What shapes smart mobility? A comparison of smart mobility governance in Seattle, Greater Manchester and Stockholm

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

This thesis compares how smart mobility services have been shaped and steered in Seattle, Greater Manchester, and Stockholm, and explores how smart mobility providers can be held accountable for contributing to meeting local sustainable transport objectives. The research draws from and contributes to literature on governance, innovation, and smart mobility. The data used for this research was collected through semi-structured interviews with policymakers and other stakeholders involved in shaping smart mobility services in the three cities. Seattle has taken strong regulatory action to steer services, Greater Manchester has favoured a mix of regulation and collaboration with smart mobility providers, and Stockholm has adopted a hands-off position unless there is a need to address market failures. The comparative approach taken in this research provides new insights into the key elements shaping the interaction between governance context and smart mobility adoption. Smart mobility services are shaped by pre-existing governance arrangements in each city. They are also shaped by the corporate strategies of smart mobility providers, which are often developed at the international level but determine how services evolve locally. Direct steering in the form of experimentation, local strategies, policies, and regulations also plays an important role in shaping services in each city. This research argues that cities need to develop strong partnerships and reciprocal relationships with smart mobility providers in order to gain more leverage in steering services and delivering public value. However, the three case studies show that, for now, smart mobility provides unspectacular benefits and presents various risks, which need to be understood and managed. The concluding discussion stresses the need to think critically about the role of smart mobility services as part of the broader transport system, particularly in relation to rapid decarbonisation.

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List of Abbreviations

API: Application Programming Interface

BRT: Bus Rapid Transit

CAV: Connected and Autonomous Vehicle

DFAS: Department of Finance and Administrative Services

DfT: Department for Transport

FoT: Future of Transport

FTZ: Future Transport Zone

GMCA: Greater Manchester Combined Authority

GMITA: Greater Manchester Integrated Transport Authority

GMPTE: Greater Manchester Passenger Transport Executive

IDA: Investment and Demonstration Area

KC: King County

KCM: King County Metro

KOMET: Committee for Technological Innovation and Ethics

MHCLG: Ministry of Housing Communities and Local Government

MLG: Multi-level Governance

MLP: Multi-level Perspective

MoU: Memorandum of Understanding

PHV: Private Hire Vehicle

PnR: Park and Ride

RTSP: Regional Transport Supply Program

SAMS: Sustainable Accessibility and Mobility Services

SDOT: Seattle Department of Transportation

SP: Stockholm Parkering

STA: Swedish Transport Administration

TfGM: Transport for Greater Manchester

TfL: Transport for London

TNC: Transportation Network Company

TRO: Traffic Regulation Order

UITP: International Association of Public Transport

VC: Venture Capital

WSDOT: Washington State Department of Transportation

1. Introduction

1.1. Research rationale

For nearly a century, transport systems have been dominated by automobility. Cars, in particular, have facilitated a socioeconomic transformation by radically changing the range and speed of travel by personal modes and, as a result, have played a key role in redefining the land-use planning of economic activity, housing, education, healthcare, retail and leisure. In addition, having once been seen as a key element of economic progress, automobility is deeply embedded in the economy, by supporting economic activity and being a large industry in itself. As such, “the system of automobility” is about much more than just transport, permeating most aspects of the socioeconomic status quo (Urry, 2004). However, the inverse relationship between automobility dominance and economic, environmental and social sustainability, particularly in cities, is well-established in the transport literature (Banister, 2008) and in urban studies (for some early examples see Jacobs, 1961; Gehl, 2011). Mass car use is linked to a range of negative externalities including congestion, poor road safety, poor air quality, and social exclusion. Crucially, emissions from transport continue to increase year-on-year, and they have to be reduced dramatically if global warming is to be limited to 1.5°C, or even 2°C (IPCC, 2022). As such, cities need to deliver a drastic shift towards sustainable transport, more urgently than ever before.

In response to transport challenges, smart mobility comes with the promise to enable the transition towards a smarter *and* more sustainable transport future, or a “smart mobility transition”. The rise of smart mobility is attributed to a large extent to the rapid rise of new technologies and business models for electric, shared and autonomous mobility. At the core of the narratives surrounding smart mobility services is the prospect to deliver a shift away from car ownership, which is replaced by on-demand access to a package of connected services. Smart mobility services also promise to contribute to the rapid decarbonisation of the transport system through increasing travel efficiency and using low emission vehicles (Docherty et al., 2018). While the electric, shared and autonomous elements of the smart mobility narrative are not entirely new, their combined version has been compared to a ‘revolution’ (Sperling, 2018) and a transition of a similar scale to the automobility transition (Dowling and Simpson, 2013).

Considering that state intervention in the governance of transport has so far struggled to mitigate and eliminate the negative impacts of automobility, it is important to pay attention to

the role of the state and public policy in steering a smart mobility transition. Despite the ambitious narratives about smart mobility futures, there is already evidence that smart mobility services have questionable or even negative impacts in relation to sustainable transport objectives. For example, Transportation Network Companies such as Uber and Lyft have been found to increase congestion in the United States (Erhardt et al., 2019), and research by de Bortoli (2021) shows that dockless e-scooters only reduce carbon emissions under certain circumstances. Most importantly, even if the benefits of smart mobility services do materialise, past experiences highlight that technological innovation alone is not enough to address major transport-related challenges such as congestion, social exclusion and the reduction of carbon emissions - all negative externalities of automobility (Fonzone et al., 2018). As such, a transition to smart mobility requires changes in the governance of mobility to ensure that services deliver public value (Docherty et al., 2018).

This research is inspired by early work on the governance of smart mobility (for example Docherty et al., 2018; Reardon and Marsden, 2018b) and adds to the growing body of literature that explores the interaction between the state and smart mobility. Drawing from the broader transport governance literature this thesis provides a holistic perspective on what shapes smart mobility in cities and introduces the concept of accountability to explore under which circumstances smart mobility services can contribute positively to the delivery of local sustainable transport goals. The thesis is built around three research questions that aim to shape the research findings in a cumulative way, rather than being three distinct areas of research. The three questions, which emerged from the literature review in Chapter 2, are listed below.

Research question 1: How have cities governed smart mobility so far?

Research question 2: What are the cities' plans for smart mobility?

Research question 3: How could cities hold smart mobility providers accountable for contributing to local sustainable transport objectives?

This thesis comprises three in-depth case studies of smart mobility governance in Seattle, Greater Manchester and Stockholm. Using qualitative data from interviews with transport stakeholders, the case studies discuss the transport governance arrangements of each city, smart mobility developments and the cities' aspirations, and the role of smart mobility services in relation to sustainable transport objectives in each site. The comparative analysis of the case studies places a great emphasis on the interplay between local governance context and smart mobility developments, providing a unique insight into what shapes the governance of smart mobility and how much services can be steered by cities, especially considering that many smart mobility providers are large corporations operating in multiple countries. Based

on this understanding, the focus on accountability arrangements sheds light on when smart mobility services can be steered to deliver public value, and when this is not an option. Finally, this research highlights that a smart mobility transition cannot be achieved by simply focusing on supporting new types of services. Transport governance should continue to focus on reversing the dominance of automobility in socioeconomic systems, a hugely challenging task that does not disappear with the advent of new technological solutions. It is hoped that the insights of this research will help further the debate on smart mobility governance and inform existing, emerging and new transport policy.

1.2. Terminology

This research does not adopt a definition for what constitutes smart mobility and what does not. This approach has a theoretical and a methodological basis. The literature includes overlapping efforts to develop a taxonomy of smart (and shared) mobility, which often extend their scope to cover transport infrastructure and tools that are aimed to make travel "smarter", such as traffic monitoring (Cledou et al., 2018; Benevolo et al., 2016). Narrower taxonomies focus solely on means of mobility, and distinguish their market orientation (non-profit or for-profit) and transaction type (peer-to-peer, business-to-consumer, government-to-consumer) (Castellanos et al., 2021). Golightly et al. (2019) explain that the diversity in form means that shared mobility and, by extension, smart mobility should not be perceived as one thing. This motivated this research to adopt a "flexible framing" of smart mobility focusing on three key elements: a. *services* that combine innovative technologies and business models b. *provided by the private sector*[1] and c. *promising to transform* individual and collective mobility. Methodologically, this approach has allowed the participants in this research to discuss the smart mobility related interventions they considered important in their city, expanding the findings to smart mobility developments that are not necessarily focused on a particular type of service.

For added clarity, the following paragraphs list the terminology used in this thesis, as it was shaped following the data collection.

Bikesharing: refers to systems of shared human-powered or electric bicycles, which are provided by a public or private operator. Bikesharing systems can be docked or dockless (also referred to as free-floating). Stockholm's City Bikes are an example of a public docked system, and Mobike is an example of a dockless private system.

[1] The same types of services may also be run as public schemes, usually through concession agreements.

E-scooter sharing: refers to systems of shared electric scooters, which are, at least at the moment, mostly dockless and provided by the private sector. Voi is an example of a dockless e-scooter operator.

Bikesharing and e-scooter sharing schemes are often collectively referred to as **micromobility**. As private operators can offer both bikesharing and e-scooter sharing (for example Lime, Voi) services, they are often referred to as micromobility providers.

Ridesharing (also found in the literature as ridehailing or ridesourcing): refers to platforms provided by the private sector that offer a service similar to that of a taxi, through a mobile application. The applications often "match" people so that they can share their ride with others travelling towards the same direction. As the "sharing" element is not always available on the platforms, the term bears an inherent weakness, which is reflected in the fact that regulation has introduced new terminology for ridesharing. For example, in the United States ridesharing platforms are referred to as Transportation Network Companies (TNCs), and in the United Kingdom they are classified as Private Hire Vehicles (PHVs), a category of taxis. Both terms are used in this research when discussed in their respective contexts, as well as ridesharing, as a general term. Uber and Lyft are two examples of ridesharing platforms.

Carsharing (also found in the literature as car clubs): refers to systems of shared cars (often of different types) that are offered by private companies or by public authorities. There are different classifications of carsharing systems, such as free floating or back-to-base, where users return the cars to the same location after they use them. Carsharing differs from car renting as users pay to access the cars for short periods of time (minutes or hours). Car2go is an example of a private carshare operator.

Mobility-as-a-Service (MaaS): Butler et al. (2021, p.2) refer to MaaS as a "system whereby traditional services such as public transport can be integrated with other on-demand and shared services—such as ride-, bike- and car-sharing—and a single online interface utilised for payment, journey planning and other traveller information". As this research shows, applications of MaaS are still in their infancy. Therefore, this definition refers to an "ideal" form of MaaS, but elements of it, such as the single interface for payment, are often missing from current applications.

(Connected) Autonomous Vehicles ((C)AVs) (also found in the literature as automated vehicles): refers to vehicles, for example cars or buses, in which the driving task is fully or partially automated. The Society of Automotive Engineers has developed an industry standard taxonomy of automation in six levels from no driving automation (Level 0) to full driving automation (Level 5), which is also commonly used in the academic literature (SAE, 2022). This research generally refers to Levels 4 and 5, with further detail of each application provided

in the analysis. The ”Connected” element of the term refers to the vehicles’ ability to communicate with each other (vehicle to vehicle communications) and/or with infrastructure (vehicle to infrastructure communication). Applications of (C)AVs are in their infancy. Both the AV and CAV terms are used in this thesis, reflecting how they are defined in each context.

1.3. Research framing

This research focuses on smart mobility services for people’s travel in urban areas in western European or North American democracies. It is acknowledged that there is an extensive body of literature that explores smart mobility applications for freight, in rural areas, and in emerging and developing economies. These areas present their own challenges and opportunities and are also considered worthy of research. However, the framing of this research reflects my own experience, expertise and interests.

This research was carried out as a part-time PhD between 2016 and 2022, with the data collection mainly taking place in the second half of 2019. The duration of the part-time PhD was taken into consideration from the start. As such, the scope of this research was deliberately kept broad to ensure that it remains relevant for over five years, despite the fast developments in the smart mobility space.

The data collection was completed in late January 2020 and therefore was not directly impacted by the COVID-19 pandemic. However, changes in the transport system and in transport patterns that resulted from the pandemic may potentially impact the findings and interpretation of the interviews. To ensure that the discussion in this thesis has not been superseded, the interviews and events referenced in Chapters 4, 5 and 6 were cross-referenced with local press and council records in each location.

It is noted that the study visits to Stockholm were funded through the Mistra Sustainable Accessibility and Mobility Services (SAMS) International Young Researcher Grant, a competitive grant that allows PhD students to carry out short-term visits at Swedish universities or other research environments within the Mistra SAMS research programme. Mistra SAMS is hosted and managed by the KTH Royal Institute of Technology in close cooperation with vti, the Swedish National Road and Transport Research Institute, and explores how public and private actors can work together to “facilitate a societal transition to platform-based accessibility and mobility services that contribute substantially to sustainability” (Mistra SAMS, 2022, no page).

1.4. Thesis structure

This thesis comprises 8 chapters.

Chapter 2 provides a review of the literature that shaped this research and its questions, focusing on three areas: governance, transport governance and policy, and smart mobility. The chapter finishes by setting out the research questions.

Chapter 3 describes the methodology used to develop this research. It sets out the rationale behind selecting a comparative case study method, discusses the research design, and outlines the approach to analysing the data.

Chapters 4 to 6 provide detailed accounts of the three case studies of this research: Seattle, Greater Manchester, and Stockholm. Each chapter follows the same format, which corresponds to the three research questions. The chapters discuss the governance context of each city, the smart mobility developments in each city and the cities' policy positions, and, finally, how smart mobility services relate to sustainable transport goals in each case.

Chapter 7 includes the comparative analysis of the three case studies, the discussion, and the conclusions of this research. It provides a short account of developments in each city, and then revisits the research questions set out in Chapter 2, adding one more research question in response to themes that emerged through the data analysis.

Chapter 8 discusses the research implications of this PhD. It summarises its original contribution, discusses the research limitations, and makes recommendations for policy and future research.

2. Literature review

2.1. Introduction

This chapter provides a review of the literature that shaped this research and its questions. It is not a summary of all the literature studied as part of this research, nor is it meant to be an exhaustive account of all the literature related to the topics discussed. Instead, this chapter sets the theoretical and analytical framework in which this research aims to make an original contribution. The following sections aim to "tell a story" about smart mobility governance and its theoretical underpinnings. Section 2.2 focuses on governance theories, Section 2.3 focuses on transport governance and key transport policy issues, Section 2.4 discusses the governance of smart mobility, and Section 2.5 sets out the research questions of this PhD.

2.2. Governance

2.2.1. Definitions and theories of governance

The term "governance" emerged in the 1990s and has since evolved into a "popular but imprecise" concept (Rhodes, 1996, p.652) that has been adopted in different contexts (e.g. corporate, organisational etc.). As will be the case with other broad concepts in the following sections, this research uses a description instead of a definition for governance, and does not seek to explore all its potential interpretations. The description used as a starting point here is drawn from the "Governance" title of the "A Very Short Introduction" book series, where Bevir (2012, p.1) explains that governance refers to "all processes of governing, whether undertaken by a government, market, or network, and whether through laws, norms, power, or language". This broad description refers to an evolved interpretation of governance, which aligns with the way the term is used in this research. However, early literature on governance saw government and governance as two ends of a continuum of different governing types. On one end, government referred to a strong state with consolidated powers, and on the other end governance was a self-organising and coordinated network of societal actors, powerful enough to resist governmental steering, influence government policy, and take over the business of government (Jordan et al., 2005). As such, early governance literature referred to a "change in the meaning of government" where there would be "less government" (Rhodes, 1996, p.652 and p.654) and even a possibility of "governance eclipsing government" (Jordan et al., 2005). However, a shift in the interpretation of governance is observed from the early

2000s. New interpretations place a greater focus on the processes of governing across different government levels and networks of actors. Governance includes government, with the informal authority of networks supplementing the formal authority of government (Rhodes, 2006).

From an analytical perspective, this research has been informed by Treib et al. (2007) who categorise the different dimensions of governance into policy, politics and polity, each of which can take more or less rigid forms depending on the level of state intervention involved. More specifically, the policy dimension refers to the steering instruments deployed to achieve certain goals. These can be rigid, such as regulations, sanctions and legally binding rules, or flexible, such as guidelines and recommendations. The politics dimension focuses on the public and private actors involved in the policymaking process and the power relations between them. Finally, the polity dimension is interpreted as the forms of organisation of actors and authority involved in governance. Treib et al. (2007) identify hierarchies and markets as opposite forms of organisation, with networks referring to an intermediate form of organisation that "denotes a non-hierarchical constellation of interdependent actors with varying power resources" and authority (Treib et al., 2007, p.9).

The interpretation of governance in this research was also inspired by literature that approaches governance as an evolving process that reflects sociopolitical and economic developments in each context. Bevir (2013) provides such an interpretation through a historical account that starts from the rise of modernism and the bureaucratic state in the late nineteenth and early twentieth century in response to the declining regimes at the time. Modernist theories set the basis for the bureaucratic state, assuming greater responsibility for citizens' welfare. The bureaucratic state itself started to fail towards the end of the twentieth century, when neoclassical theories challenged its welfare practices by arguing that fiscal crises were an inherent pathology of the welfare state. Bevir (2013) then argues that the narrative of present-day governance reflects two waves of public sector reforms that have spread across much of the world but are closer related to Anglo-Saxon countries.

The first wave started in the 1970s, when neoliberal policies emerged in response to a "crisis of the welfare state", promoting markets and networks as replacements for and complements to old bureaucracies and hierarchies (Bevir, 2013; Peck, 2001). Neoliberal policies, such as those pioneered by Margaret Thatcher in the United Kingdom and Ronald Reagan in the United States, were described by privatisation and marketisation of public services, as the market was considered more efficient than the state, and a fragmentation of bureaucracies through outsourcing of government functions and breaking up the hierarchies of the welfare state. These changes were described as "hollowing out" of the state and are linked to earlier understandings of governance (Rhodes, 1996). The second wave of reforms started during

the 1990s and tried to address the fragmentation in the plethora of networks created by first wave policies. As such, "[t]he key issue became not how to promote markets but how the state could steer the shifting alliances involved in the delivery of services formerly delivered by the bureaucratic state" (Bevir, 2013, p.162). This second wave of reforms was characterised by "Third Way" policies spearheaded by governments such as Tony Blair's in the United Kingdom (Giddens, 1998). These policies did not seek to "turn back the clock" on the first wave of reforms but rather to preserve market-oriented changes while increasing state capacity and oversight through partnerships and the development of shared agendas. Peck (2001) explains that, in this process, states effectively engineered their own reform, deploying paradoxically interventionist practices to support economic competitiveness and maintain a good business environment that supports the market.

This research is not linked to one specific governance theory. Instead, it adopts an "open" understanding of governance as a complex process, an approach that was inspired by Bevir's proposition for a *decentred narrative* of present-day governance, which is itself inspired by Rhodes (2006). Bevir argues that different theories, including neoliberalism, rational choice and new institutionalism, have affected public policies that have in turn transformed public organisation and action, creating a heterogeneity in governance that should not be forced into one monolithic theoretical framework. He adds that social scientists should decentre the state from the analysis. Far from focusing only on whether the powers of the state are hollowed out or reconvened, social scientists should take into consideration the variety and contingency of governance, which relates to *how* power is asserted, how policy decisions are interpreted by policymakers, and how citizens respond to them (Bevir, 2013).

The following section discusses accountability, a key theoretical concept in the literature of governance and in this research.

2.2.2. Definitions and theories of accountability

Accountability is a broad concept that is embedded in theories of governance. The description of accountability used in this research comes from Mashaw (2006) who argues that any accountability relationship is described by at least the following six questions:

- To whom is accountability owed?
- By whom is it owed?
- For what is accountability owed?
- What is the process and how is it created?
- What are the standards that need to be met?
- What happens if the accountable party fails to meet these standards?

According to Mashaw (2006), these questions form an *accountability regime*, which this research adopts as a definition and analytical tool. The literature on accountability is vast and incoherent, which makes it difficult to point to a specific part of it as a source of influence. In short, this research focuses on the accountability regimes that influence governance and result from policymaking, with a focus on public accountability. The following paragraphs provide an account of the literature discussing the aspects of accountability that concern this research.

The "shift to governance" also signified a shift in public accountability, which broadly refers to the expectation that people with public responsibilities should be answerable to the public for the performance of their duties (Dowdle, 2006) and the use of public funds (Wilkins, 2002; Committee on Standards in Public LIfe, 1995)[2]. While elected officials are directly accountable to the public, and civil servants are indirectly accountable to citizens through chains of delegation, actors and institutions beyond government are primarily accountable to their own stakeholders. The coexistence of these accountability regimes is described in the literature as a fraught process. Ranson (2003) explains that through processes such as outsourcing, accountability shifted to contract and performance management, obscuring the lack of progress towards delivering public benefits. In addition, Mulgan (2017) contends that in processes of institutional transformation changes of responsibility do not automatically translate to a shift in accountability, and Rhodes (1996) argues that increasing institutional complexity eroded public accountability and obscured who is accountable to whom and for what. In a more balanced approach, Papadopoulos (2016) suggests that the sharing of accountability among actors who have conflicting interests and priorities requires collaboration and compromise. Resulting accountability regimes can be in the form of "soft" non-codified arrangements or "hard" sanctions. However, these still carry their own risks as too little accountability can lead to a lack of transparency and too much may impact mutual trust and undermine motivation of actors to act collaboratively. Overall, while responsibilities and the power to shape public decisions have been dispersed across many actors, the same did not always happen for public accountability. The result is "fuzzy" shared accountability arrangements that can lead to blame games about who is responsible for tackling social and economic issues (Stoker, 1998; Bache et al., 2014), and often create a public perception that democratic institutions are still accountable for decisions that have been removed from their remit (Papadopoulos, 2016).

While public accountability may become harder to achieve in a network of actors, there are also inherent complexities in the way it is enacted in public policy. Firstly, accountability requires transparency and visibility in decision making, and information that people can access

[2] Accountability is also considered part of the ethical standards those working in the public sector are expected to adhere to.

to scrutinise. Decisions are often made away from the public eye, either deliberately to avoid accountability, or as part of a process, for example when authority is delegated to unelected civil servants (Papadopoulos, 2016). Tools such as the Freedom of Information Act in the United Kingdom increase transparency but do not necessarily make decision making more democratic, as they do not provide the public with the tools to change a decision (Rhodes, 1996). In addition, accountability requires someone to have the willingness – and the resources – to play watchdog. Without robust and transparent accountability processes, such as monitoring of policy impacts, it is difficult for the public alone to enact accountability. Furthermore, it is often difficult to establish a causal relationship between policies and specific impacts and therefore to set standards of accountability (Papadopoulos, 2016). Finally, even if accountability regimes are designed well, individuals in a society experience accountability in a variety of ways, making perceptions of accountability highly fragmented (Dowdle, 2006).

2.2.3. Forms of governance

While this research does not use a specific governance theory, it does draw from literature on different forms of governance. Firstly, as this research focuses on cities and regions, it draws from literature on urban and regional governance. Reflecting the development of theories of governance, the study of urban governing processes has also evolved to encompass the diversity of actors involved in shaping cities. Pierre (2016) tracks this evolution from the local government approach, which focuses on institutional structures and actors, to urban politics, which covers the entire range of formal political decision-making processes, and has a multidisciplinary nature drawing from sociology, geography, history and economics. Eventually, urban governance theories expanded the study of urban governing processes to focus on the steering and coordination of the local state by public and private actors (Pierre, 2016). The study of regional governing processes has a broader scope than urban governance, as beyond the coordination of local actors and institutions towards collective regional goals, it also encompasses processes of “regionalisation”, which refer to efforts by national and supranational governments (such as the European Union) to strengthen regions as economic units. Most regional governance research comes from Europe where regionalisation has been promoted through the territorial mobilisation of regional identities and changing institutional and political structures, which often involved the creation of new regions (Pierre, 2016; Docherty et al., 2004; Brenner, 1999).

Cities and regions remain institutionally constrained by rules and policies set by a central government, which shapes their governing capacity. As such, cities and regions have a long-standing tradition of building coalitions with strategic societal actors aiming to harness financial and territorial resources to achieve local objectives and expand their governing capacity,

although often with little democratic discourse and deliberation in the process (Pierre, 2016). At the same time, neoliberal politics exacerbated the policy challenges for cities and regions, as they reduced public resources and supported the internationalisation of economic activity. In this context, urban and regional governance takes an international dimension as cities and regions try to exploit the opportunities presented by the global flow of capital while also addressing its negative impacts. Cities and regions have shifted to entrepreneurial practices that aim to attract highly mobile and flexible labour, capital and consumers, and compete with each other at a global scale (Harvey, 1989). At the same time, many developments that affect cities and regions have a globalised character and are outside local control, while external issues and challenges, such as migration and the climate emergency, become increasingly important on the urban political agenda (Pierre, 2016; Pierre, 2011). It is precisely this limited governing capacity of cities and regions that led to the expansion of the theoretical basis of this research to include theories of multi-level governance.

Marks and Hooghe (2004) argue that the organisation of public decision making at multiple territorial levels is better at capturing the varying needs of citizens, while multiple jurisdictions can facilitate credible policy commitments and innovation in the development and implementation of policies. In addition, multi-layered decision making can capture the nuances of policy externalities at different government levels, and address them more effectively compared to a centralised state. However, as explained above, this decentralisation of power is also seen as undermining public accountability and allowing authority to seep away from publicly accountable institutions or create conditions where public actors can avoid accountability (Bache et al., 2016).

