City of Edmonton imagines itself, as a municipal government, within this open data ecosystem in two key ways: first through a system of collaboration with diverse groups within the city, and second as a member, and a leader of a global open government community. By using open data the City of Edmonton can realize a future where services are connected not only with its citizens and partners, but internationally as well. Affirming that "an open city is a connected city" physically *and* philosophically (City of Edmonton, 2017c, p. 3), the City of Edmonton imagines a future whereby it is open by being connected throughout many levels of an open data ecosystem.

5.3.4.2. Collaboration

A key way the City of Edmonton aims to usher in this connectedness is by fostering a diverse user base of open data. The operating idea is that if open data is used by "data experts, engaged citizens, and community leaders" a collaborative environment will be formed in which value can be co-created among these partnerships (City of Edmonton, 2017b, p. 10). A collaborative environment is an important part of an open data ecosystem as it can improve and integrate service delivery, create greater knowledge and ideas, as well as advance open city principles. The City of Edmonton recognizes its role as one part of the larger ecosystem where itself, and "post-secondary institutions, the arts, not-for profits, school boards, private business and citizens are [all] integral partners of [a] smart and intelligent community" (City of Edmonton, 2017b, p. 3). By engaging these various public and private entities, an effective open data ecosystem can be created.

Another way the City of Edmonton becomes connected within the city is by forming collaborative groups such as the Open Data Advisory Group (ODAG) and the Metro Edmonton Open Data Group (MEOD). The ODAG includes representatives from different areas of within the City of Edmonton where they provide advice on publishing open data. This group aims to also add citizen representation, further connecting the City of Edmonton to its residents. The MEOD includes many groups in the city including academic institutions, libraries, health organizations, police agencies and regional governments. This level of collaboration is meant to facilitate knowledge building, event organizing and resource sharing. Both of these groups bolster the open data ecosystem, making Edmonton more open, more collaborative and more connected.

5.3.4.3. Leadership

Another mode of connection is in how the policy documents position the City of Edmonton as part of a global community. The City of Edmonton: "commits to participating in building out a vibrant and cohesive data and information ecosystem across regional, provincial and Canadian public sector jurisdictions and entities" (City of Edmonton, 2015, p. 2), as well as establishing itself as a "preeminent global city" (City of Edmonton, 2017a, p. 8). The City of Edmonton already sees itself and has been recognized by others as an open data leader, winning many

awards for open data including being named ‘Canada’s most open city’ (City of Edmonton, 2017c, p. 3). It wishes to continue this leadership as well as learn from other open government initiatives within the larger open data ecosystem. Some of these initiatives include supporting the UN Sustainable Development Goals through the release of open data, committing to the International Open Data Charter, and using the World Bank’s ‘Open Data Value Chain’. The City of Edmonton enmeshes itself in these global networks and by doing so is connected to a global open data ecosystem. The City of Edmonton is already connected in these networks, but wishes to capitalize on them, becoming an international open data and open government leader. If the City of Edmonton becomes this leader, they would be cemented in a connected open data ecosystem and can “then fulfill [their] role as a preeminent global city” (City of Edmonton, 2017a, p. 8).

In summary, being connected is an important theme in this open data imaginary. Using open data and technology allows for more than just a physical connection, it also allows for connections with Edmonton’s citizens and the global open data community. The future is then a connected one, one where the city is linked into a multitude of networks, and can therefore enhance its global positioning. A connected city should also allow for improved knowledge building and decision making. By tapping into the open data ecosystem the City of Edmonton is able to expand its involvement in governance. Being connected then means a future where the city has far reach and status.

5.3.5. An Inclusive City

A future city is one that aspires to be inclusive. An inclusive city actively “reduc[es] socioeconomic, physical and technical barriers” and “creat[es] accessible channels for delivery of programs and services” (City of Edmonton 2017b, p. 5). Inclusivity, in this imaginary, works in two ways. First, data and technology can be used to reduce barriers that citizens face whether in terms of physical accessibility or general access to services. Second, the data and technology themselves must be easily accessible to those who wish to use them. Both of these are a way to improve inclusivity within Edmonton. What is important is that everyone is able to use city services, including data and technology, no matter who they are. While policy documents claim that Edmonton already embodies a “spirit of inclusion” (City of Edmonton, 2017a, p. 22) they

still frame it as something that can be improved: the City of Edmonton can always break down more barriers and make things more accessible. Policy documents illustrate how, with data and technology at the helm, the City of Edmonton can endeavor to create an inclusive Edmonton for its citizens.

5.3.5.1. Breaking Barriers

In practice, data and technology are to be used to remove socioeconomic, physical and technical barriers (City of Edmonton, 2017a). Socioeconomically, the City of Edmonton gets goals to make sure a future city supports women, Indigenous Peoples, youth and vulnerable individuals. The City of Edmonton also recognizes an ability to support programs ranging from arts and culture, to ending poverty, or improving healthcare. Data and technology are therefore seen as wide-ranging and carrying an ability to remove prevalent socioeconomic barriers. Physically, the City of Edmonton aims to create a transportation system which enhances mobility for people of all ages and physical ability, as well as improve access to public transportation more generally. 'Smart' programs such as self-autonomous vehicles are also seen as a very inclusive and accessible mode of transportation. In addition to these socioeconomic and physical barriers, there are the slightly more nebulous technical barriers. To solve the problem of technical barriers the policy documents evoke the idea of 'digital equality.' While never really defining this concept, the City of Edmonton seems to want to ensure that everyone has access to digital and technological services, whether by making high speed internet more widely available, providing free access to digital services at public libraries, or just increasing citizen awareness of technological services. Of course, evoking a concept without defining it leaves much to be interpreted, but also leaves room for the City of Edmonton to make its own definition of digital equality. By leaving the idea of 'digital equality' open ended, defining what it means to be digitally 'equal' can be determined in the future.

5.3.5.2. Accessibility

Another way the City of Edmonton aims to become inclusive, is to improve the accessibility of the data and technology themselves. If data and technology can make Edmonton more inclusive, they first must be available and easy to access for anyone to use them. By enhancing usability more people will be able to use open data and contribute to other goals such as progressiveness

or democracy. In order to "facilitat[e] accessibility and usability" the City of Edmonton will publish data in "common, easy to use formats" (City of Edmonton 2017c, p. 7). By doing this open data does not just exist for people with the technical skills to interpret data. Other ways of increasing accessibility include improving the search tools in the Open Data Catalogue or ensuring there is a variety of platforms and tools for citizens to use. The City of Edmonton also wishes to "increas[e] citizen awareness of the benefits of open data and provid[e] the mechanisms by which to interpret data" (City of Edmonton 2017b, p. 6). The City of Edmonton therefore imagines a future in which all citizens can access and use open data, which will result in an inclusive city.

In summary, by using data and technology the City of Edmonton aims to become inclusive. It is important to the City of Edmonton that citizens "have access to information, programs and services and the democratic processes that shape municipal decisions" (City of Edmonton 2017b, p. 5). Data and technology can make access to these things easier, as well as increase the amount of users of municipal information and services. If you want citizens to make use of municipal programs and services, as well as be involved in municipal decision making, the City of Edmonton must first be inclusive. By breaking down socioeconomic, physical and technical barriers, and improving the accessibility of data and technological services, the City of Edmonton can become inclusive. By creating this inclusive city, Edmonton is then one step closer to a democratic future where everyone and anyone can be involved in municipal decision making.

5.3.6. A Responsible City

Up until this point, the imaginary that has been described is one that reveals a future that is progressive, prepared, connected and inclusive on the basis of the use of open data and technology. The next theme: responsibility, is also another look into the future of Edmonton, but one that positions the City of Edmonton as the maker of this future. The data and technology used to create this imagined future do not come from nowhere, and it is the City of Edmonton which is responsible for its existence. The City of Edmonton is the body in charge of, and responsible for data, whether that be the "provisioning, delivering [or] consuming" of data (City of Edmonton, 2017b, p. 4). Throughout the policy documents the City of Edmonton establishes

itself as the provider of open data currently, and imagines this continued role for itself in the future.

5.3.6.1. Provisioning

The main purpose of the *Open City Policy* (2015) is to "articulate the City's commitment to bring to action the Open City principles of transparency, participation, collaboration, inclusiveness and innovation" (City of Edmonton, 2015, p.1). These principles are primarily brought to action through open data, which the City of Edmonton is responsible for. One of the main roles the City of Edmonton fulfills is the role of *provisioner* of data. Provisioning open data involves finding, storing, managing and maintaining "vast stores of information" (City of Edmonton, 2017c, p. 7). The policy documents outline how the City of Edmonton will proactively search for datasets that are of interest to citizens, and prioritize their release based on value. The City of Edmonton will look for data, and encourage the adoption of open data among city staff. In this regard, the documents position the City of Edmonton as a steward of data for citizens, and therefore responsible for its continued existence. The City of Edmonton must not only manage the data but continue to add to their current stores, refresh the content of current data and continually increase the quantity and quality of data available.

5.3.6.2. Delivering

This is perhaps a reflection of the wider belief that a responsible city is ultimately responsible to its citizens. While the first step of this responsibility is finding data, the second is delivering and releasing that data to the public. The City of Edmonton endeavours to provide data consistently to citizens, engaging in an "open by default" philosophy for data release (City of Edmonton, 2015, p.1). This open by default philosophy holds the City of Edmonton responsible to release all data they have available. The notable exception to this is if the data infringes on privacy then it will not be released, but still only when required. Releasing the City of Edmonton's data to the citizens as open data makes the government transparent, which in turn promotes accountability. The City of Edmonton therefore does not only have the responsibility to release data, they are also responsible for the content of that data. By releasing open data they are accountable to citizens who can then hold the government responsible for findings they glean from data. The main reason the City of Edmonton provides for releasing data publicly is to build trust between

the citizens and the government. To be a responsible city is to have the trust of the citizens, which could bring about any number of potential futures.

5.3.6.3. Consuming

To be responsible, the City of Edmonton must also not simply unload the burden of data use to the citizens, it must use data as well. According to the *Open Data Strategy*:

> an effective open data program balances both the release of information as a public asset and the consumption of data as a strategic resource (City of Edmonton 2017b, p.7).

Both the release and consumption of data are crucially important to the City of Edmonton, and both are needed for Edmonton to be responsible. By using data to make decisions the City of Edmonton can better deliver services to citizens and work more efficiently. The city presents that data has the ability to enhance what the government can achieve for citizens, whether that be through increased programming or better decision making. The City of Edmonton therefore has a responsibility to use that data if it will benefit citizens. Again this takes into account the trust between citizens and government. If the City of Edmonton uses data to improve its governmental practices, the citizens in turn should have greater trust and faith in the government.

Overall, the theme of responsibility explores what a future relationship should look like between a city and its citizens. A responsible city is one that provides data to its citizens, and in turn uses data in ways that will improve governance and benefit citizens. A responsible city is also one that is accountable to its citizens, which is achieved through the release of open data. All of these things engender trust between the city and citizens, and the relationship could be the foundation of a future city. What then, does a future look like when citizens trust their government?

5.3.7. A Democratic City

If progressiveness is the overarching theme of this imaginary, then democracy can be seen as a concluding bookend. What was clear from policy documents is that while the City of Edmonton is aiming to grow and change by being prepared, connected, inclusive and responsible – they are doing this with the goal of being more democratic.

5.3.7.1. Citizenship

Each theme touches on the relationship the City of Edmonton has with its citizens, and how it aims to improve their daily lives. A large improvement offered is citizen involvement in municipal government, and the opportunity to set the course of Edmonton's future alongside the City of Edmonton. In fact, throughout this imaginary the most important 'object', other than Edmonton itself, is the citizens. The City of Edmonton aspires to be a democratic, citizen-centered government, and the main way it envisions to do this is through citizen engagement via open data and technology. Because most of the documents are predicated on the principles of 'open government', the City of Edmonton evokes a central idea that by using data and technology it can 'open' up government to the citizens, making the city more democratic. Open government is defined by the City of Edmonton as:

> a philosophy of government which emphasizes the value of greater transparency and accountability, increased citizen engagement, and innovation and economic opportunities driven by these values and by the release of data and information (City of Edmonton, 2015, p.1).

The City of Edmonton aims to employ this philosophy of open government, and by establishing goals to deliver on its principles through the release of these strategic plans and policy documents, the City of Edmonton creates an overarching plan to institute a democratic future.

5.3.7.2. Participation

A main tenet of a democratic city is participation. On the topic of participation, the City of Edmonton states that it "believes that a democracy values and respects public input and engages people in decision making" (City of Edmonton 2017b, p. 5). A democratic city is therefore one that solicits and incorporates citizen input in governmental affairs. This is where data and technology can come into play. The policy documents provide direction regarding how, using data and technology, the City of Edmonton can foster more informed citizens and greater connections with them. Open data in particular holds the potential to improve citizens' awareness and knowledge of municipal government decisions, which in turn should increase citizen

participation in government. In creating these informed citizens, the City of Edmonton also aims to let citizens identify which datasets would be prevalent to them, in hopes of furthering the analytic projects that citizens can engage in. The policy documents continually reiterate that the City of Edmonton will solicit valuable input and participation from citizens. Citizen input is valuable on its own, but is heightened and enhanced by data and technology. The City of Edmonton can not only gain more participation, but better input from more informed citizens. This participation will greatly contribute to a democratic future city.

At the heart of a democratic city is "citizen-driven change", where "empowered and engaged citizens demand more from all orders of government" (City of Edmonton, 2017a, p. 3). The City of Edmonton frames citizens demanding more from the government as a good thing – if citizens are more involved in government and want them to do better, the city will be better. A democratic future city "creates opportunity for diverse input and participation by inviting citizens to play a larger role in shaping their community and enabling social and economic growth" (City of Edmonton, 2017c, p. 3). This future city is one that has citizens at the centre of government, guiding and establishing the changes that Edmonton will undergo. If a progressive city is one that changes, then a democratic one has citizens dictating that change. The City of Edmonton evokes the idea that by committing to the principles of open government and creating an 'open city', it not only 'opens' up city services and programs, but democracy itself.

5.3.8. Conclusion

These documents cultivate a vision for the future of Edmonton, an imaginary in which data and technology are central to the creation of a progressive, prepared, connected, inclusive, responsible, and democratic city. A progressive city is one that grows and changes, and a prepared one is one that anticipates the future and plans for its impacts. This municipal government is also one that is connected locally and globally through a larger open data ecosystem, it is responsible for provisioning, releasing and consuming data, and it is one that uses open data and technology to be inclusive. Overall this future city is one that is democratic, using open data and technology to involve citizens in municipal decision making and city-building.

This imaginary is a vital component of the open data gaze. While it is not unchanging, it is a dominant force within the open data gaze that allows for the reach of open data to grow. Beer (2019) defines the data imaginary as "the data gaze's diamond tip, used for cutting, chipping, tearing and opening the spaces into which it can expand" (p. 15). This is expressed in Edmonton, where the future the data imaginary articulates allows for the open data gaze to expand throughout the city, and its citizens. If the future envisioned in the data imaginary is an enticing one, the open data gaze becomes a desirable phenomenon.

5.4. Infrastructures: The Open Data Program

5.4.1. Introduction

Moving on from the data imaginary described above, this section delves further into the open data gaze at the level of the actual Open Data Program. The Open Data Program is the flagship program of the City of Edmonton's smart city and data-driven initiatives, responsible for providing open data via the Open Data Portal. Open data at the City of Edmonton "allows for direct visibility into how decisions are made, empowers citizens and enhances the relationship between citizens and public organizations" (City of Edmonton, n.d.-b). The program has a small staff of a few open data analysts, who source, provide and maintain open datasets for the Open Data Portal. Key to looking at the Open Data Program then is asking: what does this program do? When interviewing one open data analyst with the Open Data Program they described their role in the following way:

> I manage and maintain the city's Open Data Catalog. So if we get requests from the public for specific pieces of data, I need to track down where that data lives, who owns it, seek their permission, and then go through all the steps to get that data into the Open Data Catalogue. And then just day-to-day maintenance of that. (Participant Two)

Within the Open Data Program are open data analysts - the primary professionals behind the operation of the program. The Open Data Program, along with the open data analysts are a crucial piece within the open data gaze.

The data imaginary in Edmonton opens an analytical space for the Open Data Program and for the open data analysts to exist and work within. Within this analytical space, the open data analysts are responsible for actualizing and performing the open data gaze. This proliferation of the open data gaze occurs through the actions of the open data analysts, and the infrastructures they are embedded in. This section will examine the Open Data Program and its role within the open data gaze. By providing rich descriptions of the processes involved in getting data onto the Open Data Portal, the connections the open data analyst must foster in their role, and their relationship with citizens, this section should illuminate the Open Data Program.

5.4.2. The Analytical Space of the Open Data Gaze

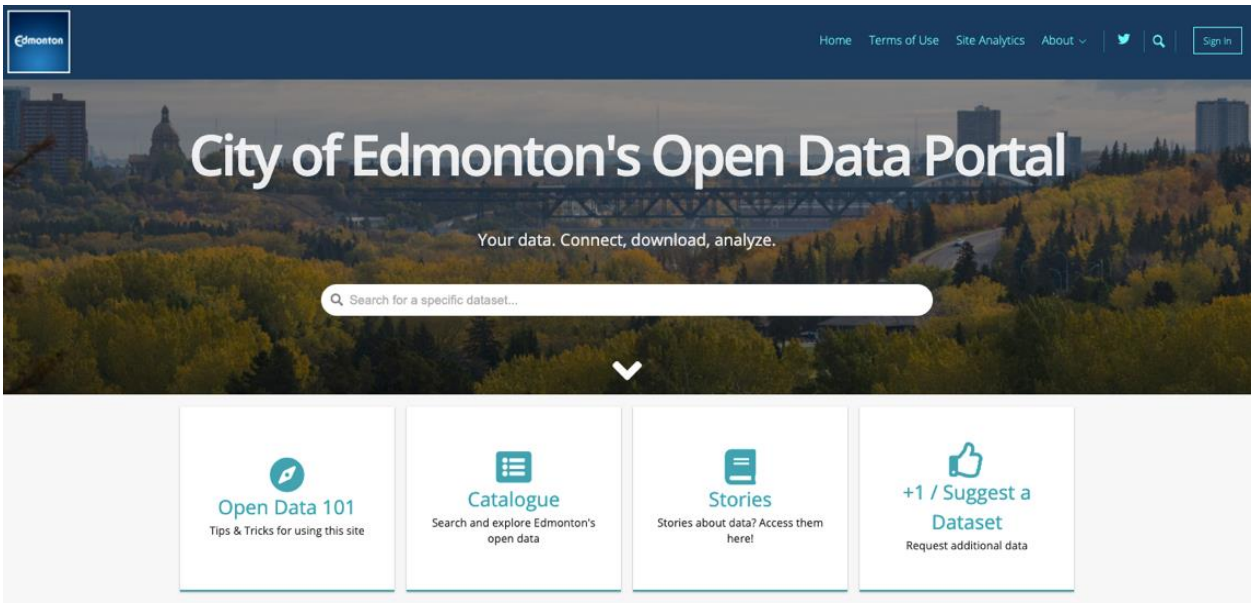
Before looking at the open data program and its analysts we must look at the configuration of infrastructure that allows for the data gaze to operate (Beer, 2019). This configuration of infrastructure is opened up by the data imaginary, and allows the open data analysts to work and deploy the open data gaze. The analytical space of the open data gaze is comprised of key infrastructures including: the Open Data Portal, software such as Socrata, FME and Tableau, and physical hardware. Together these infrastructures create the analytical space of the open data gaze, which is the space the open data analysts operate within.

5.4.2.1. The Open Data Portal

The first, and most integral infrastructure of the analytical space is the Open Data Portal, a central repository of datasets for users to look at, download and use. As shown in figure 5.3, the Open Data Portal houses all of the city's open data, information on how to use it, and a tool to request new datasets.

Figure 5.3.

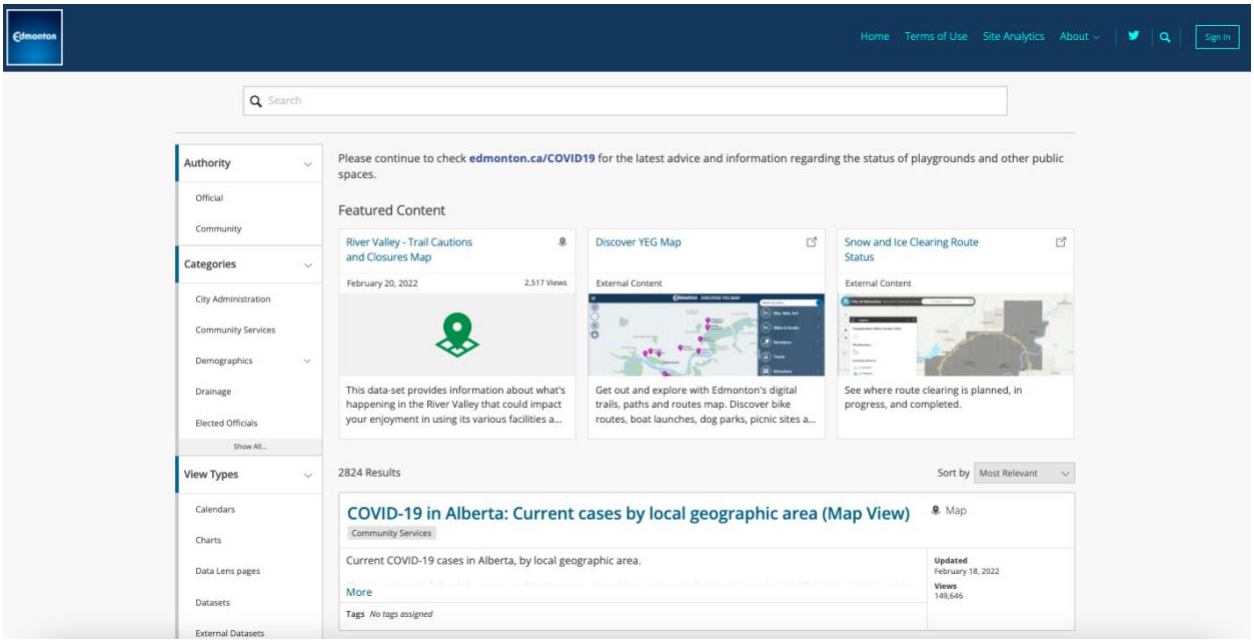
The Open Data Portal (City of Edmonton, n.d.-f)



Acting as a key infrastructure in the analytical space, the Open Data Portal is a place where open data is shared by the open data analysts, and used by citizens, businesses and other organizations. The main function of the Open Data Portal is the Open Data Catalogue, which can be seen in figure 5.4.