The concept of multi-level governance (MLG) was originally developed to study the interaction between subnational, national and supranational actors and policymaking in the European Union, and later evolved beyond the analysis of intergovernmental relations to include non-state actors (Bache et al., 2016). Theories of MLG were consolidated by Hooghe and Marks (2003) in their influential two-type framework of MLG arrangements. Type I MLG describes system-wide governing arrangements in which authority is allocated to a limited number of clearly defined, non-overlapping jurisdictions at a limited number of territorial levels, each with a specific remit. Type II MLG describes governing arrangements in which authority is task-specific, and where jurisdictions operate at multiple territorial levels and may overlap. Therefore, Type I MLG refers mainly to state actors and Type II refers to organisations such as agencies and commissions, often resulting from the breakup of hierarchies (Hooghe and Marks, 2003). Although the two-type MLG framework has been widely deployed in the study of governance, it has also been criticised. The critique of the method provides an insight into the complexity of governance across different territorial levels. Bache et al. (2016) stress the

need to understand the links *between* the two types of MLG and argue that different types of actors compete with and complement each other, operate in different and shifting mixes, and create complex and multi-faceted governance arrangements, which are unlikely to be fully captured by the binary divide of the MLG taxonomy.

The complexity of governance is indeed captured in the empirical studies as, in practice, forms of governance are not mutually exclusive nor distinctive. Therefore, deploying a certain analytical lens does not invalidate other perspectives. For example, in examining the politics of climate change at the urban level Bulkeley and Betsill (2005) stress the need for different perspectives to be combined so that they capture the complexity of governance arrangements in each context. They find that local interpretations and implementation of sustainability are shaped by forms of governance that stretch across geographical scales and beyond the boundary of the urban. As such, they conclude that the 'urban' governance of climate protection involves relations between levels of the state and new network spheres of authority that challenge traditional distinctions between local, national and global environmental politics (see also Bulkeley and Betsill, 2013). The next section discusses the governance of transport and the transport policy issues, taking into consideration the complexity of governance theories and forms.

2.3. Transport governance and key transport policy issues

2.3.1. The governance of transport today

At a basic level, the state has always been involved in the regulation and management of transport, as genuinely free market conditions rarely exist in transport provision. For example, the state plays a key role in the provision of transport infrastructure, which offers maximum public benefit when it is provided as a public good (Docherty and Shaw, 2012; Docherty et al., 2004; Stough and Rietveld, 1997). Nevertheless, state involvement in transport has fluctuated over the last century, broadly reflecting Bevir's (2013) account of sociopolitical and economic developments discussed in the previous section. Between the 1920s and the 1970s, western economies generally followed a welfarist approach, and invested heavily in transport infrastructure. Neoliberal reforms between the 1970s and the 1990s reduced state intervention in favour of the market, reduced or removed competition restrictions on transport provision, and shifted the procurement and financing of infrastructure and services to the private sector. However, by the late 1980s, the failure of drastic neoliberal reforms, combined with the increased understanding of the scale and importance of environmental and social costs of a laissez-faire approach to the rapid growth of private car use and the continued expansion of

road infrastructure (see for example Button, 1990), led to the re-engagement of the state in transport governance (Docherty and Shaw, 2012; Docherty et al., 2004).

This “filling-in” happened at a time of market internationalisation, increasing influence of supranational entities such as the World Trade Organization, the European Union, and the North American Free Trade Association, and a growing desire for increased regional autonomy, which resulted in the emergence of complex, multi-layered transport governance systems in many countries (Docherty and Shaw, 2012; Docherty et al., 2004; Rietveld and Stough, 2004). The resulting transport governance landscapes, although they present considerable differences across different locations (research on transport policy reform and its impacts includes Stone, 2013 on Melbourne and Vancouver; Witzell, 2019 on Sweden; and Veeneman and van de Velde, 2014 on the Netherlands), are described by an ever expanding network of actors involved in shaping and offering transport services. This has made it more difficult to reach consensus on how transport infrastructure (Rietveld and Stough, 2004) and services (Hirschhorn et al., 2020) should be planned, and created a need for the development of new coalitions of actors and the creation of new governance tools to deliver public policy objectives, although often at the expense of public accountability (Paulsson et al., 2018).

As Marsden and Reardon (2017) note, the empirical study of transport policy has not paid sufficient attention to the complexity of transport governance and on issues of context, power, resources and legitimacy. However, there are examples of research that highlight the interplay between institutional structures, conflicting values of different actors, policies and policy cultures, and contextual socioeconomic factors in shaping transport governance (see for example Hirschhorn et al., 2019; Isaksson and Heikkinen, 2018; Rye et al., 2018). Acknowledging this complexity, Paulsson et al. (2018) stress the importance of collaboration in transport planning, which is not only about delivering policy goals but also about establishing support, commitment and shared identity among the actors involved in transport governance. The authors stress that collaboration is key in complex governance networks but requires additional resources and, crucially, only matters when there is a genuine political commitment to delivering sustainable transport goals (Paulsson et al., 2018).

2.3.2. Sustainable mobility and the climate emergency

Sustainability and sustainable mobility (or sustainable transport) are two more broad terms used in this research. This section provides an overview of the academic literature that has shaped the understanding of sustainable mobility in this research, and then focuses on the role of transport in addressing the climate emergency. The concept of sustainable mobility was first introduced in a 1992 Green Paper by the European Commission, which was

developed as a response to the challenges raised a few years earlier by the “Our Common Future” United Nations report, which largely established the use of the term sustainability today (Brundtland et al., 1987; European Commission, 1992). Broadly, sustainable mobility is the alternative position to a transport system that is designed for and shaped by car-centred mobility and unrestricted motorised travel (Banister, 2008; Urry, 2004). Especially in the 1970s and 1980s, the autonomy and increased mobility opportunities that came with car ownership were seen by neoliberal governments as a tool to facilitate the delivery of their urban planning, housing and labour reforms, and therefore to support economic growth (Docherty et al., 2004). While the car has indeed provided significant benefits in prosperity and quality of life, there is absolutely no doubt that the uncontrolled proliferation of automobility has also had detrimental socioeconomic and environmental impacts.

The environmental and social impacts of uncontrolled car use are well-established in the literature: traffic-related air pollution has been proven to cause millions of premature deaths globally every year (see for example Glazener and Khreis, 2019; Sanchez et al., 2020), similarly to road collisions (World Health Organisation, 2022), while car-reliant lifestyles, shaped by car-oriented land-use design, have been linked to higher obesity rates and cardiovascular disease (Frank et al., 2004). At the same time, there is an extensive body of literature demonstrating the correlation between transport disadvantage and key areas of social policy concern, such as unemployment, health inequalities, and poor educational attainment (Lucas, 2012). However, by far the biggest and most urgent challenge posed by the dominance of automobility is its significant and continued contribution to carbon emissions, due to the sector’s massive reliance on fossil fuels. Carbon emissions from transport account for approximately a quarter of all carbon emissions globally and, crucially, they continue to increase year-on-year. While emissions from other key economy sectors have steadily dropped in the last 30 years, there has been almost no progress from transport, with developments such as the increase in ownership of Sports Utility Vehicles effectively cancelling out any reductions in emissions achieved through sustainable transport policies (Tran and Brand, 2021; IPCC, 2022; Sims et al., 2014).

The research on the governance of transport decarbonisation shows that, despite the clear scientific evidence and ambitious national government commitments to decarbonise transport, in practice, action is watered down due to perceptions that economic growth is more important than reducing emissions. In addition, the lack of a clear breakdown of responsibilities from national to local level often creates uncertainty about who should achieve what (Bache et al., 2014; Marsden and Rye, 2010). In addition, decarbonisation is closely linked to social justice. Carbon is emitted mainly by wealthier individuals – and countries – while low-income and already disadvantaged groups generally emit less carbon and have fewer options to change

any of their carbon-intensive practices. As such, already disadvantaged groups can be disproportionately impacted by carbon reduction policies if these are designed in an unjust way (Mattioli et al., 2019; Mullen and Marsden, 2016; Brand and Boardman, 2008).

The literature provides ample examples on how transport can be decarbonised. As Holden et al. (2019) explain, the understanding and interpretation of sustainable mobility has evolved over the years, initially focusing on limiting transport's negative environmental impacts through technological improvements (see also Schwanen et al., 2011), and later expanding to incorporate the social and economic challenges resulting from car-based transport systems and exploring more diverse alternatives to automobility. Broadly, sustainable transport and urban planning policies aim to avoid car trips altogether (for example through online substitution), shift them to more sustainable modes (such as shared modes), or reduce their impact (for example using cleaner vehicles). These outcomes can be achieved through a variety of policy, infrastructure, financial and behavioural change measures (Banister, 2008; Banister, 2011; Hickman et al., 2013; Creutzig, 2014) and there is a consensus that now more urgently than ever they need to be pursued all at once (Holden et al., 2020). In fact, the mounting evidence on the impacts of a climate breakdown and the continued failure of transport policy to deliver substantial reductions in the sector's emissions, mean that "disruptive" measures focusing on demand reduction and lifestyle changes also need to be pursued if global warming is to be kept below 1.5°C (Brand et al., 2020).

2.3.3. Theories of change

Before discussing the role of smart mobility in the transition towards sustainable transport, this section provides a brief overview of theories that examine the role of innovation in processes of systemic change in public policy. One of the most prominent analysis frameworks, which is probably the one that has been most widely applied in the transport sector, is the multilevel perspective (MLP) on socio-technical transitions. This work, primarily driven by Frank Geels (see for example Geels, 2004; Geels, 2012), discusses how innovations evolve from being small scale experiments (niches) to changing established institutions and practices (regimes), and how wider societal conditions (landscapes) contribute to this transition. This research does not use the MLP as an analytical framework, but uses its notions as a point of departure in understanding the smart mobility transition. Firstly, Docherty et al. (2018, p.115) stress the importance of the notion of regime in the MLP, which in the case of transport "comprises technology (e.g. cars and traffic lights), infrastructure (tracks, roads, filling stations and paths), knowledge, markets and user practices, cultural and symbolic meaning, policy and institutions, and the industries involved in production and operation". As such, the current automobility

regime is not just about transport policy but encompasses how norms, customs and practices have been shaped by the dominance of private cars and can be very difficult to change.

The notion of niches in the MLP is also important to discuss. Theories of transition have been criticised for focusing only on specific innovations (Smith et al., 2010), and for failing to consider how transitions evolve in different spatial and governance contexts (Smith et al., 2005; Truffer and Coenen, 2012). However, later contributions to the literature on urban sustainability transitions re-evaluate how innovation is approached and suggest that "urban transitions are not about technological or social innovation per se, but about how multiple innovations are experimented with, combined and reconfigured in existing urban contexts and how such processes are governed" (Hodson et al., 2017, p.1). Hodson et al. (2017)stress the importance of understanding which urban mobility innovations are selected and how they are combined and configured in relation to existing urban transport systems. They suggest that "[S]electivity is mediated though context-specific governance and institutional arrangements, drawing on contested knowledge and of interpretations of 'sustainability'. This leaves the possibility for weaker and stronger conceptions of 'sustainability' to inform transition" (Hodson et al., 2017, p.2). Therefore, many, not just one, sustainable transport futures are possible depending on the types of innovation deployed, the local context and policy priorities.

2.4. Smart mobility

2.4.1. Smart mobility narratives

In response to the challenges of transport, smart mobility comes with the promise to enable the transition towards a smarter *and* more sustainable transport future, or a "smart mobility transition". The rise of smart mobility is attributed to a large extent to the rapid rise of new technologies and business models for electric, shared and autonomous mobility, which claim to challenge to how people practice and perceive personal and public transport. While the electric, shared and autonomous elements of the smart mobility narrative are not entirely new, their combined version has been compared to a 'revolution' (Sperling, 2018) and a transition of a similar scale to the 'automobility transition' (Dowling and Simpson, 2013), which refers to mass adoption of motor vehicles in the early 20th century that has profoundly shaped modern society (Urry, 2004).

Docherty et al. (2018) identify some common themes in smart mobility visions. First, there is shift away from vehicle ownership, which slowly becomes obsolete and is replaced by on-demand access to a connected package of mobility services (car, taxi, bus, rail, bike) that is facilitated by aggregation and payment platforms, with intensive processing of 'big data' to

match provision to demand in real time. This leads to improved connectivity and accessibility, and sustainable use of resources and infrastructure. Secondly, information is generated by users and is personalised for their needs. The detail and quantity of information reaches new levels and allows for the creation of connected, personalised services that match the individual users' needs and help them plan their lives in real time. Third, there is a focus on decarbonisation. The rapid advancement in electric battery technologies and other renewable sources means that transport becomes carbon emission free, at least at the point of use. Finally, automation revolutionises the travel experience. By eliminating the possibility of human error mobility becomes safer, while all occupants of a car can focus on other tasks en route to their destinations (Docherty et al., 2018).

However, critics warn about the complex issues that may arise from the unexamined adoption of new services, and highlight the need for timely state intervention to steer smart mobility towards a direction that delivers public value (among others see Docherty et al., 2018; Reardon and Marsden, 2018b; Paulsson and Hedegaard Sorensen, 2020). The following sections provide a review of the literature discussing the opportunities and risks of smart mobility, the governance challenges presented by smart mobility services, the governance tools that can be used to steer services, and, finally, Section 2.4.5 links the literature on accountability to the literature on smart mobility.

2.4.2. Opportunities and risks of smart mobility

Smart mobility services are widely seen as having the potential to help cities deliver their sustainable transport goals by accelerating the adoption of sustainable modes of travel. In idealised smart mobility futures, shared, low or zero carbon services transform not only people's travel behaviour but also the public space, through freeing street capacity that is currently occupied by cars, creating safer environments, and transforming land uses (see for example Buscher et al., 2014). Marsden (2022) also summarises the potential social benefits of shared and, by extension, smart mobility, which include greater spatial and temporal accessibility compared to standard public transport, lower journey costs, and even improved wellbeing and happiness. However, overall, the academic literature reviewed as part of this research scrutinises smart mobility visions, and gives a sobering account of the risks involved in their delivery.

The first broad category of risk identified in the literature relates to the lack of clarity on whether smart mobility services are indeed an environmentally sustainable transport option. Fernando et al. (2022), through a systematic review of the literature on the impacts of car-based shared mobility on greenhouse gas emissions, identify significant methodological inconsistency in

assessments of emissions savings of carsharing, ridesharing, carpooling (also known as peer-to-peer carsharing), and standard taxis. The authors find that reductions in emissions are largely related to vehicle electrification, but the calculated savings vary significantly depending on the assumptions of each study, and especially the scope of life cycle assessments, which ranged from tailpipe emissions only to extended benefits such as changes in land use. Hollingsworth et al. (2019) find similar results for micromobility through modelling different usage scenarios. They explain that the carbon footprint associated with shared e-scooter use is dominated by materials, manufacturing, and automotive use for e-scooter collection for charging. As such, they conclude that while e-scooters may be an effective solution to urban congestion, they do not necessarily reduce the environmental impact of the transport system.

As the two studies mentioned above point out, emission savings are greater when smart mobility services replace personal car trips. However, the evidence on trip replacement is also inconsistent. For example, Fearnley (2020) summarises the modal shift impacts of e-scooters, as these are cited in various public authority and operator reports. While personal car trip replacement rates range between 3-48%, with the highest percentages reported in American cities and the lowest in European cities, most surveys show that e-scooters predominately replace walking trips (Fearnley, 2020). Furthermore, there is a risk that smart mobility services lead to a net increase in the number of trips taken. While part of such an increase may result in improved access opportunities, this is clearly not always the case. For example, a study from San Francisco shows that TNCs accounted for approximately 50% of the increase in the area's congestion between 2010 and 2016, exceeding the combined effects of population growth, employment growth, and network changes. These effects were concentrated in the densest parts of the city, where there are already good active travel and public transport opportunities (Erhardt et al., 2019). Pangbourne et al. (2020) and Ringenson and Kramers (2021) examine the risk of increased travel in a broader smart mobility context, where services are integrated through MaaS applications. Ringenson and Kramers (2021) highlight the need for non-travel options, such as the use of co-working hubs, to be integrated in MaaS models so that unnecessary trips may be avoided. Pangbourne et al. (2020) argue that, as profitability for private businesses focuses on growing the use of their services, there is potential for increased mobility among those who can pay for it, resulting in the exacerbation of issues such as poor air quality and congestion, while still not helping those who experience transport poverty.

The inequitable distribution of smart mobility benefits and negative impacts raised by Pangbourne et al. (2020) is the second broad category of risk identified in the smart mobility literature. In a comprehensive review of the literature on racial, income, gender, age, and disability equity in relation to bikesharing, carsharing, and e-scooter sharing, Dill and McNeil

(2020, p.18) find that “the research does not provide evidence that vehicle sharing systems are improving accessibility for disadvantaged populations” and that, although some modelling research indicates that there are potential benefits, this is supported by limited empirical findings. The authors point out that the evidence to date, at least in many developed countries, shows that shared services are used disproportionately by more privileged populations, such as affluent and highly educated people, and people who are male, non-disabled, white, and/or younger (Dill and McNeil, 2020). The literature also points to the potential long-term effects of the inequitable use of smart mobility services. As explained by Sourbati and Behrendt (2020), data-led policy making risks carrying existing user inequities into the future, as certain groups are underrepresented in the data that is collected through smart mobility services and used by policymakers to shape future interventions.

As such, inequity in smart mobility may not only be limited to usage and access to services, but also to the design and planning of services. For example, Papafoti (2021), through interviews with officers from UK local transport authorities, demonstrates that while there is an emphasis on the potential benefits of AVs for the UK’s ageing society, barriers to adoption of AVs by older people are often overlooked and the negative impacts of AVs on older people’s accessibility as users of other modes (e.g. walking) are given limited consideration in policymaking. Furthermore, in his analysis, McKinney (2020) expands the discussion about equity and argues that ensuring equal access to services that have been designed taking into consideration the needs of a limited part of the society, is not a genuinely equitable solution. Instead, he argues that equity also requires a fairer distribution of the power to create the services themselves and tailor their operations to the needs of its users.

Crucially, the literature shows that even when disadvantaged groups are provided with incentives such as subsidies to use smart mobility, this does not necessarily lead to the adoption or increased use of services. Dill and McNeil (2020) explain that modal preferences may be rooted in larger structural or systemic problems related to race, class, gender, age, and ability, as well as related to the dominance of automobility and lack of appropriate infrastructure for active modes (see also Golub et al., 2019). Fleming (2018, p.14) explains that ensuring that smart mobility is accessible to all “requires a deep understanding of the roots of systemic inequity in transportation and urban planning”, otherwise there is a risk that new services “will leave the already underserved behind the same way other revolutionary technologies have in the past”.

Finally, the literature points to long-term challenges related to the unmanaged proliferation of smart mobility services, especially AVs. Modelling studies showing that on-demand shared AVs could lead to increased urban density are based on assumptions that vehicles will be predominately provided as part of shared services, there will be good integration with public

transport, and marginal changes in the value of time (Soteropoulos et al., 2018). For example, the International Transport Forum undertook a study that modelled how Lisbon, a proxy for a typical European city, would change if shared AVs would be adopted. The study demonstrated that shared AVs would have to be universally used by everyone to deliver the dramatic levels of reduction in road traffic that they promise. However, if only 50% of private cars were replaced by a shared autonomous fleet, the same study showed that overall traffic would double (International Transport Forum, 2017 cited in Docherty, 2018). Other studies explain that in a scenario where AVs make the travel experience cheaper, more pleasant and more productive, this could alter the organisation of daily schedules and open up the time and spatial horizons for some AV users (Milakis et al., 2017; Pudāne et al., 2019). However, as Legacy et al. (2018) explain, the widespread adoption of AVs, especially in a scenario where they are privately owned, could dramatically change the land-use and economic patterns in cities, incentivising urban sprawl, shifting investment away from public transport systems that cities will still require, and reversing policy commitments towards transport accessibility and urban containment (see also Docherty et al., 2018).

2.4.3. Smart mobility governance challenges

Considering the risk that smart mobility services could end up delivering the opposite of what they promise, the literature shows a broad consensus that the state plays a key role in shaping and steering smart mobility services (see among others Docherty et al., 2018; Reardon and Marsden, 2018b; Wallsten et al., 2021; Creutzig et al., 2019). Docherty et al. (2018) argue that, given the pace of innovation, the window of opportunity when policymakers have a broad range of options to shape smart mobility services might be relatively brief. However, even at this early stage, the literature identifies significant challenges in governing smart mobility services.

First, there is often no clear path for state intervention when it comes to new services. Curtis et al. (2019) and Stone et al. (2018) in Australia, and Guerra (2015) in the United States identify uncertainty as a key challenge in the governance of AVs, which are very much part of the “future of mobility” narrative but only just emerging in cities. The authors find that uncertainty is hampering proactive planning, resulting in a “paralysis” on the part of local authorities. Curtis et al. (2019) demonstrate that while governments recognise that they have a role to play in the governance of AVs and in ensuring that policy objectives such as social equity are delivered, they have doubts about how this can be achieved. In addition, there are genuine knowledge gaps in relation to new modes, both in terms of the new technologies and the new business models.

Furthermore, Reardon and Marsden (2018a, p.162) highlight the importance of local governance contexts, and argue that “the histories, traditions, cultures and expectations of individuals, towns, cities, regions and nations” in which smart mobility is introduced will inevitably shape how it is governed. As referenced in Curtis et al. (2019), authorities may already have a diminished capacity to steer smart mobility services, resulting from previous neoliberal reforms. Smart mobility governance challenges related to uncertainty and lack of local steering power are also identified in Moscholidou (2020), where the findings are based on interviews with English local authority officers and were carried out as part of this research. As such, state intervention in the governance of smart mobility is not a default position, but depends on the capacity and willingness of authorities to steer services (Wallsten et al., 2021).

The literature also discusses the challenges that arise when authorities try to steer services. Docherty (2020) explains how, in multi-level governance contexts, regulating and steering smart mobility services may result in conflicts between different government levels. Using as an example the regulation of MaaS, Docherty (2020) explains that city-led regulations aimed at dramatically reducing vehicles kilometres travelled, could conflict with national economic objectives, which are heavily reliant on vehicle taxation. As such, smart mobility policy alignment will require careful coordination across government levels and with smart mobility actors to ensure that societal goals are achieved and any potential conflicts are addressed through mutual agreement (Docherty, 2020).

Furthermore, smart mobility expands and diversifies the network of actors involved in transport governance and sometimes changes the agenda of existing actors (see for example Oldbury and Isaksson, 2021 on the changing agenda of bus operators in Stockholm). Therefore, steering smart mobility services is a complex process that involves multiple players, some of which may have powerful commercial interests that conflict with the cities’ priorities. This complexity of governance is aptly illustrated in Marsden et al. (2020), who “zoom” into the management of curbside space in the era of smart mobility. They explain that curbside space, a valuable and highly contested public asset, is already under pressure due to poor management by authorities and changes such as the increase in home deliveries and the advent of micromobility companies. The introduction of AVs is expected to exacerbate this situation and points to a clear need for proactive government action to set rules for the allocation and pricing of curbside space, so that it remains a functional “place for people”. However, the authors argue that it is unclear whether the state is capable of acting to deliver change for the full set of public interests or even understands what is at stake, while private actors actively seek to frame the debate, establish their claims, and shape what could be the “normal” curbside rules of the future (Marsden et al., 2020).

In addition, governance challenges are created due to the nature of the new actors in the space of smart mobility. Smart mobility companies are often start-ups funded by Venture Capital (VC), which means they are at once volatile and powerful. Smart mobility companies often change where they operate and even remove services from cities at short notice, resulting in a lack of stability in service provision (Moscholidou and Pangbourne, 2020). Aside from the reliability challenges this creates for local transport networks, volatility has equity implications. Dill and McNeil (2020) explain that, as pressures for profitability mount on VC-backed smart mobility providers, there is evidence that they are raising prices, which may make them less viable options for lower-income people. In addition, not knowing how long the service will be around may be an additional barrier that impacts disadvantaged communities (Dill and McNeil, 2020).

The literature also provides evidence that smart mobility providers are actively trying to reduce the state's steering capacity. Davis (2018) explores the process in which Uber, Lyft and Sidecar were legalised in San Francisco, setting a strong precedent for other cities and countries. She explains that the providers in San Francisco moved tactically to pressure local authorities, first by arguing that they should not be regulated at all, then ignoring regulators' orders to cease operations while building a strong user and driver base, and finally lobbying senior and elected officials to support the development of favourable legislation for TNCs. At the same time, San Francisco's Mayor shifted the jurisdictional locus of debate on the regulation of TNCs to the state level, where regulators were more business-friendly than the city. This meant that the regulatory process was largely led by and benefited the TNCs but did very little to enhance San Francisco's capacity to deliver local objectives or improve the city's revenues. In fact, as explained earlier in this chapter, TNCs in San Francisco have exacerbated congestion in the city and do not appear to complement the existing public transport network (Erhardt et al., 2019).

Finally, Docherty et al. (2018) explain that data information asymmetries, where smart mobility providers collect a wealth of data on transport demand that is not shared with local authorities, also undermines the long-term steering capacity of cities. The authors argue that "[d]ata is the knowledge upon which the power to control the marketplace is built" and therefore a shift in the control of knowledge and associated power will make governing mobility much more difficult in the longer term, especially in a future where AVs become the norm (Docherty et al., 2018, p.121).

2.4.4. Smart mobility policy tools

The literature includes a wide range of empirical studies examining how smart mobility services are governed in different contexts. While this section does not intend to provide a exhaustive account of this literature, it provides examples of how different types of smart mobility are most commonly governed to demonstrate the diversity of approaches authorities take to steering services. Although in some cases private services have faced outright bans (Spicer et al., 2018), the literature shows that authorities at various government levels have generally introduced measures to facilitate and control smart mobility, utilising existing policies or new rules specifically created to deal with smart mobility.