Figure 5.4.

The Open Data Catalogue (City of Edmonton, 2022a)



The catalogue contains all of the City of Edmonton's open data, including base datasets as well as charts, maps and other graphic displays. The Open Data Portal allows users to locate datasets in two ways: searching and filtering. The catalogue's filtering system is based in several categories as shown in table 5.1. By allowing users to both search and filter for datasets the Open Data Portal becomes a more usable infrastructure, a theme very important to the open data analysts (see also section 5.5.6).

Table 5.1.

Open Data Catalogue Filter Categories and Examples (City of Edmonton, 2022a)

Filtering Category	**Filter Option Examples**
Authority	Official, Community
Categories	City Administration, Demographics, Financial, Social Impact, Transportation, Public Works
View Types	Calendars, Charts, Datasets, Forms, Maps, Measures, Stories
Departments	City Manager, Community Services, Corporate Services, Financial Services and Utilities, Sustainable Development, Transportation Services
Tags	Health, Home Occupancy, Lights, Officers, Public Schools, Sidewalk, Taxes
Federated Domains	This site only, dashboard.edmonton.ca

Once a dataset is located there are several features contained within the dataset's webpage on the Open Data Catalogue, as shown in figures 5.5a – 5.5d. In figure 5.5a you can see that users have several options for what they can do with a dataset – either view, visualize, or export. As well, each dataset will contain a description, where it is from (external or internal), and often a reference to the license the data has. Figure 5.5b shows the key metadata, download and update information associated with the dataset. Visual samples of the data, whether it be charts, columns or maps, of the dataset are also included on the dataset's webpage, which can be seen in figures 5.5c and 5.5d.

Figure 5.5a.

Utility Corridors Dataset on the Open Data Portal – Information and View Options (City of Edmonton, 2022b)

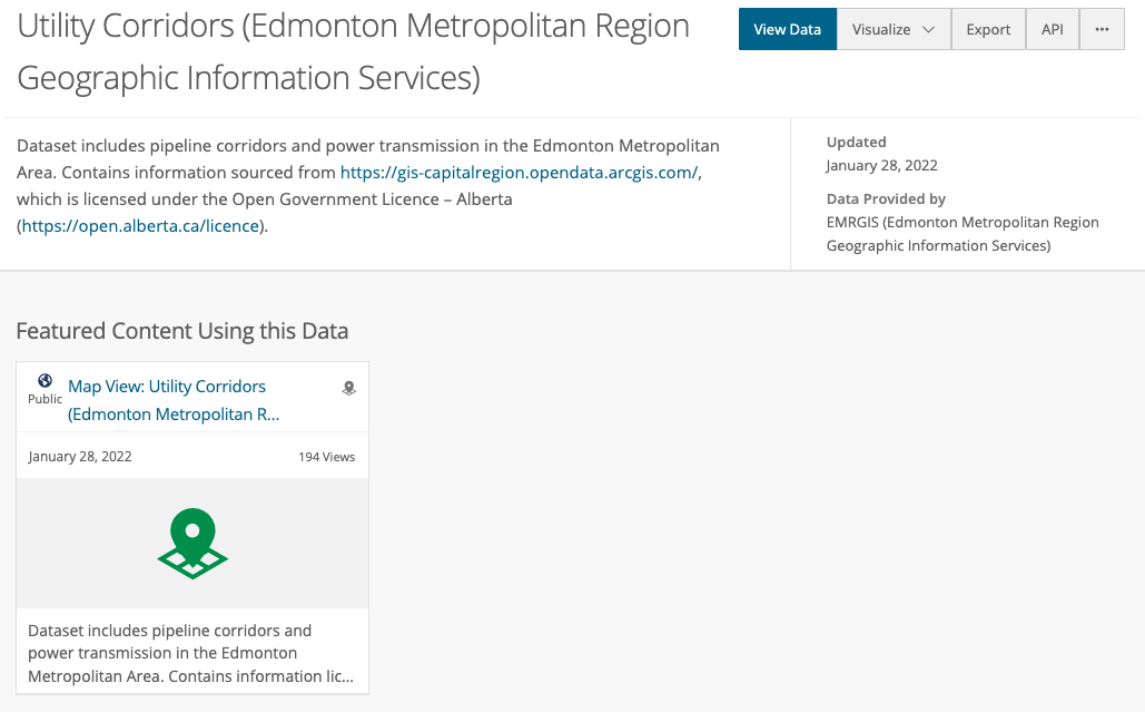


Figure 5.5b.

Utility Corridors Dataset on the Open Data Portal – Metadata, Updates and Downloads (City of Edmonton, 2022b)

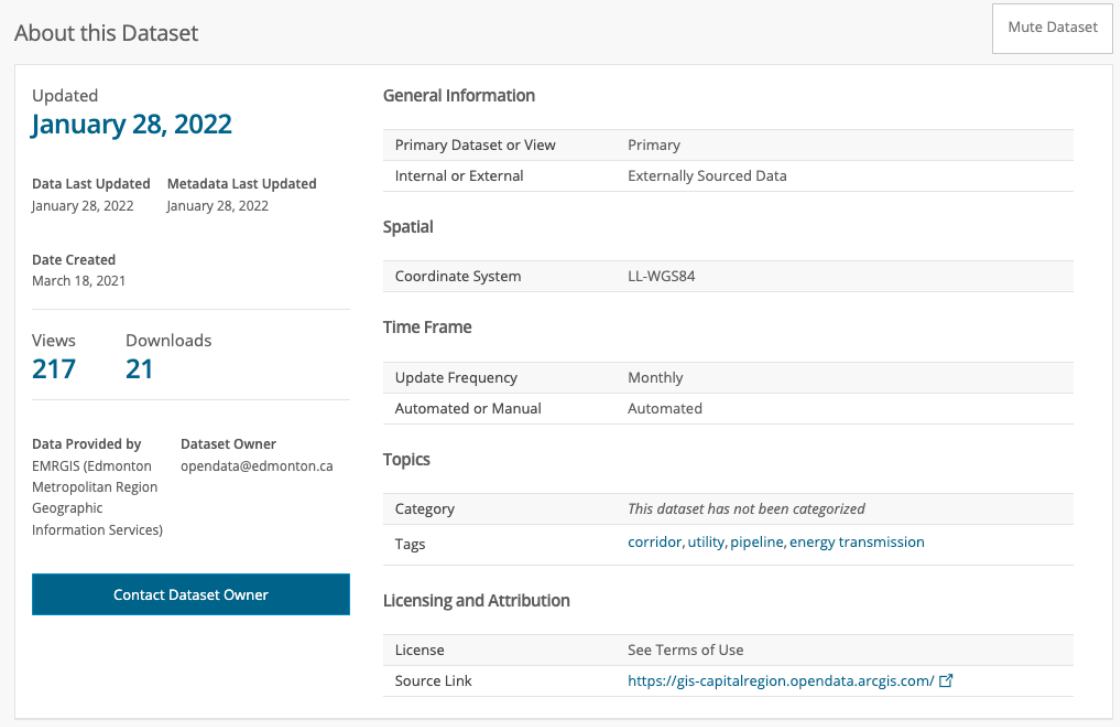
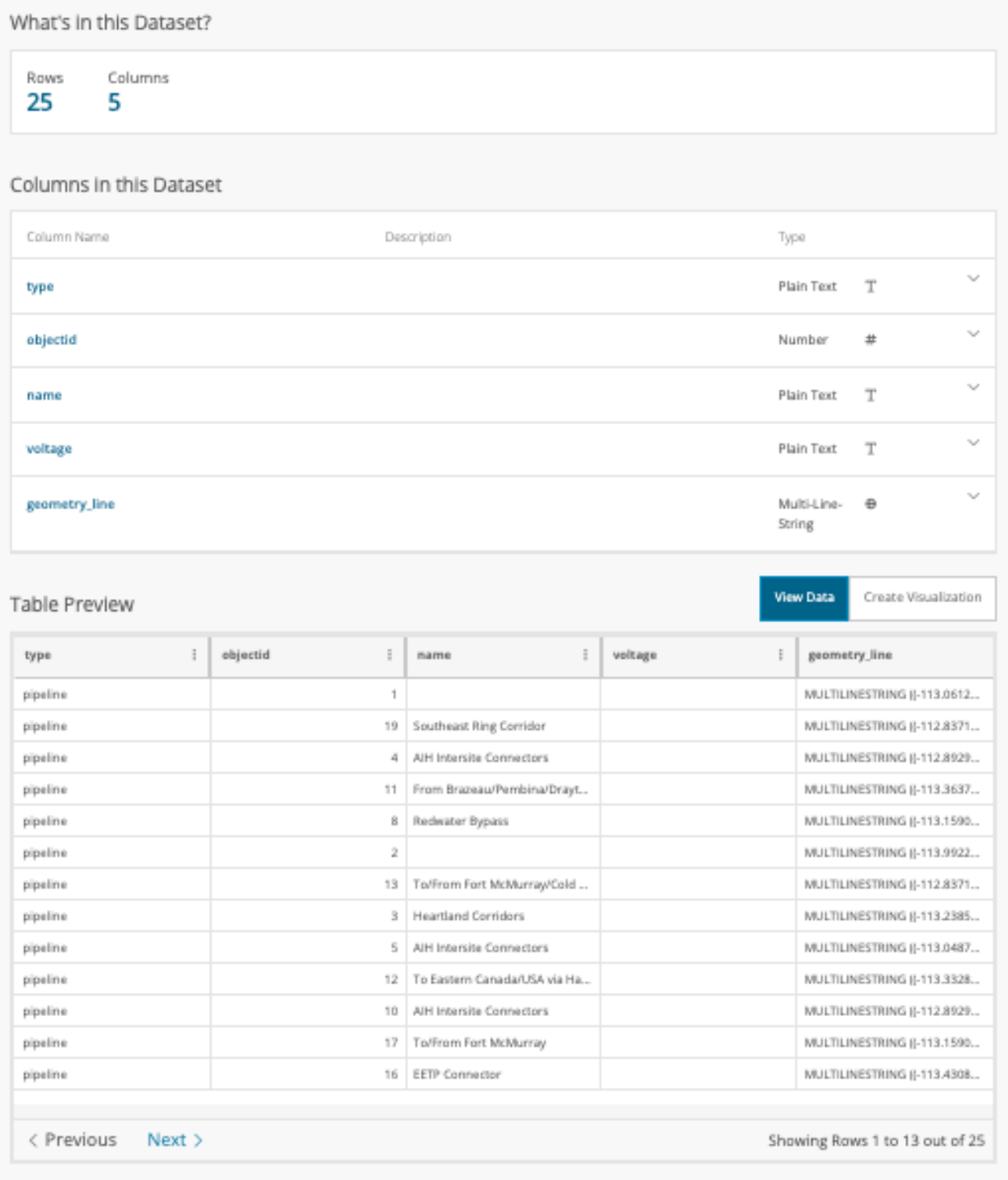


Figure 5.5c.

Utility Corridors Dataset on the Open Data Portal – Columns and Table Preview (City of Edmonton, 2022b)



What's in this Dataset?

Rows 25 Columns 5

Columns in this Dataset

Column Name	Description	Type
type		Plain Text
objectid		Number
name		Plain Text
voltage		Plain Text
geometry_line		Multi-Line-String

Table Preview

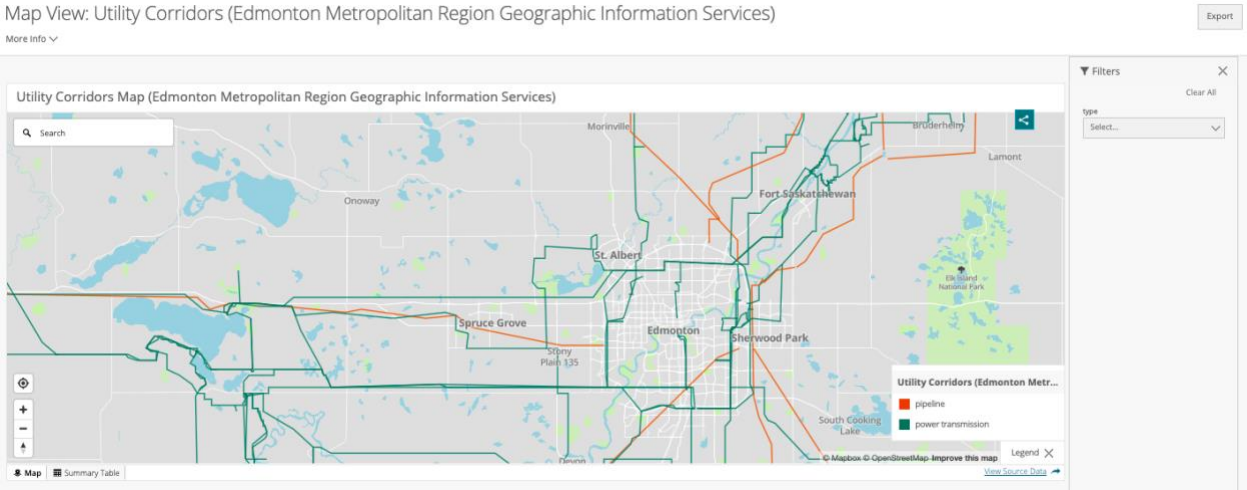
View Data | Create Visualization

type	objectid	name	voltage	geometry_line
pipeline	1			MULTILINESTRING ((-113.0612...
pipeline	19	Southeast Ring Corridor		MULTILINESTRING ((-112.8371...
pipeline	4	AIH Intersite Connectors		MULTILINESTRING ((-112.8929...
pipeline	11	From Brazeau/Pembina/Drayt...		MULTILINESTRING ((-113.3637...
pipeline	8	Redwater Bypass		MULTILINESTRING ((-113.1590...
pipeline	2			MULTILINESTRING ((-113.9922...
pipeline	13	To/from Fort McMurray/Cold ...		MULTILINESTRING ((-112.8371...
pipeline	3	Heartland Corridors		MULTILINESTRING ((-113.2385...
pipeline	5	AIH Intersite Connectors		MULTILINESTRING ((-113.0487...
pipeline	12	To Eastern Canada/USA via Ha...		MULTILINESTRING ((-113.3328...
pipeline	10	AIH Intersite Connectors		MULTILINESTRING ((-112.8929...
pipeline	17	To/from Fort McMurray		MULTILINESTRING ((-113.1590...
pipeline	16	EETP Connector		MULTILINESTRING ((-113.4308...

< Previous Next > Showing Rows 1 to 13 out of 25

Figure 5.5d.

Utility Corridors Dataset on the Open Data Portal – Map (City of Edmonton, 2022c)



By containing all of the City of Edmonton's open data, and acting as an interface between the open data analysts and users of open data – the Open Data Portal is a key infrastructure in the analytical space. All work done in the Open Data Program is to grow and maintain the Open Data Portal, so this is a vital space of the open data gaze. The open data gaze is able to operate through, and because of this analytical space that the open data analysts work within. The Open Data Portal is an infrastructure that came to be because the data imaginary opened up the space for it to exist within, and a space where the open data gaze is exerting its influence. In this way the Open Data Portal is the central infrastructure of the open data gaze, that allows for citizens, open data analysts and the City of Edmonton to unite.

5.4.2.2. Software of the Open Data Program

Behind the Open Data Program is a selection of software tools that allow for the uploading, maintenance and use of open data. The tools used most frequently by the open data analysts are Socrata and Safe Software's FME (Feature Manipulation Engine). Socrata is the API (Application Programming Interface) of the Open Data Portal, meaning it is what programs all the features of the Open Data Portal including filtering, querying and aggregating data (Socrata, n.d.; City of Edmonton, 2022a). Through the Socrata Open Data API, Socrata hosts the Open Data Portal and allows for data to be added, updated and deleted (Socrata, n.d). Additional

information, metadata, and visualizations can also be managed through this program (Socrata, n.d.). Socrata is the software behind the Open Data Portal and controls its features and use.

The other software used consistently is Safe Software's FME, the ETL (extract, transform and load) tool used to get data onto the Open Data Portal. FME is mainly used to take datasets from their source and load them onto the Open Data Portal (or, the Socrata API). With FME there is also the ability to schedule updates for datasets automatically. The open data analysts use FME mainly because it easily manages spatial data, a data type used frequently within the City of Edmonton and one that is popular among citizens. FME and Socrata need to work harmoniously in order to maintain the Open Data Catalogue. This is not always the case, and the open data analysts often need to perform many fixes to get them working together. While the Open Data Program does very little analysis themselves they do use some analysis tools including Tableau for dashboarding and visualizations, Beyond2020 for Statistics Canada Census data, and ArcGIS for spatial data. All of these software tools contribute to the analytical space of the open data gaze. Without these tools, data would not be able to be added to the Open Data Portal, limiting the capacity for the open data gaze to spread and grow.

5.4.2.3. Physical Hardware

All infrastructures that have made up the analytical space so far have been virtual infrastructures comprised of various software. In addition to this collection of software there are also material, physical infrastructures, albeit less, that make up the analytical space of the open data gaze. This physical infrastructure is mostly computers, specifically home computers due to COVID-19 work from home protocols. When working from home the open data analysts are connected to computers at their City of Edmonton office so technical FME jobs could run. There is a connection between the software and hardware, where specific material infrastructure is needed to complete technical tasks. When I was embedded within the Open Data Team I was not able to do certain tasks due to this barrier of needing access to an in-office computer. While the open data gaze exists in a largely technical world, there are still material requirements for the analytical space.

5.4.2.4. Conclusion

Of course it is not just these technical or material infrastructures that make up the analytical space of the open data gaze. Infrastructure is a wide ranging term, covering these technical infrastructures as well as organizational, social, political, economic and cultural infrastructures. These additional infrastructures will be explored in depth throughout the rest of this chapter, but all these together create the analytical space necessary for the open data analysts to work in, and the open data gaze to operate. As previously mentioned the data imaginary acts as the data gaze's "diamond tip" that allows for the analytical space of the gaze (Beer, 2019, p. 15). This collection of infrastructure is by and large the space that allows the open data analysts to do their work, as opened up by the data imaginary. Opened up by the imaginary, this analytical space allows for the open data analysts to do their work and spread the open data gaze. This work will be detailed throughout the rest of this section, drawing on observational field notes to look at the data publishing process, group associations and relationships to the citizen.

5.4.3. Data Publication Process

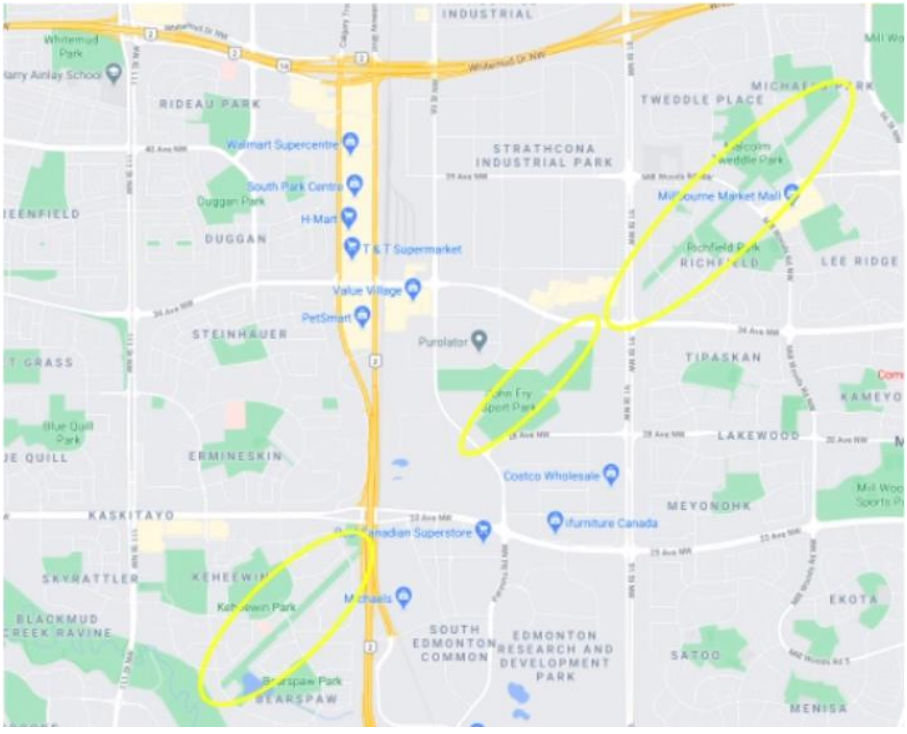
There are a variety of processes at work when publishing data onto the Open Data Portal. The first process is finding, or sourcing data to add to the portal. A goal of the Open Data Program is to grow the Open Data Portal by continually adding datasets. While their focus has shifted from data quantity to data quality (as I will discuss throughout this chapter) there is still an emphasis on adding as many datasets to the portal as they can. The first step in adding data to the Open Data Portal is therefore sourcing the datasets to add. One misconception I had about the Open Data Program is that the open data analysts created the datasets themselves, but they instead source out and find datasets others have created. Of course the Open Data Catalogue is huge, and one small team could never create that amount of data from scratch so it is imperative instead to find data. Open data is either internally or externally sourced, which both have slightly different processes. Internally sourced data is data that comes from within the City of Edmonton and can either be sought out by the Open Data Team, or asked by the business area (City of Edmonton term for department) providing the data to be put on the portal. Externally sourced data is data from outside the city that the open data analyst has acquired permission to publish on the Open Data Portal.

5.4.3.1. Sourcing Data

If the open data analysts are tasked with searching for a certain dataset it is typically because they have received a request from a citizen for that data. One example of a dataset that was requested from a citizen was utility corridor data. Utility corridors are defined as narrow strips of land where there are utilities such as electric power, oil or natural as are distributed (Rubino et. al., 2002). One open data analyst referred to them as "the unusually straight strips of grass without trees" (Participant Two) and provided a map with examples (figure 5.6). First, the open data analyst tried to source this data internally by checking the internal contacts linked to the relevant business areas, and reaching out to EPCOR. This did not yield results so then the open data analyst asked me to try to externally source this data. There were a few databases of potential data to check including the ArcGIS Rest Services Directory, Government of Canada Open Maps and Altalis, but sourcing data in this way is "basically a scavenger hunt across the internet" (Participant Two).

Figure 5.6.

Map with utility corridors circled (Participant Two).



It did turn out to be a scavenger hunt, and a fairly challenging one at that. I could not find data that was precisely what the request was looking for. I found Transportation Utility Corridor data and various pipeline datasets but nothing specifically on general utility corridors. Searching in this way I did find various leads and ended up contacting Alberta GIS to see if they had the data. The person I spoke to reached out to Environment & Parks and Energy but neither had the data I was looking for and speculated that the data was owned by the utility companies themselves. At one point I was sure I had found the right dataset under 'Cadastral Data' but could not access it as I was not a Government of Alberta employee. I did find a close dataset on Altalis, but this data had to be paid for and therefore could not be put on the Open Data Portal. Finally I came across Pipeline and Energy Corridor Data on the Edmonton Metropolitan Region Geographic Information Services (EMRGIS) page, and while they were not the exact 'strips of grass' utility corridor data we were looking for, they were fairly close.

Once the data was found, the next step was ensuring we were able to publish it. This is a significant step of the open data sourcing process. If data is privately owned outside the city, the owner needs to give permission to the Open Data Team to republish it under the Open Data License. So, even if some data is available to buy it cannot be republished under an open data licence because that would make it 'freely available'. This data luckily was published using an Alberta Open Government License so it could be republished on the Open Data Portal just with attribution of the source, and acknowledgement of the licence. The process of externally sourcing data is fairly extensive, and can range from fairly easy to fairly difficult. Externally sourcing data becomes particularly tricky because you have to ensure you are pulling the data from an open source.

One way the Open Data Program can create their own dataset is by extracting data from web sources using Python scripts, or 'web scraping' (Perez, 2021). This is what the Open Data Team did for their COVID-19 datasets – scraped data from the AHS (Alberta Health Services) website and republished it on Open Data, with attribution to AHS. Web scraping is the type of sourcing the Open Data Team does the least, because it can lead to more problems within the data itself. The other main way the city can obtain data is when business areas ask to put data onto

the Open Data Portal, which eliminates the sourcing data step altogether and the data can just be prepared to put on the portal.

5.4.3.2. Preparing Data

Once sourced, the dataset must be prepared to go onto the Open Data Portal. Preparing the data is likely the most time-intensive process of adding a dataset onto the portal. The main concern in preparing the data is that it is technically able to go onto the Open Data Portal. Adding data onto the portal requires it to go through a few separate software tools, and therefore needs certain technical specifications for it to work computationally. With externally sourced data the open data analysts mostly just ensure that the data is compatible with the software they use, or at most doing simple changes such as combining datasets together. In the case of the utility corridor data, the pipeline and energy corridor data were combined to be one dataset, titled 'Utility Corridor Data'. As well, the pipeline corridor dataset had height data which was incompatible with the Socrata program. Once this height was removed, the data was easily added to the FME tool and the Open Data Portal. With external data the open data analysts do not want to alter it too much because it is firstly, not their data, and secondly begins to break into 'data analysis' territory.

With internally sourced data, the data typically requires more preparation and cleaning. Internally sourced data is usually given in the same form the business areas use, which is typically a spreadsheet. The data is also formatted in the way that best suits the work of the business area. Because of this the data is typically human-readable, but not machine readable (see also section 5.4.6.). The job of the open data analyst is then to 'clean' this data so that it is in a form that can be added onto the Open Data Portal. Cleaning is similar to normalizing, where data such as dates, addresses and coordinates are formatted consistently in all datasets. As well, certain things need to be removed in the data cleaning process such as blank rows or columns, and URLs. When internally sourced data is 'not clean' the open data analysts can either send it back to the business area and ask them to make the changes, or do the data cleaning themselves. More often or not it is the latter for a couple of reasons. First, is the Open Data Team has an interest in adding data to the catalogue, therefore they are willing and have an incentive to take on the work of cleaning the data. Second, business areas do not have the technical abilities or

know how to easily manipulate data. Because the open data analysts have the technical expertise, they often do the data cleaning themselves.

In addition to cleaning the data, the data must be prepared so that it meets certain guidelines before being published. The open data analysts apply ‘data suppression techniques’ to ensure the privacy of individuals are protected while publishing open data. These techniques occur at a geographic level, where locations may be buffered or changed to a neighbourhood level so that location data is not clearly identifiable. Other potentially identifiable data is also eliminated, such as aggregating citizens' age data to a general range, or removing free form answers from survey data. With internally sourced datasets business areas provide all necessary information about the dataset including ownership information, public safety concerns, business information, data column descriptions, and more. These questions assist in the approval of the dataset by the data steward (the person appointed responsible for the data) and the FOIP (Freedom of Information and Privacy) and Legal Team. The more information the open data analysts, the data steward, and the FOIP team have about the dataset, the better they can ensure the data is ready and safe to be published.

One last part of preparing datasets for publishing lies not with the data itself, but the metadata. Metadata is the information about a dataset, and can include its description, licence, owner, how the dataset was sourced, geographic coordinate system, update frequency, relevant ‘tags’ for search terms, etc. (Open Knowledge Foundation, n.d.-b; City of Edmonton, 2022b). For internally sourced datasets the business areas provide the metadata because they are the subject experts of that dataset. They know better than the open data analysts what that data is about, and can therefore provide rich descriptions for it. With externally sourced data the open data analysts must fill in the metadata with the best information they can find. The open data analysts are very interested in improving the metadata for their datasets, but this unfortunately relies on what they can find for external data, or what is provided by the business area. The open data analysts also cite adding metadata as the longest part of the data publishing process because they must wait for the business areas to provide it. Because metadata is what allows open data users to understand data, it is very important that there is as much metadata provided as possible to give that bigger picture.

5.4.3.3. Uploading Data

Apart from a legal and privacy review, the last part of the data publishing process is the upload of the data itself onto the Open Data Portal. While the open data analysts use many tools in finding, and preparing data (e.g. Python scripts for web scraping and ArcGIS for spatial data) as previously mentioned, they primarily use FME and Socrata. Two things are important to note in this part of the process – first, the importance that FME and Socrata work well with each other, and second, the ability to set automatic updating schedules. FME loads data from whatever form it is provided in (e.g. CSV) and uploads it to Socrata. Adding in this step lets the data be dynamically changed and altered as needed, as well provides a more computationally stable source than a google sheet or excel. It is important that FME and Socrata work together so errors are avoided and data remains working on the portal. FME also allows for the open data analysts to set an automatic updating schedule for data, running monthly jobs for each dataset. If data is updated frequently then the data should remain accurate to its source, and free of errors. Once data is uploaded to Socrata from FME it can be published to the catalogue and is available for public use.

Publishing data to the Open Data Portal is the main way that the open data analysts work to spread the open data gaze, as publishing data to the Open Data Portal is the primary way the Open Data Program grows. By growing the Open Data Program, the open data analysts work to enable the city's envisioned future of being progressive, prepared, connected, inclusive, responsible and democratic. For each of these themes the more data available, the more the respective themes can be actualized. For example, with more data on the Open Data Catalogue businesses can better understand the city and consumers' needs, facilitating economic growth and therefore establishing a progressive future. Another example is that with more data, open data users can better identify potential threats the city faces and become more prepared for the future. So by adding more data to the catalogue, the open data analyst acts as an intermediary between the citizens and the City of Edmonton. The analytical space opened up by the imaginary allows for growth and proliferation of the open data gaze, and the open data analysts are those facilitating this expansion. In addition to a quantity of data being available, the open data

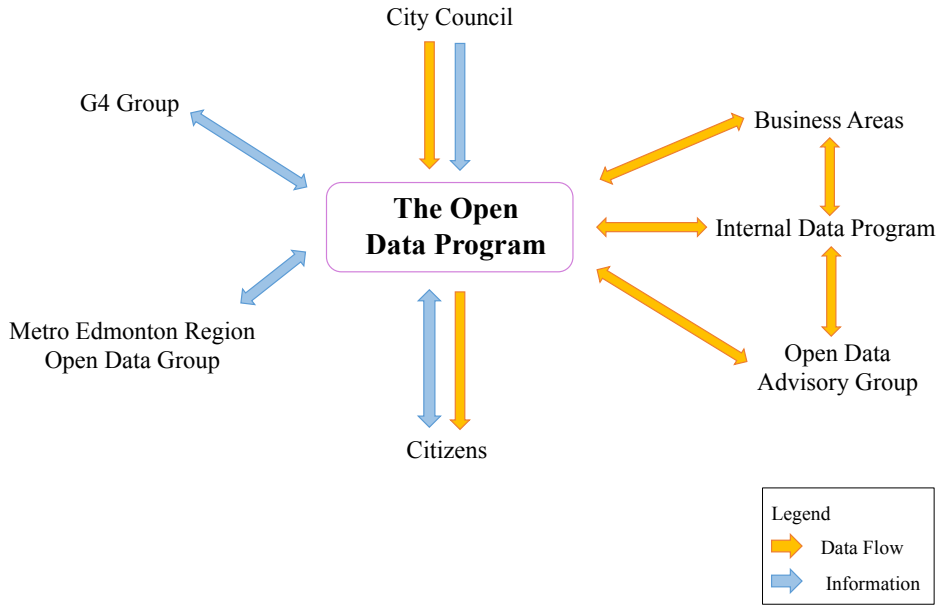
analysts also strive for quality data. They do this by first, associating with other groups, and second fostering a relationship between citizens and the Open Data Program.

5.4.4. Group Associations

In addition to working with business areas on gaining data for the portal, the open data analysts work with many other groups. From being part of the ETL (Extract, Transform, Load) group, to connections with the Internal Data Program, private businesses who use open data, or even presenting to city council – the open data analyst must foster many connections within and outside of the city. A diagram of the Open Data Program and their relationship to other groups can be seen in figure 5.7. This section will focus on three main groups that the Open Data Team works with: the Open Data Advisory Group (ODAG), the Metro Edmonton Open Data Group (MEOD) and the G4. Connections with these groups spread from the inner city level, to the metro region to other cities across-Canada. Connections with these diverse groups expands the reach of the open data analysts, better allowing them to spread the open data gaze.

Figure 5.7.

The Open Data Program Relationships to Other Groups



5.4.4.1. Open Data Advisory Group

The most frequent group the open data analyst works with is the Open Data Advisory Group. The ODAG is an 'oversight group' (Participant Four) that reviews internal and open datasets that are ready to be published, and provides checks and balances on the data publishing process. The group meets every three weeks and includes FOIP and Legal representatives, the Open Data team, and representatives from Internal Data, Data Ethics, and Communications. The open data analysts provide FOIP and Legal links to private versions of the datasets on the catalogue so that they can see what the data will look like when published. The FOIP and Legal officers then look at these datasets prior to the meeting if possible and then have the opportunity to pose questions and concerns during the meeting. FOIP and Legal can then provide approval, or the open data analysts go back to address their concerns in the data. The open data analysts can also present other projects such as dashboards, which often garner a lot of discussion. Because dashboards provide information and some level of analysis, they carry some more privacy and safety concerns. For example, one business area wanted to publish a 'Homeless Encampment Dashboard' which had a map of previous and current homeless encampments. At the ODAG meeting one open data analyst brought up some issues with this dashboard because they were concerned that people could use the spatial data to find these encampments and potentially cause harm. They then put the data ethics advisor in contact with the business area to talk further about the safety of the dashboard, and what else could be done. In this instance it was the an open data analyst who identified the risk, but it is usually FOIP and Legal who identify risks, and the open data analysts then subsequently need to make adjustments accordingly.

The open data analysts main task is to get open data published, so they often try to address all of the FOIP and Legal concerns quickly and completely. One dataset the open data analysts were very interested in publishing was Statistics Canada postal code data, but the FOIP team was very concerned with personal identification. The open data analysts went back and forth with the FOIP team over many meetings to try and get the dataset published. They even developed a tool that could allow the FOIP team to search datasets and see if they could match anything (e.g. match a postal code to a citizen survey dataset). To get approval on datasets the open data analysts often must compromise, or do extra work to prove there is no privacy risk. When there is too much work involved in this process however, the open data analysts have concerns that

business areas will not put data onto the Open Data Catalogue. If it takes too long to put onto the Open Data Portal, business areas may take another route (e.g. embedding a google map instead of an open data one) or not adding the data at all. The FOIP team also makes some concessions in this regard, making sure that non-identifiable data such as snow clearing data or recreation centre data gets approved quickly. They also give blanket approval to tools or visualizations that use already published data. While there are some challenges, the ODAG allows the FOIP team and the open data analysts to work together and get data published to the Open Data Portal.

5.4.4.2. Metro Region Open Data Group

Another group the Open Data Team is part of is the Metro Region Open Data Group. This group meets quarterly and includes municipalities in the Edmonton Metro Region (St. Albert, Stony Plain, Strathcona County and Spruce Grove), as well as the Edmonton Public Library, universities and other business partners. The main purpose of this group is to share knowledge and data. The MEOD is mainly led by the Edmonton Open Data team, but they are hoping to get other members to lead future meetings. The meetings include anything from technical presentations to opportunities to ask the other members if they have data. At one meeting I attended for example, one open data analyst asked if the University of Alberta had tree and activity registration data, and the university was able to provide some contact points for them. Another open data analyst suggested organizing something among the members for Open Data Day where they could showcase each other's open data. The Open Data team wants to foster this relationship further, but they find it sometimes difficult to organize and engage this very diverse group. The MEOD has great potential to facilitate data and knowledge sharing, and grow open data use across the region. This capacity for growth and connection is what makes this a valuable group for the open data analysts.

5.4.4.3. G4 Group

The final group of interest is the G4 Group. This group holds monthly meetings with Canadian cities that have mature open data programs (Edmonton, Calgary, Vancouver, Toronto, Winnipeg, Montreal, and Ottawa). The members in attendance are typically the individuals who run their respective open data portals. In these meetings every city gets an opportunity to talk about what they are currently working on, their struggles and successes, and ask questions to the rest of the

group. For Edmonton, some examples of things the open data analysts brought to this group was asking what other cities had done with their utility data, and asking for some advice on technical Socrata issues. One meeting was right after the Open Cities Index (OCI) results were announced where three cities came in the top three (Edmonton, Ottawa and Winnipeg). While they congratulated each other first, they also talked about what each city did to win this award. The Edmonton open data analysts contributed their win to a lot of their COVID-19 data, and the fact that their open data catalogue was largely built around these OCI parameters, sometimes at the cost of high quality or user friendly data. The members also talked about what the benefits of this title were, and the main answer was that you can use it to motivate leadership or business areas. The ability to motivate leadership and business areas to share data is a strength of this group, where they leverage what other cities' have on open data to get that data shared. For example, Edmonton open data analysts can say 'Calgary has this data so why can't we', which can motivate others to share data. This group is mainly meant for knowledge sharing, but also fosters Canada-wide connections for the open data analysts.

These groups are another important part of the work of the open data analysts. By fostering these group relations, the open data analysts improve connections and enhance the 'open data ecosystem'. By growing connections with other open data groups the open data analysts actively work towards the imaginary's theme of becoming a connected future city.

5.4.5. Relationship to the Citizen

The relationship the open data analyst has to the citizen is an important way that the open data gaze is spread. The Open Data Team prior to the current one I observed seemed to have more of an emphasis on the quantity of data, rather than the quality. While this is an important part of facilitating the open data gaze as I mentioned earlier, low quality data can alienate the citizens the City of Edmonton is trying to reach. The open data analysts I observed have a commitment to improving data quality, and therefore a commitment to the citizen. By improving quality, the citizens can use the data easier and more effectively, and by doing so realize the democratic goals of the data imaginary. One example of this was the utility data, where, after we had received the data from the EMRGIS page, one open data analyst tried to combine the data with a land use dataset to get the precise 'green areas' of utility corridors that the data requester had

asked for. I asked the open data analyst if that was a common thing they did, because people with GIS skills could do that themselves. They answered that it was something they consider often, “how much analysis should Open Data do themselves?" They have to balance goals of providing data, with service to the citizen. By answering citizen inquiries, adding quality data to the open data portal, and trying to get the most accurate data for requests, the open data analysts show a commitment they have to building and maintaining a relationship to the citizen. By maintaining and building this relationship, the open data analysts work more effectively within the analytical space as they know what the citizens want. If the open data analysts then give citizens what they desire, the future city the data imaginary envisions is closer to being achieved, and the open data gaze will work more effectively.

5.4.6. Conclusion

The Open Data Program is comprised of open data analysts who are key actors in the open data gaze. The role of the open data analyst is to work within the analytical space to provide open data, thereby helping to facilitate the open data gaze. The open data analyst is then responsible for the future the data imaginary envisions. Through processes of publishing data onto the Open Data Portal, fostering connections with other open data groups and building a relationship with the citizen, the Open Data Program is a vital component in spreading the open data gaze. The analytical space of the Open Data Portal, and the software and hardware behind it is also a key component of the open data gaze, and as it is added to and built within the Open Data Program, the open data gaze similarly grows. As the actor responsible for providing open data, the open data analyst is therefore responsible for the expansion of the open data gaze – making their role essential to illuminate.

5.5. Practices: The Eye of the Open Data Analyst

5.5.1. Introduction

The last section of this chapter will be reflecting on the themes that emerged from the interviews with open data analysts and privacy officers associated with the City of Edmonton Open Data Program (see participant information in Chapter 4). The previous section looked at the key infrastructures and the role of the Open Data Program within the open data gaze. The data imaginary opens up the analytical space for the open data analysts to work in, and therefore

spread the open data gaze. This section will further examine the open data analysts, unveiling their 'eye' – what they see, perceive, and find important to communicate. The eye of the open data analyst is a 'diagnostic one', aiming to fully understand and comprehend open data. This section should further illuminate the 'open data gaze', looking at how precisely the workers involved with Open Data conceptualize, understand and work with open data. As the primary actors who facilitate the open data gaze, it is vital to understand what the open data analysts find important, and therefore understand their eye - how they see, and therefore influence the open data gaze.

5.5.2. Opening Data

The first, and main step in any municipal open data program is to 'open up' the city's data. The City of Edmonton specifically has a swath of data on any number of topics – from tree pruning schedules to council decisions, but historically at the City of Edmonton individual business areas control their own datasets. In order to create an open data program this individually 'owned' data must be shared with the Open Data Team and made publicly available. The theme 'Opening Data' describes these attitudes around data sharing and releasing city data publicly.

5.5.2.1. The Challenge of Opening Data

Opening data can be described in a few ways. For example, it can be described as an attempt at "changing the culture" (Participant One) and convincing business areas to share their data. It seen as a challenge to convince business areas to "not be so fussy about public data" (Participant One) and to release it. This is even a challenge for getting data shared to the Internal Data Portal (IDP), and so another portion of 'opening data' is to use the IDP to make business areas comfortable releasing data internally - and then push that data onto the Open Data Catalogue. This process of 'opening data' takes time and requires various steps to get the data open, including continuous growth and open data advocacy.

Data within the City of Edmonton is often described as being 'siloed'. In a business sense, being 'siloed' refers to an environment where departments within the same company do not want to share information with each other (Gleeson, 2013). This same mentality is often referenced by the open data analysts. From the interviews it is clear that there is sometimes a reluctance to

share data even within the same branch at the city, which is a barrier the open data analysts must overcome. Business areas may have this reluctance to share data because they are concerned that their data will be misinterpreted if shared, they do not want to put in the time and effort to share data, or they do not want to be responsible for data that is publicly available. However, interview participants noted that as attitudes shift around 'opening up' the city and data, business areas are becoming more willing to share data among each other and with the public on the Open Data Portal. This issue does still persist with the Internal Data Program however, which is considerably younger than the Open Data Program. The challenge of getting business areas to share data is very significant, and one participant even defined the general concept of openness within the City of Edmonton as "the willingness to share your data […] even if it's good or bad, but [to] let them view it" (Participant One).

5.5.2.2. Sharing Data

The first step in opening data is sharing data, which can be achieved in a few ways. One significant way to get business areas to share their data is to change the culture around data sharing. While interviewing one participant they spoke to the difficulties of data sharing, and asked: "so what has changed? Why are we here today? What has changed?" (Participant One). The answer the participants collectively provided is that open data culture has changed to one that is less hesitant, where business areas want to proactively publish their data. This has led to both the Internal and Open Data Programs growing their catalogues and getting to a point where they are not having to "use a big stick" and say "give me the data" (Participant One).