Ridesharing companies are probably the type of smart mobility service that has drawn the most attention in academic literature due to their highly disruptive character. As explained earlier in this chapter, Davis (2018), as well as Flores and Rayle (2017), analyse how TNCs were legalised in San Francisco through the introduction of a new state-level regulatory framework that established the provision of for-profit, on-demand ridesharing services using personal vehicles, setting a precedent for cities in the United States and other countries across the world. The legality and licensing of ridesharing platforms, vehicles and drivers has been widely controversial, and authorities at different government levels have generally tried to address issues of non-compliance through more or less permissive regulation including caps on licence numbers (Seidl, 2020), requirements for driver training (Dudley et al., 2017), and fare controls (Puche, 2019). However, As McKee (2017) explains, ridesharing services have also raised issues in relation to tax, labour, competition, and anti-discrimination law, which vary from one jurisdiction to another depending on the characteristics of each regulatory context. Therefore, the transport-related policies used to steer ridesharing companies represent only a small part of authorities' regulatory efforts to control them (McKee, 2017).

Dockless micromobility services, especially e-scooters, have also been disruptive and have presented regulatory challenges for authorities. Similarly to ridesharing, micromobility has also been a "blind spot" for legislation as it was often unclear who was responsible for the introduction of rules and which rules applied to them (Fearnley, 2020). Riggs et al. (2021) explain that local authorities in the United States, following a short period of uncertainty and inaction, started to control micromobility operations through regulations and permits that included rules such as fleet size caps and equity standards. Fearnley (2020) also provides a detailed account of tools authorities use to control micromobility, such as geofencing, entry rules, charges and fees, penalties, and mandatory data sharing.

Research on the governance of carsharing provides different examples of how authorities have steered services. For example, Faivre d'Arcier and Lecler (2019) discuss the case of Autolib, an electric, one-way carsharing system that operated in 19 municipalities in France, including Paris. Autolib was a public service developed through the initiative of the municipalities to complement their public transport networks and was run through a concession agreement. Conversely, Dowling and Kent (2015) examine the policies around Sydney's private car clubs. In this case, the local governments only facilitated carsharing operations through the allocation of dedicated on-street parking spaces (Dowling and Kent, 2015).

In terms of MaaS and AVs, while there are very limited large-scale applications, government intervention takes largely two forms: the introduction of high-level regulation that facilitates and delimits their deployment, and enabling through small-scale experiments. For example, the Finnish government introduced pioneering new legislation in 2018 requiring that all mobility providers make open access essential data about their services and allow the resale of their tickets, ensuring the interoperability of ticketing and payment systems (Ydersbond et al., 2020). In the case of AVs, governments have also started to introduce legislation, which mainly focuses on issues of safety and liability, creating a legal framework for their future widespread adoption (Bryan, 2017).

van den Hurk et al. (2021) provide an example of MaaS experimentation in Merwede, a low-parking neighbourhood that is part of an urban redevelopment area in Utrecht, the Netherlands. In Merwede, MaaS platforms are to be deployed as part of the City of Utrecht's plan to ensure that people who live in the new area have access to an integrated set of mobility services provided in local mobility hubs (van den Hurk et al., 2021). Similarly, Oldbury and Isaksson (2021) discuss how authorities in Stockholm supported the deployment of small driverless shuttles to serve as feeder services to the core public transport network in a newly developed urban area. Applications of MaaS and AVs are often introduced as experiments delivered in partnership between authorities and providers. Mukhtar-Landgren and Paulsson (2020, p.148) explain that the purpose of these experiments is "to protect the public from hazards and risks stemming from new and unproven technologies on the one hand, and to allow unproven technologies to be tested and piloted", avoiding a scenario where services develop independently and eventually become ungovernable.

The diversity of empirical examples of smart mobility governance demonstrates that services are not "one thing" in practice. Instead, their governance reflects the local contexts where they are introduced as well as the power dynamics between providers and each government. In addition, governments and providers are not the only actors involved in shaping services, as providers often gather support through partnerships with other private actors (Dowling and

Kent, 2015). However, as Hedegaard Sorensen and Paulsson (2020) note, efforts to steer services have so far largely focused on making sense of what works and making the field "governable". As such, there is a need for deliberative citizen participation in the field of smart mobility as current steering efforts lack "policy instruments that establish the population as citizens with rights, voice, and roles (and not just as users or customers) in the smart mobility transition and the transition towards a sustainable society" (Hedegaard Sorensen and Paulsson, 2020, p.216). The following section discusses how accountability regimes can be shaped for smart mobility services, and how the role of the public can be incorporated in them.

2.4.5. Accountability and smart mobility

The literature provides detailed accounts of the challenges presented by smart mobility, strongly recommends that the state should steer services, discusses how services could be steered, and provides examples of state intervention in relation to smart mobility. However, there are few examples and analyses of how – and if – services can be steered to contribute positively to local sustainable transport objectives. As a result, there are also few discussions of the governance and accountability challenges that emerge in different contexts when the state tries to align services with local priorities.

Taking a step back, the literature provides some insight on perceptions of "smartness" and sustainability among different actors. Noy and Givoni (2018) explore how, and if, the concepts of "smart" and "sustainable" are aligned in the perceptions of transport innovators and entrepreneurs. Their findings demonstrate that "the concern of […] transport entrepreneurs is primarily with commercial considerations and […] their appreciation of what it takes to advance towards a more sustainable transport system is lacking. The belief amongst those entrepreneurs, it emerges, is that technological developments alone, specifically with respect to autonomous and connected vehicles, can lead to sustainable transport" (Noy and Givoni, 2018, p.1). More broadly, Lyons (2018) reinforces the findings of Noy and Givoni and highlights that large corporations are exerting significant influence in the 'era of smart' based on principles that are conflicting with traditional concerns of the public sector such as social and environmental sustainability as well as economic prosperity. Therefore, it is not sufficient to assume that smart mobility services will have a positive impact. Instead, it is necessary to ensure that providers understand transport policy objectives and the challenges involved in their delivery or, in other words, *for what* they are accountable.

However, even when perceptions are aligned, there is no guarantee that smart mobility services will have a positive impact. van Oers et al. (2020) discuss how claims about the benefits of smart mobility applications carry a strong inherent legitimacy and therefore remain

unchallenged, even when applications fail to deliver the societal benefits they promised. More specifically, the authors examine claims about the transformative potential of data collection and use in smart mobility applications, focusing on two data management tools deployed in projects in France and the Netherlands, which aimed to optimise bikeshare operations and guide policy on cycling infrastructure respectively. In both cases the deployment of the data management tools was underlined by a shared understanding among all actors involved that their goal was to increase the share of cycling. They authors find that claims that data-led policy decisions are depoliticised gave legitimacy to the deployment of the data management tools, but their application lacked transparency, limited public participation and, crucially, led to the exclusion of non-smart alternatives. The research by van Oers et al. (2020) points clearly to the need for robust accountability regimes that define *through which processes* and *by what standards* smart mobility providers are meant to contribute to local transport objectives.

As explained, there are few examples of public authorities working with smart mobility providers to deliver public benefits. One of these comes from the United States, where cities and public transport agencies are subsidising TNC rides as alternatives to conventional bus services, for purposes such as connecting major employment sites to transport nodes or offering affordable and accessible travel for older age groups and people with disabilities. In effect, TNCs take part in programmes that were previously operated by taxi services, either replacing them or operating in parallel. These programmes usually subsidise the cost of rides, rather than the TNC or taxi operator (Deakin et al., 2020). While TNCs have some benefits compared to taxis, mainly better availability, due to the higher number of cars and drivers, and more polite drivers and cleaner vehicles, usually attributed to the rating system on TNCs apps, they have also introduced many challenges. Deakin et al. (2020) explain that cities and transit agencies in the United States have little say over TNCs compared to taxis. This is because, while in most States taxis continue to be regulated at the local level, about two-thirds of States have passed legislation to pre-empt local regulation of TNCs (for further detail see Section 4.2.2.2). The research by Deakin et al. (2020) shows that, in the absence of a separate contract agreement, TNCs raise equity challenges when providing services to older age groups or people with disabilities, such as shortage of wheelchair accessible vehicles and lack of driver training. The authors also identify issues with driver and vehicle safety, lack of data sharing and, importantly, concerns about the long-term viability of the TNCs business model. The research by Deakin et al. (2020) points to the final accountability regime question: *what happens if standards are not met*?

There are examples of public authorities steering and capitalising on the benefits of other transport technologies to deliver public value, which can be transferred to smart mobility

services. The research by Davis (2018) on the introduction of congestion charging scheme in Stockholm is such an example. Davis explains that although the introduction of the scheme happened in a politically complex setting, the Mayor of Stockholm at the time capitalised on the use of traffic monitoring technology to demonstrate the benefits of the scheme. In addition, the scheme was supported by public transport improvements and was put to a vote after a trial period. As a result, congestion charging garnered public support and democratic legitimacy, and became permanent. In addition, Stockholm's Mayor managed to turn political disagreement into consensus, building the foundations for the introduction further sustainable transport policies. Contrasting her analysis with the example of the introduction of TNCs in San Francisco discussed in Section 2.4.3, Davis demonstrates that, in the case of the state-introduced congestion charging scheme in Stockholm, state capacity was increased through collaboration and trust between the state, the technology companies and the public. Unlike the cases in van Oers et al. (2020) this process also addressed inherent challenges of enacting accountability, by providing transparency and public information. In addition, the case of congestion charging in Stockholm provides food for thought regarding another inherent accountability challenge: establishing causality. The deployment of transport technologies was done alongside other sustainable transport measures, making it impossible to establish the exact contribution of the transport technology to delivering public benefit. Is it, however, reasonable to expect a direct and measurable contribution? As explained earlier in this chapter, there is a need for systemic change to address today's transport challenges. As such, the accountability of smart mobility services should also be considered alongside broader transport policy changes, and not as a standalone goal.

In conclusion, further research is required to understand how smart mobility services are governed in different contexts, and which accountability arrangements can ensure that smart mobility services contribute positively to local sustainable transport goals. The following section sets out the research questions that aim to help bridge this identified gap in the literature.

2.5. Research questions

It is noted that the research questions were shaped concurrently with the decision to take a comparative case study approach to this research, with each case study examining all smart mobility developments in a city. This is clarified here as the wording and description of the questions reveal this decision, but more details about the development of the methodology are given in the next chapter.

Three research questions have been formulated based on the literature review and are meant to shape the findings of this thesis in a cumulative way, rather than being three distinct areas of research. The rationale behind the sequencing of the questions is to develop a detailed understanding of the governance context in each city, the smart mobility developments that have taken place, and cities' aspirations, to then explore how accountability regimes are shaped and could evolve in different governance contexts. The three questions are listed below.

Research question 1: How have cities governed smart mobility so far?

The first research question explores how smart mobility services have developed in each city, including: Which services have cities dealt with, how has the mix of services been determined, and has it been deliberate? Have cities used experiments, regulations, collaborations or other governance tools? Have cities faced any challenges in governing smart mobility services? Are the same types of services governed in different ways in different cities? What lessons have cities learned from their interaction with smart mobility providers?

Research question 2: What are the cities' plans for smart mobility?

The second research question explores how smart mobility is approached in the cities' strategies and plans, including: Do cities have standalone smart mobility plans, is smart mobility considered in transport strategies or are there no plans at all? What approach do cities want to take in the future and how does it compare to the present? How are the cities' plans and strategies shaped? What role are smart mobility services envisaged to play in transport systems in the future and how important are they considered for achieving strategic goals? How do the cities' strategies and plans compare?

Drawing from theories of governance, the transport governance literature, and the literature on smart mobility, the first and second research questions aim to provide an insight into the governance of smart mobility in different contexts that is more granular compared to the current literature, which either provides a broad discussion of the governance of smart mobility or examines the governance of individual types of services.

Research question 3: How could cities hold smart mobility providers accountable for contributing to local sustainable transport objectives?

The third question explores how smart mobility providers could be held accountable to contribute to the cities' sustainable transport objectives, including: How do cities think smart mobility providers should be held accountable in the future, and does this differ across the case studies? Do cities have the power to create the accountability regimes they desire? What

are the barriers in shaping accountability regimes? How do cities perceive providers' willingness to help deliver local sustainable transport objectives?

Through this question, this research introduces the concept of accountability regimes in the study of the governance of smart mobility. In particular, this research will explore how accountability regimes can be shaped to ensure that smart mobility services make a positive contribution to local sustainable transport objectives in different contexts, going beyond the existing research that largely focuses on the regulation of smart mobility to manage its externalities.

It is noted that a first attempt to respond to these questions has already been made in two publications that have resulted from this research, namely Moscholidou and Pangbourne (2020) and Moscholidou (2020). The first was a co-authored paper published in Transport Policy that used "London and Seattle as case studies to explore whether the regulation they have introduced can hold smart mobility providers accountable for their impacts on the urban environment, and if the accountability arrangements that are in place in each city can help local governments achieve their strategic goals for smart mobility" (p.170). The findings pointed to "three key features of regulations that are essential for shaping and steering smart mobility: regulations should be directed to specific types of smart mobility; should clearly set out providers' responsibilities and what happens if they fail to fulfil them; and should seek to clearly align the smart mobility offer with the cities' long-term strategies" (p.170). Acknowledging that regulation is only one element of smart mobility governance, the paper recommended that "future research should build on the analysis of the regulatory responses of cities and place the governance of smart mobility within a wider context of a differential and contingent shift towards sustainability, in order to assess which parts, if any, of smart mobility are conducive to long-term transformative change" (pp. 176-177).

The second publication was a book chapter in an edited collection by Paulsson and Hedegaard Sorensen (2020), focusing on governance and policy instruments for steering smart mobility. The chapter drew on interviews with policymakers from English local authorities, which were carried out as pilots ahead of the main data collection of this PhD (for further detail, including the methodological insights from the pilot interviews, see Section 3.3.1). The chapter explored how the policymakers envisaged steering smart mobility in the future, and what accountability arrangements would be necessary to achieve their ambitions. The analysis showed that although there was an agreement among participants that the state should steer smart mobility in a way that maximises public value, they believed that, at least in the near future, steering should be done through non-binding collaborative agreements with providers in a competitive market context. Where a more hands-on approach was considered appropriate, it was difficult for participants to identify the processes and standards that would

achieve the alignment between smart mobility service provision and local transport goals. The participants also showed a strong faith that smart mobility services will have a beneficial impact in cities, aligning their views with the narratives of smart mobility providers. The chapter argued that there is a need for two key actions: rebalancing the narrative around smart mobility so that its risks are better understood and managed by local authorities, followed by focused steering to address any negative impacts and capture the benefits provided by services.

These publications provide an overarching confirmation that this research is filling a gap in the existing academic literature, and create a basis for this thesis to delve further into the research questions.

3. Methodology

3.1. Introduction

This chapter describes the methodology of this research, including the research methods and design, the data collection and analysis, and how ethical considerations were approached.

3.2. Methods and research design

This research takes a qualitative approach and comprises three city case studies, which are combined and compared to respond to the research questions set out in Chapter 2. The data used was collected through interviews with transport professionals in each of the three cities. This section justifies this methodological approach.

3.2.1. Ontological and epistemological position

As Marsh et al. (2018) explain, a researcher's ontological and epistemological position is "a skin, not a sweater" that shapes their orientation to their subject. It shapes what they study and how, what role theory plays in their empirical studies, and what they think they can claim as a result of a study. My experiences as a researcher and transport planning practitioner have shaped my ontological and epistemological position and, in turn, the approach to conducting this research.

More specifically, I have adopted a critical realist philosophical approach and therefore this research distinguishes between the 'real' world and the 'observable' world. From an ontological perspective, critical realism considers that the 'real' cannot be observed and exists independently from human knowledge. Therefore, the world as we understand it is constructed from human perspectives and experiences, through what is 'observable'. Critical realism contends that unobservable social structures and phenomena can cause observable events, and therefore the social world can only be understood through the examination of the structures and phenomena that cause and shape the observed events. The adoption of a critical realist approach in this research means that it seeks to *understand* how observable events, i.e. smart mobility developments, are shaped by unobservable structures, i.e. their governance (Marsh et al., 2018). In addition, this research aligns with the critical realist position that "the future—which is real but not yet determined and therefore consists of a multiplicity of different possibilities—unfolds through various transforming events and nodal

points, themselves presupposing particular concept- and action-dependent historical social structures" (Patomäki, 2015, p.29). Therefore, the discussion of future accountability regimes that can help cities deliver their sustainable transport objectives does not aim to predict future accountability regimes, but instead provides an account of how regimes could be shaped in different contexts. As such, this research does not take a positivist epistemological approach seeking to interpret smart mobility developments and argue that predictable outcomes emerge under certain conditions; nor does it take an interpretivist approach, claiming that smart mobility developments can only be interpreted within certain discourses, contexts and traditions, rendering any generalisations unattainable (Marsh et al., 2018).

As explained above, according to the critical realist approach, human perspectives and experiences shape a person's understanding of the world. Therefore, my experience as a transport professional, and particularly as a transport policymaker, inevitably affected how this research was conducted. Although no part of this research draws from my professional experience, my exposure to processes of policymaking and my practical understanding of how local governments work, were particularly relevant in designing this research and analysing the case studies. More specifically, my experience provided me with an advantage in recognising how local authorities are organised and therefore helped me in identifying interview participants, and shaping who was approached and how. Similarly, the nuanced discussions with participants during the interviews were related to my prior recognition of the potential complexities of issues they raised, for example in relation to policymaking processes or the lack of human and financial resources. In addition, my experience helped me in developing the analysis of the case studies, through my existing understanding of the nature of the relationships that participants talked about, including relationships between local authorities and the private sector or between officers and politicians, as well as the influence of contextual factors in policymaking, such as local policy traditions.

3.2.2. Research design

As Mason (2002) argues, qualitative research has "an unrivalled capacity to constitute compelling arguments about *how things work in particular contexts*" (Mason, 2002, p.1, original emphasis). As such, this research takes a qualitative approach in seeking to produce a 'thick' description of the governance of smart mobility. More specifically, this research focuses on the entire phenomenon of the governance of smart mobility, rather than some of its variables, and is located in the social, historical and temporal contexts from which data has been gathered (Vromen, 2018). The data was collected through in-depth interviews with transport professionals, which were used to develop three case studies. Dooley (2002, p.335-336) defines case study research as the "scholarly inquiry that investigates a contemporary

phenomenon within its real-life context". Each case study can give a holistic and in-depth view of *how* smart mobility develops in certain contexts and *why,* and what that means for sustainable mobility. As such, from the beginning of this research it was clear that some form of a case study approach would be used. However, understanding the limitations and advantages of case study research was key in selecting and designing the case studies.

Flyvbjerg (2006) provides a succinct overview of why case studies have not been widely accepted as a standalone social research method and explains why such views are wrong or misleading. He states that the context-specific knowledge that case studies offer is, in the absence of a 'hard' universal social theory, our best chance to learn how certain phenomena evolve in different social contexts. In addition, he states that case studies can certainly be unbiased so they can be used to build theories and to generalise. However, he suggests that generalising is sometimes not the best use of a case study, as its *narrative* can provide valuable insight into the case (Flyvbjerg, 2006). In this research, the comparative analysis of the case studies is not structured around a pre-determined set of common parameters. The purpose of this research design is not to test if certain smart mobility developments occur in one context and not in another, but to combine and compare the insight of the three case studies to provide detailed responses to the research questions.

Finally, it is worth explaining why entire cities are used as "units of analysis" in this research. There are multiple examples in the smart mobility literature that explore, or compare, how specific aspects of smart mobility develop in cities (see for example Flores and Rayle, 2017; Davis, 2018; Christoforou et al., 2021), but much fewer examples that explore how cities approach smart mobility as a whole (for example Wallsten et al., 2021; Ruhrort, 2020). A range of different options were considered when shaping the focus of this research. Acknowledging that smart mobility is a rapidly changing sector, a key consideration was how the analysis would remain relevant five years later. Focusing on a specific smart mobility provider, or even a specific type of service, was considered a high-risk approach as it was already clear services can come and go at a very quick pace. As such, focusing on cities and how they deal with all types of smart mobility was considered the best way to shape this research. Cities, instead of countries, were selected because they offer a more direct and visible manifestation of how smart mobility can shape public space, social life, and government response (Pierre, 2011). In addition, smart mobility services tend to be concentrated in urban areas and therefore there is a lot of material for this research to investigate at the city level.

However, in selecting cities as case studies, this research is not oblivious to the limitations and challenges of this approach. Defining what a city is, its geographical, administrative, and political boundaries, and identifying its functional equivalents within the same country or in different ones, requires careful consideration. As Pierre (2005) highlights, American and

European countries may use the same term to refer to different phenomena so care needs to be taken for nominal and conceptual similarities to not conceal empirical observations in the analysis. In addition, cities do not operate and are not governed in a vacuum, so regional and national influences also need to be considered. **To facilitate the reader, the term city is sometimes used as a general description for all case studies, even though the analysis is not limited to the city level. The concept of core institutions is used in the beginning of Chapters 4, 5, and 6 to explain who are the key actors shaping smart mobility in each case, alongside a detailed account of the governance arrangements in each "city".**

3.3. Data collection

3.3.1. Pilot interviews with transport professionals in England

Following the development of the first interview design, it was considered sensible to test it in pilot interviews. At the time, I had already decided that the three case studies would be from different countries (see further detail in the next section), so the pilot interviews were carried out only with transport professionals from local authorities in England to avoid any significant overlap. The initial research design comprised three "accountability scenarios", describing three generalised smart mobility governance positions for local authorities using the accountability regime questions developed by Mashaw (2006). The scenarios ranged from laissez-faire with minimal state intervention (City A), to moderate state intervention (City B), to comprehensive intervention (City C). The purpose of the scenarios was to make participants think critically about how smart mobility can achieve their goals and how to shape accountability to do so, what works in the present conditions and what does not, what should change in the future, and what are the barriers in making this happen (Moscholidou, 2020). The pilot interviews would therefore show if the scenarios were a good tool to steer the conversation and help the participants focus and feel engaged. At the same time, the pilots would be a way to test my interviewing techniques and to practice managing different interviewees before the main part of the research.

The transport authorities approached for the pilot interviews already had some interaction with smart mobility providers or were already running local trials, but, as these were only pilots, their selection was not the result of a rigorous process. The participants selected were senior transport innovation or strategy officials who were likely to have a broad understanding of how each transport authority deals with smart mobility providers. However, smart mobility was not necessarily their only focus. Invitations to participate were sent out via email to officials from seven local authorities, which were deliberately chosen to be diverse in their remit and smart

mobility initiatives. Five of the seven officials agreed to participate in hour-long interviews, representing three combined authorities (Greater Manchester, West Midlands and West Yorkshire) and two city councils (Leicester and Milton Keynes)[3] (Moscholidou, 2020).

3.3.1.1. Methodological insights

The interviews revealed some benefits and several weaknesses regarding the use of accountability scenarios as a tool to steer the conversation. The participants easily understood the scenarios and discussed in detail many of the questions raised in the description of accountability regimes, such as data sharing and regulation. Therefore, the scenario exercise was a good prompt that opened up a range of topics for discussion.

However, there were several weaknesses in the design of the scenarios. Firstly, the use of scenarios restricted the breadth of the discussion. Opening the discussion with the accountability regimes encouraged participants to speak about existing services and relationship with provides, leaving less space to discuss what ultimately shapes each local authority's approach to accountability and how it may vary for different types of services. In addition, by asking participants how they could ensure that public value was delivered through smart mobility, it was assumed that this was already their objective. However, the interviews showed that there is substantial uncertainty about what services can do and if services can be steered in any way. In other words, adopting any kind of pre-determined approach to accountability, let alone delivering comprehensive state intervention, was too advanced a step for local authorities. Therefore, by focusing on the accountability arrangements the interviews bypassed all the steps and changes that would allow local authorities to determine their own accountability regimes, if this is at all possible.

As such, although improving the design of the scenarios could have been useful in prompting participants to discuss possible future arrangements (see for example Lyons and Davidson, 2016), it was considered that they were limiting in identifying the contextual factors shaping accountability regimes in each location. The key methodological insight from the pilot interviews was that the conversation should build up to discuss accountability arrangements, rather than start from accountability, which is reflected in the design of the interviews that were conducted in the three case studies, as discussed in Section 3.3.2.3.

[3] For a description of transport governance in England see Section 5.1.

3.3.2. Interviews with transport stakeholders in Seattle, Greater Manchester and Seattle

3.3.2.1. Case study selection

The selection of the case studies was informed by both practical and theoretical considerations. From a theoretical perspective, the selection followed the strategic sampling approach proposed by Mason (2002), who explains that the aim of the selection process is to produce "a relevant range of contexts or phenomena […] to make strategic and possibly cross-contextual comparisons, and hence build a well-founded argument". As such, individual case studies are not considered representative cases of how smart mobility services develop in every city, but the conclusions drawn from this research are considered transferrable to other locations.

From the early stages of the PhD process, it was decided that this research would focus on how smart mobility is governed in western European and North American democracies, where local governments were already considering the impact of new services on the delivery of their strategic objectives and on people's lives. The inclusion of a North American case study was considered particularly important, as many new smart mobility services originate from there. The selection of case studies took into consideration that they would shape the way the research questions are answered and, ultimately, the outcomes of this research. A range of criteria were considered, which were discussed during the transfer interview. Based on the feedback received at the transfer, and after further consideration, it was decided to select cities that meet the following criteria:

- Cities that have different governance arrangements, to allow a comparative approach.
- Cities that already have considerable 'experience' with different types of smart mobility services.
- Cities that include smart mobility in their published strategies and plans, and/ or have taken regulatory action to steer or control smart mobility.

In addition, the selection of case studies was influenced by the following practical criteria:

- Language: Cities would either be in English or French-speaking countries, and in countries where the use of English is widespread enough to assume that all interviews can be carried out in English.
- Number of case studies: Three study visits were considered realistically achievable based on the time and financial resources available.
- Duration: Each study visit would need to last up to two weeks, to align with my annual leave allowance.

- Cost: Unless a new funding source was identified, the available budget allowed for only one overseas study visit.
- Contingency: 'Option B' cities were identified in case planning of the study visits was unsuccessful.

Based on the above criteria, it was decided that the three case studies would be located in North America (Canada or the United States), the UK, and western Europe. The final selection followed a longlisting and shortlisting process, which were discussed with the supervision team. The longlisting process, which mainly relied on a desktop review of smart mobility developments and academic literature on different cities, showed that there was a limited number of UK cities that met all the selection criteria, and there were multiple options for Europe and North America. Approximately 15 longlisted cities were narrowed down to a total of six (three Option As and three Option Bs), following a closer investigation of the conditions in each location and any potential barriers. The shortlisted cities and the rationale for their selection are discussed below.

UK: Option A: London, as it was the only city that met all the selection criteria. Option B: Greater Manchester, where there had been some smart mobility developments, including a dockless bikeshare trial with Mobike.

North America: Option A: Seattle and Option B: Austin. Both were selected as they seemed to have a comprehensive policy approach towards smart mobility. Seattle has a higher modal split for public transport, walking and cycling, which made it the preferred option. It was considered that Seattle would be easier to compare with cities in Europe, where there is a stronger sustainable transport tradition. Austin's very high car dependency was considered to limit the potential for comparison of wider strategic transport plans and objectives, which were "weaker" than those in Europe.

Western Europe: Option A: Stockholm and Option B: Amsterdam. A range of smart mobility trials had taken place in Stockholm and were well-documented in the academic literature, while Amsterdam was the only city identified with a dedicated smart mobility policy. When the Mistra SAMS International Young Researcher Grant was secured, Stockholm was prioritised for practical and financial reasons.

The preparations for the study visits started with London. However, all interview invitations to TfL officers were rejected on the same day they were sent out by the senior officer leading on smart mobility policy. This meant that, if the case study was taken forward, there would be very limited input from key stakeholders[4], which could potentially influence the quality of the

[4] It later transpired that the rejection was linked to TfL's legal conflict with Uber at the time.

findings. As such, the three case studies selected are Seattle, Greater Manchester and Stockholm. The case studies will continue to appear and be referenced in this sequence throughout this thesis, reflecting the order in which the data collection was completed.

3.3.2.2. Selection of interviewees

In each city, the potential interviewees were identified so that their views would provide a comprehensive picture of smart mobility developments and plans. As such, there was no target number of interviews for each location. The approach to identifying a first group of interviewees was different in each city but, broadly, it started with a desktop review of smart mobility projects, and transport policies and strategies to identify relevant officers and other key stakeholders involved. Once the interviews with this initial cohort had taken place, more invitations were sent out, if needed, based on recommendations from participants or further desktop research.

More specifically, Seattle's Department for Transportation website provides a regularly updated and detailed organogram, so it was easy to identify all the members of the team that works on smart mobility, as well as the transport strategy team. Multiple emails were sent out to different individuals, who provided a single response, explaining that having discussed it internally, a group of three officers working on smart mobility and transport strategy would like to participate in a group interview. In addition, there was clear information online on how different services are licensed, including contact details for their respective project managers. As some services are licensed and managed across different organisations, invitations were also sent out to people working for King County, King County Metro, and the Seattle's Mayor's Office (Section 4.1). Finally, all policy documents in Seattle detail the names of the people who worked on them. This allowed for the names on the organogram to be cross-referenced with those on the policy documents, which made it clear that, with a change in administration, there was also a change in the team working on smart mobility. Therefore, ex-employees of Seattle's Department for Transportation were also approached. One of the participants recommended an additional contact that had not been identified, which led to one more interview. The response rate in Seattle was effectively 100%, considering that when multiple members of a team were contacted, they agreed between them who would participate in an interview.

In Greater Manchester the first contacts from Transport for Greater Manchester were recommended by my supervisors, who had previously worked with them on joint projects with the Institute for Transport Studies. The first interviewees in Greater Manchester then provided recommendations on who to approach across the region to discuss smart mobility, and

transport policy and strategy. Online information was very limited in the case of Greater Manchester and therefore the identification of participants relied almost entirely on recommendations and snowballing. The response rate in Greater Manchester was lower than Seattle. Despite multiple efforts to reach interviewees, no responses were received in some cases, most notably from Transport for Greater Manchester's transport policy team, and from the Salford City Council officer working on their car club scheme (Section 5.2.1.1).

The identification of participants in Stockholm was similar to Greater Manchester. The initial round of invitations was based on recommendations made by members of the Mistra SAMS team, who already had extensive experience on working with public actors in the Stockholm area. Further contacts were identified through online searches around smart mobility developments and policy documents, as there was slightly more information available online compared to Greater Manchester. As is shown in Chapter 6, the interviewees in Stockholm came from a broader range of institutions compared to the other two case studies, reflecting the fragmented way in which smart mobility is approached. On one occasion, an ex-Stockholm Region employee was contacted but was not available, so they recommended two of their colleagues as a replacement. The response rate in Stockholm was similar to Greater Manchester. No responses were received from Stockholm City Council's environment department, although the officers were approached multiple times via email and in person during an informal meeting.

All interviewees were invited via email and arrangements for interviews were also made via email. At total of 22 interviews took place: 6 were in Seattle, 6 in Greater Manchester, and 10 in Stockholm. Most interviews were carried out in person at the participants' offices, although all interviewees were given the option to be interviewed remotely.

Table 1 includes the codes used in the analysis, a short description of where the participants worked, and how they were identified. It is noted that numbers are not sequential because any informal conversations were also recorded in the contact logs for each case study.

Table 1 Interview participants

Participant	**Organisation**	**Interview format**	**How was the participant identified?**
Seattle			
Se2	King County Metro	In person	Desktop review
Se3a Se3b Se3c	SDOT - Mobility solutions team SDOT - Policy and planning group SDOT - Mobility solutions team	In person	Desktop review
Se4	Consultant/ manager for ex-micromobility provider/ ex-SDOT	In person	Desktop review

Se5	Seattle Mayor's Office	In person	Desktop review
Se6	King County	In person	Desktop review
Se7	City of Seattle - Department of Finance and Administrative Services	In person	Recommended by Se6
Greater Manchester			
GM2	TfGM - Transport strategy lead	In person	Recommended by supervisors
GM3	TfGM - Innovation team	In person	Recommended by GM2
GM4	TfGM - Innovation team	In person	Recommended by GM2
GM5	Mobike ex-manager	Telephone	Recommended by GM3
GM6	Research organisation focusing on the future of mobility	Telephone	Recommended by GM2
GM7	TfGM - Innovation team	In person	Recommended by GM2
Stockholm			
St1	Stockholm City Council - Traffic department	In person	Recommended by Mistra SAMS team
St2	Stockholm Region	In person	Recommended by Mistra SAMS team
St4	Stockholm City Council - City planning department	In person	Recommended by Mistra SAMS team
St5a St5b	Stockholm City Council - Executive Office Stokab	In person	Recommended by Mistra SAMS team Recommended by St5a
St6	Stockholm Parkering	In person	Desktop review
St7	KOMET	In person	Desktop review
St8	Drive Sweden	Telephone	Desktop review
St10a, St10b	Consultants - transport planning (working on mobility hubs in new housing developments)	In person	Recommended by Mistra SAMS team
St11a, St11b	Consultants (urban planning)	In person	Replacement to contact recommended by Mistra SAMS
St12	Stockholm City Council - Executive Office	Skype	Recommended by St5a

3.3.2.3. Interview design and process

The interview structure followed the ‘tree and branch’ logic of Rubin and Rubin (2012), according to which the research problem is divided in parts, each explored through a main question. The list of main questions, which are based on the research questions, is provided below.

Opening: Role and remit

First part: Experiences with smart mobility

- Details of individual smart mobility projects or trials
- Lessons from smart mobility projects or trials

Second part: Policy position towards smart mobility

- New policies
- Policy challenges

Third part: How can smart mobility providers be held accountable for contributing to local sustainable transport objectives?

- Current impacts of services
- Role of smart mobility services in the future transport system
- Future accountability regimes

Closing: Any additions

The opening questions were what Robson and McCartan (2016) call ‘warm-up’, asking interviewees about their role and remit within their organisations. Knowing the topic of the interview, most participants immediately started taking about how their role relates to smart mobility developments in each city. As such, the first part of the interview focused on how cities had dealt with smart mobility services to date and any lessons learned until the time of the interviews. In the second part of the interviews, the participants were asked about the smart mobility policies and barriers to developing them. Prompting questions for the first and second part of the interviews were informed by a desktop review of smart mobility developments in each context.

The third and main part of the interviews focused on accountability arrangements for smart mobility. Building on the lessons learned from the pilot interviews, this part took into consideration any operational and policy challenges mentioned by participants in the first and second part of the interviews and used them as prompts in discussing how accountability can be shaped. During this part of the interview, the participants were asked what role they thought smart mobility services play in the local transport system, how this could evolve in the future, and how services can be steered through policy and regulation. The discussion then extended to broader questions about accountability, the interaction with smart mobility to providers and the role of smart mobility services in relation to sustainable transport objectives. Finally, at the end of each interview the participants were asked if they had anything to add or if there was anything that was not covered in the discussion.

This broad structure and sequence were useful in maintaining the focus of the study, and ensuring that all interviews broadly covered the same topics. Nevertheless, this was only a guide, as participants were generally allowed to elaborate on their experiences. This sometimes led to them deviating from the topic, which I controlled with short statements such as “returning to the main discussion”. In addition, the questions were tailored to the participants’ experiences and roles, aiming to capture their unique perspectives. Allowing the participants to provide extended responses meant that they offered a lot of contextual information, which was helpful in building the full picture of smart mobility governance in each context. On very few occasions, short sections of the interviews were not transcribed or analysed as they were clearly not relevant to the research.

The data organisation and analysis process began with the audio recording of the interviews, which was essential in ensuring that the data used in this research was an accurate representation of the conversations with interviewees. During and immediately after each interview, I also took brief notes of any details to cross-reference in subsequent interviews, in policy documents or online. In addition, I took notes of information that was not captured in the recordings. For example, many of the participants made comments on the interview as they were accompanying me out of their offices, usually reinforcing with additional details points they had already made. All interviews were recorded using my mobile phone and the audio files were transferred to the University of Leeds server and deleted from my phone as soon as possible after the end of each interview. The interviews lasted between 60 and 90 minutes were all fully transcribed manually.

3.3.2.4. Data analysis

For the analysis of the data this research draws from the case study construction process proposed by Patton (2002, p.450), who states that “[t]he case study is a readable, descriptive picture of or story about a person, program, organization, and so forth, making accessible to the reader all the information necessary to understand the case in all its uniqueness. The case story can be told chronologically or presented thematically (sometimes both), presented with any context necessary for understanding the case”. Patton (2002, p.450) adds that “in many studies, the analyst will work directly and selectively from raw data to write the final case study”. As such, in constructing the case studies, the primary purpose of the analysis was not to identify themes or patterns in the data, but to provide a full account of the developments and the context of each case.

Nevertheless, the value of qualitative data analysis was not at all underestimated. All transcripts were imported in the computer-assisted qualitative data analysis software

(CAQDAS) NVivo 12 and were analysed using an inductive and then deductive coding approach. The inductive coding allowed for categories of data to be discovered and for findings to emerge from the data, acknowledging, however, that inductive coding is not done in a vacuum and is still informed by the theoretical underpinnings of this research. The deductive coding was then used to confirm the appropriateness of the coding framework that resulted from the inductive coding and examine whether data across the interviews fits the codes developed (Patton, 2002).

More specifically, following the careful review of the transcripts, the interviews were coded using a draft framework that included only five headline codes: local context, smart mobility governance, smart mobility impacts, city strategies, and (types of) smart mobility services. The first four codes represented overarching topics discussed in all interviews, while coding the data by type of service was considered a potentially useful exercise, although there was no intention to produce any analysis based on each smart mobility type. The final codes and subcodes were produced though the inductive coding and were iteratively validated through deductive coding, although the five headline codes stayed the same. The final coding framework, provided in Figure 1, was also shaped by feedback from the supervision team, as well as from sharing parts of two transcripts and the coding framework with a fellow PhD student from the University of Leeds and comparing my coding with his. Coding was valuable in making sense of the large volume of the interview data. The codes generated by the analysis were used both in the construction of the case studies and in responding to the research questions in Chapter 7. However, in both cases the codes were used to complement the narrative, rather than as building blocks of the analysis. The following paragraphs describe the approach taken to constructing the case studies and responding to the research questions.

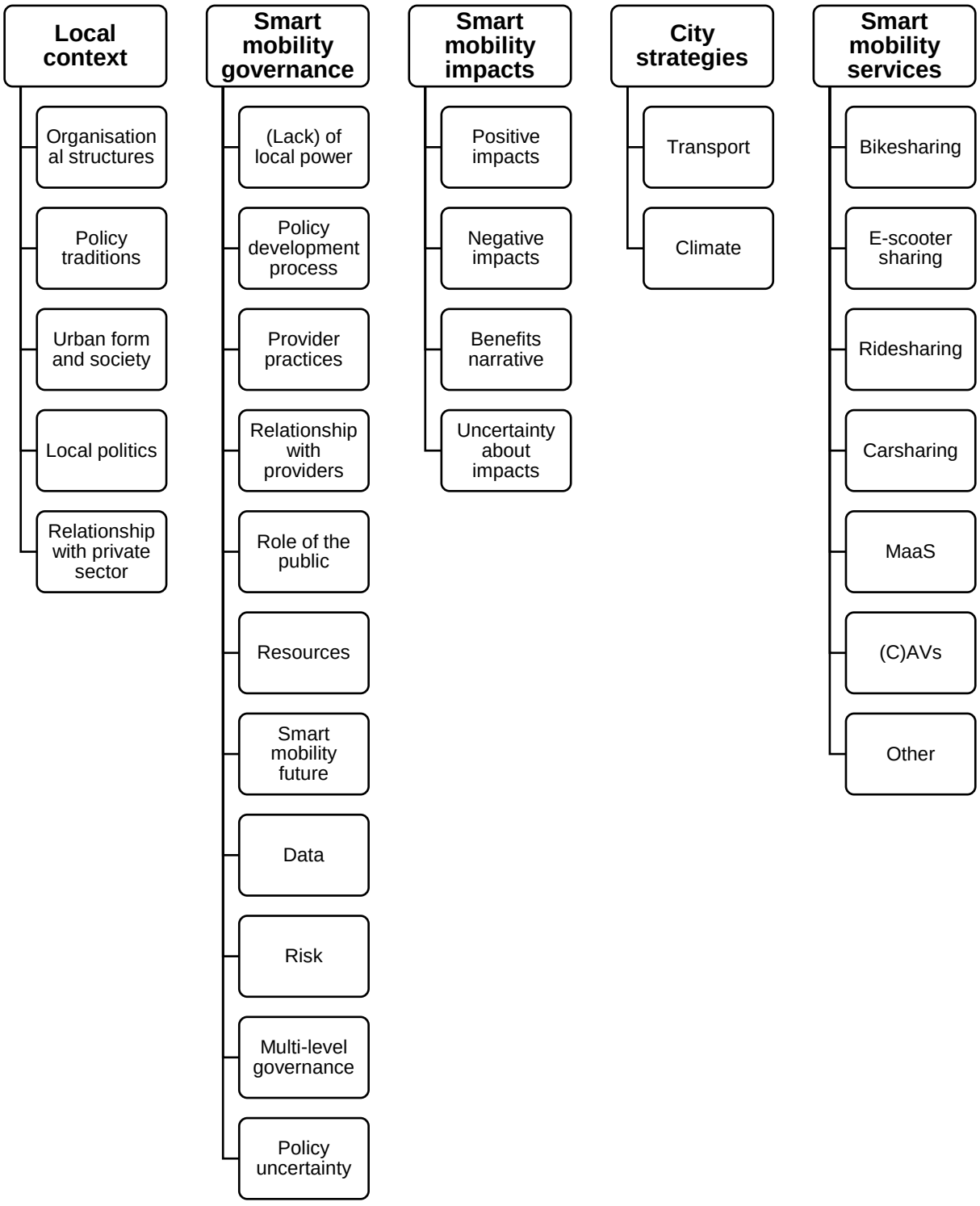
To construct the case studies, the data and codes were organised in a structure broadly reflecting the interview question sequence presented in previous section. This approach means that the case studies broadly follow the argument development process of most participants. In addition, the case studies include direct quotations to capture the participants' voice and unique perspectives.

A key part of the case study construction was the alignment and factchecking of interview data. More specifically, to describe the governance contexts of each city (Sections 4.1, 5.1 and 6.1), the interview data was complemented with additional literature provided by the cities' official channels and, in some cases, academic research, to ensure that the same level of detail is included across the case studies. It is noted that all interview data was also factchecked for the sections discussing the development of smart mobility services and smart mobility policies in each city (Sections 4.2.1, 4.2.2, 5.2.1, 5.2.2, 6.2.1, 6.2.2), as there were often inconsistencies in the information provided by the participants (for example, references

to dates or policy targets). The analysis of smart mobility developments in each case study was based on the interviewees' accounts of their work with smart mobility services in each city. However, the interviews were not sufficient to provide a complete and accurate picture of these developments, which participants themselves often admitted. As such, the interview data was complemented with information from the providers' and cities' official channels, local media sources that were deemed impartial and trustworthy, and, in some cases, academic literature. At this stage, the academic literature was not used to support the interview data analysis, but only to complement the description of smart mobility developments in each city. In addition, the smart mobility policy sections of each case study are based on the policy review that preceded the interviews, on interview references to policy developments and to policy aspirations, and on the review of the policy documents themselves. In the case of Seattle, additional academic research and legal studies were used to discuss the regulation of TNCs (Section 4.2.2.2). Finally, the case studies include information on events that took place between the time of the interviews and the time of writing, particularly in relation to the impact of the COVID-19 pandemic on the developments discussed by the participants. This information was also identified through the providers' and cities' official channels, and local media sources that were deemed impartial and trustworthy.

Finally, to respond to the research questions and develop the analysis provided in Chapter 7, the text from the three case studies was re-coded thematically, broadly using the approach proposed by Braun and Clarke (2006). The coding was conducted manually, and the resulting themes were used as subsections in the responses to the research questions. The themes are discussed alongside the existing literature, demonstrating the original contribution of this research.

Figure 1 Coding framework



3.4. Ethical considerations

An application demonstrating that this research meets the ethical standards of the University of Leeds was approved in August 2018, and was later amended and re-approved twice to reflect minor changes in the research design. The University's protocols were followed in securing informed consent from the participants, and in anonymising, storing and sharing the research data.

The interviewees received an information letter with the invitation to participate in this research, which provided details on the research project and the interview process, explained how the interview data would be collected, stored, analysed and disseminated, and clarified how anonymity would be secured. More specifically, the participants were informed that they would be referred to as "participant from organisation X". The letter also made clear that in some cases, the identity of the participants would still be possible to be inferred, especially if the reader of the research outputs was familiar with the organisations represented by the participants. The letter also included contact details that the participants could use in case they had any questions or complaints about this research. As an example, a copy of the information letter provided to participants in Stockholm is included in Appendix A.

In addition, informed consent from all participants was obtained and recorded before the start of each interview using a consent form, which explained how the data would be used and stored, and specifically asked participants for consent to be quoted. The form made clear to participants that they can withdraw at any point they wish from the interview or not answer questions they do not wish to. Participants were given two weeks from the time of the interview to completely withdraw from the research. The participants were also allowed to add their own terms in the form. A copy of the consent from given to participants is provided in Appendix A. None of the participants expressed any concerns about anonymity, however some specified during the interviews that certain statements they made were strictly their personal views. Consent forms were scanned as soon as possible after each interview, stored on the University of Leeds server, while the paper copies were stored in a safe locker located at the Institute for Transport Studies.

Transcript and recording files were saved using pseudonyms, while files containing information on which pseudonyms correspond to which participants, as well as communications and contact details, were saved separately from the transcripts. All electronic files were saved on the University's server and any files stored temporarily on my personal computer were encrypted.

4. Smart mobility governance in Seattle[5]

4.1. Seattle's governance context

4.1.1. Institutional context

Seattle is the biggest city and the main economic centre of Washington State. The City of Seattle has a Mayor-Council form of government and is a charter city, which in the United States context is a city where the local governing system is defined by its own charter (constitution) (Ballotpedia, 2022). The city's Mayor for the period 2017-2021 was Jenny Durkan. The City Council can vote bills into ordinances (laws) with a majority vote by its members, and also approves the city's budget, which is proposed by the Mayor and is also adopted through an ordinance. Legislation can be initiated by the City Council, the Mayor, the municipal court and the city attorney. Members of the public can also initiate legislation through petitions. The Mayor does not have to approve a bill for it to become law but can veto it. If the Mayor vetoes a bill, it goes back to the City Council for reconsideration, and if at least two thirds of the council members vote to override the Mayor's veto, the bill still becomes an ordinance (City of Seattle, 2013).

Seattle's municipal transport agency, Seattle Department of Transportation (SDOT), is responsible for managing and planning the city's road infrastructure, and for local traffic management. SDOT can propose levies for citizens, which are subject to a vote. The current 9-year, $930 million Levy to Move Seattle accounts for roughly 30% of the city's transport budget and was approved by voters in 2015 (SDOT, 2022a; SDOT, 2022c). SDOT is managed by a Director of Transportation, a position appointed by the Mayor of Seattle and confirmed by a majority vote from the Seattle City Council.

Seattle is the main urban area in King County (KC), which is governed by an elected executive and a Council (King County, 2022c). King County is also governed by a charter and has the power to adopt ordinances, levy taxes, and adopt budgets for the County (King County, 2021). KC's transit agency is King County Metro (KCM). KCM provides bus, paratransit, vanpool, and water taxi services, and operates Seattle Streetcar, Sound Transit Link light rail (a light rail system connecting Seattle to the Seattle–Tacoma International Airport), and regional bus services (King County, 2022a). Sound Transit is a metropolitan transport agency that builds

[5] The cut-off date for this Chapter is 31 August 2021.

and operates regional transit services throughout the urban areas of KC and in the neighbouring Pierce and Snohomish Counties. Sound Transit is governed by a board of directors, which includes the heads of local and regional governments in its operating area as well as Washington state officials (SoundTransit, 2022). Finally, the Washington State Department for Transportation (WSDOT) is mainly responsible for strategic road projects across the state. **For Seattle, the core institutions identified are the City of Seattle and SDOT, with KC and KCM playing an important but supporting role focused on specific aspects of smart mobility.**

4.1.2. Policy context

Seattle is considered one of the most socially liberal cities in the Unites States and has a strong tradition of environmentalism, along with other major cities in the Pacific Northwest. The participants from SDOT suggested that the city is perceived as green-minded across the country, even if this not always reflected in the City's policy decisions. In addition, Seattle has a strong citizen participation, deliberation and advocacy culture, also referred to as 'the Seattle process', and a long-standing focus on equity, which is evident in the city's policies and in the strong presence of community groups and unions (Brooks Olsen, 2022). These principles and traditions are reflected in the governance of smart mobility, as will be discussed in more detail below. For example, equity implications were considered in the detailed specification of the bikeshare pilot, which became a template for other places across the United States. Citizen engagement efforts were even more rigorous during the development of the e-scooter pilot, which, according to the participants from SDOT, would be introduced in a slower and more deliberative way compared to bikeshare.

The focus on sustainability is also present in mayoral priorities about transport, with smart mobility services such as e-scooters and bikeshare seen as a part of the solutions that will benefit the city in the future. However, the city's transport decarbonisation plans have traditionally focused on electrification. Seattle's ambition is to become carbon neutral by 2050. The city has been using carbon neutral electricity since 2004 (mostly coming from hydropower, while the city purchases offsets for the 5% of the electricity that is not produced through renewable sources), meaning that approximately two thirds of the city's carbon emissions come from transport-related sources. A transport electrification strategy was published in March 2021, setting its targets for 2030, including all shared mobility trips being zero emissions (including scooters, carsharing and TNCs), 90% of all personal trips being zero emission (including the use of electric cars), and 30% of all goods deliveries being electric (City of Seattle, 2021b). The strategy also stresses that the city's broader goals for transport will be achieved through a combination of electrification, modal shift, and equitable road pricing.

SDOT's latest strategic vision also sets the target to reduce the percentage of residents travelling to work in a single occupancy vehicle to 25% or less by 2035 (SDOT, 2015).

In addition, large infrastructure investments in and around Seattle are aimed at prioritising public transport, walking, and cycling over private car use. Across the city and region there is a 25-year plan for extensive investment in public transport, including light rail and bus priority, known as Sound Transit 3, which was adopted in 2016 (Sound Transit 3, 2022). In addition, SDOT removed a large part of the highway infrastructure that was going through Seattle's centre in 2019, reducing capacity for cars (Lloyd, 2019). However, it is noted that Mayor Durkan was criticised for backtracking on previous commitments to implement a congestion charge in central Seattle by the end of her term (Trumm, 2021), and for delaying or cancelling the delivery of new cycling and public transport infrastructure, partly in response to revenue shortfalls due to COVID-19 (Trumm, 2020b).