According to interview participants, this change in culture occurred largely because the open data analysts educated business areas on what open data is, and ensured they were comfortable with the infrastructure surrounding the Open Data Portal (i.e. technical infrastructure, security, legalities). Commenting on this change in culture, one participant noted:

> it's been interesting to see the change over the years. … I would say people weren't as familiar with it and those who were often were hesitant to release their data because they didn't necessarily understand how it would be handled, they were worried if there were mistakes in it what would people say? And I have definitely seen that shift over time to

> where now we have business areas who are proactively wanting to release their data and they come to us rather than everything being driven by a citizen requesting something and we have to go track it down … I will say that definitely the attitudes have shifted towards people – A: understanding what open data is, and B: being very willing to release their data (Participant Five).

This increasing understanding of open data and willingness to share it can be attributed in part due to the Edmonton City Council's support for the Open Data Program. With more direction and support from the Edmonton City Council in the form of the *Open City Policy* (2015) and *Open Data Strategy* (2017), City of Edmonton employees are now much more willing to release data. This support from council was seen as a key contributor to 'opening data', as business areas now need to defend to council why their data couldn't be open if they choose not to share it. Given the council passed notion that "that data is open by default" the open data analysts use that as a guiding principle and use it as a bargaining chip by saying: "knowing that data is open by default, let's justify why this data cannot be open" (Participant One)? This changing of mindsets further establishes a growing open data culture, where data is 'open by default' and the addition of datasets to the catalogues is not only important to the open data analysts, but to business areas themselves.

5.5.2.3. Continuous Growth

Even though the open data analysts have reached a point where it is relatively easy to receive datasets from business areas, they are still always looking to grow their catalogues. Participants described how both the Internal Data and Open Data Programs have grown and improved over time. With the Internal Data Program, the idea is that it grows organically - when there is more demand it grows faster, and when there is less demand it grows slower and requires more marketing. While the Internal Data Program has had a steady pace of growth, the Open Data Program instead grew quite rapidly in the beginning of its lifespan, and is still currently looking to improve, do better, and release more data. With this continuous desire for growth there is also the importance of having someone on staff who is an open data advocate. While hiring for the open data analyst position, the managers of the Open Data Program were looking for someone who was passionate about open data. Having technical skill, while important, could be taught,

whereas being an open data advocate is more inherent. One participant, speaking on the importance of open data advocacy, affirmed:

> I think having a champion of open data, it's kind of, it's kind of the way you need to get it done. I mean if it's just on the side of someone's desk you might have it, stuff put out there like Council frequently says "bring us this data, and put in open data", that might have been the only time stuff gets put on Open Data. If you have someone that's actually passionate about it, then they actually look for, not only data to put out there, but look for quality data (Participant Three).

Having this 'champion' of open data moved open data from a 'side of the desk job' to something that is actively pursued. With advocacy, the open data analysts can push business areas to share data by persuading them that their data is of value, and should be put on the Open Data Portal. A large part of this advocacy is also educating businesses on presenting their data to the public in the best possible way. The role of the open data advocate is to further contribute to the process of 'opening data' thereby ensuring the growth of the repositories of data.

5.5.2.4. Open Data Culture

'Opening data' is one of the most crucial steps and goals of the Open Data Program, because how can the open data analysts achieve their other goals without first opening the city's data to the public? One participant asked: "wouldn't it be nice if all the data is open, in this way we don't worry about it?" (Participant One). And of course while it would be ideal, the process "takes time" (Participant One). Once all the data is open, 'opening data' will be less important to the open data analysts, but they have to first work to get to a point of ubiquitous data release. 'Opening data' is not only about getting data onto the Open and Internal Data Portals, but also about establishing an open data culture where data is 'open by default'. By fostering this culture of openness these programs will continue to grow and thrive. This attitude of openness and growth was quite prevalent among the open data analysts, where they "think [they] can always do better … [they] can always release more and that's something [they're] working towards" (Participant One). Opening data then requires the open data analysts instill this attitude throughout the rest of the City of Edmonton as well.

This effort to establish an open data culture and 'open data' was quite effective, going so far as establishing Edmonton as a leader of open data. Edmonton's Open Data Program has high status within Edmonton, the Metro Edmonton Region, and nationally. The program started in 2010 with only 12 datasets and has grown significantly since then. Moving from the odd presentation to FOIP employees, to being solicited to present at other cities and conferences, Open Data in Edmonton is now quite well known and respected. The City of Edmonton wins many open data awards, including being voted Canada's most open city 5 years in a row. On this success, one participant notes that:

> if you compare the city to any other different municipality or at the provincial level, I can pretty much guarantee you the City of Edmonton is actually pretty forefront in opening it up, the data (Participant One).

This success of opening data is largely due to the significant support from City Council (see section 5.5.3.), leading to almost every city employee touching open data in some way. The participants also confirm that they have never been told not to publish data because it could make the city look bad, and therefore they operate within a really open political environment. Where many municipalities have open data as a 'side of desk' job, Edmonton prioritized open data by creating its own department (albeit a small one), centralizing a FOIP department and using open data for visualizations and web tools - leading it to being one of the most mature open data programs, especially in Canada. As of right now, the Open Data Portal houses nearly all of the data the City of Edmonton has, and this strength of the program led to the creation of the Internal Data Portal. Despite their program's status, the open data analysts still emphasized a need for growth and improvement, and even though the "City of Edmonton is known for its open data … it can be done better" (Participant Three).

5.5.3. Municipal Politics

Behind any municipal governance strategy is the political landscape it operates within, and the Open Data Program is no different. This theme will explore the ways the open data analysts are impacted by and navigate municipal politics while doing their work.

5.5.3.1. Perspectives of Elected Officials

For the most part, the Open Data Program has the support of City Council, but participants noted that there are still political tensions surrounding the release of data, decision-making and funding for the program. Elected officials have certain stakes in the release of open data as it can paint a certain picture around their decisions. If all council data is released, citizens can more easily track their councillor's decisions and spending, and keep them accountable. This openness could potentially impact their political standing and status, either positively or negatively affecting them come election season. One of these potential impacts includes campaign financing data – a dataset that was being considered when I was observing the open data team. Campaign financing was the most voted-on dataset to crowdsource from citizens, but the open data team was concerned with the potential negative impacts of publishing this data. Publishing this campaign financing could shed unfavorable light on some city councillors, which in turn could make given councillors stop supporting the Open Data Program. The open data analysts were also concerned that the desire for the data itself was targeted at certain councillors over others, and therefore it was potentially unethical, or at least not neutral for them to publish this data.

The status of the Open Data Program is greatly influenced by its relationship with City Council, and its growth relies on a supportive political environment. On this note one participant speculated:

> if we were to get a council that is very focused on austerity, one of the things that I had thought of as far as like if we got a real kind of back to basics, 'we just want to pave roads and keep taxes low' - something that could be considered as fat to be cut rather than bone could be Open Data generally as a program (Participant Four).

The political landscape seems to greatly impact the program and throughout the interviews with the open data analysts it appeared to be important to remain 'in good favour' with council. The relationship the Open Data Program has with City Council is clearly very important, and to date is rather positive. Former Mayor Don Iveson (mayor at the time of data collection) and Edmonton City Council have long been supporters of Open Data. They passed the *Open City*

Policy (2015) and specified that data in the city is 'open by default', making open data more popular and easier to publish to the public. This support is quite imperative to the open data analysts as they "rely on … leadership to help … champion open data as a concept" (Participant Five). This relationship that the Open Data Program has with the City Council is an interesting one. On one hand, open data is meant to provide transparency and accountability to governmental practices, and on the other they rely on support from City Council to remain in operation. Even while balancing these potentially competing interests, the Open Data Program commits to the principles of transparency, and the open data analysts believe it is important to release data even if it may be slightly 'controversial' (Participant Five). This concept will be explored more in the theme 'Accountability' (see section 5.5.5) but it is important to note the tensions that municipal politics does create.

5.5.3.2. Decision Making

Another aspect of municipal politics is decision making. City Council and urban governance is built off of making decisions and it is what controls both day-to-day urban life, and larger strategic plans. Interviewees feel that making decisions based on data, or data-driven decision making, is the 'gold standard'. Participants asked questions like "why aren't all decisions based on data" (Participant Two), or expressed that many political decisions do not need to be debated. Decisions can and should be made using just the data, and afterwards the result of the data should be accepted and used to improve. An example of this was using data to determine if photo radar improves safety or is just a cash grab. One open data analyst expressed that if the data proves photo radar is not effective then:

> just accept that the data shows that they're in the wrong place … and improve. So it's not just reporting on things that have already happened, but also doing evidence-based decision making. Because Edmonton could be a good place to live, if people use the data to actually make reasonable decisions (Participant Two).

Data-driven decision making is understood as crucial to creating a good city. By using data, government can make the right decisions and eliminate any debate and agendas.

Interview participants also asserted that data should only be collected if it is going to be used to make reasonable decisions, or do higher level analysis. In principle they support data collection but "it's only useful if someone actually analyzes it and makes sense of it, and then it's used to make reasonable decisions" (Participant Two). Open data is not used to make city decisions; however, by providing open data other bodies may be able to make better decisions (e.g. schools, or the police). As well, elected officials have access to the granular internal data to work with, so do not necessarily need open data to make decisions. There is also an idea that all decisions have to be made with data, but some interview participants pushed back on this suggesting it should depend upon what decision will be made with the data - either allowing them to pinpoint what data is needed, or realize that data does not always need to underlie decisions. Additionally, in the case of mobility data, while it could provide a lot of information and make decision-making easier, just owning the data has significant privacy implications and concerns. To summarize, participants bought into an imaginary of "the smarter the city - the more data you get; the more data you get - the better decisions you make" (Participant Three), but still understand that there are complications to this.

5.5.3.3. Value Realization

Of course, a government program cannot exist without funding, and the extent to which value can be realized from open data is a crucial concern to City Council and administration. Even though data is widely known as 'important', not much money gets given to it because it is difficult to see the quick realization of value. Often data starts as 'garbage' and requires a lot of cleaning to get to a usable place. This process however, takes a significant amount of time, effort and money so there is no such thing as getting 'quick data'. Because of this upper management do not always 'have the confidence they'll realize the value' (Participant One), and they could spend the money elsewhere. The fact that they *might* realize the value of data after they have put a lot of money into it does not always lead to investment in data. One participant speculated on these underlying issues:

> now do you want me to take the money to go construct a bridge, or build an LRT or build something that the citizen will see right away and you get the vote right away? Or, do I spend a lot of money cleaning the data, and some of the data is garbage in garbage out, so

> how? It actually takes a lot of effort to clean the data, and because of that … it takes so long that they don't have the confidence they'll realize the value. (Participant One)

If data takes a long time just to clean and get to a usable spreadsheet, how does administration justify spending the money on it? Data is almost an invisible infrastructure, where it is important and useful, but not necessarily something voters and citizens will see and value. To remedy this the open data analysts suggested teaching business areas how to better use data and give their upper management appealing products such as dashboards. By having a product people can then use and see, they might better understand the value of data and become more willing to put money into the Open Data Program.

5.5.3.4. Funding

Internally, the open data analysts also try to use open source or internally built products to deal with tight budgets. While this is a good work around it sometimes leads to getting a product that will cost more time and money in the long term, as it is less effective to use. The open data analysts also take the bulk of work getting data onto the Open Data Portal so that the business areas do not have to use their own resources for the project.

An additional funding concern is that smart city infrastructure has taken longer than expected to implement, likely because of the costs associated with using this technology. When I asked if the promises of smart cities were 'over-promised' one participant answered:

> I mean, a smart city in theory is fantastic, but it costs money, and it requires you to actually use the data to make data-driven decisions. Where in practice, maybe there isn't the money, so maybe you don't do all the sensors that would be helpful, you do some of them, and then you're with incomplete data, and maybe you're not using the data, maybe you're capturing the data, but you're not actually using it to drive decision making so. In theory, I think it's great, in practice, maybe a little over-promised (Participant Three).

Due to budget constraints and economic downturn less money has been put into smart city infrastructure, which has lead to either delays in its implementation or cutting corners and getting

less quality data as a result. Funding is crucial to implementing new infrastructures and technologies, which is a challenge that the open data analysts are up against.

5.5.4. Entrepreneurial Interests

Building off the theme of municipal politics, we can start to look at the entrepreneurial interests that intertwine with the Open Data Program. Going back to the data imaginary described in Section 5.3 above, 'economic growth' (found in section 5.3.2.1) is one of the main goals that the City of Edmonton wishes to achieve through the Open Data Program. The open data analysts are therefore responsible for enabling some of this economic growth themselves. One important feature of the internal culture of the City of Edmonton is that it frames itself as a 'corporation': the city is the corporation, and the departments are 'business areas'. The Open Data Program is in the Financial & Corporate Services department because it is their job to "support the corporation" (Participant Three).

5.5.4.1. Empowering the Business

Interview participants saw their role as "empowering the business" (Participant One). This phrase is used to refer to how the open data analysts support and assist business areas in the city through the process of adding data to the catalogues, and the importance of data more generally. The language of 'business' is important here, because while it could be phrased as 'empowering the city' it is instead 'empowering the business'. This idea gives a particular shape to the imaginary of 'progressiveness' and economic growth. Economic growth is such a vital component of the data imaginary, a perspective shared by interview participants who see it as a crucial part of their program.

Largely, 'empowering the business' involves educating and training business areas on data use and importance. This includes courses and training around data literacy and data storytelling, as well as providing programs for data visualization and analytics including Tableau or Google Data Studio. The Internal Data Team also runs a Business Intelligence Forum that gathers diverse areas of the city to speak to new and important technological trends that can assist business areas in their work. This kind of training and support aims to get people across the city to "use data better" (Participant Five) and use analytics to help achieve their work.

In addition to providing training, both the open data analysts assist business areas in properly formatting their data for public use, as well as determining when and how to best use data. One participant observes that city staff often want a quantity of data but they first must determine what they need the data for, and then what data is going to be best suited to making a decision. In this regard, some of the day-to-day work of the open data analysts is to:

> educate them and then instead of giving them everything, [they] can give [the business areas] exactly what they want first – and that, those are the questions that [they] try to ask them… A typical day is to empower the business to collect more data and then empower the business to say "now how can I train you?" [They] work with the training team to train them on how to use the data, how to pull in, collect data, how to visualize the data, and [then work] with the business to say 'how can you further leverage data to make decisions?' (Participant One).

By educating staff, discovering new programs and provisioning data, the open data analysts help the "business of the city" and aim to "reap the gain" of utilizing data (Participant One).

5.5.4.2. The Corporate User

Another 'entrepreneurial interest' the city holds in the Open Data Program is corporate use of open data. While the imaginary envisions everyday citizens as the primary user and benefactor of open data, the reality is quite different. The biggest users of open data in Edmonton are corporations. In Edmonton, companies such as Darkhorse Analytics and HonestDoor, in addition to realtors, use open data. Significantly, Google pulls data from the Open Data Catalogue frequently, especially for transit. Realtors are particularly interested in any data to do with property, for example: lot, assessment or permit data. The transit data that Google pulls from is specifically formatted with Google in mind (GTFS feeds), and is geared towards using it programmatically. When citizens do use open data it is often through another tool created by a corporation. The open data analysts largely saw this as a benefit of the program, where even if citizens aren't directly using open data there is "either a company or some citizen who is tech

savvy [that] has taken that data and created something, and then folks consume it through whatever product has been created" (Participant Five).

Because corporations are the biggest user of open data in the city, the open data analysts must make some concessions to them. First, as previously mentioned concessions sometimes take the form of providing data in a format that can be used by the companies' technological systems. This can come at a cost of accessibility for the everyday citizen – who is supposed to be the target user of open data. Second, because the Open Data Program is still at the mercy of municipal budgets, data that they may have provided previously can lose funding. For example, one participant spoke about how they:

> provided parcel polygons, but it's resource intensive with budgets the way they are, [they] had to offload that to a private company, [making] some people upset that the data that they used to consume is no longer freely available (Participant Three).

If a company was using this data and could no longer, then they would have to incur a cost, which could then negatively impact a relationship between the company and the Open Data Program. The City of Edmonton has an interest in understanding who their user base is, so that they can better tailor their open data to who is using it most. Overall, the open data user is mixed but concentrated in key stakeholder groups which include corporations, the everyday citizen, and the police. Who then, do the open data analysts cater to? Do they focus on datasets that corporations can use and enhance the business and economic growth of the city? Or, do they focus on datasets that everyday citizens can use and gain insights about governmental decisions? Focusing on either of these can achieve goals of the data imaginary (progressiveness and democracy respectively) individually, but do not necessarily co-exist well together. What then wins out – entrepreneurial interests or democratic citizen engagement?

5.5.5. Accountability

Accountability was one of the most common themes that came up throughout the interviews. This theme relates to the official goal of the Open Data Program which is "providing openness and transparency to citizens through information" (Participating Three). Connecting to one of the

often stated goals of open data (transparency), accountability really refers to how open data can be used to ensure City Council is held responsible for their decisions. Open data gives the public access to the underlying datasets that drive decisions, thereby allowing them to check to ensure that their councillors are acting in accordance with what they would like to see. By opening up and providing city data, open data can allow for advocacy and general understanding. For advocacy - journalists, media or even citizens using social media or other platforms, can do analysis and present this to council or the general public in the hopes of 'exposing' council decisions, or changing governmental practice. While advocacy based on open data does not often go back to council, it still can be put in the public realm, as well as come back to the open data analysts to request clarification.

5.5.5.1. Culture of Openness

To create a culture of openness the City of Edmonton provides open data in the hopes of strengthening the relationship between citizens and the government. On the relationship between City Council, open data, and citizens, one participant stated:

> I think municipal politics are unique in that, much of them happens in the open, so most decision making … you can tune in, [you] used to be able to go in person and you will again one day be able to go in person but right now you can tune on YouTube, and see all of our City Council meetings…, all the debate. … and administration will present things in public, and I think open data is a good extension of that. And so not only are the decisions transparent, and that you can see them being made, but the underlying data that helps make those decisions should also be transparent (Participant Five).

This idea of giving the public access to the underlying data that drives decision making is a key part of accountability. By doing this, the public can see why council makes the decisions they do, be able better scrutinize the decisions by having access to the same data, and also see that certain unpopular decisions were backed up by relevant data. While open data does not drive decision making, by publishing the data used to make decisions the Open Data Program allows for more citizen knowledge and understanding of "why [the city] make the decisions [they] do" (Participant Three). This is a way of 'proving' why the government makes decisions, because if the decision does not line up with the data – citizens can scrutinize this.

Interview participants felt that this transparency should instill a "culture of openness" (Participant Four) at the city, furthering the trust between the government and citizens. In this environment of openness it is assumed that citizens have the right to see and use governmental data. When I asked one participant how they would define openness they answered:

> I think there's sort of a cultural aspect of just we put it out and whatever consequences happen, if something blows up in Council, then that's the environment we work under. That's what I think openness would mean, is just that we accept as a corporation that we're operating in an open, in an open business, where [we're] a public entity and most of what we do will be scrutinized by citizens, sometimes in smart ways and sometimes in really dumb ways, but that's the world we live in. That's what I would say like kind of a culture of openness would be (Participant Four).

This response gets at the idea that by publishing city collected data, whether good or bad, the city is operating in an open environment, and in a transparent relationship between it and the citizens.

5.5.5.2. Citizen Entitlement to Data

One of the common justifications the open data analysts give as to why data should be open is because city data is collected using tax dollars, and therefore citizens are entitled to this data. This is one of the most cited reasons for opening data, because the public pays for data, therefore they should have access to it. The open data analysts are passionate about providing data to citizens, on this topic one open data analyst noted that:

> a lot of the data that the city collects is relevant to and partially funded by or fully funded by tax dollars, and so it only makes sense to make as much of that as possible available to the general public so that they can be better informed about you know the data that informs our decision making (Participant Five).

For the open data analysts, because collected data is funded by tax dollars, it is seen as almost a given that citizens should be able to use the data. One participant even remarked that they "think

the citizens own the data, [they] just need to make it available to them as easily as possible so that they can do things with it" (Participant Two). It is then not only the job of the open data analysts to provide data, but provide it in a usable, accessible way. In addition to providing data the open data analysts also answer many public inquiries about datasets or open data more generally. Almost daily, they receive emails from the public including highlighting updating issues, requesting datasets, or asking questions about where to find data. The Open Data email is also one of the most accessible city emails, so it receives many questions, many of which are not necessarily related to open data. Nonetheless, this open line of communication is seen as a real strength of the Open Data Program, one participant believed that:

> one of the things that's great about our portal is it shows when the data was last updated and there's also a way to contact the dataset owner. So if people have a question they can actually reach out to the steward who is responsible for it. So I think it being understandable and if people don't understand it, having the ability to ask questions is a big deal (Participant Five).

The open data analysts feel strongly that the City of Edmonton government has a commitment to the citizen, and should not impede citizens' right to accountability. The data does not just get put on the portal and then communication closes, they are also available for further communication about datasets.