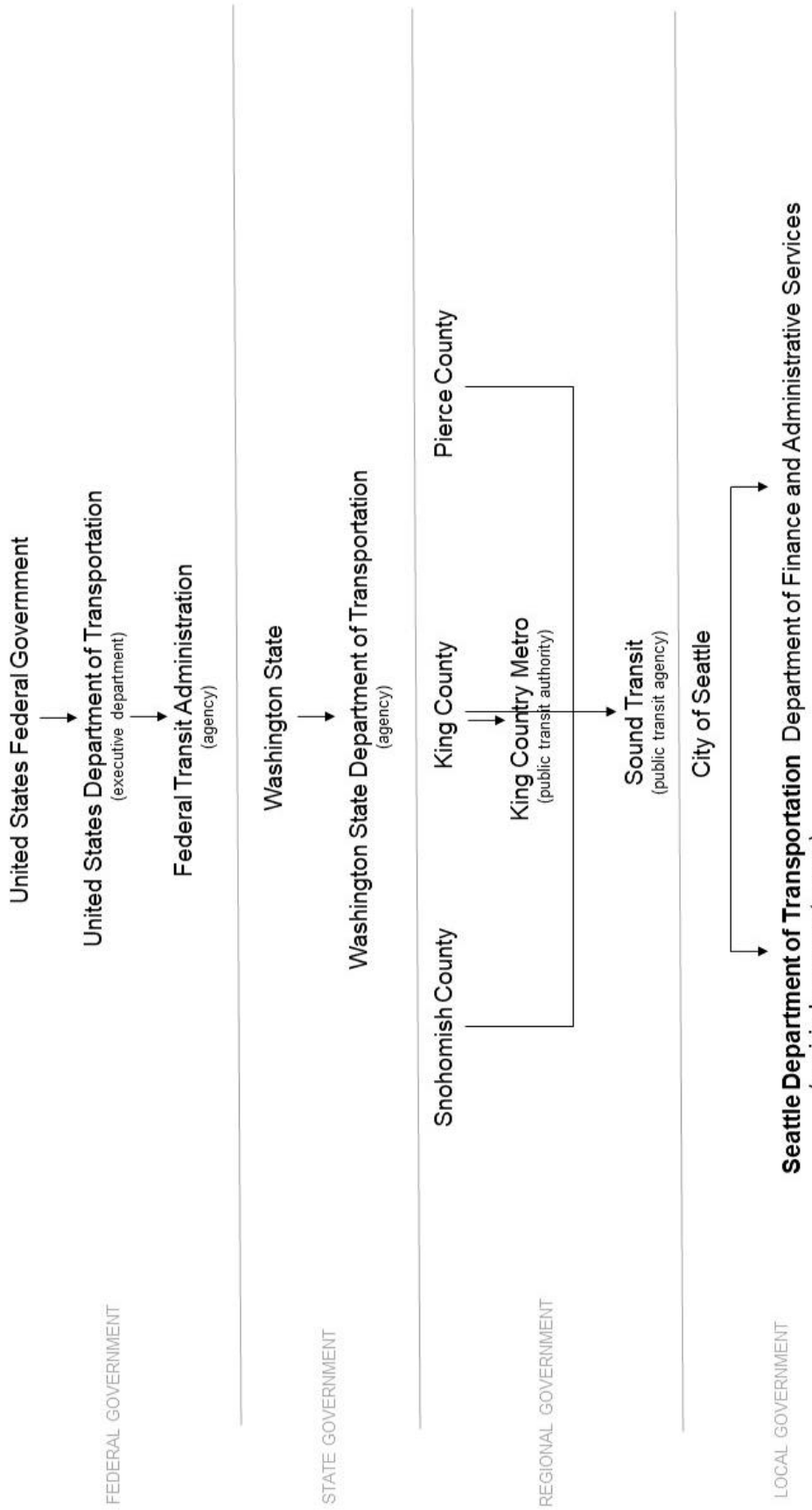


Figure 2 Key government institutions and associated transport bodies referenced in the Seattle case study. Official description of each transport body in brackets. Core institutions in bold. Designed by the author.

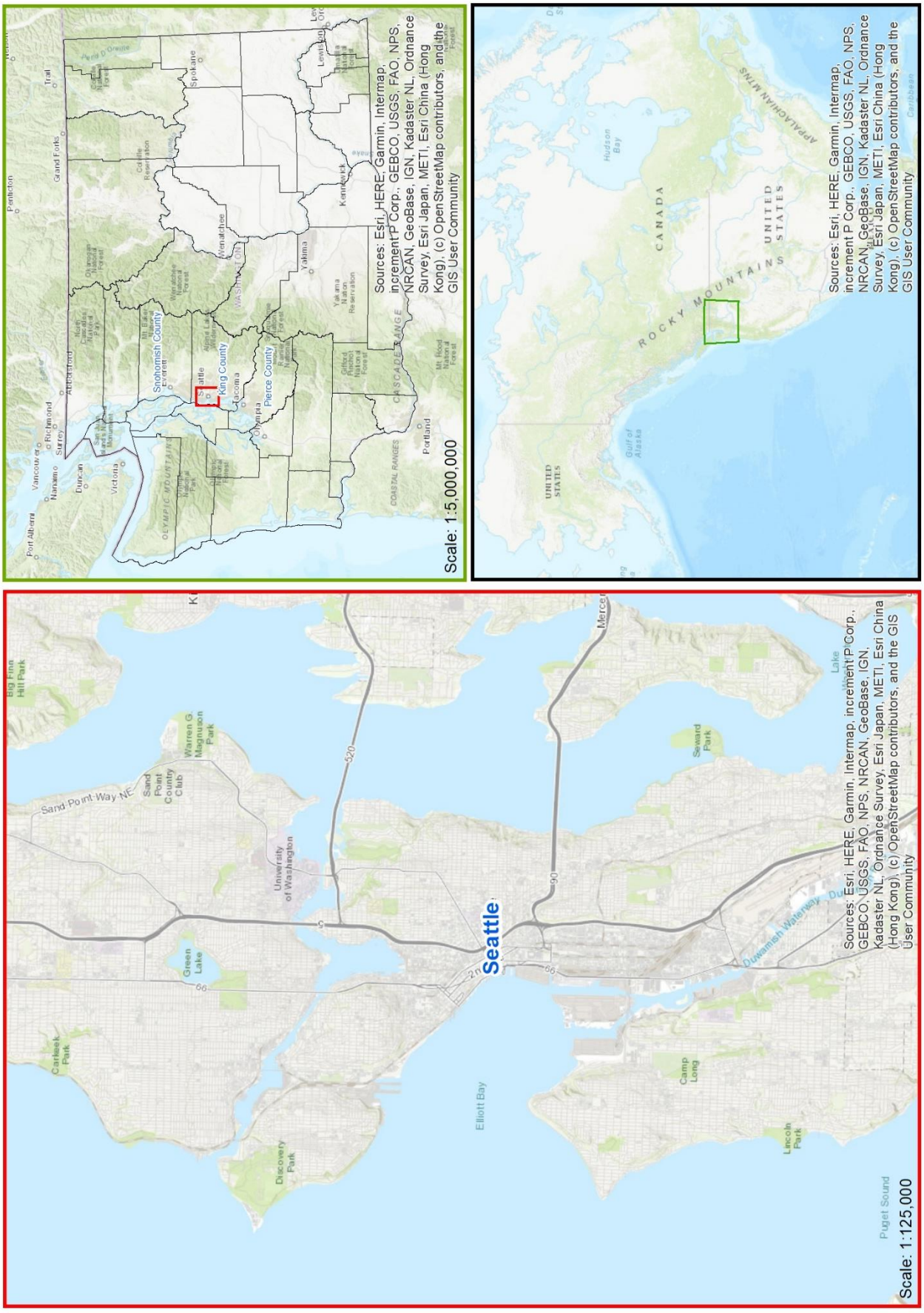


Figure 3 Map of locations referenced in the Seattle case study. Designed by the author.

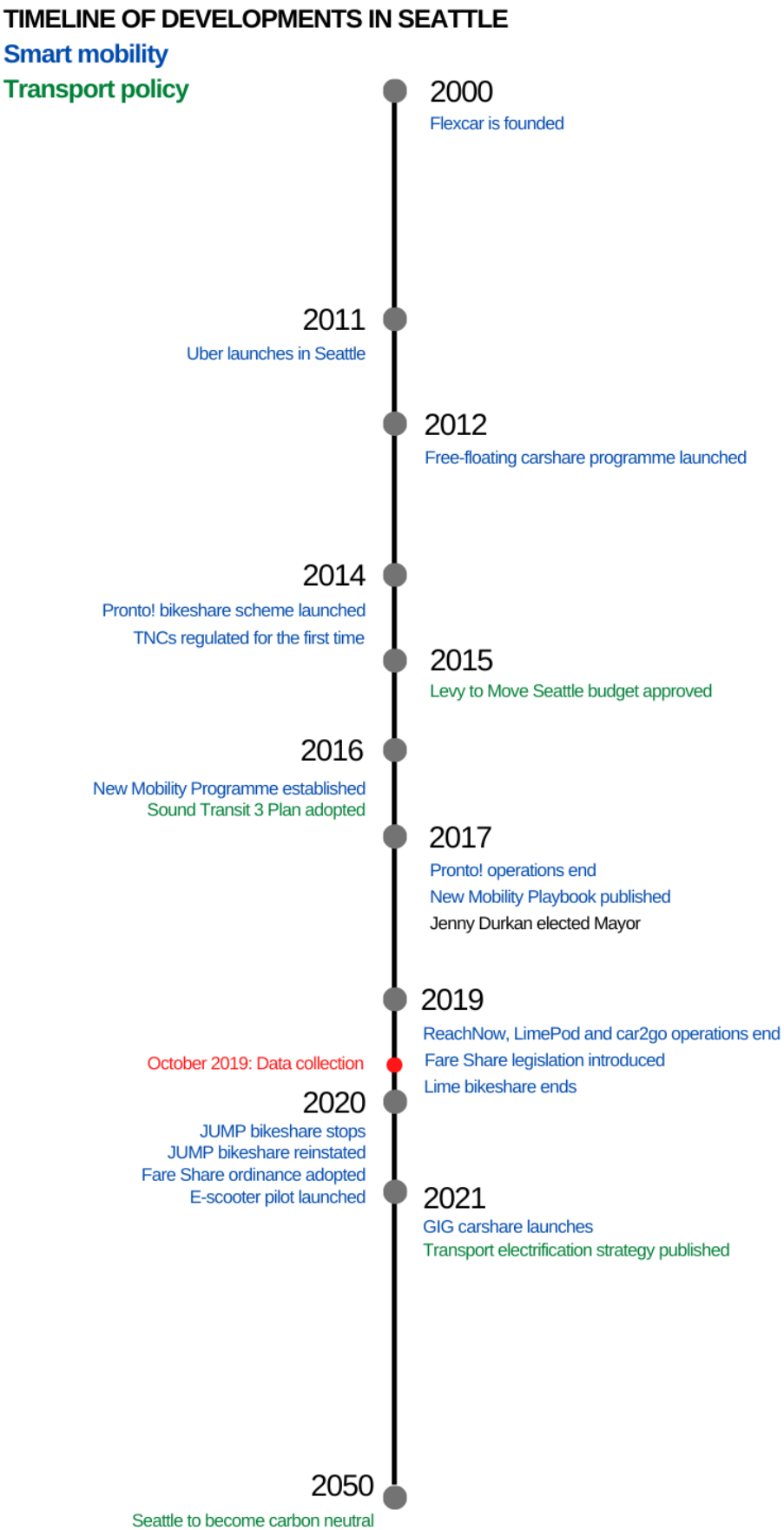


Figure 4 Timeline of developments referenced in the Seattle case study. Designed by the author.

4.2. Smart mobility in Seattle

Section 4.2.1 provides an overview of how services were introduced by the City of Seattle and KCM. Section 4.2.2 provides a detailed account of the policy context for each service.

4.2.1. Development of smart mobility services

In Seattle, smart mobility services have been introduced in a range of ways, but in most cases the city was an early adopter. The interviewees from SDOT attributed this to demographic and socioeconomic conditions in the city that involve a young population, fast real estate development and a long tradition of supporting technological innovation, with companies such as Amazon and Microsoft founded and headquartered in Seattle. This makes Seattle a place where operators 'want to be in' (Se3a), and, according to the participant from Seattle's Department of Finance and Administrative Services (DFAS), creates an expectation for Seattle to be on the cutting edge and adopt anything 'new and sexy' (Se7) in the smart mobility space.

4.2.1.1. Actions led by the City of Seattle

The carsharing company Flexcar was founded in 2000 in Seattle through a public-private partnership with KCM, who actively promoted its integration with public transport (Brewster, 2007). In the years that followed, SDOT expanded their carsharing permit programme, and more carsharing companies launched in Seattle, maintaining large fleets and a variety of offer until 2019. In the mid-2010s Seattle was one of the biggest carsharing markets in North America, alongside other cities in the Pacific Northwest, such as Portland, and Vancouver in Canada (Durning, 2016; Fesler, 2016). Initially, cars had to be picked up and dropped off at the same dedicated off-street location, but Seattle gradually facilitated on-street parking for carsharing fleets. In 2012, SDOT launched its free-floating carshare programme to further support carsharing companies that operated this model (SDOT, 2017). However, in 2019, following the merger of the mobility arms of BMW and Daimler[6] and their subsequent exit from North American markets, two of Seattle's carsharing companies, ReachNow and car2go ended their operations in the space of five months. During the same period, the city's third free-floating carsharing service, LimePod, also exited the Seattle market, leaving the city with no free-floating carsharing service for the first time since they were allowed to operate

[6] Car2go and ReachNOW were respectively Daimler's and BMW's carsharing services. car2go and DriveNow merged to form a new company called ShareNow in 2018.

(Nickelsburg, 2019a; Nickelsburg, 2019b). After approximately six months, a new free-floating carshare operator, GIG, launched in the city and was still active at the time of writing (Soper, 2020).

In the 2010s, in line with global trends, ridesharing and micromobility also took off in Seattle. During this time, the participants from SDOT pointed out that Seattle was not necessarily the place where providers chose to launch their services first. They argued that Seattle got a refined set of services compared to cities in California, where multiple smart mobility providers tested services 'in their back yard' (Se3b). In their typical approach, Uber launched in Seattle in 2011 without any opposition or support from the city, and it was not until 2014 that the city voted to legalise the operations of TNCs (Uber, 2016). Since then, a number of TNC operators have launched in the city, including Uber's main competitor, Lyft. As explained in more detail below, TNCs are managed jointly by Seattle's DFAS and KC, and over the years created multiple legal and political challenges around issues such as workers' rights, data sharing, and inspections.

Finally, in 2014, the city launched its own docked bikeshare scheme, Pronto!, through a sponsorship model (Fucoloro, 2014). The programme had low ridership levels and following an array of financial and management issues, its operations ended in spring 2017 (Packer, 2017). In summer 2017, SDOT launched its bikesharing permit programme, which was one of the first in North America and was still in operation at the time of writing. By the end of 2018, Seattle was the only city with a dockless bikeshare system, while the industry swiftly focused on e-scooters (NACTO, 2019). Deviating from its tradition as an early adopter, SDOT's e-scooter pilot was launched in November 2020 (SDOT, 2021). Although it was initially planned for spring 2020, it was delayed due to the COVID-19 pandemic.

The above summary shows that, although most initiatives were led by private companies, SDOT has eventually controlled all services under permits and regulations, so no service can operate outside these rules. However, at the time of the interviews (October 2019), it was notable that e-scooter services were not yet available in the city, despite being widely adopted across the United States and even in neighbouring local authorities such as Tacoma (Eldridge, 2019). While SDOT were developing their pilot scheme specification, there was technically no reason to stop providers from launching an e-scooter service in the city. The participants from SDOT suggested that the delayed adoption is partly related to the steer from Mayor Durkan, who chose to take a more careful approach and learn from other cities before introducing a pilot in Seattle (Durkan, 2019). The participants argued that a 'rogue launch' would never happen in Seattle, as providers know that SDOT would have removed e-scooters instantly. They added that, especially in the recent years, providers have started to recognise that a collaborative and positive relationship with cities is necessary for their success, but also make

calculated decisions about where local regulatory approaches create favourable conditions for launch. At the same time, the participants from SDOT noted a wider shift across the US, with smaller cities learning from bigger ones and also introducing regulations. Especially in the case of micromobility, early examples of non-collaborative launches by providers were dealt with relatively quickly, so at the time of the interviews most cities had pilot programmes and operator licenses.

I think there's a red state- blue state phenomenon where a lot of the companies will go after a market with a small jurisdiction where there's not a lot of resources to come after them or even write a strict permit. They're going to go to areas where it's more conservative, republican, free market wins and they like to test. […] I do think they are making political calculations about where they can get away with stuff. Seattle is definitely a highly regulated environment – like the west coast before Arizona. Everything north of that has a lot of rules and we're strict about it. (Se3a)

Finally, at the time of writing, there had been no attempts to test or adopt any MaaS initiatives in Seattle. The participants from both SDOT and KCM suggested that public agencies may not necessarily take the leading part in delivering MaaS in the future, although they were both still developing their understanding of the MaaS market and how they can support and steer a MaaS ecosystem. The SDOT participants described the introduction of MaaS as a way to better communicate with technology providers and exchange and integrate data in order to delivery policy objectives. SDOT considered that their own data was not yet ready to be made available through a MaaS ecosystem, and they were working on overcoming this challenge. In addition, they were considering which policy levers, such as the General Bikeshare Feed Specification, they could use to steer a local MaaS ecosystem, even if a platform was not provided by the city itself. However, participants from SDOT believed that they lacked the clear political mandate to require openness of data, information, and payments from providers, and therefore promote the adoption of MaaS.

Similarly to SDOT, KCM saw MaaS 'beyond the app' as a 'framework of integration' (Se2) to deliver a range of transport services in the area, including public transport. However, KCM are a transit agency and their broader perspective differed from SDOT's, as they could see themselves becoming a MaaS provider in the future. The participant from KCM argued they considered themselves a mobility agency, not just a public transport one, and they were trying to understand how their role may evolve in the future. The participant from KCM explained that there is a need for a diversified offer that complements the public transport network, not just for the first and last mile, but also to cater for hours of the day and types of trips that public transport does not serve traditionally. While this integrated offer will need to ensure improved mobility options for all citizens, it does not necessarily need to be provided in its entirety by

KCM. They suggested that while public transport needs to continue growing as the 'spine' of the network, new services should complement it in a way that serves a shared vision. Yet how this can happen remains uncertain. The participant from KCM suggested that regardless of who is the MaaS provider in the future, it is key to develop strong collaborations with the private sector and local communities in order to deliver services that meet local needs, and not just focus on the technological aspect of a MaaS ecosystem.

I think what we are trying to do is orchestrate a new transportation system where all these shared concepts start to facilitate an improvement of access for everyone in ways that we have not seen before (Se2).

Finally, smart mobility is linked to Seattle's smart city agenda. Seattle's smart city coordinator, a role focusing on connecting technological expertise and city agencies, worked with SDOT on traffic management initiatives, and on the development of the Fare Share Plan, which mandated a minimum wage, provided critical worker protections for TNC drivers, and imposed new charges for TNC rides that will be reinvested in public transport (see further detail below). In addition, the city's Innovation Advisory Council, a public-private partnership that connects city agencies with representatives of large technology corporations around Washington State, is specifically focused on homelessness and mobility issues. While neither of these initiatives played a fundamental role in shaping smart mobility in Seattle, they are evidence that new mobility technologies are not simply seen as a niche solution, but that they are being integrated in policymaking and steered to address the city's issues.

4.2.1.2. Actions led by KCM

KCM have also run several small-scale pilots with smart mobility providers. As an agency with a tradition of innovative approaches to shared mobility, such as its Metro Vanpool programme that offers vans to groups of over 5 people to commute together, KCM ran the pilots to understand how smart mobility services interact with and impact public transport (King County, 2022e). Their goal was to also collect their own data to shape their future actions, as they found it difficult to access data directly from providers. The pilots were a mix of KCM's own ideas and opportunities presented to the agency by external partners. The participant from KCM stated that it was the former that produced the most valuable lessons and results that were easier to trace.

At the time of the interview, KCM were nearing the end of a first phase of pilots that were developed through procurement processes and were all broadly aimed at complementing public transport services and addressing specific challenges and gaps in provision. There were three first-last mile pilots that each connected specific residential areas to local public

transport nodes in order to address specific challenges. The first service offered a connection to a transit Park and Ride (PnR) that was reaching its capacity; the second to two high-capacity public transport services during a period of large roadworks in downtown Seattle; and the third was a feeder service to five light rail stations. KCM also created special permits that expanded existing rules about the role of public transport in Washington State. The first was aimed at supporting carsharing and allowed free-floating carsharing companies to park in transit PnRs (when these facilities were previously limited to public transport users), and the second allowed shuttle service provision to multiple employment sites with the intention to attract private providers (when previously only individual employers could run shuttle services). Finally, KCM partnered with carpooling services (i.e. services that match people who want to carpool via a mobile application or website) and offered a limited time subsidy for riders and higher reimbursement for drivers (King County, 2022b; King County Metro, 2017).

4.2.2. Smart mobility policy

This section details the wider policy context in which smart mobility services are set in Seattle.

4.2.2.1. New Mobility Programme

SDOT's smart mobility initiatives are carried out under the New Mobility Programme, which was established in 2016. As part of the Programme, SDOT manages and monitors the city's bikeshare and e-scooter share pilots, issues permits for those and for the carsharing programme, runs targeted initiatives with TNCs (such as a dedicated pick up zone pilot in busy nightlife areas), and provides input and steer in the city's regulation of TNCs. All permits are issued through a competitive tender or application process and are accompanied by detailed standards and requirements. For example, in the case of bikesharing, providers must apply to get a permit, pay operating fees depending on the size of their fleet, and meet requirements related to safety, parking, operating hours and areas, data sharing, and equity. Equity requirements include the provision of non-digital booking and payment, and for mandatory minimum coverage of 'equity focus' areas (SDOT, 2022b). The bikeshare programme also includes an independent audit plan. In the case of carsharing, companies have to apply for a permit (costs differ if the permit includes on-street parking) and they pay a per-trip operating fee (fees differ for internal combustion engine and electric vehicles). Carshare companies used to be allowed a maximum number of cars, which they could only reach if they demonstrated that they served the entire city. This requirement was in place in 2019 (Moscholidou and Pangbourne, 2020) but had been lifted at the time of writing. In addition, the carsharing providers must comply with data sharing standards and cooperate with SDOT in

their initiatives. All permits last for a year, so providers must apply annually to maintain the right to operate in Seattle. For further details on SDOT's permits, see Moscholidou and Pangbourne (2020).

In addition, in 2017, SDOT published the New Mobility Playbook, a document that includes "a set of plays, policies, and strategies that will position Seattle to foster new mobility options while prioritising safety, equity, affordability, and sustainability" (SDOT, 2017, p.6). Spearheaded by the Director of SDOT under the administration before Durkan, the Playbook was one of the first such attempts in the United States. According to the ex-SDOT interviewee, the Playbook was not a policy but served as a proactive risk management tool, which would provide a strong base for the city when advocating for policy positions locally, regionally, state-wide and nationally. The development of the programme was made possible through the readily available funding from the carshare permits, which pre-existed the creation of the New Mobility Programme, and later from the micromobility permits. However, this meant that funding was precarious as it depended on whether smart mobility operators would choose to renew their permits every year, whether they would maintain the same scale of operations, and more broadly on market developments.

The Playbook was intended to be a dynamic document that would be updated every 6 months. Following the 2017 Mayoral elections[7] and the election of Jenny Durkan, the SDOT director was replaced, most of the then New Mobility Programme team left SDOT, and new members were appointed. The Durkan administration brought a shift in focus. The New Mobility Playbook, which included a Preliminary Automated Mobility Policy Framework, remained a reference policy document for the city, but, at the time of writing, it had not been updated since its initial publication. Both the interviewee from the previous SDOT administration and the interviewees from SDOT confirmed that the position of the city towards AVs had changed. The interviewees from SDOT suggested that previously outlined 'heaven or hell' scenarios that called for the city to shape AV rules in order to avoid chaos, had become less prevalent as the rollout of highly autonomous vehicles was much slower than it was previously believed, likely due to reduced VC funding. Although SDOT still participated in policy conversations at the state level and tried to influence policy to represent Seattle's priorities, they had shifted their focus to micromobility.

Waymo's CEO used to say they [AVs] would be here next year and then a few more years, but now at SXSW said probably 2030 and others are saying it might even be further than that. The focus on AVs might have adjusted in the last few years and now we're focusing more getting micromobility right. (Se3b)

[7] The next Mayoral election took place in November 2021.

Over time, it appears that the New Mobility Programme became increasingly embedded within SDOT. The interviewee from the previous SDOT administration acknowledged that the programme was initially siloed and had limited expert input from other teams. The mobility solutions team that ran the New Mobility Programme at the time of the interviews was part of SDOT's transit and mobility division, and its members were focusing on different aspects of smart mobility, such as micromobility, data and equity, and electric and automated mobility (SDOT, 2022d). The member of the policy and planning group that was interviewed suggested they were adopting an integrated approach to transport strategy development that involved working closely with the mobility solutions team.

We've only begun to think about emerging mobility in those broader plans. We're now embarking on an integrated multimodal plan where I'll be the one pushing for more integration of emerging mobility, electrification… all things that I think that we have not focused on in previous planning efforts – in general transportation for the 21st century. Previously it was cars, buses, bikes, walking etc. but there is a new suite of things that we have to think of to integrate in our long-term transportation planning. (Se3b)

4.2.2.2. TNC regulation

The regulation of TNCs has been challenging and complicated, and reflects the disruptive character of smart mobility services across multiple public policy areas. The participants from SDOT explained that while in the case of micromobility there had been a swift shift towards pilot-based regulations once the issues with unregulated models became clear, the introduction of regulations for TNCs had been far slower, revealing the complexities introduced by the 'human factor' of drivers and consumers involved in TNC transactions. The City of Seattle first regulated TNCs in 2014 by passing a series of local ordinances that introduced rules for TNC providers, vehicles, and drivers, which are described in more detail below. Around the same time, KC also created a new role that would oversee the implementation of the regulation. KC and the City of Seattle work in close collaboration, with KC focusing on the driver part of regulation and City of Seattle focusing on the vehicle aspects. This division of responsibilities was historical, as it also applies to the taxi and for hire licensing and regulation. However, as the participants explained, collaboration between the two sides became much stronger and strategic following the advent of TNCs. At the time the interviews, there were 7 TNCs operating in KC and Seattle, and both authorities were engaging in weekly conversations with other companies that were interested in entering the local market. It is noted that KC also have an interlocal agreement with 16 other KC cities, representing 92% of the county's population. As part of this agreement, the participating cities adopt the KC Code

in substantially similar form or by reference, and KC provides TNC licensing services on their behalf, using the partnership with the City of Seattle for vehicle licensing (Calder et al., 2019).

State-wide action

Aside from the licensing of TNCs operators, drivers and vehicles, the City of Seattle and KC partnered and jointly pursued the introduction of TNC regulations, which involved extensive legal challenges with providers. It is noted that, although local and regional authorities are usually responsible for the taxi functions within their remit, in many states across the US, TNCs (particularly Uber and Lyft) have heavily lobbied state governments and managed to pre-empt local regulation by promoting state-wide legislation. By January 2019, 49 US states and Washington, D.C., had passed at least one piece of legislation regulating some aspect of TNCs. The state of Washington was one of four states that passed legislation that regulates insurance only, and therefore its cities were not prohibited from passing local TNC ordinances (Calder et al., 2019). Across the country, pre-emptive action had left many local governments unable to manage TNCs despite their rapid growth and their dominance over the local taxi markets. For example, between 2014 and 2016 in Texas, 20 cities approved regulations regarding TNCs to address issues such as operating permits and fees, background check requirements, operational standards, and protections for passengers. These regulations were nullified by the state-level regulations introduced in May 2017 (Moran et al., 2017). It is noted, however, that progressive action by cities and states also sets a precedent for other places in the country, as is shown below in the case of introducing a minimum wage in Seattle.

Seattle City Council and KC introduced local regulations to prevent pre-empting, although by the time of the interviews, TNCs had already made two failed attempts to promote state-wide legislation, which KC and Seattle had to fight off (O'Connor-Kriss et al., 2017). Nevertheless, KC and the City of Seattle saw a benefit in setting state-wide standards covering areas such as background checks, training requirements, and insurance. The two authorities led a multistakeholder engagement process aiming to agree on state-wide regulation across jurisdictions and with the TNCs themselves. The purpose of this process was to negotiate a structured bill that worked for all stakeholders across the state. Although rigorous and time-consuming, the engagement process was inconclusive. As such, during the 2018 legislative session in Washington, two competing alternatives for state-wide regulation of TNCs were proposed by the two sides, neither of which advanced despite significant efforts to identify a middle ground on a number of contentious issues.

These contentious issues reveal the tension between public policy priorities and commercially sensitive areas for TNCs. It is key to stress that through their bills, TNCs were actively advocating for existing powers that KC and City of Seattle already held to be removed or

scaled back, such as their ability to enforce the rules, remove the privilege of driving and impose fines in case TNCs were not taking appropriate action against the drivers who were engaging in illegal practices. An issue among those that surfaced was driver certification. TNCs were advocating for self-regulation and strongly opposed the creation or preservation of arrangements that would allow local authorities to hold them accountable. The bills proposed by TNCs placed responsibility for certifying driver and vehicle compliance with regulations on themselves and pre-empted existing regulations by cities and counties. The bills backed by KC and the City of Seattle directed the state Department of Licensing to regulate individual TNC drivers, maintaining the regulatory authority of Seattle and KC. According to the participant from KC, their ability to see all driver background checks ensures consumer protection and public safety, which could not always be provided through self-certification.

The participant from KC argued that their bill would give or preserve powers for smaller authorities outside KC and mainly in east Washington State to deal with any potential issues they faced in the future. Although issues with TNCs were concentrated KC and the City of Seattle, the participant from KC suggested theirs was a precautionary tale of what may ensue in other parts of the state. However, the engagement process also revealed pre-existing tensions between authorities within the state. Some of the challenges that KC and Seattle were facing were not materially impacting smaller cities in the state, due to the small scale or complete lack of taxi or TNCs operations within their remits. As such, smaller local authorities opposed state-wide legislation that gave them more powers. To this fed historical tensions between the Seattle area and the rest of Washington State, and it was perceived as a shift of state responsibility to the local jurisdictions to satisfy the interests of KC and Seattle.

Crucially, the efforts to find a middle ground clearly show that aligning TNCs with transport planning objectives is only one of the many areas of disagreement, and it is often not at the top of the agenda. For example, the participant from KC explained that as part of the negotiations with TNCs, there was disagreement over data sharing, but KC and Seattle were ready to drop the requirement on data that would facilitate transport planning and policy, which was being requested by SDOT, as long as they could still get access to data that facilitated control over regulatory compliance.

Actions by KC

In KC and Seattle, TNCs challenged local perceptions about the role of taxis as part of the transport system, became hugely popular with users and drivers, and fuelled political debate. However, the discussions with participants from KC and Seattle's DFAS showed that their role remained largely regulatory and, in a way, facilitated TNC growth, notwithstanding the

implications for transport policy. The participant from KC explained how they overhauled their licensing system to process an unprecedented number of driver applications (87,000 driver applications in a year, with a processing period of fewer than 10 days each). They added that this process helped the relationship between TNCs and the local authorities, as quick processing facilitated the rapid growth of TNCs in the area.

However, TNCs captured a large share of the pre-existing taxi and for hire market (King County, 2022d)[8]. As a result, KC started focusing on the reform of the taxi and for hire industries to even the playing field across different operators and allow new flexibility to incumbent actors. The interviewee from KC suggested the introduction of new rules to facilitate TNC operations, such as efficient licensing, was becoming a barrier to the competitiveness of taxis and for hires. At the time of the interviews, the participant from KC had recently shifted to a full-time role focusing on advocating change for the taxi and for hire industries. This includes regulatory changes, such as flexibility in how the rates are set so that they can offer more competitive pricing, and a broader advocacy element aimed at creating more opportunities for the taxi and for hire industries. The role also involved advising taxis and for hires on how to diversify and improve their offer, modernise their systems, and capture parts of the market that TNCs had not yet fully captured, such as contracted services for corporate travel or non-emergency medical transport.

[w]here are taxis in terms of the market – I would say somewhere in the neighbourhood of 7.5 million before I came in with limited data, and it's somewhere between 4.5 to 5 million trips now. And if you think about it, this decline happened while the number of trips from TNCs has gone from essentially zero prior to 2012, and during the first year under regulation up to 8 million – so immediately in the first full year they eclipsed the number of trips in the incumbent industry […]. And then a continued growth trajectory that is huge – last year in KC including Seattle – 33 million trips were provided by TNCs with almost 40,000 vehicles and 33,000 drivers versus the taxis with just under 1,600 vehicles and a couple thousand drivers. I hope to change the regulation so that taxis have a little more say in how they operate and get that trajectory moving up not down. (Se6)

Actions by the City of Seattle

TNCs were first introduced in Seattle in 2011 and in the years that followed the City Council dedicated significant resources towards their regulation. Between March 2013 and July 2014, Seattle City Council considered how to legalise TNCs. The first ordinance that legalised TNCs was passed in February 2014 and, among other rules, it mandated a cap of 150 drivers at any

[8] Taxicabs can be hailed from the street or dispatched from a phone call. Fares are calculated based on time and distance, measured by a taximeter. For hire vehicles charge a fixed fare per trip, based on pick up and drop off zip codes in a published rate book. For hire services are unique to Seattle.

one time for each TNC. Although the ordinance was passed unanimously by the Council, it was strongly opposed by TNCs. By April 2014, TNCs (namely Uber, Lyft and Sidecar) had given more than $600,000 to a coalition group that collected enough petition signatures from citizens to suspend the ordinance and put it up for public vote in a referendum that would be posed as part of the local elections that year (Soper, 2014a). To do this, TNCs used a provision made in Seattle's city charter, which stipulates that a referendum relating to an ordinance passed by the Mayor and City Council may be invoked by a petition signed by at least 8% of the total number of votes cast for the office of Mayor at the last preceding municipal election (City of Seattle, 2021a). At that point, Seattle's mayor intervened and brought together a multistakeholder group to work on a new regulatory approach (Soper, 2014b). This group included TNCs and representatives of the taxi and for hire industries, and, after nearly two months of discussions, reached an agreement in June 2014. The new agreement removed the vehicle cap for TNCs, and introduced licensing and insurance requirements for them and their drivers. In addition, the city agreed to provide 200 new taxi licences over the following 4 years, and provided hailing rights to for hire drivers. For both taxis and for hires the city transitioned to a system similar to medallions offered in other cities, thus offering a property right to owners. Finally, the city created an accessibility fund through a $0.10 per ride surcharge for drivers and owners to offset higher trip and vehicle costs for riders who require accessible vehicles. Consequently, the new proposal was accepted by the Council and therefore the referendum initiative was withdrawn. The participant from KC described this process and how TNCs were the main beneficiaries of the new arrangements, while taxis and for-hires secured rights that would be proven to be of little value in the following years.

So the city was forced to the table. Unfortunately, it was just the Mayor's office that went to the table. The County was not part of that group, even our counterparts in the regulatory side of the city (i.e. DFAS) were not part of that group. And so you really didn't have a good representation from a regulatory standpoint of the changes that would be made. Who was at that table? A few reps from the taxi and for hire side, and Uber and Lyft. […] On the taxi and for hire side the taxis negotiated the implementation of a medallion system – before that there was a licence-based system and what that gave them was a tangible property that they could then get a loan on […]. The reality is because of the value of -whether you look at it as a license or a medallion- the values are declining in some cases very rapidly to the point that you're not going to get a commercial loan anyway – who is going to loan you money on something that its value is doing this (shows downwards). [..] I think they were cut a little bit flat footed in not knowing – nobody really knew – what was going to happen and the magnitude of the change and the impact. (Se6)

The focus of this first phase of regulation was licensing and insurance for TNCs, but did not address issues around driver rights and compensation. The participants from KC and DFAS explained that unions, and the city's and county's long-standing pro-union stance, played a major role in promoting driver compensation regulation. In December 2015, Seattle City Council unanimously passed another ordinance creating a collective bargaining system for drivers who were classified as 'independent contractors', including both app-based and traditional taxi drivers. The ordinance outlined a set of issues that were eligible for collective bargaining on behalf of drivers, and a process for selecting organisations authorised to represent drivers. The drivers who lobbied for the ordinance to be introduced were supported by Teamsters Local 117 (the Teamsters branch in Washington State), which already had experience supporting collective action by drivers classified as independent contractors (Garden, 2017).

However, previous experience in regulating TNCs, and their increasing popularity with drivers and riders, had already made TNC regulation a political 'hot potato'. This may have contributed to the Mayor's refusal to sign the ordinance, which was nonetheless allowed to go ahead without his endorsement. In the months following its adoption, the ordinance was faced with opposition from TNCs but also with difficulties in the rulemaking process. As the participant from DFAS explained, their role was to translate the ordinance into detailed rules, namely to identity who were the 'qualifying drivers' who would be eligible to vote for union representation. TNCs wanted all drivers, regardless of the number of hours they were working, to be eligible for a vote, whereas unions wanted only full-time drivers to have this right. Full-time and part-time drivers generally have different priorities, with the former focusing on stability and eventually acquiring an employee status, and the latter focusing on flexibility (although the participant from DFAS stated that, anecdotally, TNCs pressured part-time drivers to work more hours) (Garden, 2017). During the rulemaking process, TNCs launched a 'no union' campaign that included adverts and calls to drivers encouraging them to oppose the union drive, and, through separate channels, submit comments to DFAS suggesting that every driver should have the right to vote.

The rulemaking process also revealed tensions between the Mayor and the Council, with DFAS initially resisting to make decision on who is a 'qualifying driver'. Eventually, in May 2017, DFAS proposed a compromise position on the definition. Once the rulemaking process was finalised, Teamsters 117 applied and became the only qualified body to represent drivers, but the ordinance never took effect due to legal challenges. There were two lawsuits filed against the ordinance in federal court, and a third in state court, which meant that the ordinance was held up at different stages by different courts. Each case was dismissed at the

trial court level, but the plaintiffs in both federal cases appealed to the Court of Appeals for the Ninth Circuit (the Court of Appeals that covers Washington State) (Garden, 2017).

While the legal challenges were still ongoing, two key actions indicated a shift in the city's strategy. Firstly, in January 2019 the Council amended the collective bargaining ordinance to remove driver compensation as a topic from its scope. Secondly, Mayor Durkan introduced her Fare Share legislation package in October 2019 focusing on driver compensation and rights. As such, the city took ownership of setting a minimum wage for drivers, rather than leaving it to unions to bargain for it. Following the example of New York City, which is one of the most progressive authorities in terms of TNC regulation in the United States, the plan included a set of bills that established a minimum wage for TNC drivers and increased taxes for TNCs. The plan also included a resolution setting out that revenues from the tax increase will be spent on key public transport infrastructure and transit-oriented development of affordable housing, as well as on the creation of a new Driver Resolution Centre to support drivers in resolving claims of unwarranted "deactivation" by Uber and Lyft, and the establishment of an appeals process to a neutral, impartial arbitrator (Seattle City Council Insight, 2019). In April, TNCs and the City jointly agreed to end all legal challenges on the case of collective bargaining, and TNCs stated that they will not challenge the Fare Share plan (Seattle City Council Insight, 2020c). Although TNCs still claimed that the city was imposing a tax on users and tried to mobilise their user base against it, the final bill of the Fare Share plan, which set out the minimum wage, was adopted in the form of an ordinance in September 2020 (Seattle City Council Insight, 2020b).

The rulemaking process for setting the minimum wage was marked by the different priorities between full-time and part-time drivers, and showed that the Council's decision could inevitably favour only one of the two. In the case of New York City, the local rules have clearly sided with full-time drivers by setting the minimum wage as a reverse function of a TNC's utilisation rate, which is the average percentage of the time a driver is logged in a TNC app that is spent in driving passengers from the pick-up the drop-off point (while previously TNCs paid drivers only for the time they spent driving passengers). Therefore, the minimum wage becomes higher as the utilisation rate becomes lower. This definition of minimum wage was aimed at minimising cruising and therefore congestion caused by TNCs, as it encourages them to increase their utilisation rate (Seattle City Council Insight, 2019). Eventually, this led Uber and Lyft in New York City to cap the number of drivers able to access the app at times and areas of low demand, and therefore limiting opportunities for part-time drivers who usually do not operate on a schedule (Bellon, 2019). However, Seattle's minimum wage definition does not have a similar potential to reduce congestion and favour full-time drivers, as, in a

last-minute change, the Council decided to fix the average utilisation rate used in their definition for three years, which means that it will not be affected dynamically by demand (Seattle City Council Insight, 2020b).

The deprioritisation of transport objectives reflects the DFAS participant's statement that TNC policies were "*not built with traffic impacts in mind*" (Se7). Reflecting the developments at the State level, the participant from DFAS explained that, although collaboration with SDOT had become stronger since efforts to regulate TNCs began, transport priorities were difficult to meet or had to be compromised, while there was a stronger focus on securing consumer protection and public safety requirements. It is noted that the scepticism about TNCs that was expressed by SDOT employees was not as prevalent with the TNC regulators. For example, the participant from KC suggested that although TNCs can cause traffic problems in specific contexts, and they are not necessarily used for sharing rides, they do objectively fill a gap in the market. In their view, TNCs were a flexible and, for the moment, affordable transport option that could be improved in the future, especially if it is paired with zero carbon and autonomous vehicles. They also added that TNCs allow people to live car-light lifestyles, and have co-benefits such as reducing drink driving. However, the same participant advocated the pursuit of public policy objectives through cooperation with TNCs and, where necessary, regulation. These objectives were centred on increasing rather than reducing mobility. They specifically focused on mandating that TNCs offer accessible vehicles and serve traditionally underserved communities, and for rules to be in place to address instances of discrimination, such reported issues of TNCs drivers refusing rides to passengers based on race (Ge et al., 2020).

I would argue we need to continue to be flexible in our regulations, to support innovation, to steer the public interest as much as we can in the direction that benefits the public broadly – but also does not become a hindrance to innovation and allows everyone to operate in a way that allows them to be competitive. (Se6)

4.2.3. Interaction with smart mobility providers

The introduction of smart mobility services in Seattle and the development of policies to steer them provide an insight into two distinct types of interaction between the local authorities and providers: the regulation/ permit model followed by the city of Seattle and King County to regulate TNCs, micromobility and carsharing; and the procurement model followed by KCM to develop their pilots. The analysis below highlights the lessons learned from the two models and the different principles that guide the actions of providers and local authorities.

4.2.3.1. Lessons learned from the permit model

The interviewees from SDOT pointed out the lack of local authority leverage in the permit model, under which providers are paying the city to participate in the pilots or get a permit. As such, these smart mobility services incur no direct cost to the city. This means when providers choose to leave, there is nothing that the city can do to stop them, and when providers are not performing according to the permit, the city does not have nuanced tools to steer them but can only ask them to leave. As one of the SDOT participants stated, ultimately, the public lose anyway, either because the city cannot regulate providers properly or because providers leave, and the public have no access to the service. The ex-SDOT employee referred to this situation as an 'exploitation of austerity urbanism' (Se4) with smart mobility companies claiming to offer free solutions to underfunded local authorities, while it is impossible for them to make a profit and deliver public value at the same time.

Another conflict is the question whether private mobility services are actually able to provide public transit. In a permit model where you are looking to quickly test the service and understand whether it is something that provides value to the public, what I have learned in the last 3 years is that you cannot provide a true public service under that type of regime. It is just not possible. What you can do is to franchise a service from one or two companies and you set a very clear service level agreement covering the expectation on service, operation, data sharing, equity etc. and if they meet those expectations then you should reward them – give a subsidy – it's impossible to expect a company to operate perfectly to the letter of policy and think that they are going to make a profit. It is funny how there is that disconnect. Transportation service is expensive, and cities need to start to understand that. (Se4)

Although this is not Seattle's official position, participants from SDOT suggested that cities could only steer services effectively if they procured them through competitive processes similar to those adopted for KCM's pilots. This would mean that cities carry the operational risk, but also ensure that services are integrated with the city's transport system. This is not an unfamiliar model to many cities that are running docked bikeshare projects, such as London, but participants in Seattle pointed out that both the market and the city will need to go through many changes before they adopt it. Firstly, they highlighted the need for more flexibility in procurement models so that cities can quickly adapt to market changes. They added that the current model sets a precedent, which will be difficult to overturn and make the case for subsiding or providing financial incentives to services that were previously offered at no cost to the local authorities. Cities will need to identify the added value of these services so that they can make a case for public funds to be spent on them, which, as explained below, requires data and evidence that providers are not always willing to share.

Some large smart mobility players are already venturing into contracted services, such Lyft's acquisition of Motivate, the bikesharing company that operates Citi Bike in New York City, and Ford's GoBike program in San Francisco (O'Kane, 2018). However, a shift towards a public procurement model would mean that global smart mobility providers will be called to meet the hyperlocalised needs of cities, which conflicts with their one-size-fits-all approach and possibly limits their paths to profitability. The participants from SDOT were able to clearly describe what the global reach of smart mobility providers means for cities:

For example, there are two competitors in our bike market right now – the green and the red bikes (Lime and Jump). In theory, these two are competing against each other in the Seattle market. But they are not. They are competing in a global market and it's naïve to think that putting these two against each other here means anything to them. They are looking at their balance sheets at their entire global business. So that's where cities have been naïve. We're letting them play out, we don't have political cover to do anything but that, but the market is playing out in such a massively decentralised way that we can't even track it. Uber is making decisions about Jump based on what is happening on their TNC operations. How is my programme supposed to understand that? It can't. (Se3a)

The international character of smart mobility services means that their success is also judged at the global level. The volatility that results from this was manifested twice in the recent years in Seattle. Besides the withdrawal of all free-floating carshare operators from the city that was described earlier in this chapter, at the end of 2019, Lime stopped its bikeshare service in Seattle. That left the city only with one bikeshare operator, Jump, a company owned by Uber. In mid-2020, Uber made a significant investment in Lime as part of which Lime took on Uber's JUMP bikeshare service. Lime immediately pulled the JUMP bikes from service and scrapped them, leaving the city without a bikeshare operator for a few months. Such shifts do not necessarily reflect the services' performance in a particular city, but global flows of capital and revenue. However, at the local level, they are affecting both citizens who relied on services and, in the case of Seattle, revenue resources for SDOT from their permit system, and efforts by KCM to facilitate access to public transport (Nickelsburg, 2020a; Trumm, 2020a; Hawkins, 2020).

4.2.3.2. Lessons learned from the procurement of services

The lessons learned from the KCM's pilots also reflect the global character of smart mobility providers. For context, the participant from KCM explained that when they started working on the pilots, the main market players were TNCs, who were usually partnering with small cities and transit agencies that were losing ridership to replace bus routes. In these partnerships,

TNCs seemed to be dictating the rules. However, bus patronage in KC was increasing, and KCM were seeking not to replace, but to complement their public transport offer by working with TNCs. As such, KCM were in a position of strength to steer the market, rather than accept anything TNCs offer. The points of contention that emerged from the processes of negotiation between KCM and TNCs, lay bare the conflicting principles between public and private actors in the provision of mobility. For example, for KCM, efforts to work with TNCs stalled twice due to lack of agreement over data sharing and providing wheelchair accessible services. This led KCM to start working with providers that had a different business model and priorities than large TNCs.

[…] we also got a grant from the Federal Transit Administration as part of their grant programme for transit agencies to 'play' in this space, it's called mobility on demand sandbox programme. We applied with the rail agency here, Sound Transit, and we proposed a project across two regions – it was Seattle and Los Angeles. The idea we proposed was to use Lyft specifically to serve as a first-last mile provider. We were awarded the grant and – to tell you the same story – we worked with Lyft for about 6-7 months or even more, and these issues about data and data sharing, accessible vehicle provision, how you do it… there was also a big gulf between us where their interests did not align with the type of pilot that we wanted to implement. We ended up going separate ways – that is the project we eventually implemented with Via, which is the one that runs in those five different light rail stations. (Se2)

KCM's pilots show that operators themselves are a key player in the governance of smart mobility, and that their business models and funding mechanisms affect the extent to which they can be steered and regulated at the local and regional level. Providers have their own agendas and, in some cases, are backed by larger organisations, such as motor companies, whose priorities introduce further conflicts with local authorities. The participant from KCM described the challenges of developing legal agreements for their local first-last mile pilots, which reflect the tension between public agencies and private companies.

To give you a small example, we're trying to use the University of Washington research subjects protocol as a tool to actually get the data from Uber so that they would be protected by the university but we would also have access to it, and Uber would feel that by giving us the data it would not be exposed to a public record request because they would be protected by those protocols. But very early on we started to realise that Uber was delaying the process even though this seemed to be a solution that we all agreed with. We started to realise that we were trying to implement that with a Microsoft solution for data warehousing and cloud services. Then you realise that Uber did not even feel comfortable with that! The game feels like 5-dimensional chess! (Se2)

The same could be said for Ford – in the beginning we thought we thought we were working with this cool start-up that was an appendix to the Ford Motor company and then we realised that when we had to write a contract it was not with this nimble start-up but with the Ford Motor company. Again, lawyers from Detroit trying to figure out what these people working from their Palo Alto office want to do and how it works. I think there are still a lot of inefficiencies in this space because of that and that's why pilots take forever to launch and that's why we needed to get going otherwise it takes years to get it on the ground, for people to use and it to learn if these things are going to work from the transport side. (Se2)

4.2.3.3. Conflicting principles between government and the private sector

Regardless of the model adopted, local and regional government agencies in Seattle tried to set the 'operational boundaries' for smart mobility services so that they best serve local objectives. As such, they put increasingly more pressure on providers to meet priorities such as better accessibility and workers' rights, while they also tried to deepen their own insight into how people use the services. As discussed in the sections above, the introduction of rules was often challenging, revealing conflicting priorities between local authorities and smart mobility providers. It is noted that participants described a gradual shift in the practices of smart mobility providers, in Seattle and across the country, who were becoming more cooperative with local authorities and dedicated resources to find common ground with cities. However, according to one of the participants who previously worked for a large micromobility company, even if their role there was to be an advocate for cities within the company, their recommendations were often disregarded as they were conflicting with business priorities.