5.5.5.3. Open Without Restriction

Another important aspect of accountability is ensuring that data is open without restriction, and released without alterations. To be fully open data must be released without restrictions. Whether this is technically open where you do not need proprietary software to use the data, or not restricting its use. For example, you cannot say data can only be used for certain purposes, it must be available to use freely for whatever the user would like. The open data analysts maintained that types of data provided cannot be restrictive, meaning they strive not only to provide the locations of spray parks and trees, by they must provide more controversial data as well (i.e. council data) – or else they are not fully open. Commenting on this idea, one interview participant provided a definition of open data:

> open data, is like you know, machine readable, no restrictions, so you can't put restrictions on like what data can be used where. You can't say "you could have my data, but you can only use it for these things" like that's not fully open. But basically, it has to be open in format, meaning, you don't need proprietary software to view it. Open in terms of the spirit of openness … if we only ever put out data that was like the locations of our, I love that we have data [of] things like the locations of our spray parks and rec centers, but also, that's not terribly controversial (Participant Five).

To provide accountability the Open Data Program must be fully open, about all aspects of city governance. It is important too that the Open Data Program does not operate with a political agenda, and open data is released "without the spin" (Participant Three). If data is simply released to the public without any normative measures or indicators, then citizens can "sort it out" (Participant Three) for themselves. The open data analysts are committed to providing this accountability to citizens and being as open as possible themselves.

5.5.6. Human vs. Machine Readability

This theme captures the tensions between the technological and human aspects of open data. Open data is defined as data that can be freely accessed to use, reuse and redistribute with at most attribution (Open Knowledge Foundation, n.d.-b.). Open data must also have an open licence and be machine readable (Open Knowledge Foundation, n.d.-b.). Data is machine readable when it can be automatically processed by a computer, meaning it has to be structured in certain formats (e.g. CSV) with certain conventions in the data (Open Knowledge Foundation, n.d.-b.). This sometimes comes at the expense of human readability and usability. One open data team member spoke on this tension, stating:

> ultimately, the big thing about open data is it's free and it's machine readable. The whole idea is for analytics and computers to consume the data easily. But at the same time, not all our users are computers, they want to be able to like open up something and see it and actually see what, like easily see what they're looking at (Participant Three).

Often the Open Data Program focuses on datasets that are geared towards the 'tech geek' and higher level analytics, resulting in that data not being interpretable by users who may just want to answer questions. One participant brought attention to an example of this machine and human readability tension where the users of data are often able to interpret their data even if it is not at an IT level of '100% quality". While IT and technologists may want this perfect machine-readable data for better analysis, it is often not necessary for the subject matter experts or users of that data. Another example given by participants was having multiple datasets with similar topics - while computers can combine and analyze these files as needed, average users may have more difficulty finding what they need if it is spread across multiple datasets.

Alternatively, sometimes data is formatted for the human reader at the expense of machine readability. This can occur when the unique row ID is hidden because the human user doesn't need it, but it is necessary for computer analysis. When data is presented in only a human readable way further analytics or history keeping can sometimes not be done at all. Keeping open data machine-readable is still important because you can do more (technologically speaking) with it. This importance of machine readability was reiterated by the open data analysts, one participant even noted:

> one of the big philosophies of open data and what would be considered accessible from an open data perspective is that it's machine readable, which you know may or may not make it accessible to the general public, but I think I still think it's really important because one of the ways open data becomes accessible is by making it available to what I would call the 'tech geek' so they can use it to make cool stuff that people can consume (Participant Five).

Ultimately the open data analysts need to strike a balance between machine and human readability, increasing human usability and interpretation either by creating visualizations or combining datasets, all while keeping the data machine readable.

5.4.6.1. The Everyday Citizen

Part of making open data human-readable is understanding who the 'everyday citizen' is. While the everyday citizen is actually a small subset of the users of open data, there is still a decent amount of attention on this user. The open data analysts want to enhance data quality for the everyday citizen, mainly by improving metadata and making search terms more clear. Often the open data analysts receive requests from the public for data that already exists but the citizen could not find it because the language used is internal City of Edmonton lingo, rather than "normal, everyday, layman's search" (Participant Two) terms. An example of this given by one participant is calling aerial photography data - orthophotography, even though this is a very technical term. Often the everyday citizen will want to use open data to see things 'as is' or help provide information on things such as buying a house. If data is of poor quality or hard to find, that makes open data less "meaningful for citizens" (Participant Four). Finally, if open data is meant to provide transparency and accountability to government (particularly elected officials) data needs to be clear and interpretable to the everyday citizen. On this topic, an open data analyst mentioned that:

> normal everyday people, they have jobs to go to, they have other things to deal with. They can't keep an eye on literally everything that's happening. They have to put their trust in this elected representative to represent their best interests. Do they do that? (Participant Two)

Open data allows for citizens to check in on their elected representatives, but this requires open data to be interpretable without too much technical ability.

5.5.6.2. Accessibility

This theme can largely be summed up with the term 'accessibility', or the question 'how can open data be more accessible'? This is a major focus for the open data analysts, who work tirelessly to make the Open Data Portal more accessible. With enough status and quantity of data, interview participants feel that the Open Data Program can now focus on other goals such as increasing accountability and accessibility. Over the last couple years the open data analysts have changed their views on "who [open data] should be accessible to" (Participant Five), and

are more so trying to reach that 'everyday citizen', who may not always have the technical skills or even interest in extracting data and doing analysis, but still want to use open data. One participant even mentioned that people need to be able to use open data "at a glance" (Participant Three), meaning that they can get an answer to their question just by looking at the data.

The main ways the open data analysts are increasing the accessibility of the portal is making the search function easier to use and providing visualizations and tools that make data easier to understand. A passion of one of the open data analysts confirmed is their desire to make:

> open data accessible and not just to tech geeks. So some things I have done in the past and do try to direct or lead now, is to doing things like creating open data visualizations or tools that use open data to make it available to more people (Participant Five).

If data is more accessible to citizens in formats such as charts or maps, the Open Data Program will be able to 'connect with people a lot more' and expand their reach. Largely, open data is just formatted as table, so if the open data analysts can create visualizations to accompany the data, they may be able to make it more understandable at a glance.

One other aspect of accessibility is not only making the data more understandable, but also easier to find. When searching for data, many datasets or tools come up that may not be relevant, making it difficult to find or choose a dataset. Participants noted that they are trying to eliminate extraneous datasets and visualizations, or merge them together to remove 'noise' from the search function. If there are separate datasets for method or year for example, these are being merged together to one dataset with a column within it dictating method or year. By making the portal easier to navigate and providing intuitive tools (e.g. maps, charts) to interpret data, open data becomes more accessible and makes "it available to more people" (Participant Five).

5.5.7. Data Problems

The theme 'data problems' refers to the various issues and problems that occur with data. This theme is more technical in nature than others, and captures the more tangible, 'material' complications of working with data. Data problems include errors, data quality, the cleaning of

data, data context, and barriers. Essentially this theme gets at some of the main complications and issues the open data analysts face in their work.

5.5.7.1. Errors

The day-to-day maintenance of the Open Data Portal often includes fixing issues and dealing with errors that come up. Errors can include instances when scheduled jobs do not run, false hits when data matching, programs not authenticating every 30 days, or just general "data weirdness" (Participant Two). One of the most consistent data errors occurs when platforms are not compatible with each other and cause issues. This occurs on Socrata which will not accept URLs, FME which needs a certain date format, or Tableau which needs a Google Sheet and cannot pull from the Open Data Portal. All of these errors require workarounds, or making sure that the platform is pulling from the source dataset to ensure integrity and prevent issues. A final issue is when data errors because it has been scraped and there is a problem at the ownership level. This is a frequent occurrence with COVID-19 data which often does not update because the Alberta Health Services (AHS) data has issues. When the AHS data has issues, the open data analysts either have to wait or find workarounds because they are not the owners of the data. One participant noted that:

> as the pandemic went on like more and more people were scraping the data and doing interesting stuff with it. But … when you're not the owner it's hard to keep up with too, because something might change at the source and then you have to kind of deal with that downstream and fix your feed and so it was a not insignificant amount of work (Participant Five),

So while there is a lot of value in providing COVID-19 data to the public, there are also a lot of accompanying data errors and issues that cause a lot of work for the open data analysts.

5.5.7.2. Data Quality

Another common issue for the open data analysts is data quality, which they are always trying to improve on. With data there is the rule: "garbage in garbage out" (Participant One). If the data that goes into analysis is of poor quality, then the analysis will likewise be of poor quality.

Because of this, the open data analysts aim to improve data quality by: removing or adding things as necessary, updating, maintaining and refining datasets, using consistent naming conventions, and providing accurate and complete metadata. Providing as much metadata as possible provides context for data, making it more meaningful and easier to use. The Open Data Program has now reached a level of "eminence" where the open data analysts now want to make the Open Data Portal more usable by being able to find "valuable data", not just any data "dumped" onto the portal (Participant Three). Another way to ensure data quality is to locate the data's "source of truth" (Participant One) which is essentially its original location, or source. By doing this the data can always be found, and data quality can be checked at the source where they can make sure it is "clean" or improve it if it isn't (Participant One). Data quality and data cleaning then go hand-in-hand where data quality is achieved through a process of data cleaning.

5.5.7.3. Barriers

An additional 'data problem' comes with the more human element of data handling where there are barriers imposed by other people. These are still the day-to-day issues of getting data onto the Open Data Portal, not bigger issues such as political climate or combating business and citizen interests. The biggest common barriers to getting data onto the catalogue include getting buy-in from business areas and direction from the FOIP (Freedom of Information and Privacy) and Legal Team. Privacy issues will be explored further in the following theme 'Information vs. Privacy' (section 5.5.8), but this is still a daily 'data problem'. The open data analysts have to "tip [toe] the line with FOIP still" (Participant Three) as the FOIP Team can stop datasets from being published. FOIP also often requires a lot of paperwork to get data published which can discourage business areas from publishing data. Other barriers include the desire for perfect data, the time it takes to publish data or get metadata from business areas, and technical limits that do not always allow people to use datasets programmatically. For the some of the participants, a large part of their job is managing these barriers and trying to "clear the roadblocks before [they] come … so [that] way the road is paved" (Participant One) in order to be successful.

5.5.7.4. Missing Context

The final data problem is data being taken out of context, as there is often not a subject matter expert to accompany and explain the data. In fact, one of the major concerns for business areas is

that their data will be taken out of context when made public. To prevent this the open data analysts try to provide as much information and context to the data as possible. This way data is less likely to be misinterpreted and they will get fewer questions about a dataset. While one participant noted that the fear of misinterpretation is often unfounded, they still maintained that:

> the more information we can put into a dataset, the less questions we'll get about it, and one of the biggest concerns from business areas are people will incorrectly take the data and derive insights out of it that aren't correct. The more context we can provide on the data, the less likely that'll happen (Participant Three).

By providing this context the open data analysts have never had to contact anyone using the data to say they have misinterpreted it, they have however made some internal datasets private after some unfavorable charts were made. As well, without a subject matter expert explaining the context for the data it can sometimes be difficult to understand. Subject matter experts provide relevant context and interpretation to data, which is often an important thing missing from open data. One participant mentions that they felt like open data "does miss that context" and while open data "drives" insights, "sometimes it does require that subject matter expert" (Participant Three). Because open data is meant to provide accountability, missing the context on data could cause significant problems. For example, council is not given a raw table of data but instead given a chart created by a subject matter expert, but citizens are not given this kind of context. Again to remedy this they try to provide as much context as possible, and business areas are also expected to provide information about the datasets as the open data analysts are not the subject matter experts.

5.5.8. Information vs. Privacy

When talking about data it is very unlikely for the topic of privacy not to come up. This is perhaps one of the biggest tensions surrounding the data industry today, and something that not only data and privacy professionals are concerned with, but also academics and everyday citizens. Privacy is largely cited as a good thing as it is important to protect citizen identities from predators or those who would mean them harm. If the City of Edmonton is trying to use open data to gain the trust of the citizens, they do not want to break that trust by releasing

personal information. One participant mentioned that, “privacy wise - obviously we pass everything past legal counsel and FOIP, for good reason” (Participant Three), but it still is a significant tension the Open Data Team navigates carefully.

5.5.8.1. Right to Information

The open data analysts are primarily concerned with the right to information, and providing valuable information to citizens. A tenet of open data is to provide transparency through information delivery, so for the open data analysts a significant barrier is not being able to publish data due to privacy concerns. This tension between citizens' right to information, and their right to privacy is what this theme will explore in more detail, and the various ways privacy and open data collide or connect.

One conflict I observed, and the open data analysts reiterated during the interviews, was not being able to provide postal code data even though citizens were requesting it, because of privacy concerns. One participant commented on the matter stating that:

> we haven't been able to publish this dataset that a couple of members of the public have been asking for, for months, because it's being held up by FOIP, even though the data is already in the public domain (Participant Two).

The dataset included addresses with postal codes, something Open Data had not been able to previously publish because it was owned by Canada Post, and only something you could find on Google by searching an address. Postal codes would then be valuable information to the public, because having them all in one dataset could lead to good analysis, but the FOIP team was concerned about the ability to find private information about someone. Despite this frustration, the Open Data Program still follows the byline “open by default, protected by design” (Participant Three) to try to strike a balance between openness and privacy. FOIP also tries to balance their own competing interests of “right to know” and “data privacy” (Participant Four), where sometimes they support each other and other times they are competing interests. One participant spoke on these competing interests, saying:

> I think the key tension is there are sometimes where openness and privacy support each other. So an example is that you have the right to request your own information, so you can see how government is using your information and the reason why and all of that. But in other places it is a tension that my right as a citizen to have privacy does conflict with the citizens' right or expectation to know what government is doing. So I feel like in general the FOIP Act has a very good way of, we don't like to say balancing because, we don't really see it as like a balance necessarily, but of expressing how those different, how those competing rights intersect. So we have a right to know how our government is spending money, we don't necessarily have a right to know the specifics (Participant Four).

An example they elaborated on was the AISH (Assured Income for the Severely Handicapped) program in Alberta, where someone requested data on a person to see if they were receiving AISH so they could determine if they could sue them or not. In this instance they were not even able to confirm or deny if a record existed due to concerns for that person's privacy. So while the public has the right to see how much money is spent on AISH and what benefits or problems it brings - they do not have the right to see if someone is using that program.

5.5.8.2. Regulation

As previously mentioned, the open data analysts go through quite substantial FOIP and legal processes prior to being able to publish data to their catalogues. The open data analysts regularly meets with and consults FOIP and legal experts and addresses their concerns by removing private information and aggregating data to minimize risk. FOIP has several 'regulatory' measures including: ensuring compliance with the FOIP act, creating an Open Data Privacy Impact Assessment (PIA), and potentially auditing datasets using a 'motivated intruder test'. Open data published to the catalogue must also go through a legal review to make sure publishing that data does not infringe on other City of Edmonton contracts or commitments. Historically, the Open Data Program was very restricted by FOIP, because to collect information there had to be a statement filled out saying what data would be used for, and open data (or

republishing data) was not an allowed reason. Now largely FOIP oversees open data publication and evaluates risk.

5.5.8.3. Assessing Risk

Evaluating and assessing risk is a key component to dealing with privacy and data. There are two subcomponents to this: how the open data analysts conceptualize and understand risk, and how the privacy officers apply a risk assessment to a dataset. While both teams work together to minimize privacy concerns on datasets, they have different conceptualizations of risk, and assess it in differing ways. Risk here refers to the potential that a dataset may expose private information. The open data analysts do not always "know what [they] don't"(Participant Three) when it comes to privacy, and while individual datasets might not pose a risk - combining them could lead to the identification of an individual. Other issues may also come up, such as being able to determine trends within datasets that could give away an individual's location at given times. While the open data analysts do not always see these issues, the privacy officers are there to provide a second check, ensuring that risk is minimized. The open data analysts can also take this back to convince business areas to publish data as they can say there is minimal privacy or legal risk. Within the Open Data Program there is a tension between wanting to publish a quantity of data, and making sure private information is not exposed. This results in a need for negotiation between the privacy officers and the open data analysts, as well as the open data analysts feeling that object data (data not about people) should not have to go through FOIP approval. This again was a point of contention with the postal code dataset, where:

> publishing address data, including postal codes, … should not [have] anything to do with FOIP at all, because it's not personally identifiable data, it's data about objects. It's not data about people (Participant Two).

While address data is about objects (i.e. buildings, houses), people do live in those objects which was the privacy officers' concern. This 'gray area' of what counts as data about people, and what FOIP should have authority over is another portion of assessing risk.

While there are some tensions between the open data analysts and the privacy officers, both parties would largely agree that they work together and cooperate as a team in order to protect private information. Both teams mitigate and work though the tensions to balance the need to publish data and the need to maintain privacy. Of course data such as the postal code data, parking data, or mobility data, could be very useful for analysis, but the open data analysts are careful to not expose private information. This is where the privacy officers assess data and ensure that private information will not be exposed, and that individuals cannot be identified from a dataset. Working together in the Open Data Advisory Group (ODAG), they work to do oversight assessments, and analyze the potential for 're-identification' (identifying an individual based on a dataset). The ODAG is seen as:

> an oversight group to kind of bring those internal risk assessments that we need to make with regards to the publication of data. The Open Data Group … are very interested in having a large quantity of data out there and as kind of the checks on that there's from a FOIP perspective (Participant Four).

'Checks' by the FOIP team largely come in the form of risk-assessment. Risk can be assessed in a variety of ways, including matching datasets with each other to determine if there is private information, or looking at a given dataset to see if you could identify an individual based on external factors such as location or time. Often the privacy officers must try to embody the ideas of a person who would use data for ill (predators, for example) to determine if a dataset holds risk. One participant mentioned that they:

> basically looking at what is the risk that this [data] could become identifiable, that you could match it with other sources of information and use it to gain information about someone that you wouldn't otherwise be able to access, and potentially harm them. And that potential is a little bit of the, probably the trickiest part is trying to figure out what that potential is, how realistic it is. Because oftentimes I find myself thinking if I was like the creepiest, most evil person, what could I do with this information against my enemies? (Participant Four)

To eliminate some of this 'potential' the privacy officers have thought about performing a 'Motivated Intruder Test' to see what information you could get just by having the dataset. A Motivated Intruder Test essentially uses publicly available information to see what you could do if you had bad intentions. In this test you do not have to be technically skilled, so it evaluates what personal information you could get with a moderate amount of data.

Another part of risk assessment is to ensure that a person cannot get more personal information than they would otherwise get - for example, fine data from 311 where they would typically only be told that action was taken, not the amount the individual was fined. Finally, if personal information is exposed by a dataset, there must be a disclosure for it under the FOIP Act. Councillor expenses are a good example of this, where there is an individual exposed, but there is disclosure under the FOIP Act for it as they are a public figure. With this, there is the attitude that overall citizens have more rights to privacy than the city, or businesses. One interesting opinion on this was:

> There is always interpretation to it, but … personally my ideology has me far less sympathetic towards confidential business information than individuals. So I know there's some genuine things that need to be kept from a business perspective to preserve, the investments that they made. So if they share information about a technology that hasn't been made widely available, if the city were to disclose something that gave their competitors that technology and gave them a leg up that would that would allow them to leapfrog and use research that the business had invested in, that's a legitimate thing to withhold. But also details about, say, the arena deal, I don't really care to be honest. And that's just and that's not me speaking as a City of Edmonton employee, that's me as an individual that, philosophically, I don't think that businesses have the same rights to privacy that individuals do (Participant Four).

With this it is important to note that the privacy officers are not trying to protect the City of Edmonton from harm or protect their private interests, but the privacy of individual citizens.

5.5.8.4. Data Ethics

While yes, privacy is seen as the main barrier and tension for the open data analysts, they do think privacy is important and always uphold whatever the FOIP and legal team suggests. This successful partnership has also led the Open Data Program to try to incorporate data ethics into their evaluating practices by looking at the morals of publishing data beyond that of privacy. Sometimes data may be acceptable on a FOIP or legal basis, but it is still not ethically sound to release that data. With potentially identifiable data, one participant noted:

> 90% of the times [data] probably wouldn't be, or 99% of times it wouldn't be [used maliciously], but, if it were to be used once, then, while not legally on the hook, I mean, there's still the ethics so. Having a good addition to kind of the whole review process was adding data ethics. Could we do it legally? Yes. Can we do it from a FOIP perspective? They're getting a little iffy, but yeah, we likely could. From a data ethics perspective? No probably shouldn't. And I think data ethics is kind of a, the newest thing with data, it's coming up. Which probably should be, because there's a lot of unethical decisions made by some corporate tech companies (Participant Three).

One example given on data ethics was when the Alberta Government began posting name changes in the Gazette to deter people from changing their name and disappearing. When the Gazette went online they continued to do this, which made it much easier for people to find name changes. Putting the Gazette online means people can search names and then a history can come up which could affect people such as abuse victims or transgender people (Jantzen & Kennedy, 2011). Data ethics takes the question from 'can we release data' to 'should we release data'. Again, the open data analysts are aware of the privacy and ethical implications of releasing data, and while they act as a potential roadblock to publishing data, they are seen as crucial to consider.

5.5.9. The Smart City

This final theme explores how the open data analysts see the smart city, how they interpret Edmonton as a smart city, and how they see data within the smart city.

Participants largely see data as the foundation of a smart city, where sensors and underlying technology are mainly a vessel to receive data, which then should be used to drive decision-making. Maybe more interestingly, one participant said:

> what really intertwines everything together, for me is just like your data, is just like your blood, it has to flow, it's the one that connects everything together (Participant One).

Data is then essential to the smart city, "how can you be smart without using data" (Participant One), or if data is 'your blood' a smart city can therefore not live without data. The more technology implemented and the smarter a city gets, the more data can be put onto the Open Data Catalogue - driving decision making and allowing for public insights. While acknowledging the potential of smart cities, participants also maintain that there are issues with them - notably privacy issues, the time it takes to establish smart city infrastructure, and only collecting but not using data. One participant does not even define smart cities in a technological way but instead as doing things in a "clever and efficient manner" (Participant Four), but they still maintain that it takes time and effort to get to this point.

On the status of Edmonton as a smart city, one participant noted:

> it's a lot of work to figure out for a smart city, if you are doing things like having smart infrastructure in your city [they're] still figuring out how that's all going to work. So I think we'll get there, but we're maybe not as far as people might like to be right now (Participant Five).

An aspect of time is therefore important to the smart city. When something is so futuristic and innovative, it seems as if it should not take much time to implement – especially since infrastructure such as the internet is automatically available to use. A smart city still needs to implement physical infrastructure however, and is still at the mercy of governmental bureaucracy and funding. As a rule, smart city and open data policies will take longer to implement than is sometimes desired. On the topic of smart city benefits one participant clarified:

> I think there is possibly in the public discourse an over-optimism of the timelines at which these benefits can be realized. I think there could be an under appreciation, especially among kind of the techno-enthusiast proponents on how transformative this can be quickly. And having an oversight role, and particularly one that's often viewed by people as like a pointless bureaucratic impediment. I feel that there is a lot of potential for these things, but it's not going to come into a hurry and that it is going to take more work than a lot of people appreciate. So, to kind of qualify, I think it is there, but I think it's not something that's going to be realized within the next few years. I think it might be more on the scale of decades (Participant Four).

This is an attitude shared among the participants, who feel that while the Open Data Program is quite effective, smart city policy and infrastructure is just not quite there yet. The Open Data Program in Edmonton, for example, is well renowned nationally, but Edmonton has (at the time of interviewing) yet to implement the 'Smart Fare' system they proposed in years ago. To speculate, the difference between the smart city timeline and open data timeline could lie in the material infrastructure needed to run each of these strategies. Being a 'smart city' requires a complete transformation of the physical city to achieve, but Open Data requires largely software infrastructure, and only some hardware and servers to operate. Because smart cities are more materially intense to implement, it will take longer to create a smart city, than an open city.

5.5.10. Conclusion

These themes further illuminate how the open data analysts see and understand open data. The interview themes move from the general processes and work of the open data analysts, to the eye of the open data analysts - how they see their role within the open data gaze. I previously stated that it is the role of the open data analyst to work within the analytical space opened up by the data imaginary, thereby allowing the open data gaze to expand. The eye of the open data analysts show that they are similarly concerned with the growth of the open data gaze, as the themes they reflect on work to further this force. By opening data to the public, and concerning themselves with the municipal politics and entrepreneurial interests at play the open data analysts translate an emphasis on economic growth by providing open data. They also maintain a commitment to the citizen, focusing on human readability, accountability and privacy. By focusing on these

issues, the open data analysts better connect to the citizen and further spread the open data gaze. The eye of the open data analysts also sees some general problems with open data, as well as the complications of achieving the city's smart and open city goals. With these themes we can better understand how the open data analyst sees their role within the open data gaze. The conceptions and understandings the open data analysts have open data greatly influence the formulation of the open data gaze. The open data analysts imbue their experiences and concerns into the open data gaze, and their eye therefore etches into the ever-evolving open data gaze.

5.6. Conclusion

The results for this thesis started with presenting Edmonton as a smart city – one which utilizes its municipal advantage, works as a living lab, and establishes a smart city market. It then presented an exploration of the 'open data gaze'. First, by looking at open data and smart city strategy documents from the City of Edmonton, a data imaginary emerges. This imaginary presents the vision of open data and technology to have the power to create a future city where Edmonton is progressive, prepared, connected, inclusive, responsible, and democratic. Operating as the 'diamond tip', the data imaginary is what allows for the open data gaze to blossom (Beer, 2019, p. 15). Out of the analytical space born from the data imaginary, the open data analyst becomes a key actor in the open data gaze. By exploring the practices involved in the open data analysts work, it is shown that they are the facilitators of the open data gaze, and allow it to grow and spread. Finally, by illuminating the eye of the open data analysts through presenting several interview themes, we see how the open data analysts add their own experiences into the open data gaze. By adding their own conceptions and experience to the open data gaze, it will always change, so long as the interests of the open data analysts change. The open data gaze begins to operate through the data imaginary in Edmonton, and is cemented and expanded through the practices and values of the open data analysts.

Chapter Six – Discussion: The Entrepreneurial Open Data Gaze

6.1. Introduction

This thesis has set out to unpack data-driven urbanism in Edmonton by developing a rich understanding of the open data gaze. In researching data-driven urbanism in Edmonton I saw an opportunity to incorporate the scholarship on entrepreneurial urbanism and, in particular, municipal statecraft. Both of these 'urbanisms' are operating in tandem in Edmonton, and ultimately data-driven urbanism can be understood in Edmonton as *entrepreneurial*. Overall, the open data gaze is a form of municipal statecraft that can allow for Edmonton to become an entrepreneurial city. This chapter will first examine the intersection between data-driven urbanism and entrepreneurial urbanism, and why it was constructive to align these literatures. Second, it will describe how the open data gaze is an exemplar form of municipal statecraft. Lastly it will link the open data gaze to the entrepreneurial, describing, in the process, how this entrepreneurial open data gaze is applied in Edmonton.

6.2 Intersection between Data-Driven and Entrepreneurial Urbanism

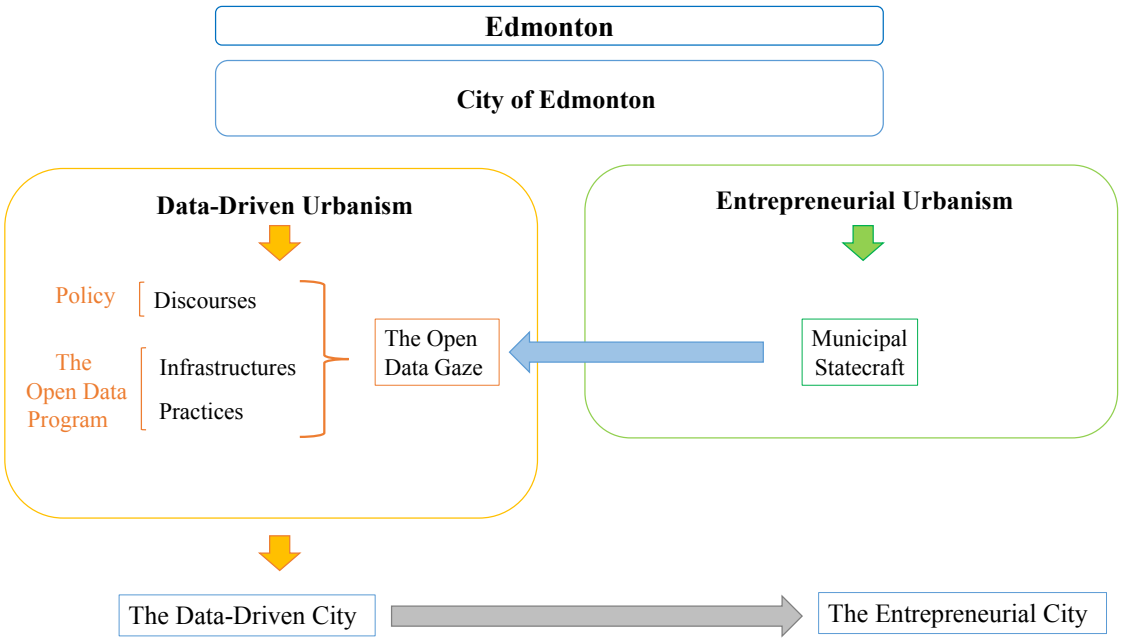
6.2.1. Overview of Concepts

A number of concepts have been introduced throughout this thesis, including data-driven urbanism, entrepreneurial urbanism, municipal statecraft, the open data gaze and so on. This chapter aims to unite these concepts, and by doing so answer the question 'how has data-driven urbanism unfolded in Edmonton?' Figure 6.1 shows the relationship between these concepts that will be referenced throughout the chapter. First, the figure distinguishes between Edmonton and the City of Edmonton. While of course closely related, the City of Edmonton government is a distinct entity with goals and intentions, operating within Edmonton. Second, two urbanisms are shown: data-driven urbanism and entrepreneurial urbanism. The connection between these two will be discussed at length throughout the chapter (see also Chapter 2) but two key processes operate within each: the open data gaze and municipal statecraft. Simply, municipal statecraft connects data-driven and entrepreneurial urbanism, and in Edmonton it takes the form of the open data gaze. By doing so the open data gaze can be understood as an entrepreneurial effort, aimed to enhance economic growth for the city. Entrepreneurial urbanism therefore acts as the

catalyst and reason for data-driven urbanism, and through the process of becoming a data-driven city – Edmonton becomes an entrepreneurial city.

Figure 6.1

Key Relationships Surrounding Data-Driven and Entrepreneurial Urbanism in Edmonton



6.2.2. Connection Point: Municipal Statecraft and the Open Data Gaze

As I came to examine smart city policy and the Open Data Program, it became clear that the driving force in Edmonton was entrepreneurial. Both the discourse and interview participants frequently cited the desire for economic growth and risk taking through entrepreneurialism. In Edmonton, it is the desire to be an entrepreneurial city that appears to be at the core of its data-driven transformation. Processes of data-driven urbanism and entrepreneurial urbanism are inextricably linked in Edmonton so it was conducive to consider them together.

The literature on municipal statecraft is well-suited for conceptualizing the intersection between data-driven and entrepreneurial urbanism. Both Lauermann (2018) and McGuirk et. al. (2021) position the smart city as a key example of municipal statecraft in entrepreneurial cities. Smart city and data-driven policy efforts can be conceived as a form of municipal statecraft that

municipalities use to drive entrepreneurialism (McGuirk et. al., 2021; Lauermann, 2018). While municipal statecraft is an emerging concept in the scholarship on entrepreneurial urbanism, it is a promising way to connect data-driven and entrepreneurial urbanism.

It is clear that the City of Edmonton is using municipal statecraft to become an entrepreneurial city. The Open Data Program is a proactive policy effort put forth by the City of Edmonton in order to facilitate economic growth. Entrepreneurialism is the primary factor behind the development and operations of the Open Data Program, and was often cited by research participants as the reason the program exists in Edmonton. The veracity of municipal statecraft is perhaps the most clear when it comes to the data imaginary in Edmonton (section 5.3). Throughout this imaginary 'the City of Edmonton' is positioned as both the speaker and creator of the discourses presented. It reads almost monotonous and unnecessary to keep referring to 'the City of Edmonton' but it is crucial to position it as the authoritative source of the data imaginary. As a municipal government they have crafted the policies, and therefore the imaginary, which is the driving force of the open data gaze. This is an important consideration in the context of municipal statecraft, which positions the urban state in full control of the municipalities operations.

The remainder of this chapter will discuss first, how the open data gaze functions as a form of municipal statecraft to further its entrepreneurial interests. Ultimately, Edmonton can be understood as a data-driven, entrepreneurial city – or more so an entrepreneurial city which has chosen to fulfill this title by being data-driven. The concept of open data gaze is additionally important here because it is through this type of municipal statecraft that the city is becoming data-driven, and thereby fulfilling its entrepreneurial goals.

6.3. The Open Data Gaze as a form of Municipal Statecraft

In Edmonton, municipal statecraft takes the form of the open data gaze – a government-initiated process that drives data-driven urbanism in the city. The open data gaze describes the discourses, infrastructures and practices surrounding open data in Edmonton. It defines these key categories, and details how the gaze aims to expand its reach and authority throughout Edmonton. On the other hand, municipal statecraft refers largely to the actions taken by the urban state, to manage

the city and its residents (Cirolia & Harber, 2021). Municipal statecraft is a governance process whereby municipal governments take active efforts to control the organization and development of the city. Because the municipal government of the City of Edmonton is who creates and drives the open data gaze, it can be understood as an governmental action taken to influence and transform the city (i.e. municipal statecraft).

Contemporary cities are also increasingly using municipal statecraft in order to engage with entrepreneurial urbanism (Lauermann, 2018). In particular, smart city and data-driven policies have been identified as a key way in which the municipal state exerts their influence in order to foster entrepreneurialism (McGuirk et. al., 2021; Lauermann, 2018). This is similarly the case in Edmonton, and it is clear that the open data gaze is clearly a form of municipal statecraft as it is an active, transformative process operating in the fabric of the city. This section will detail how the open data gaze acts as a transformative force in Edmonton, and how the City of Edmonton uses the gaze as municipal statecraft in an effort to become a contemporary entrepreneurial city.

6.3.1. The Open Data Gaze as Municipal Statecraft

In Edmonton municipal statecraft takes the form as the open data gaze. The open data gaze includes an imaginary developed through City of Edmonton policies, and carried out by the open data analysts. Both of these work together to facilitate the open data gaze and ensure its expansion. The open data gaze spans several governmental goals including increasing democracy, service delivery, and increasing entrepreneurialism. The latter goal of entrepreneurialism will be discussed at length throughout this chapter, but this section is primarily examining how the open data gaze is an act of municipal statecraft. The open data gaze can be defined as an act of municipal statecraft mainly because there are intentional governmental efforts working towards its expansion including: the action of the data imaginary, the efforts of the open data analysts, and the contest for authority. These together establish the open data gaze as a way the City of Edmonton performs municipal statecraft to achieve their entrepreneurial goals.

6.3.1.1. The Open Data Gaze's Diamond Tip

The data imaginary was formed by City of Edmonton policy and strategy on data and technology, and in doing so defines a future for Edmonton. Because the City of Edmonton is the creator of the policy, it is therefore the creator of the imaginary, it makes the data imaginary (and the open data gaze by extension) a form of municipal statecraft. In general social imaginaries are imbued with ideals and a "projection of how things are" (Beer, 2019). They are more or less an understanding of the current state of social affairs, but often intersect with practice, leading to shaping what occurs in the social and material world (Beer, 2019). This holds true with the data imaginary in Edmonton, which opens up the analytical space for the open data analysts to work in. Because the data imaginary opens the space for the open data analysts to practice and grow the Open Data Program, it is what allows the open data gaze to exist and expand. The data imaginary is cultivated from City of Edmonton policy and strategy documents, which define its properties of aiming to make Edmonton a progressive, prepared, connected, inclusive, responsible and democratic city. By defining the type of city they want Edmonton to become through data, the data imaginary is an intentional policy effort from the City of Edmonton. This intention behind the data imaginary is an essential way in which the open data gaze acts as a form of municipal statecraft. Because the City of Edmonton cultivated and formed the data imaginary through policy, the municipal state is the driving force behind the imaginary.

Defining the goals of the data imaginary and creating policy and strategy surrounding smart city and data-driven efforts created the space for the Open Data Program to exist. Driven by policy goals, the Open Data Program gains authority and is allowed the ability to exist and grow. Here we are reminded of the concept of the 'diamond tip' where the data imaginary opens up the space into which the open data gaze can expand (Beer, 2019). By acting as the diamond tip the data imaginary 'cuts, chips and tears' into the fabric that establishes the analytical space for the open data gaze (Beer, 2019, p. 15). As cutting, chipping and tearing are much more forceful and willful processes than simply 'opening', it is evident that the data imaginary is a policy effort that does not just allow for the open data gaze to operate, it *makes* the open data gaze operate. By extension, through municipal statecraft, the City of Edmonton propels the open data gazes subsistence within Edmonton.

Additionally, Beer's (2019) data imaginary is more of a projection of how things *are* in the data analytics industry, whereas the data imaginary in Edmonton is a presumed understanding of data to make an envisioned future possible. The 'now' in the data imaginary in Edmonton is the power of data, and its ability to perform a future. So key in this imaginary is how things *will be*, instead of how they are. While Beer's imaginary is more focused on the current state of data analytics, he does posit that this "industry is inevitably attempting to theorize and imagine a future that potential customers will be seduced by" (2019, p.33). As demonstrated through the policy documents, the City of Edmonton is doing the same thing essentially, 'theorizing and imagining' a future that they can, and will achieve. The future is then something the City of Edmonton can define. They have the ultimate tool of data and technology to do anything they want; so will they achieve a sustainable future? An open one? A smart one? A global one? The possibilities are again, endless. By presenting the ever-impressive abilities of open data and technology, the City of Edmonton then imagine and cultivate a future that is entrepreneurial.

6.3.1.2. Humanizing the Open Data Gaze

The open data gaze may appear at first glance to be a nebulous force that courses through Edmonton, but that is not the case. Often data and technology become disconnected from the human as they are seen as a purely technical force (Rose, 2017). The critical literature on smart cities and data-driven urbanism is full of calls to understand data as non-neutral, and rooted in politics and culture, but despite this there is little humanizing of data among geographers (Kitchin et. al., 2017; Rose, 2017). The open data gaze too could fall into this as it is looking at policy and analytical spaces – and is easy to see how data is expansive on its own, rather than an intentional, human effort. The open data gaze however is riddled with human influence and intention. This is where literature on municipal statecraft becomes quite useful. By understanding the open data gaze as a human force – it must come from some human, or social origin. In the case of the open data gaze this origin is the municipal government which is both the creator and practitioner of the open data gaze. As the City of Edmonton intentionally cultivated and continually grows the open data gaze, it is clear the gaze is an intentional effort by the (human) urban state.

Evidence to its humanizing element is that most of the open data gaze focuses on the open data analysts, the people in charge of facilitating and growing the gaze. In the open data gaze we see the work of the open data analysts through the data publication process, their connections with other groups, and their relationships to the citizens. It is also clear how much weight the perspectives, or the 'eye', the open data analysts hold. The perspectives of the open data analysts explain the Open Data Program, and show how the open data gaze is allowed to expand. For example, the open data analysts strive for continuous growth (see section 5.5.2.3), continuing to advocate for business areas to share their data so the Open Data Program can grow. By being tuned into this desire for growth, the open data analysts are instrumental in the expansion of the open data gaze. If the data imaginary is what opens up the analytical space, the open data analysts are who ensure its continuation. Still, the open data analysts are actors within the municipal state, and as employees of the government their efforts are equally contribute to municipal statecraft.

Ultimately, this human element is another example of how the open data gaze is an act of municipal statecraft. Municipal statecraft is an intentional action from governments to manage the urban state, and therefore the open data gaze falls into this. Because there was an intentional policy effort that resulted in the data imaginary, there is an analytical space opened up for the open data analysts to work within. They are therefore then also participating in municipal statecraft by working to apply and expand the open data gaze allowed for by policy efforts.

6.3.1.3. The Authority of the Open Data Gaze

The open data gaze is partially made up of two highly connected parts: the data imaginary and the open data analysts, in addition to the Open Data Program itself. The data imaginary is cultivated from City of Edmonton policy and strategy documents and therefore is coming from higher level decision makers and administration. The open data analysts are employees of the City of Edmonton, and are responsible for translating the interests of the City of Edmonton through the Open Data Program. All components of the open data gaze are made up of municipal government intentions and efforts – making it a clear form of municipal statecraft. From the onset of the gaze with the imaginary formulated by policy, to its material infrastructure and

practice with the Open Data Program – the municipal government touches every aspect of the gaze.

Through this influence, a clear interest within the data imaginary is the desire to be entrepreneurial and achieve economic growth. While this is a main goal for the City of Edmonton, it is not the main goal of the open data analysts. The open data analysts more so have their sights set on accountability, accessibility and citizen use of open data, rather than its entrepreneurial potential. The question then to ask is who has the authority within the open data gaze? What wins out? Because of the intervention from the City of Edmonton through the imaginary, the most prevalent interest of the open data gaze is the entrepreneurial one. It is not to say that the democratic interests dissipate and are not present, but they are not what is driving data-driven urbanism in Edmonton. It is mainly the policy, and therefore the City of Edmonton that is driving the open data gaze, with the open data analysts working towards this goal. Together through the open data gaze the City of Edmonton and the open data analysts use municipal statecraft to facilitate entrepreneurial urbanism.

6.3.2. The Open Data Gaze in a Contemporary Entrepreneurial City

Contemporary entrepreneurial cities are increasingly using municipal statecraft in order to make themselves economically competitive (Lauermann, 2018). Using municipal statecraft gives urban governments more autonomy and control over their economic futures. Municipalities are no longer simply reacting to an ever-changing economic environment – but actively intervening in the economy to ensure their own growth (McGuirk et. al. 2021). This is very evident in Edmonton, where data-driven urbanism is in essence an entrepreneurial tool for continued economic growth and success. The desire to be an entrepreneurial city is what drove the spread of data-driven urbanism in Edmonton. Since contemporary entrepreneurial urbanism is increasingly being identified by cities using municipal statecraft to achieve their entrepreneurial goals, it is worth conceptualizing this same process in Edmonton. Municipal statecraft is a tool of entrepreneurial urbanism, which the City of Edmonton leverages in the form of the open data gaze. The interventionist practices of the open data gaze reflect the practices that Lauermann (2018) and McGuirk et. al. (2021) identify to show how contemporary cities use policy efforts (e.g. smart cities) to become entrepreneurial, namely: experimentation and introspection. The

City of Edmonton uses these practices of municipal statecraft through the open data gaze in order to transform Edmonton into a contemporary entrepreneurial city.

6.3.2.1. Experimental Policy Effort

Contemporary entrepreneurial cities are moving from speculative projects to experimental ones in search of economic success (Lauermann, 2018). Conventional entrepreneurial urbanism used speculation as the bases for new entrepreneurial projects, where projects were performed in anticipation of profit (Lauermann, 2018). Contemporary entrepreneurial urbanism however is moving towards more experimental policy efforts where policy does not necessarily require profit in order for it to be defined as successful (Lauermann, 2018). Policy experiments generally include their own measurements for success, and will change as experiments are changed and repeated (Lauermann, 2018). The smart city is one example of an experimental policy effort, where the "entrepreneurial city functions as a sort of 'urban laboratory, [where] municipal states experiment with various governance practices" (Lauermann, 2018; p. 214; Karvonen & Van Heur, 2014; McGuirk et. al., 2021). Edmonton similarly engages in these experimental policy efforts – creating the smart city and open data programs as a way to 'experiment' with data-driven transformations.