I was in partnership role and an advocacy role at the same time, which proved to be difficult to balance. Because business and operational interests of companies like [redacted] typically win out in a policy conversation – if there is something that would objectively be good from a policy standpoint but also objectively impacts operations in a negative way, they would take the policy approach that improves the operations and the business side. (Se4)

Perhaps the clearest example of conflicting priorities between providers and cities is the balance between abundance of offer by providers, and a manageable scale of operations by the local authorities. Larger operations mean more profit for providers and more opportunities to signal that their service is available as a mobility option (for example, more e-scooters on the road, or more Uber cars). On the other hand, the higher the offer, the more issues there are for local authorities, from vetting drivers and vehicles for TNCs, to ensuring that micromobility devices do not conflict with other users on the street and footways. In addition, as already shown through the KCM trials, the business models of smart mobility providers go

beyond mobility. The participant who used to work for a large micromobility provider pointed out that companies pursue more than one line of business, and although modal shift is their main selling point, it is often not at the top of their agenda.

[n]ot every company is just trying to sell trips. They are trying to sell access and get people to put money into the wallet. […] I think there are the true believers are really good at selling what companies are providing and they conveniently forget about what is going on behind the curtains on the operations and business side, which eventually is why a lot of people leave these companies. (Se4)

The conflict between business priorities was clearly demonstrated in the same participant's description of how micromobility companies shifted from providing (e-)bikes to e-scooters. Early e-scooter operators showed prospective investors that there is potential for large profits, as in some cities companies were managing to achieve really high daily usage. Once the investors started signalling that this is an attractive product for them, this led to a large shift in the market, where in the space of approximately one year, dockless bikeshare schemes dwindled across the United States and e-scooter operations soared (NACTO, 2019). When companies like Lime, who offered both bikes and e-scooters, started making this shift, policymakers saw that "*it is less about mode shift and it is more about what is going to increase the (profit) margins" (Se4)* for operators. According to the interviewee who used to work for a large micromobility company, this had an impact on the trust and collaborations that providers were trying to build with cities, political partners, and community organisations. The same participant explained that decisions such as this, or rogue launches that were aimed at demonstrating to investors that governments do not know how to react, are representative of the nature of venture capital investment, which seeks quick wins and is very responsive to market changes.

Developments in Seattle show that the relationship between the business decisions of smart mobility providers and the political decisions of local governments can involve compromises on their conflicting priorities. For example, the case of TNC regulation discussed earlier in this chapter shows that the City of Seattle eventually chose to abandon the plans to allow collective bargaining, and find an alternative way to secure appropriate compensation. In addition, Seattle's unique position as a late adopter of e-scooters and one of the last US markets that maintains a dockless bikeshare pilot, also appears to involve a compromise. In Seattle, bikeshare providers used their pilot as leverage to secure a licence for the e-scooter trials. In a statement made shortly after bikeshare operations were reinstated in August 2020, Lime's director of strategic development stated that the bikeshare pilot does not have a long-term future in Seattle if it is operating at a loss. He explained that operating a shared bike costs two to three times more than an e-scooter due to higher maintenance and transport costs, but e-

scooters are rented about three times more often. As such, he insisted that the economics of a bikeshare scheme in Seattle can work only when they are paired with e-scooters (Nickelsburg, 2020b).

4.3. Smart mobility services and sustainable urban transport

4.3.1. The role of smart mobility services in Seattle

During the interviews, it became clear that assessing whether smart mobility services align with local sustainability objectives is far from straightforward. The participants from SDOT described the limitations to implementing their pilots and what this means for data collection and evaluation.

In an ideal world we'd launch a pilot and we'd have all the data to evaluate its success. But there is this interplay between how to create a permit that vendors are interested in, what can we ask for, and what can we collect as a city that can help us answer our questions without violating the privacy of the customers. In Washington the Public Records Act is very strong and we have to be very careful about the data that we do collect and protecting the privacy of the customers of these vendors. So with all of this in mind sometimes there are data gaps in the metrics that we want to track. (Se3c)

In an ideal world, we would create a permit that if someone operated under it then it would create benefit. And if you can't operate under it and create benefit, then you can't operate in the city. Obviously, the marketplace is more nuanced than that, especially when we don't understand the true benefit yet of what these can provide. (Se3c)

The participants from SDOT clearly stated they do not have sufficient data to understand the real impact of smart mobility services, both because of insufficient data sharing and because the right type of data is not available. The participant who used to work for a major micromobility company suggested that smart mobility providers are often opposed to sharing their data, claiming practical limitations but, in reality they are simply avoiding openness. Sharing their data carries the risk of local authorities getting a deeper insight into smart mobility operations and their negative impacts, and introducing further regulations, which would inhibit providers' ability to operate freely. At the same time, the participants from SDOT explained that when data is shared by providers, it largely focuses on usage and growth, which is often misinterpreted as a benefit for the city. However, more nuanced information that explores the interaction of services with the rest of the transport system or long-term shifts in travel behaviour is expensive to collect independently. Therefore, the city continues to largely rely

on data provided by smart mobility operators, without an in-depth understanding of the impacts of services.

Although participants identified different negative impacts of smart mobility services, such as street clutter from micromobility and TNCs worsening traffic, they were sceptical about the positive impacts, especially car trip replacement. Some of the participants suggested that smart mobility services are cannibalising transit and referred to practical limitations some services present for carrying out certain trips, such as e-scooters not being suitable for carrying any shopping bags. On balance, the participants could not say whether any potential benefits outweigh the negative impacts of smart mobility. They suggested that although this does not mean that services do not have a value, they should be evaluated further to assess their role in the wider transport system and whether they serve the city's goals. Nevertheless, if such an evaluation were to show that services are not beneficial, it would not necessarily mean that the pilots would end. They explained that having a trial creates an expectation that a service will eventually be made permanent, while the participants from SDOT and KC also referred to the difficulty of 'taking something away from the people', especially as providing more options to the public has a deeper association with freedom of choice.

[w]hat are the success metrics? Is it just trips? Is it trip replacement, which is really hard for us to figure out because we have to do surveys that are expensive. I would say nobody has really proven that internationally – that they are one to one replacing trips or are better for the environment or whatever – all we can show is that people use them. And by use we insinuate inherent good. Especially in North America, use and choice and tech and options equals good. The more of those things that we have the better our city will be. If we're being cynical, I don't know if that's true. (Se 3a)

The impact of smart mobility services was also considered in context. For example, the participants from both SDOT and KCM considered it unsurprising that TNCs took the opportunity to grow rapidly in the complete absence of access restrictions for private cars. Although they believed that TNCs are probably competing with transit, they also argued that they do offer some benefits in certain contexts. However, they are vilified because they are politically easier to tackle than private cars, which should be the 'number one enemy'. In addition, the participants from SDOT described a double standard for micromobility services, when the negative impacts of cars are taken as a given, but it is incumbent upon the authority to prove the value of micromobility services year on year.

Car deaths are part of doing business but deaths on a scooter or a bike – we can't have any of that. (Se 3b)

4.3.2. Smart mobility services in context

The above sections show that it would be an oversimplification to understand the governance of smart mobility in Seattle as a matter of local transport. Smart mobility is a large industry with powerful players who use their political leverage to steer decisions and systems in their favour. This means that cities are often under external and internal pressure to not introduce local regulation. This section 'zooms out' of the previous analysis and provides an overview of Seattle's wider context, in which local decisions take place.

Firstly, the smart mobility developments that are analysed here are happening while Seattle is experiencing the impact of the 'Amazon boom'. There is a large number of technology companies moving to Seattle, particularly from the San Francisco Bay area (Canales, 2019), which has affected policy developments in the city and funding of political candidates. Proving the city's liberal priorities and after years of attempts, in 2020 Seattle City Council passed an ordinance requiring companies with annual payroll expenses exceeding $7 million per year to pay a head tax to the city (Nickelsburg, 2020c). The funds collected will be used to address the city's homelessness crisis, which has been exacerbated by increasing housing prices resulting from high-income individuals moving to the city. In the years preceding the introduction of this tax, technology companies made unprecedented donations to Seattle's political races, demonstrating a shift in local power dynamics (Beekman, 2018).

In addition, smart mobility is often seen as part of the larger 'smart city' space, and therefore interacts with other city policies and policy positions. For example, the interviewee from the Mayor's office stressed the importance of collaboration between technology companies and the city but focused on the early stages of developing solutions. They suggested that governments need to rethink how they work with the private sector in order to leverage the advantages of innovation and move past a "regulator versus the regulated" relationship with companies. They added that this is not necessarily easy for departments like SDOT, who are by default in the position of the regulator, and can be done more easily by a dedicated function in the city that works with technology companies. This would allow the city to build collaborations and test different innovations before these are promoted at a larger scale by the market, giving the city a head start in terms of policy. An early sign of this approach is Seattle's smart cities coordinator role, as well as small scale, localised pilots on sustainable freight deliveries with companies such as Amazon and UPS. These initiatives show that there are parallel narratives around innovation within the city, which that are serving different priorities.

The pre-existing powers of Seattle City Council and KC play a crucial role in how smart mobility is governed in the city. Their power to regulate and set the local agenda has allowed them to take a progressive approach overall, and consecutive administrations in the city to steer smart mobility according to their own agendas. However, as the analysis of the efforts to regulate TNCs shows, it is a common provider practice to try to undercut local regulatory efforts by lobbying for pre-emptive regulation at the state level. Indeed, the interviewee from the previous SDOT administration suggested that officials at the state and federal level were frequently arguing against the introduction of local policies and regulations in areas such as data sharing, privacy protection, and safety, as it would 'stifle innovation'. Even more broadly, the same participant suggested that smart mobility services are seen by some as representing the VC-backed technology market in the field of transport. Although they are often not technological advances themselves, the 'Uberification' of taxis, bikes and e-scooters is associated market success, which the participants from SDOT also described as 'an American thing'.

Besides the ideological aspects, the participant from the previous SDOT administration suggested some more tangible reasons why smart mobility services are more prominent in America, and therefore local authorities' thinking is more advanced and critical compared to their counterparts in Europe. Firstly, many of the companies in the smart mobility space are American and are backed by American venture capital. Hence, the political pressure to inject these services into local marketplaces is much higher than in other countries. In addition, market entry was made easier in the United States as the management and regulation of local roads is locally determined, and unaffected by national rules, which may act as an entry barrier to smart mobility services. Finally, the ex-SDOT interviewee suggested that the largely monomodal public transport offer in the United States has affected the take up of smart mobility services, whereas in European multimodal transport systems there is a lesser need for supplemental services.

4.3.3. Reflections and summary

Smart mobility services have exposed local authorities' low agility and adaptability to new conditions, even in the case of quickly evolving and progressive agencies like those of Seattle. The interviews showed that participants across agencies are already adopting new ways of working but are still facing limits posed by political cycles, internal processes that are traditionally slow, and lack of sufficient resources. Although clearly some services and providers present more challenges than others, the participants often still lack the experience in dealing with the complex and powerful set of actors involved in the smart mobility space. Innovation in smart mobility is also particularly fast, with most participants suggesting that they cannot predict what is coming next. This means that aside from making it harder for local

authorities to ensure that services work well for the city ‘on the ground’, rapid developments are also introducing a large number of uncertainties for the future. But does that mean that cities are incapable of dealing with innovation? The interviews show that it is not just the rapid pace of technological innovation that presents a challenge, but also the new business models, the conflicting priorities with the smart mobility providers, and the power and resource imbalance between providers and local authorities.

The case of Seattle shows that smart mobility services have financial backing that allows them to be agile, grow fast and, most importantly, operate without making a profit. This allows smart mobility to be a case of ‘innovation as a social mantra’, and creates a compelling narrative for the future of mobility that obscures the conflicting principles between private companies and the public sector. While racing to monetise large numbers of trips that were previously not captured by public transport systems, smart mobility creates a false perception of public service. Even if the current situation is unsustainable in the long term, as the participants suggested, the future is far from certain. In the space between fully procured services and fully private, there is the major risk of creating a two-tier system with multiple losers, ranging from under-resourced local authorities to priced out social groups. An important element of the discussion about that future is who has a say in shaping it. Innovative services are not the result of a process of identifying the right solutions to local problems, while visions of the future are not developed through consensus. As the participant from KCM suggested, ‘*[t]his idea of future mobility we have is not the result of everyone coming together to the table and saying that we all want to do it.*’ (Se2). Crucially, the role of citizens is largely reduced to that of consumers, and their agency and power are limited to accepting and rejecting the services. It is notable that three of the interviewees in Seattle mentioned potential lawsuits against companies brought forward by cities and members of the public as a method of shaping smart mobility policy. Although lawsuits do hold significant power in the United States, this reference shows an acceptance that the public’s power to steer developments is not in co-creation or consultation but only in opposing decisions that have already been made.

5. Smart mobility governance in Greater Manchester

5.1. Greater Manchester's governance context[9]

5.1.1. Institutional context

The current institutional context of Greater Manchester has been shaped by recent devolutionary processes in England. In the early 2010s, a range of powers and resources started to get devolved from central government to groups of elected local authorities, known as combined authorities. This devolution was aimed at stimulating regional economic growth, allowing resource-poor local authorities that were part 'functional economic geographies' (usually concentrated around one key economic centre) to coordinate investment and strategic planning after years of power centralisation and London-centric economic growth (Lowndes and Lemprière, 2017). The Greater Manchester Combined Authority[10] (GMCA) was established in 2011 and was followed by six 'devolution deals' agreed between 2014 and 2017, which gave the region additional powers (mainly around transport, planning, skills, and policing), control over budgets, and accountability through an elected mayor (Torrance, 2022; GMCA, 2022a; gov.uk, 2017). The GMCA consists of 11 members, which are the elected leaders of the ten metropolitan boroughs of Greater Manchester (referred here as the cabinet), and the directly elected Mayor of Greater Manchester. The first GMCA Mayor is Andy Burnham who was elected in 2017 and re-elected in 2021. The Mayor is required to consult the cabinet on proposed strategies and plans, which can be rejected if there is a two third majority. The cabinet examines the Mayor's spending plans and has to unanimously approve GMCA's spatial development plan. Each cabinet member is the political lead for key policy areas (such as economy, culture etc.), and the Mayor is also the portfolio holder for transport (GMCA, 2022b). Transport was a key area in Greater Manchester's devolution deals, with the powers assumed by the Mayor including the responsibility for a devolved transport budget, and the responsibility for franchised bus services, should they be adopted (Treasury and GMCA, 2014).

In terms of transport governance, with its creation the GMCA absorbed the Greater Manchester Integrated Transport Authority (GMITA), which was the body responsible for

[9] The cut-off date for this Chapter is 30 November 2021.

[10] The city of Manchester is the main economic centre of CA, and one of the ten metropolitan boroughs. The other nine are Salford, Trafford, Bury, Stockport, Rochdale, Oldham, Bolton, Tameside and Wigan.

setting local public transport policy and investment priorities. GMITA's decisions were implemented by the Greater Manchester Passenger Transport Executive (GMPTE), which was replaced by Transport for Greater Manchester (TfGM) in 2011 (GMPTE, 2010; GMITA, 2009). As such, according to the Greater Manchester Combined Authority Order 2011, TfGM is the executive transport body of GMCA and is responsible for delivering GMCA's transport strategy and commitments. TfGM is headed by a Chief Executive Officer, a position that is confirmed by the GMCA (TfGM, 2022a; The National Archives, 2011). Both the GMITA and the GMPTE were established in 1969 (although nomenclature has varied) and since then have undergone various changes in their remit and powers, including the deregulation of buses in 1986 that transferred the operation of bus services from the GMPTE to private companies. However, it is key that since 1974 transport policy and delivery in Greater Manchester were implemented jointly by the 10 local authorities that form the GMCA today, covering the same geographic area. As such, GMCA and TfGM build upon a legacy of collaboration between local authorities in the Greater Manchester area. According to Lowndes and Lemprière (2017), this legacy played a crucial role in the local leaders' ability to negotiate for new powers to be given to the GMCA as part of the devolution deals that were agreed with the central government.

TfGM's responsibilities include managing part of the road network known as the Key Route Network (although the majority of the road network in Greater Manchester is managed by the local councils, which are also referred to as highway authorities); working collaboratively with bus and train operators to improve services in the area; delivering infrastructure schemes that improve public transport, such as bus priority measures; owning bus stations, stops and shelters in the region; subsidising bus services where there is no commercial interest and providing concessionary travel reimbursements to operators; owning and commissioning the operation of Metrolink, the local tram network; and promoting and investing in walking and cycling schemes (TfGM, 2022a). TfGM have limited operational control over bus travel as local bus services have been deregulated and have been run by private operators since 1986 (Mackie et al., 1995). Although Metrolink has been expanded significantly since its opening in 1992, and connects key areas in the region, buses are providing essential connectivity in the area. Over 80% of bus services are run commercially by companies who set the routes, timetables, fares, frequencies and quality standards. The remaining services are considered socially necessary but not profitable to run on a commercial basis, so they are subsidised, and operators compete to win contracts commissioned by TfGM to run them (TfGM, 2022a). In March 2021 it was announced that, under the Mayor's devolved powers, the region would bring buses again under local control through a franchise model expected to be implemented between 2023 and 2025 (TfGM, 2022e). This decision was still under development at the time

of the interviews and, as the following sections show, it is considered a major shift for the local transport system.

In Greater Manchester and the rest of England, decision-making processes about transport are multi-layered and involve multiple institutions. TfGM also work with National Highways (previously Highways England), the organisation responsible for planning and managing the country's motorway network, and Transport for the North, a Subnational Transport Body responsible for facilitating connections between cities to accelerate economic growth in the North of England. This section will not provide a detailed overview of the network of institutions that affect transport decisions in Greater Manchester, as issues around smart mobility are managed primarily by the local authorities, TfGM and the Department for Transport. The following sections discuss in more detail the implications of this distribution of power. **In the case of Greater Manchester, the two core institutions in terms of shaping smart mobility are TfGM and the Department for Transport.** It is noted that, although TfGM are shaping the CA's strategic position on smart mobility, 'on the ground' applications require strong collaboration with and approval by the local councils.

5.1.2. Policy context

The overarching transport strategy document in Greater Manchester is the Greater Manchester Transport Strategy 2040, which was adopted in 2017 (TfGM, 2021a). The Strategy sets out the vision, principles, and policies for transport in the region, and is accompanied by 5-year Delivery Plans, which provide details on the specific steps towards delivering the strategy (TfGM, 2021b). The 2040 strategy is extensive and covers all modes but is also supported by sub-strategies focusing on specific issues, such as air quality, walking and cycling, and the development of Manchester city centre. Two key elements of the 2040 strategy are the 'right mix' vision and the local decarbonisation target. The 'right mix' refers to the ambition for at least 50% of all journeys in Greater Manchester to be made by walking, cycling or public transport by 2040. Greater Manchester's decarbonisation target is to achieve carbon neutrality across the CA by 2038, which the latest delivery plan acknowledges may affect the 'right mix' target (TfGM, 2021b).

The development of strategic priorities and delivery of key transport interventions has been actively pursued in the last few years, as Andy Burnham carried out his first term as the first Mayor of Greater Manchester. Among the wide range of progressive strategies supported by Burnham was the franchising of the local bus network, and the development of a 10-year infrastructure plan to support walking and cycling across the region. For example, in 2017, as part of the walking and cycling plan, Burnham appointed Chris Boardman, a former Olympic

cyclist, as Greater Manchester's first cycling and walking commissioner (TfGM, 2022c). In addition, in 2018 the region's active travel network was branded as the 'bee network', borrowing the worker bee symbol of the city's industrial past (TfGM, 2022d). However, the political push to prioritise active travel is new compared to the city's long-standing car dependency and congestion problems, which is reflected in the public criticism of the progress on delivering the walking and cycling plan (Walk Ride GM, 2021).

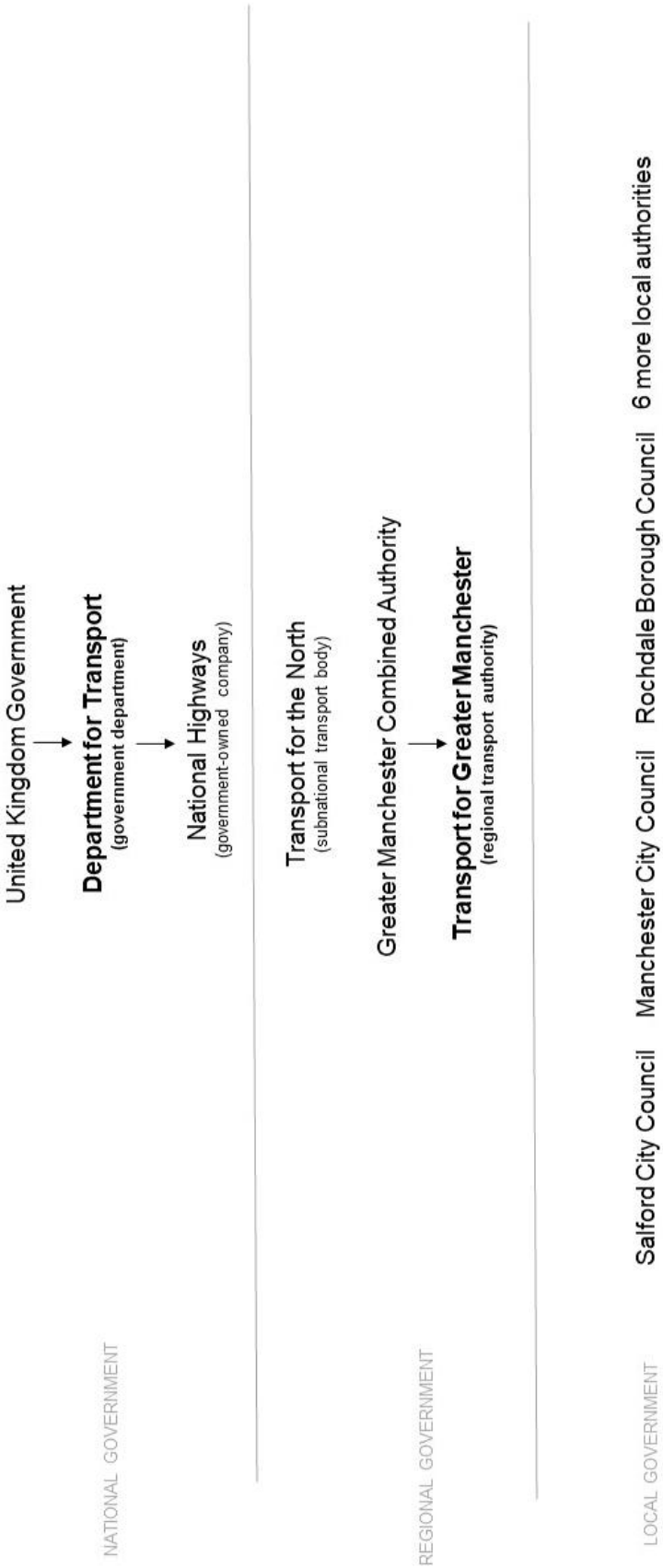


Figure 5 Key government institutions and associated transport bodies referenced in the Greater Manchester case study. Official description of each transport body in brackets. Core institutions in bold. Designed by the author.

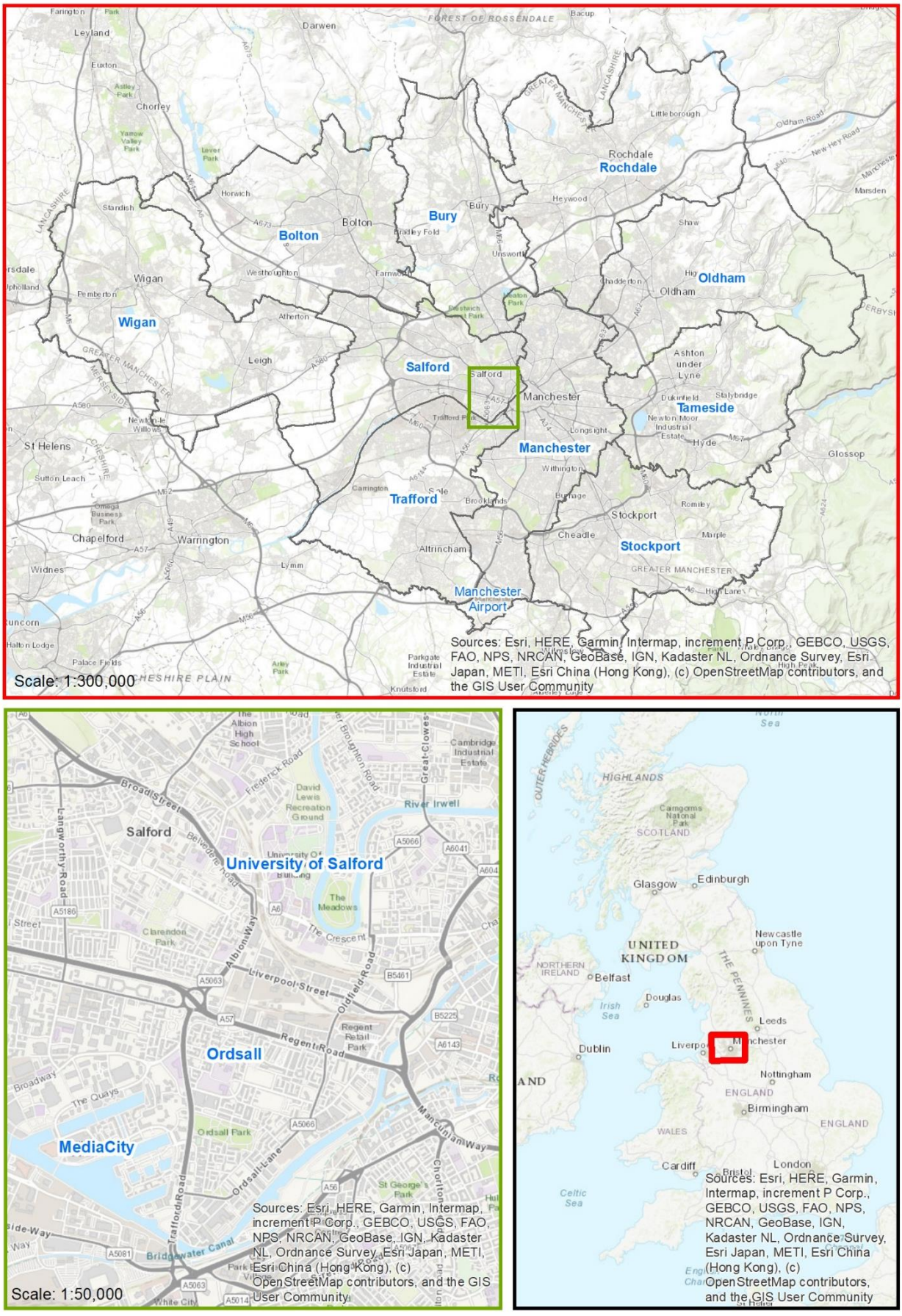


Figure 6 Map of locations referenced in the Greater Manchester case study. Designed by the author.