We see through the open data gaze that smart city and data-driven policies are used to cultivate an imaginary that defines certain goals and ambitions, specifically entrepreneurial ones. Through this they are not aiming for certain measurements of economic profit, but general success in entrepreneurialism. Open data will be used as a strategic resource to enhance innovation and creativity in the city, ideally leading to entrepreneurialism. Smart city policy will be used to make the city a one-stop for all citizens' needs. Neither of these are defined on the basis of economic profit, but more so the potential for entrepreneurialism. The Open Data Program was also identified by policy and many participants as being 'successful', but no one really defined what success meant. Is it the number of awards? The amount of open data? The number of people using the Open Data Portal? Even if asked, most participants would not answer that the Open Data Program is successful because it has been economically profitable – but because it has opened up the possibility for further entrepreneurial opportunities in the city.

Data-driven urbanism has unfolded in Edmonton as an experimental practice – with the City of Edmonton testing out data-driven processes (i.e. the open data gaze) to see if they work. It is clear from the key informant interviews that Edmonton sees itself as a sort of 'living lab' whereby they can try innovative new programs, without needing to define outcomes or even strive for total success. Unsuccessful programs, unexpected results, and unintended outcomes are all understood as part of this 'entrepreneurial experiment' of data-driven innovation. Entrepreneurialism in general refers to taking risk in pursuit of profit, so it is unsurprising that this experimental landscape is encouraged. This risk taking is an intentional effort from the City of Edmonton to 'try out' and experiment with data-driven urbanism, and by not having any defined measurements for success, they can evaluate the data-driven and smart city policy efforts using their own metrics. The open data gaze is similarly rooted in entrepreneurialism, meaning the trying of new economic ventures, but not necessarily economically profitable. Because of this the open data gaze allows for policy experimentation on the bases of entrepreneurial vision. Experimental policy is an act then of municipal statecraft, which the City of Edmonton uses to facilitate entrepreneurial urbanism.

6.3.2.2. The Introspective Municipal State

Another way contemporary entrepreneurial cities are engaging in municipal statecraft in order to contribute to their economic success is through introspective efforts to adapt the municipality itself, from within (McGuirk et. al., 2021). McGuirk et. al. (2021) offer a few strategies for this introspection, including: participating in inter-urban cooperation and creating an internal culture supportive of smart urbanism and change. The City of Edmonton utilizes both of these strategies to transform the municipal government to one supportive of change and entrepreneurial goals.

6.3.2.2.1. Inter-urban Cooperation

The first introspective strategy of municipal statecraft the City of Edmonton uses is participating in inter-urban cooperation, as opposed to inter-urban competition. Instead of competing outright with other municipalities on the basis of economic success, cities are increasingly cooperating and working with each other in order to "build on entrepreneurial practices" (Lauermann, 2018, p. 216). It is not to say that cooperating with other municipalities removes all sense of competition, but it is more diplomatic and collaborative in nature (Lauermann, 2018). The City

of Edmonton engages with this formation of municipal statecraft quite a bit, particularly through the Open Data Program which has many relations with other municipalities. Through the open data gaze there is an clear effort to use inter-urban cooperation in order to achieve its entrepreneurial vision. The data imaginary envisions Edmonton as being connected within, and being a leader of a global open data ecosystem. By being part of a connected ecosystem this implies a certain amount of cooperation that must take place. Being the leader of that ecosystem however, implies more competition and desire for reach and status.

Where the effort of inter-urban diplomacy really comes through is with the Open Data Program which has a network of other municipalities it works with (see section 5.5.4). The Edmonton Open Data Program leads the Metro Edmonton Region Open Data Group, which includes representatives from other municipalities in the region with open data programs. In these groups they share ideas, problems and data in order to grow each of their respective programs. The open data analysts want even more cooperation between municipalities in this group, because as the municipality with the most mature open data program they do not necessarily get reciprocal support. The Open Data Program is also part of the G4 group which has representatives from major Canadian cities with Open Data programs (Calgary, Vancouver, Winnipeg, Montreal, Toronto and Ottawa). This group is an excellent example of inter-urban cooperation as they all bring their successes, failures, ideas and interests together in order to grow each of their own programs. Because each program is quite mature they share similar knowledge bases and therefore have a more balanced relationship.

Fostering relationships with these inter-urban cooperative groups is a key introspective way in which the City of Edmonton practices municipal statecraft through the open data gaze. Because the data imaginary envisions being connected within an open data ecosystem, the Open Data Program seeks out and fosters relationships with other municipalities. By engaging in inter-urban cooperation the Open Data Program can grow and achieve more economic success, furthering the entrepreneurialism desired by the City of Edmonton.

6.3.2.2.2. Smart Culture

Another way cities can use municipal statecraft to achieve entrepreneurial desires is to create an internal culture receptive to smart and data-driven policies (McGuirk et. al. 2021). The open data gaze is a key way in which the City of Edmonton engages in creating this internal culture. The open data analysts work to create an open data culture whereby business areas feel comfortable and willing to share their data (see section 5.5.2.4). By creating this culture the open data analysts work to grow the Open Data Program and therefore expand the open data gaze. This creation of an internal culture that works towards data-driven processes being more commonly used within the city, is an example of municipal statecraft that Edmonton uses. The internal culture the open data analysts work to build stem from the desire to grow the open data gaze, and is therefore supported by City of Edmonton administration. The desire to transform Edmonton into a data-driven city must start internally, making governmental employees susceptible to this vision before moving outwards to citizens. Again, the transformation to a data-driven city is predicated on the desire to be an entrepreneurial city. This data-driven transformation allows for further economic efforts within the city, as the more data added to the Open Data Portal, the more citizens and businesses can use that data to entrepreneurial ends.

6.3.3. Conclusion

This section has explored how the open data gaze is an act of municipal statecraft, and explored some examples of how Edmonton uses municipal statecraft to become an entrepreneurial city. The City of Edmonton is actively engaged in achieving their economic goals, and they do this by creating interventionist smart city and data-driven policy. It is clear that the City of Edmonton uses the open data gaze as a process of data-driven urbanism, which works towards their goal of becoming an entrepreneurial city.

6.4. The Entrepreneurial Open Data Gaze

By and large, data-driven urbanism in Edmonton has unfolded due to a desire to facilitate economic growth, or, to become an entrepreneurial city. Entrepreneurial urbanism is a mode of urban governance focused primarily on advancing the city economically, as opposed to service delivery (Harvey, 1989). In Edmonton data-driven urbanism is seen as a way for Edmonton to become an entrepreneurial city, which is most clear through the application of the open data

gaze. The application of the open data gaze as an entrepreneurial tool can be understood in a few key ways. First, the open data gaze is entrepreneurial because it is focused on economic growth. Second, the open data gaze is entrepreneurial because data is seen to support the city as a corporation.

6.4.1. Edmonton's Entrepreneurial Spirit

The open data gaze operating in Edmonton is an entrepreneurial one. Entrepreneurialism largely refers to the creation of new economic ventures (Cambridge Dictionary, n.d.). This aspect of entrepreneurialism is clear in Edmonton through the data imaginary – where the data imaginary is predicated on establishing a progressive future. A progressive future is one where the city grows and changes, particularly economically. The data imaginary in Edmonton presents technology and data as an essential way to drive future growth in the city. In David Harvey's seminal introduction to entrepreneurial urbanism he presents four strategies that cities can use to enhance their economic growth: exploiting local advantages, increasing mass consumption activities, securing command and control functions, and redistributing surpluses (1989). Through the open data gaze it is clear that Edmonton uses two of Harvey's strategies to facilitate entrepreneurialism in the city: exploiting local advantages and increasing command and control functions.

6.4.1.1. The Open Data Advantage

Taking part in entrepreneurial urbanism means municipalities actively take efforts to facilitate their own economic success (Harvey, 1989; Lauermann, 2018). One strategy to achieve this by using the municipality's local advantages to increase production and consumption activities (Harvey, 1989). These advantages could include specific regional resources such as oil, or proximity to certain advantageous locations for tourism or trading (Harvey, 1989). Historically these advantages had to be physical or material in nature, limiting their success to the geography of the region (Harvey, 1989; Phelps & Miao, 2019). In contemporary cities however, there is more ambiguity when it comes to entrepreneurialism and innovation, where governmental services "involve practice and ideas rather than material goods" and "innovation in services is best recognized and evaluated as something that is socially constructed" (Phelps & Miao, 2019, p. 308). This change in innovation from something that needed material goods to one that can

come more from ideas and practice is a key opportunity that the open data gaze capitalizes on. By escaping the 'territorial traps' of the city (Phelps & Miao, 2019), the open data gaze can present open data as a key strategic resource that Edmonton can use to increase entrepreneurialism in the city.

Using open data as a strategic resource is a local advantage that the City of Edmonton has capitalized on to become more economically competitive. The data imaginary presents open data as a strategic resource, where open data can be used for any number of production and consumption activities in Edmonton. Within the data imaginary open data is presented as a strategic resource that can be consumed by citizens, the government and the private sector. Because open data is free to use and access the City of Edmonton envisions open data to be a transformative economic tool. As a free resource businesses can use this data to enhance their practice, or citizens can use it to create and develop new innovative ideas. It is both the production and consumption of data that is said to make an 'effective' Open Data Program, and the City of Edmonton desires the use of both (City of Edmonton, 2017c). Whereas some cities may use oil, agriculture or other resources as a strategic resource – Edmonton uses open data. By establishing the ability to use open data as a strategic resource throughout the data imaginary, the City of Edmonton well establishes this local, economic advantage.

The City of Edmonton has additionally capitalized on their Open Data Program. They have positioned Edmonton as a leader of open data globally, becoming connected through an international open data ecosystem and winning many awards for the Open Data Portal. On this point one participant mentioned that the Open Data program had also been invited to present on the successes of their program internationally, which they were quite proud of (Participant Three). Given both the purposes and success of the Open Data Program, it is a local advantage Edmonton can use to become economically competitive. Through the open data gaze the City of Edmonton has embedded this entrepreneurial purpose within in the Open Data Program. Data-driven urbanism in Edmonton has unfolded as entrepreneurial since the City of Edmonton positions open data to be a key strategic resource within the local economy. By presenting open data as an effective tool for entrepreneurs to use, this is the local advantage that will increase production and consumption activities in the city.

6.4.1.2. The One Stop City

An additional entrepreneurial strategy presented by Harvey is to increase the command and control functions of the city. Increasing the command and control functions in the city means to capture and centralize 'vital' sectors such as finance, information gathering and processing, and government (Harvey, 1989). Securing these command and control functions gives the city more autonomy and authority to influence the activities of the municipality. Additionally, by securing these vital sectors

> the city of the future is going to be a city of pure command and control functions, an informational city, a post-industrial city in which the export of services (financial, informational, knowledge-producing) becomes the economic basis for urban survival. (Harvey, 1989, p. 10)

The economic basis for urban survival is therefore making the city a 'one stop shop' for anything a citizen would need. Again, the City of Edmonton uses the open data gaze as a form of municipal statecraft to secure these command and control functions, and make Edmonton a one stop city. Through the data imaginary the City of Edmonton is presented as a municipality that is responsible for the provisioning and delivering of information, and able to create a resilient, workable and livable future city. By doing this, the City of Edmonton is envisioned to have secured the command and control functions of information, health, the environment, work, and overall government. By presenting these secured command and control functions through the data imaginary we see how data and technology are again positioned as a way that Edmonton can engage with entrepreneurial urbanism.

This again is an essential step in becoming an entrepreneurial city. Through the data imaginary the City of Edmonton establishes itself as the body responsible for provisioning and delivering data throughout Edmonton. By doing so the City of Edmonton becomes the sole provider of these key functions. In addition the City of Edmonton equates data to information, and therefore has captured the function of 'information gathering and processing' (City of Edmonton 2017a; Harvey, 1989). Because data is also presented as a neutral, objective and transparent tool for

decision making –the information the City of Edmonton is providing via data is not only useful, but is the most authoritative source.

As a smart city the City of Edmonton presents itself to be resilient, livable and workable (see figure 5.2.). By doing this the City of Edmonton is responsible for all areas of their citizens' lives, including their health, the way they participate in the local economy, and securing their resilient future. Edmonton as a smart city presents nine areas of the city which will be impacted by data and technology including: citizens, openness, the economy, mobility, education, infrastructure, health, community and the environment (City of Edmonton 2017c). The open data gaze gives the City of Edmonton the ability to influence all these sectors within the city by using data and technology. By envisioning this within the data imaginary, it is clear that the City of Edmonton is engaging in securing the command and control functions of the city. If a future city uses data and technology to improve health, resiliency and work – they will have a better working citizen base in order to better compete economically. In this way a smart city not only healthy, resilient and workable, but is entrepreneurial.

6.4.1.3. Conclusion

Open data in Edmonton is understood as a strategic resource that will spur innovation and entrepreneurial efforts. The City of Edmonton positioned itself as a leader of open data, further exploiting this local advantage for economic gain. In addition the City of Edmonton presents data and technology as a way to secure command and control functions for the city. Edmonton as a smart city sees data-driven urbanism as a way to centralize vital sectors such as information, health, work, and resiliency in the municipality. The entrepreneurial spirit in Edmonton thrives through the open data gaze which positions data as a key way to facilitate economic growth.

6.4.2. The Sociality of a Corporation

The City of Edmonton aims to increase its economic competitiveness and become an entrepreneurial city. This is no clearer than the fact that the City of Edmonton is structured and refers to itself as 'a corporation', with individual departments being called 'business areas'. While this structuring is not strictly technological or data-driven – it is an important

consideration of Edmonton's governance structure and therefore an important consideration of the open data gaze. Additionally, open data and technology are seen and used as a way to 'support the corporation' and are therefore another way Edmonton conceptualizes data-driven urbanism as entrepreneurial.

When thinking about the City of Edmonton as a corporation it is useful to revisit Gillian Rose's (2020) exploration of sociality in the smart city. Rose presents three forms of sociality that course through the smart city: sociological, neoliberal, and cybernetic (2020). The way the City of Edmonton presents itself as a corporation could be an example of neoliberal sociality, where groups are autonomous and self-directed, acting in conjunction with data and technology (Rose, 2020). This is the case in Edmonton where the municipal government is set up as a corporation, made up of various business areas, with data and technology being used to support the corporation. The Open Data Program endeavors to 'empower the business' of the city by encouraging business areas to share their data, and teach them how to use their data more effectively. By getting more and more data from the business areas, the Open Data Program will grow – furthering its ability to be used as an economic tool. This in turn supports the business of the city, or 'the corporation'. The Open Data Program, business areas and the City of Edmonton are all therefore disparate groups, who work together and in conjunction with data and technology to achieve the goal of entrepreneurialism. It is evident that with this framing there is neoliberal sociality occurring in the smart city of Edmonton, for the primary effort of economic growth.

Lauermann (2018) states that "the 'entrepreneur' of the entrepreneurial city is a municipal government" (p. 211). This sentiment is personified by the City of Edmonton who frame themselves as a corporation that is building both a data-driven and an entrepreneurial city. The open data gaze operates through this corporate structure, as data and technology are seen as a key resource the City of Edmonton can use as a corporation. Again, it is evident that data-driven urbanism in Edmonton has unfolded through a desire to be entrepreneurial – with the City of Edmonton itself as the entrepreneur.

6.4.3. Conclusion

Through the open data gaze Edmonton envisions the power of data-driven urbanism to lie in its ability to promote entrepreneurialism and stimulate economic growth. By becoming a data-driven city - it can become an entrepreneurial one. This envisioning is first seen through the City of Edmonton presenting open data as a locally advantageous strategic resource that can be used to increase production and consumption activities in the city. The City of Edmonton also positions itself as smart, whereby technology allows it to be a one stop shop for all vital sectors in citizens' lives (e.g. health, information, work). By capitalizing on the local advantages of open data and securing the command and control function for a city, the City of Edmonton uses two of David Harvey's strategies in order to become a contemporary entrepreneurial city (1989). In addition to this, the City of Edmonton frames itself as a corporation, where data and technology are used to support the corporation and contribute to its growth. If data and technology are presented as a way to spur on entrepreneurialism and economic growth, data-driven urbanism becomes an enticing, desirable phenomenon.

6.5. Conclusion

In looking to understand how data-driven urbanism has unfolded in Edmonton, this discussion has presented how the open data gaze is a form of municipal statecraft, used to achieve the City of Edmonton's entrepreneurial goals.

As a form of municipal statecraft the open data gaze engages in many different interventionist strategies to transform Edmonton into a data-driven city, and thereby become an entrepreneurial city. These strategies include using the open data gaze as a tool of municipal statecraft, creating experimental policy efforts and introspectively altering the municipal state. Through the open data gaze the City of Edmonton additionally establishes open data as a strategic resource, and the smart city as a one stop shop for citizen needs. By positioning itself as a corporation supported by data and technology, the City of Edmonton also envisions this entrepreneurial spirit. Together through the envisioning the open data gaze to be entrepreneurial, and using municipal statecraft to achieve that goal – the City of Edmonton establishes Edmonton as a contemporary entrepreneurial city.

Chapter Seven – Conclusion

This chapter will detail some key conclusions from the thesis research. First it will describe how the thesis has met the objectives set out in Chapter 1, and in doing so how it has answered the research question: how has data-driven urbanism unfolded in Edmonton? Second, the chapter will outline some of the key contributions of the research. Lastly, it will critically reflect on the research, offering some limitations and opportunities for further research.

7.1 Research Question Revisited

This thesis sought to answer the question: how has data-driven urbanism unfolded in Edmonton? Through qualitative research the thesis answered this question, and met four key objectives as described below.

7.1.1. Objective 1 – Define the key features which characterize Edmonton as a smart city

To meet this objective I performed a series of key-informant interviews. These interviews included participants that were involved in the development of smart city policies and initiatives in Edmonton. Participants included governmental, private-sector and non-profit experts in smart city and data-driven initiatives. These interviews aimed to understand Edmonton's place as a smart city, and what key informants deemed their most important characteristics. Interviewing key informants that were involved in the creation and implementation of smart city initiatives illuminated Edmonton as a smart city. Edmonton is characterized as a smart city with a municipal advantage that allows for the implementation of smart city initiatives, as a living lab for experimentation and problem solving, and a smart city market that aims to capitalize on technology for economic growth.

7.1.2. Objective 2 – Describe the discourses that have structured data-driven urbanism in Edmonton

The discourses that have structured data-driven urbanism in Edmonton form a clear data imaginary. This imaginary was developed by performing a discourse analysis of key City of Edmonton policies and strategies on data and smart city initiatives. These polices included the: *Open City Policy* (City of Edmonton, 2015), *Open Data Strategy* (City of Edmonton, 2017b), *Open City Initiative Refresh* (City of Edmonton, 2017c), and *Smart City Strategy* (City of Edmonton, 2017a). Through analysing these documents a data imaginary emerged which describes a future city which is progressive, prepared, connected, inclusive, responsible and democratic. The data imaginary makes up the first part of the open data gaze, a theory developed to describe how data-driven urbanism in Edmonton has unfolded.

7.1.3. Objective 3 – Identify and describe the infrastructures and practices that make possible the production, management and utilization of open data

In addition to the data imaginary, infrastructures and practices make up the open data gaze. Through an ethnography within the Open Data Program, and interviews with its staff – the infrastructures and practices that make possible the production, management and utilization of open data were detailed. The infrastructures of the open data gaze lie in the Open Data program itself, which has a myriad of tools that allow for the development and proliferation of open data. Within an analytical space, open data analysts actualize and perform the open data gaze. The infrastructures within this analytical space include an extensive data publication process, relationships with other vital groups, and a connection to citizens. The practices of the open data gaze are clear through the 'eye' of the open data analysts – what they find important to their work, and how they conceptualize, understand, and work with open data. The important themes that emerged in regards to practice included: opening data, municipal politics, entrepreneurial interests, accountability, human vs. machine readability, data problems, information vs. privacy, and the smart city. The infrastructures and practices of the open data gaze are an important way in which data-driven urbanism has unfolded in Edmonton.

7.1.4. Objective 4 – Critically evaluate the spaces that are produced by and through these forms of data-driven urbanism

Ultimately this thesis aimed to critically evaluate the spaces that are produced by and through these forms of data-driven urbanism. First, the open data gaze which described the discourses, infrastructures and practices surrounding open data in Edmonton. The open data gaze is inherently spatial, and describes how the data imaginary opens up an analytical space for the open data analysts to work within. Within this analytical space the open data analysts work to grow and expand the open data gaze, furthering its authority throughout the city, and outwards. After the development of the open data gaze, I critically evaluated its place within the broader landscape of data-driven and entrepreneurial urbanism. The City of Edmonton uses the open data gaze as a form of municipal statecraft to become an entrepreneurial city.

By meeting these four research objectives the thesis was able to answer the question: how has data-driven urbanism unfolded in Edmonton? One way data-driven urbanism has unfolded in Edmonton is via the open data gaze, predicated on a desire to transform Edmonton into an entrepreneurial city.

7.2. Thesis Contributions

This thesis answered calls to undertake empirical case study research on 'actually-existing smart cities' in the city of Edmonton, Alberta (Kitchin et. al., 2017; Rose, 2020). By performing in-depth qualitative research this thesis gained a comprehensive understanding of data-driven urbanism in Edmonton. Developing a rich description of processes operating in an 'actually-existing smart city' contributed to the increasingly observed phenomenon of data-driven urbanism.

The primary contribution of this thesis was the development of an original concept: the open data gaze. The open data gaze describes the discourses, infrastructures and practices surrounding open data in Edmonton, and how these components drive data-driven urbanism in Edmonton. The open data gaze acts as a rich descriptor of both open data and data-driven urbanism in Edmonton. The open data gaze is a valuable concept because it provides a full understanding of how open

data is produced in Edmonton, and by extension how data-driven urbanism has unfolded. It catalogues everything from the inception of data-driven phenomena in Edmonton with the discourses of the data imaginary, and carries through to the more everyday processes of open data production through the infrastructures and practices. This full vision allowed for a very effective study of data-driven urbanism in Edmonton.

This thesis also examined a relatively emergent concept in the literature: municipal statecraft. While the concept of statecraft, or even urban/city statecraft is not new, municipal statecraft is emerging as a key concept within scholarship on entrepreneurial urbanism. It brings attention to the role the municipal state takes to achieve their economic goals, and the various ways they work to make their cities entrepreneurial. In Edmonton, municipal statecraft takes the form of the open data gaze. Alongside the open data gaze, the concept of municipal statecraft acted as a key way to connect literatures on data-driven urbanism and entrepreneurial urbanism. This connection provided insight into why data-driven urbanism has unfolded in Edmonton, in addition to how.

7.3. Critical Reflections and Opportunities for Further Research

Through the development of the open data gaze this research provided a rich description of data-driven urbanism in Edmonton. It sought to answer the question *how* data-driven urbanism has unfolded in Edmonton, and as such was primarily descriptive. While the research was theoretically informed, and provided some reasons why the City of Edmonton was engaging with the data-driven urbanism it did not look to provide a broader critique as to what the greater implications of data-driven urbanism could be. With the increasing proliferation of data-driven urbanism there is opportunity to further reflect on these greater implications, and provide a critique that can apply to cities other than Edmonton. Some of these critiques include the corporatization of the city, increased governmental control through data and technology, transparency politics, or the encroaching influence of neoliberalism in municipalities. Because the open data gaze provides a rich description of the processes of data-driven urbanism in Edmonton there is opportunity to take this descriptive work and extrapolate it to larger critiques surrounding this phenomenon.

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APPENDIX A: Key Informant Interview Request for Participation Email Script

Hello,

My name is [Joshua Evans/Hannah Graham] and I am a [researcher/research assistant] in the Department of Earth and Atmospheric Sciences at the University of Alberta. I am contacting you to inquire if you would be interested in participating in a research study 'Putting Data-Driven Urbanism in its Place' (Pro00097885).

This study examines smart city strategies and initiatives in Alberta. In this study, we are aiming to document the history of smart city strategies in Alberta by interviewing key figures involved in their creation. We have identified you as a potential participant because of your involvement in [smart city strategy or initiative].

Participation in this study will involve a short (20-30 minute) one-on-one interview [or group interview]. Interviews will be completed virtually using video conferencing software (such as Zoom). Interviews will include questions about what the development and implementation of [initiative/strategy] included, as well as broader questions about [the municipality] as a smart city.

The interviews will be recorded and transcripts will be made of these recordings. Original recordings and transcripts will be stored on a computer at the University of Alberta. Only the research team will have access to these recordings and transcripts.

Some benefits of the study include an opportunity to speak about initiatives you were involved in and contribute to collective sense-making in the community. This project will contribute to existing understandings of smart cities and data-driven governance and contribute to emerging urban scholarship on these topics.

If you would like to participate please respond to this email and we can determine a time to conduct the interview. Participation in the study is voluntary, and the time at which the interview takes place would be determined by you.

Thank you for your time and consideration,

[Name]

APPENDIX B: Key Informant Interview Guide

Podcast Questions

1. People come to be involved in smart city initiatives from a variety of professions and backgrounds. How did you come to be involved in the smart city world?
2. What smart city initiative(s) have you been involved in?
    a) How did these initiatives start?
    b) What were the motivations behind starting these smart city initiatives?
3. In your experience, have smart city initiatives impacted everyday citizens? If so, how?
4. What makes Edmonton, or any city, a smart city?
5. If you were to list the strengths and weaknesses of the smart city approach what would be at the top of your list?

APPENDIX C: Key Informant Interviews Thematic Framework

1 Municipal Advantage	
1.1 Network	Diversity, Network, Breaking Silos, Coordination, Other Sectors, Connectivity
1.2 Citizen Connection	Community, Citizen Impact, Service Delivery, Serve Citizens, Human Aspect, Partnership, Citizen Partnership
1.3 The Municipal Advantage	Small Municipality Advantage, Municipal Advantage, Local Advantage, Municipality Size
1.4 City Status	Global, International Connection, Competition, Government Status
1.5 Smart Governance	Organizational Structure, Edmonton as a Smart City, Smart City Definition, Smart Culture, Governance Structure, Governance Structure
2 Living Lab	
2.1 Process	Onset, Implementation, Policy Development, Project Development, Foundations, Political Origin, Background, Journey
2.2 Problem Driven	Problem Driven, Solving Problems, Philosophy, Analytics vs. Action, Idea Generation, Improvement, Investment for Improvement, Advancement
2.3 Experimentation	Experimentation, Living Lab, Flexible, Openness
2.4 Change	Change, Change Management, Risk Averse, Time
2.5 Results	Success, Failure
3 Smart City Market	
3.1 Data	Data-driven decisions, Data, Open Data, Data Science, Leveraging Data, Privacy & Ethics, Privacy
3.2 Technology	Popularity, Tech Platforms, Technology, Unseen Technology, Efficiency
3.3 Private Sector	Business Opportunity, Private Sector, Public-Private Partnership, Smart City Market, Business
3.4 Economic Opportunity	Drive Economic Activity, Economic Growth, Value Creation, Economic Opportunity, Entrepreneurial Spirit, Investment, Return on Investment

APPENDIX D: Open Data Interview Guide

Case Study Interview Questions (OPEN DATA)

The first part of the interview is largely to learn about your job, and what you do on a day-to-day basis. I am mainly looking to understand what you do, and how you think about what you do. Some of the questions I have already learned and know by working with you, but I am mainly aiming to get this information from your perspective.

1. Can you tell me about the goal of the Open Data program?
2. What is your role with Open Data?
3. Can you describe a typical day working on Open Data?
4. What type of data do you create, handle, or manage?
5. What tools do you use in working with this data?
6. Do you depend on others to do your work? If so, who?
7. Who uses the data you work on?
8. What has been the greatest challenge in working with this data?
9. Were you aware of the concept of open data before beginning this project?
10. Has your view of open data evolved over the course of this project? If so, how?

The last couple of questions are going to ask about openness, and how you see openness as a professional in this field.

11. How would you define openness in this field of work?
    a. Are there any tensions between openness and privacy? If yes, how so?
12. How do you think open data fits within a smart city, if at all?
13. Do you think the promises of smart cities, or open data are over-emphasized at all?
    a. How do you think Edmonton has delivered on some of these promises?

Case Study Interview Questions (FOIP/LEGAL)

The first part of the interview is largely to learn about your job, and what you do on a day-to-day basis. I am mainly looking to understand what you do, and how you think about what you do. I am also interested in what you think about open data, and openness as a professional in this field. There are no right or wrong answers, just looking to understand your experience.

I am mainly aiming to get this information from your perspective.

1. What is your role with Open Data?
2. Can you tell me about the goal of the Open Data program?
    a. Could you tell me the goal of the Open Data Advisory Group?
3. Can you describe a typical day working with Open Data?
4. What type of data do you create, handle, or manage?
5. What tools do you use in working with this data?
6. Do you depend on others to do your work? If so, who?
7. Who uses the data you work on?
8. What has been the greatest challenge in working with this data?
9. Were you aware of the concept of open data before beginning this project?
10. Has your view of open data evolved over the course of this project? If so, how?

The last couple of questions are going to ask about openness, and how you see openness as a professional in this field.

11. How would you define openness in this field of work?
    a. Are there any tensions between openness and privacy? If yes, how so?
12. How do you think open data fits within a smart city, if at all?
13. Do you think the promises of smart cities, or open data are over-emphasized at all?
    a. How do you think Edmonton has delivered on some of these promises?

Case Study Interview Questions (INTERNAL DATA)

The first part of the interview is largely to learn about your job, and what you do on a day-to-day basis. I am mainly looking to understand what you do, and how you think about what you do. Some of the questions I have already learned and know by working with you, but I am mainly aiming to get this information from your perspective.

1. Can you tell me about the goal of the Internal Data Portal?
2. What is your role with IDP?
3. Can you describe a typical day working on IDP?
4. What type of data do you create, handle, or manage?
5. What tools do you use in working with this data?
6. Do you depend on others to do your work? If so, who?
7. Who uses the data you work on?
8. What has been the greatest challenge in working with this data?
9. Were you aware of the concept of open data before beginning this project?
10. Has your view of open data evolved over the course of this project? If so, how?

The last couple of questions are going to ask about openness, and how you see openness as a professional in this field.

11. How would you define openness in this field of work?
    a. Are there any tensions between openness and privacy? If yes, how so?
12. How do you think open data fits within a smart city, if at all?

NOTE: Question 13 & prompt added June 10 (after first 2 interviews)

APPENDIX E: Open Data Interviews Thematic Framework

Framework	Original Codes	Frequency
1 Municipal Politics		**62**
1.1 Value realization & funding	Value realization, Funding, Resources, Expenditures	14
1.2 Perspectives of elected officials	Perspectives of elected officials, Politics and priorities of government officials, Municipal politics, Leadership	12
1.3. Municipal status	Status of Edmonton, Comparison, Connections with other municipalities	18
1.4 Decision making	Decision making ability, Data-Driven decision making, Data not always a solution, Rationality	18
1.5. Other		
2 Data Issues		**62**
2.1 Errors	Tensions between technology and human use, Human inconsistency, Errors, Technological challenges, Stabilize/Fix data	10
2.2 Data out of context	Data out of context, Unintended impacts, Unaltered data, Data without restrictions, Meaning behind data, Alternative value to data	7
2.3 Subject matter expertise	Technical capability, Subject matter expertise, Lack of knowledge, Specialized know-how	12
2.4 Data quality	Data quality	11
2.5 Data cleaning	Systemization, Transformation, Data cleaning, Completeness, Consolidation, Filtering, Consistency, Complexity, Manipulation, Maintenance, Refinement	22

2.6. Other		
3 Privacy		**58**
3.1 Regulation	Checks and balances, Auditing, Oversight, Advising	7
3.2 Right to privacy	Right to information vs privacy, Data ethics, Information/service vs. privacy, Business vs. individual right to privacy, Right to privacy, Levels of privacy	14
3.4 Why privacy?	Privacy concerns, Privacy legislation, Private information, Privacy is important, Privacy breach	10
3.5 Assessing risk	Solutions for privacy issues, Anonymization, Re-identification, Data monitoring, Object vs. people data, Assessment of risk, Investigation, Privacy Impact Assessment, Risk mitigation, Potential for risk	27
3.6. Other		
4 Open Data 101		**76**
4.1 Open data culture	History, Open data maturity, Current vs projected needs, Side of desk job, Cultural norm, Program direction	12
4.2 Data sharing	Willingness to share data, Reasons to not share data	5
4.3 Open data advocacy	Tools to empower (advocate) data usage, Persuasion, Open data advocacy, Advocacy	16
4.4 Opening data	Opening up, Openness, Levels of openness, Open data uses	30
4.5 Interests	Users of open data, Popularity, Corporate, Trustworthiness, Responsibility, Service Delivery	13
4.6. Other		
5 The Open Data Citizen		**92**

5.1 Accessibility	Accessibility, Access to information	13
5.2 Accountability	Accountability, Transparency, Purpose of providing open data	22
5.3. Everyday citizen	Everyday citizen, Public inquiry, Citizen action, Citizen understanding	22
5.4 Data entitlement	Everyday citizen, Public inquiry, Citizen action, Citizen understanding	10
5.5. Human vs. machine readability	Ease of use, Human vs machine readability, Usability, Tools for data consumption, Visualization	25
5.6. Other		
6 Operating Conditions		**62**
6.1 Barriers	Barriers, Conflict, Bureaucratic barriers, Privacy block, Political block	17
6.2 Status of data	Data is critical, Desire for data, Changing nature of data	8
6.3 Growth	Improvement, growth	6
6.4 Efficiency	Efficiency, Streamlining/efficiency power, Streamlining	7
6.5 Authority	Authority, all-knowing, Technological ease of information, Analytic power	7
6.6. Volume	Data volume, Quantity of data, Desire for volume	5
6.7 Connectedness	Collaboration, Intermediary, Connectiveness, Consensus	12
6.8. Other		
7 Space and Time		**52**
7.1 The Smart City	Not smart' city, Complications of smart cities, Planning for technology	5
7.2 Infrastructure	Infrastructure	10

7.3 Sourcing data	Finding data, Origin, Already existing data, Open licensing, Internal vs external sourcing, Public domain, Need for open source	14
7.4 Centralized place	Central source, Centralizing	11
7.5 Time	Time and effort, Speed and timelines, Instability/volatile, Slow pace, Impermanence	8
7.6 Futurity	Proactiveness, Skip to future	4
7.7. Other		

APPENDIX F: Key Informant Interviews Informed Consent Form

PROJECT TITLE: Putting Data-Driven Urbanism in its Place

Research Investigator
Hannah Graham
Tory 3-104
University of Alberta
Edmonton, AB T6G2E3
hmgraham@ualberta.ca
780-893-6342

Supervisor
Dr. Joshua Evans
1-26 Earth Sciences Building
University of Alberta
Edmonton, AB T6G2E3
jdevans@ualberta.ca
780-265-2307

Background

The purpose of this study is to document the history of smart city strategies and initiatives in Alberta, Canada. We aim to develop a story describing how strategies were developed and implemented and how the city came to be understood as 'smart'. Our study will involve individuals, like yourself, who have been involved in the creation of Alberta smart city strategies. Findings from this study could benefit decision makers in governments and enhance public understandings of smart cities and urban data.

Study Procedures

The study will entail a 20-30 minute interview conducted over video or voice calling on Zoom. The scheduling of these interviews will be determined by the participant. The interview will consist of 5 questions designed to gather information about how smart city strategies came to be developed. Interviews will be audio-recorded and later transcribed for analysis. You will be given an opportunity to review this transcript.

Benefits

Some may not get direct benefits from participating in the research. For others, this study may have personal benefits. This study could also benefit decision makers in Alberta,or elsewhere. This study will contribute to existing understandings of data-driven urbanism and its role in governance in Alberta and beyond.

Risks

Participants are part of a small community of data specialists and because they will be talking about their jobs, and specific urban initiatives they are involved in, anonymity cannot be guaranteed.

Confidentiality

The information you share will be confidential. Study data such as interview recordings, interview transcripts, personal identifying information such as your name and contact information, will be stored on a password protected, file encrypted computer in a locked room on the University of Alberta campus. Only the research investigator (Hannah Graham) and supervisor (Joshua Evans) will have direct access to this data. The Research Ethics Committee has the right to review data if necessary. Study data, including personal information about you, will be securely stored for 5 years after the study is over, after which time it will be destroyed.

The findings from this research will be included in a Master's thesis, as well as presented at academic conferences and published in academic journals. Anonymity for participants in this study cannot be guaranteed, and your organization will be identified in these presentations and publications.

Voluntary Participation

You are under no obligation to participate in this study. Your participation in this study is voluntary.

Freedom to Withdraw

Even if you agree to be in the study and complete an interview you can change your mind and withdraw. If requested, we can withdraw your data from the study; however, this request must be received before the completion of data collection (April 22, 2022).

Additional contacts.

The plan for this study has been reviewed by a Research Ethics Board at the University of Alberta. If you have questions about your rights or how research should be conducted, you can call (780) 492-2615. This office is independent of the researchers.

Project #00097885

Consent Statement

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above and will receive a copy of this consent form. I will receive a copy of this consent form after I sign it.

_____	_____
Participant's Name (printed) and Signature	Date
_____	_____
Name (printed) and Signature of Person Obtaining Consent	Date

APPENDIX G: Open Data Participant Observation Informed Consent Form

PROJECT TITLE: Putting Data-Driven Urbanism in its Place

Research Investigator
Hannah Graham
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Supervisor
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780-265-2307

Background

The purpose of this study is to document how data is produced and used in Edmonton urban data initiatives. In doing so, we aim to develop a contextual understanding of data governance in Edmonton. Findings from this study could benefit decision makers in Edmonton or elsewhere.

Our study will involve representatives from urban data initiatives in Edmonton, Alberta. You have been asked to participate in this research study because of your affiliation with an urban data initiative.

Study Procedures

The study will entail an internship within the Open Data initiative in the City of Edmonton. The research investigator will be working alongside participants in an online environment. Participants will be observed in this virtual workspace by the researcher, who will record observations about everyday practices of data use and the social work environment (i.e. virtual meetings). These observations will be recorded in a field journal. Photographs will also be taken of the online workspace and environment (physical if possible), but not of the participants themselves, or any sensitive data or information.

Benefits

There may be no personal benefits for participants in this study. A potential direct benefit for some participants could be the work done by the research investigator within the internship. This study could also benefit decision makers in the City of Edmonton, or elsewhere. This study will contribute to existing understandings of data-driven urbanism and its role in urban governance in Alberta and beyond.

Risks

Participants are part of a small community of data specialists and because they will be talking about their jobs, and specific urban data initiatives they are involved in anonymity cannot be guaranteed.

Confidentiality

The information you share will be confidential. Study data such as field journal notes, and personal identifying information such as your name and contact information, will be stored digitally on a password protected, file encrypted computer in a locked room on the University of Alberta campus. Physical field notes will also be stored in a locked room on the University of Alberta campus. Only the research investigator (Hannah Graham) and supervisory (Joshua Evans) will have direct access to this data. The Research Ethics Committee has the right to review data if necessary. Study data, including personal information about you, will be securely stored for 5 years after the study is over, after which time it will be destroyed.

The findings from this research will be included in a Master's thesis, as well as presented at academic conferences and published in academic journals. Anonymity for participants in this study cannot be guaranteed, and your organization will be identified in these presentations and publications.

Voluntary Participation

You are under no obligation to participate in this study. Your participation in this study is voluntary.

Freedom to Withdraw

Even if you agree to be in the study and complete an interview you can change your mind and withdraw. If requested, we can withdraw your data from the study; however, this request must be received before the completion of data collection (Date).

Additional contacts.

The plan for this study has been reviewed by a Research Ethics Board at the University of Alberta. If you have questions about your rights or how research should be conducted, you can call (780) 492-2615. This office is independent of the researchers.

Consent Statement

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above and will receive a copy of this consent form. I will receive a copy of this consent form after I sign it.

_____	_____
Participant's Name (printed) and Signature	Date
_____	_____
Name (printed) and Signature of Person Obtaining Consent	Date

APPENDIX H: Open Data Interviews Informed Consent Form

PROJECT TITLE: Putting Data-Driven Urbanism in its Place

Research Investigator	**Supervisor**
Hannah Graham	Dr. Joshua Evans
Tory 3-104	1-26 Earth Sciences Building
University of Alberta	University of Alberta
Edmonton, AB T6G2E3	Edmonton, AB T6G2E3
hmgraham@ualberta.ca	jdevans@ualberta.ca
780-893-6342	780-265-2307

Background

The purpose of this study is to document how data is produced and used in Edmonton urban data initiatives. In doing so, we aim to develop a contextual understanding of data governance in Edmonton. Findings from this study could benefit decision makers in Edmonton or elsewhere.

Our study will involve representatives from urban data initiatives in Edmonton, Alberta. You have been asked to participate in this research study because of your affiliation with an urban data initiative.

Study Procedures

The study will entail a 30-40 minute interview conducted over video or voice calling on Zoom. The scheduling of these interviews will be determined by the participant. The interview will consist of 10-15 questions designed to gather information about the urban data initiative, and the work that the participant does. Interviews will be audio-recorded and later transcribed for analysis. You will be given the opportunity to review these transcripts within two weeks of the interview.

Benefits

Some may not get direct benefits from participating in the research. For others there may be personal benefits from participating in this study. This study could benefit decision makers in Alberta, or elsewhere. This study will contribute to existing understandings of data-driven urbanism and its role in urban governance in Alberta and beyond.

Risks

Participants are part of a small community of data specialists and because they will be talking about their jobs, and specific urban data initiatives they are involved in anonymity cannot be guaranteed.

Confidentiality

The information you share will be confidential. Study data such as interview recordings, interview transcripts, personal identifying information such as your name and contact information, will be stored on a password protected, file encrypted computer in a locked room on the University of Alberta campus. Only the research investigator (Hannah Graham) and supervisor (Joshua Evans) will have direct access to this data. The Research Ethics Committee has the right to review data if necessary. Study data, including personal information about you, will be securely stored for 5 years after the study is over, after which time it will be destroyed.

The findings from this research will be included in a Master's thesis, as well as presented at academic conferences and published in academic journals. Anonymity for participants in this study cannot be guaranteed, and your organization will be identified in these presentations and publications.

Voluntary Participation

You are under no obligation to participate in this study. Your participation in this study is voluntary.

Freedom to Withdraw

Even if you agree to be in the study and complete an interview you can change your mind and withdraw. If requested, we can withdraw your data from the study; however, this request must be received before the completion of data collection

Additional contacts.

The plan for this study has been reviewed by a Research Ethics Board at the University of Alberta. If you have questions about your rights or how research should be conducted, you can call (780) 492-2615. This office is independent of the researchers.

Consent Statement

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above and will receive a copy of this consent form. I will receive a copy of this consent form after I sign it.

_____	_____
Participant's Name (printed) and Signature	Date
_____	_____
Name (printed) and Signature of Person Obtaining Consent	Date