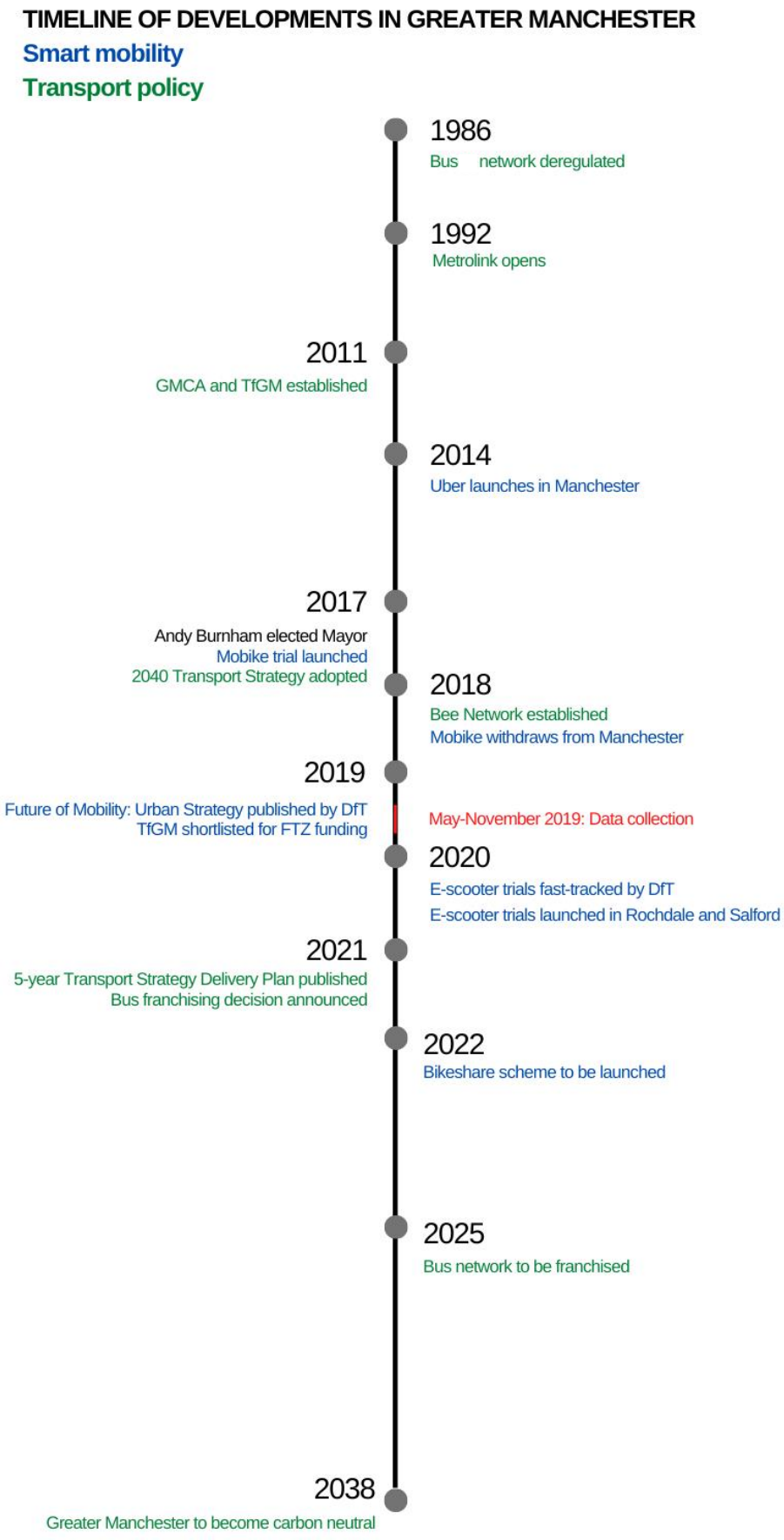


Figure 7 Timeline of developments referenced in the Greater Manchester case study. Designed by the author.

5.2. Smart mobility in Greater Manchester

The interviewees from Greater Manchester spoke extensively about smart mobility trials that had already taken place at the time of the interviews, and about their future plans. This research does not aim to provide a comprehensive review of all trials that have taken place in Greater Manchester. This section focuses on the trials discussed during the interviews and presents the lessons and challenges for TfGM. The interviews in Greater Manchester took place between May and November 2019 and coincided with the period when TfGM were preparing their application to secure funding from DfT's Future Transport Zones[11] (FTZ) Fund (further details provided in the section 5.2.2.1). This means that officers were in the process of developing their future smart mobility plans. Section 5.2.1 captures the smart mobility developments that were discussed by the participants. Section 5.2.2.1 provides an overview of the DfT's Future of Transport programme, which is a key smart mobility policy that also applies to Greater Manchester. Finally, Section 5.2.2.2 discusses TfGM's ambitions for smart mobility, as these were included in their application for the FTZ Fund.

5.2.1. Development of smart mobility services

In Greater Manchester, smart mobility services have been introduced through the initiative of the local authorities or TfGM in the form of small-scale trials; or through the initiative of providers, either in partnership with TfGM and the local authorities, or independently through available legal routes. The sections below detail the smart mobility developments in Greater Manchester, based on the route through which they were introduced.

5.2.1.1. Trials led by TfGM or the local authorities

A large part of Greater Manchester's exposure to smart mobility is related to trials and pilot projects. These are often part of bigger projects funded by the European Commission or the UK government, or are local initiatives developed with partners. There have been multiple trials in Greater Manchester, some of which had a broader focus than transport. For example, as part of the CityVerve project, Manchester was selected to become a demonstrator city for the capability of Internet of Things applications, which included transport applications that

[11] DfT's Future of Transport programme was initially launched as the Future of Mobility programme in 2019, and the associated trial areas were called Future Mobility Zones (FMZ). This research uses the latest name of the programme, which at the time of writing was Future Transport Zones. However, extracts from interviews refer to the programme and its elements with the original names, which still applied at the time of the interviews.

promoted smart mobility, connected infrastructure and real-time travel information (University of Manchester, 2021).

The participants from TfGM explained that trials were initially selected in an uncoordinated way and were often opportunities presented to TfGM through existing networks or were linked to new funding sources. These trials were either targeting small groups of people or small geographic areas, and focused on smart mobility applications that TfGM wanted to learn about, such as MaaS. At the time of the interviews, these small-scale trials had already been taking place for almost three years, and TfGM were seeking to develop more targeted smart mobility applications to meet local needs and objectives.

So I think some of it has been fairly opportunistic and there hasn't been a clear strategy on how we go on about it but now we have done 2 or 3 years of those more ad hoc pilots. We're now getting more focused on what we can do to support the 2040 strategy – we published a 5-year delivery plan as well, which includes nearer term ambitions. In our FMZ bid we're much more focused now on the different travel markets and the more specific applications that we'd like to test at scale. (GM2)

The trials that TfGM had participated in and were discussed at length during the interviews focused on MaaS or CAVs. **The MaaS trials** covered a range of aspects related to the application of a MaaS scheme. The participants suggested that the trials helped them understand different issues and challenges around the MaaS ecosystems even if some of their elements (such as the platforms used) could not be directly replicated as part of a full-scale deployment of MaaS in Greater Manchester. For example, TfGM participated in the MaaS4EU project that focused on MaaS governance, including "defining sustainable business models that support the cooperation across transport stakeholders, understanding user needs and choices, implementing the required technological infrastructure and identifying the enabling policy and regulatory frameworks" (European Commission, 2022a, no page). Another project that TfGM participated in was iMOVE, which also had EU-wide focus. The purpose of the project was to "advance the use and scalability of MaaS schemes in Europe, ultimately paving the way for a "roaming" service for users at a European level" (European Commission, 2022b, no page). Both projects included real-life applications of MaaS solutions in Manchester focusing on two transport corridors in the city. The iMOVE project also included a 'mobility budget' element where users were offered minimal travel discounts and a set amount of credit to spend on different travel options through their MaaS account.

Finally, TfGM's own 'proof of concept' MaaS trial involved a 'manual' journey planner provided to two groups of 20 people (one group of car users and one group of public transport users) over a two-week period. This trial was aimed at understanding how people respond to

personalised travel information and incentives, and showed that sustainable travel behaviours persisted after its end. However, given the size of the sample and the lack of controls, this result is not considered indicative of the potential of full-scale MaaS applications.

What we did was basically that we funded for them a 'get me there' card for bus and tram and train – bus and tram really and then we paid for train tickets if they were relevant. We had a business account set up with taxi providers on TfGM's dime and what we did was that we had six people sitting in a room in a bus station talking to the participants by WhatsApp, journey planning for them and suggesting the updates. […] [w]e helped them in the event of disruption, we nudged them to try active transport to the extent that we got Mobike[12] on board as part of the project and if it was a nice day and we knew the weather was going to be good, we'd drive there with a Mobike on the back of a van put it at the end of their road and we'd say 'hey look, it's a nice day, why don't you try a Mobike today?' They had a free Mobike account as well. (GM3)

TfGM's **Connected and Autonomous Vehicle (CAV) trials** covered both policy development and on-road applications. The first trial referenced in the interviews is called SPACE and was funded by the International Association of Public Transport (UITP). SPACE helped TfGM set high-level AV policy objectives for the future and, according to its website, it "aims to place public transport at the centre of the automated vehicles revolution and help build a combined transport ecosystem" (UITP, 2022, no page). The second trial, Levitate, is funded by the European Commission and focuses on the societal impacts of CAVs. It aims to help participating authorities understand the impacts of different levels of automation on their transport systems and develop policy responses that will help them achieve local objectives (Levitate, 2022). At the time of the interview TfGM were also planning a third trial, Synergy, which was funded by Innovate UK (UK's innovation agency). This trial involves testing a platoon of electric sports cars that are converted to operate autonomously on a 3-mile section of road alongside general traffic. The trial was expected to start in 2021 and will connect Stockport train station to Manchester Airport, where passengers will be picked up by an autonomous pod, which also offers customer-facing elements such as concierge service (UKRI, 2022). The final trial involved the introduction of autonomous pods on Salford University campus, which has a department that specialises in CAV technology. The purpose of this trial is to encourage students to drive less, as the campus is sparsely built across a large area and has limited bus services, meaning that students often choose to travel by car. The innovation officer focusing on CAVs explained that through the trials they have realised

[12] Further detail provided in section 2.1.2.

the complexity involved in full deployment of highly autonomous vehicles and that technological and market development is not sufficiently advanced to allow it.

For example, to have an AV, you can't just have that. It has to have a network that it operates on, cybersecurity, roadside units to link with traffic signals, an onboard unit that needs to communicate with the roadside unit that has to communicate with the WiFi network – and these different bits are not one system. Every component I mentioned is provided by different operators and different suppliers. When you look to get the best mix of these offerings it's hard to identify it because it's quite new technology and you can't easily compare one with another because they're all very discreet and they've been designed very specifically for the project. We don't have a general application to say it does what we want and it's cheaper because it does not have the fancy bits that you can get for an extra price. Five years ago, we thought AVs would be here by now because nobody managed the expectations – we just went with the hype of the media. […] It's scary how we thought they'd be on the roads by now because there are a lot of these issues but it's hard to say how quickly the market will move and the technology will advance. (GM4)

Separately to TfGM's trials, the interviewees referenced Salford City Council's efforts to eliminate the use of private vehicles for business travel. Salford City Council procured CoWheels, a community interest car club operator, and introduced an employee car club, which replaced council staff and elected officials using their own vehicles and claiming back business mileage costs. By changing their own policy on staff travel, Salford City Council created a market for the car club operator, while the car club vehicles were also available to hire by members of the public outside business hours. This initiative was part of the Council's travel plan and was coupled with other initiatives such as pooled bikes, pre-paid bus tickets for business travel, and improved shower facilities at Council buildings. The Council reported a 95% reduction in business miles travelled and estimated savings of more than £150,000 per year (FleetNews, 2018). The sections below provide further details on the challenges of scaling up car clubs, and TfGM's ambitions to promote carsharing, which include expanding Salford City Council's scheme to cover more 'anchor' institutions across the region.

5.2.1.2. Provider-led introduction: the Mobike trial

In terms of provider-led introduction, TfGM's main experience was a bikeshare trial that was run by the Chinese dockless bikeshare company Mobike. In 2017, and while TfGM were already exploring the feasibility of launching their own bikeshare scheme, Mobike approached them and offered to launch in Manchester at no cost to the CA and the local authorities. TfGM

accepted the offer on a trial basis for a year, seeing it as an opportunity to understand how bikeshare works, and put the development of their own scheme on hold.

The interviewees from TfGM spoke at length about the trial and their relationship with Mobike, while Mobike's Manchester trial manager was also interviewed. In addition, there is detailed research on the case of Mobike in Greater Manchester published by Dudley et al in 2019. The trial was launched following a 2-month preparation period, which involved some stakeholder briefing sessions delivered by Mobike in collaboration with TfGM, Salford and Manchester City Councils, and local Business Improvement Districts. During this time, TfGM and local officials, such as the Mayor, were openly supportive of the scheme. The participant from Mobike described this preparation period as '*ridiculously quick'* (GM5), given that TfGM had commissioned a study exploring the feasibility of a bikeshare scheme as early as 2013 (Cummins, 2013). Dudley et al. (2019) point out that no meaningful consultation with the public took place ahead of the launch, as it was believed this would be an obstacle to launching the scheme.

The trial was launched in June 2017 and a non-contractual, completely voluntary Memorandum of Understanding (MoU) was signed between Mobike, TfGM, Manchester City Council, and Salford City Council. The full terms of the MoU are not known, but it is clear that it did not include many provisions for steering the trial, even if voluntary (Ivinson, 2018). According to the interviewee from Mobike, the MoU dictated that if TfGM asked Mobike to stop operating they would have to leave within 3 months. However, they added that this arrangement effectively left the local authorities with no leverage, as asking Mobike to stop operating would leave the area with no bikeshare service and would only be justified if Mobike caused multiple issues.

At the same time, there was no overarching regulatory framework that would allow TfGM to control the trial. According to the TfGM participant leading on transport strategy, TfGM provided guidance to Mobike regarding where the bikes should be located to better serve the public and be integrated with other modes, based on the analysis that TfGM had already done. However, TfGM did not have any control over whether their recommendations would be implemented. The same participant explained that a major limitation was that TfGM or the local authorities do not have sufficient control over "what people put on the footways", which includes obstructive cycle parking. According to one of the innovation officers, TfGM, in collaboration with Transport for London, started investigating the possibility of introducing a local byelaw that would allow them to control where dockless bikes can be parked. Byelaws are laws made by a local council in England, but are only linked to actions in a specific location (such as a park or a market). The types of byelaws that can be introduced are set by the Ministry of Housing, Communities and Local Government (MHCLG), and local authorities

need to secure ‘leave to proceed’ by the MHCLG before they introduce a local byelaw (gov.uk, 2016). As such, even if a byelaw had been introduced, it would have been a long process and it would only partly control dockless operations. In addition, according to the participant who used to manage the trial for Mobike, although TfGM and the local authorities were in principle supportive of the scheme, they were tied by their procurement rules and they could not provide financial assistance to support and improve aspects of the operations. As such, Mobike were effectively operating without government support but also were not expecting any regulatory resistance. In fact, the participant from Mobike attributed to luck the fact that the scheme offered robust servicing and maintenance of the bikes, as this was not a binding requirement or indeed a financially sustainable approach for Mobike.

The trial was stigmatised by the extensive theft and vandalism of the bikes. By the end of the scheme, Mobike estimated that each month approximately 10% of its fleet was unavailable due to theft and vandalism (Dudley et al., 2019). Vandalism was linked to the dockless nature of the scheme, and the participant from Mobike pointed out it was consistent with the experience of other places with micromobility schemes in the UK and the rest of Europe. Vandalism was also a profitability issue and cited by Mobike as one of the leading reasons why they eventually withdrew from Manchester. In addition, a dockless scheme is cheaper to run than a docked scheme as, aside from the lower infrastructure cost, rebalancing the fleet between stations is also a costly part of operations. As such, the cost of recovering vandalised and stolen bikes also conflicted with the operating model of Mobike. It is noted that the vandalism statistics were questioned by one of the TfGM officers interviewed, who argued that they were not consistent with the data gathered by the Greater Manchester Police and, in any case, were impossible to confirm.

Overall, the trial involved a fleet of 1,000 bikes in Manchester and Salford, and lasted for 15 months. It is unclear from the interviews whether Mobike, TfGM and the local authorities decided to make the bikeshare scheme permanent after the end of the first 12 months of the trial, but Mobike announced they were withdrawing from Manchester in September 2018 (Pidd, 2018). During the trial there were instances of collaboration between the two sides, for example Mobike was integrated in TfGM’s MaaS proof of concept trial, and they ran events to promote cycling locally. However, the participants from TfGM and Mobike confirmed that communication between the two sides eventually broke down. One of TfGM’s innovation officers argued that they could not reach Mobike and there was no dedicated contact to engage with local authorities, while Mobike made decisions on operating parameters unilaterally, a development that is also reflected in the research by Dudley et al. (2019).

Overall, participants from TfGM suggested that the scheme’s alignment with local objectives was weak as they had no power over the operations and design of the trial. In addition, they

argued that Mobike did not share with TfGM data on the trial's impacts on modal shift or other information, such as the demographics of its users. Following the end of the trial, TfGM decided to proceed with procuring their own docked bike hire scheme. All participants from TfGM acknowledged that the Mobike trial was a learning experience and the lessons fed into the new scheme, which is going to be strongly regulated, designed to be integrated with other modes, and based on a concession model. It is noted that although the procurement and launch of a bikeshare scheme in Manchester was expected imminently when the interviews took place in the second half of 2019, it was delayed due to the COVID-19 pandemic. At the time of writing scheme was expected to launch fully in summer 2022 across Manchester, Salford and Trafford (TfGM, 2022b).

5.2.1.3. Provider-led introduction: existing regulatory frameworks

Beyond the trials and partnerships, national regulations pre-dating the advent of smart mobility services also made it possible for smart mobility providers to introduce their services in Greater Manchester. The analysis below shows that the use of pre-existing rules to introduce smart mobility services did not always 'fit' the model of digital platforms providing on-demand mobility. This meant there was often little control of smart mobility services (such as in the case of Private Hire Vehicles), or lack of flexibility (for example in the case of carsharing). It is noted that in the case of e-scooters, on which further details are provided in the next section, pre-existing regulations meant that e-scooters were illegal and therefore, at the time of the interviews, no operators could enter the UK market.

Uber first launched in Manchester in 2014. Across the UK, ridehailing platforms are regulated as Private Hire Vehicles (PHVs) and licensed by local authorities. Although TfL's legal conflicts with Uber have drawn attention across the country (Dudley et al., 2017), participants from TfGM did not refer to any specific issues with Uber. However, it is noted that in November 2019 there were discussions at Manchester City Council regarding the safety and licensing requirements for Uber, and consideration of not renewing the company's operational licence (BBC, 2019). More broadly, the participants explained that PHV regulations are increasingly outdated and unfit for purpose, as PHVs are licenced by individual local authorities and there is no common regulatory framework across Greater Manchester. In addition, following the 2015 Deregulation Act there is no requirement for PHV drivers to operate only in the area where they are licensed. This means that drivers often choose to obtain their licence in authorities that have lax rules, only to operate in other parts of the country, including Greater Manchester[13] (Laversuch, 2019; Sutherland, 2021). Indeed, the standardisation of PHV

[13] This tactic was also discussed by interviewees during the pilot interviews discussed in Chapter 2.

regulation across Greater Manchester was a commitment in Mayor Burnham's re-election manifesto (Burnham, 2021).

Finally, at the time of writing there were two car clubs operating in Greater Manchester. Car clubs as businesses are licensed nationally in England. At the local level, car clubs interact with the local highway authority if they want to offer their users the option to park on street. Councils usually allocate on-street car club parking bays to support sustainable transport options, and it is up to them how and if they will charge car club operators to use the spaces, and if the spaces can be used by only one or multiple operators. Spaces can also be allocated after car club operators prompt the local authority to introduce them. Official conversion of a standard on-street parking space to car club only often comes at a cost to the local authorities, which is associated with the legal process of reallocation (introduction of a Traffic Regulation Order (TRO) that is a lengthy legal process involving public consultation) and the loss of revenue from potential parking charges (carplus, 2014).

5.2.2. Smart mobility policy

This section provides an analysis of Greater Manchester's smart mobility policy context by focusing first on DfT's Future of Transport programme and then on local ambitions about smart mobility, as set out in TfGM's FTZ application.

5.2.2.1. DfT's Future of Transport programme

DfT's Future of Transport (FoT) programme aims to "shape transport innovation and make the UK a world leader in transport movement" (gov.uk, 2022b, no page). The future of mobility was identified as one of the four 'grand challenges' in the UK's Industrial Strategy, a national economic and development plan adopted in 2017[14]. At the time of writing, the FoT programme had four components: strategy development, regulatory review, research, and trialling.

As part of strategy development, the Future of Mobility: Urban Strategy document was published in March 2019[15]. As the first output of the programme it set out the government's approach towards transport innovation, focusing on urban areas. In addition, a second strategy focusing on rural areas is expected to be published in the future (gov.uk, 2022b). The Urban Strategy describes innovation in transport as an opportunity that needs to be managed carefully, so that it delivers advances in society, the environment, and the economy, and not

[14] The Industrial Strategy was replaced by the 'Build Back Better: Our Plan for Growth' plan in 2021, to reflect developments such as Brexit and the COVID-19 pandemic.
[15] At the same time there was an announcement of the upcoming regulatory review and Future Transport Zones.

unintended consequences, such as increased congestion and reduced sustainable travel. The strategy proposes principles-based approach that will allow the government to shape the future of urban mobility for passengers and freight. The strategy's principles are listed below:

- "New modes of transport and new mobility services must be safe and secure by design.
- The benefits of innovation in mobility must be available to all parts of the UK and all segments of society.
- Walking, cycling and active travel must remain the best options for short urban journeys.
- Mass transit must remain fundamental to an efficient transport system.
- New mobility services must lead the transition to zero emissions.
- Mobility innovation must help to reduce congestion through more efficient use of limited road space, for example through sharing rides, increasing occupancy or consolidating freight.
- The marketplace for mobility must be open to stimulate innovation and give the best deal to consumers.
- New mobility services must be designed to operate as part of an integrated transport system combining public, private and multiple modes for transport users.
- Data from new mobility services must be shared where appropriate to improve choice and the operation of the transport system" (Department for Transport, 2019, p.8).

The regulatory review was announced in March 2019 alongside the Urban Strategy as the 'biggest shake-up of laws in a generation'. The review aims to address 'areas of regulation that are outdated, a barrier to innovation, or not designed with new technologies and business models in mind' as well as introduce new regulation to manage the potential negative consequences of new technologies and services (Department for Transport, 2020c, no page). At the time of writing, DfT had put out two calls for evidence. The first call related to micromobility; buses, taxis and PHVs; and MaaS. The second call focused on zero emission vehicles, maritime autonomy and remote operations, future of flight, regulatory sandboxes, and modernising vehicle standards. The calls for evidence focused on practical, regulatory and policy aspects. For example, in the case of MaaS, the call raised questions about the role of national and local authorities in developing MaaS platforms, the measures required to support data standardisation, competition concerns, and how to ensure that MaaS encourages the use of sustainable modes. The summary of responses to the first call for evidence was published in November 2020 and reflects the challenges raised by interviewees in this research, such as the inconsistency of PHV rules between local authorities. The summary also suggested next steps for each of the areas reviewed, most of which included the need

for further research and engagement on regulatory changes (Department for Transport, 2020a; Department for Transport, 2020b). As such, there is a range of regulatory changes that are expected to be made by the DfT, which may change local and regional transport authorities' ability to shape smart mobility. At the time of writing, it was unclear what these changes could include and when they would be introduced.

In terms of research, at the time of writing the DfT had commissioned and published different research and analysis reports aiming to improve their understanding about future transport issues. These focused on two main areas: data and data sharing; and user attitudes, acceptability and equality. The reports of the first area covered a range of detailed technical topics, while the reports of the second area involved extensive and in-depth engagement with members of the public to understand their views on different types of smart mobility, such as MaaS.

Finally, the trialling component of the FoT programme has two main elements: four Future Transport Zones and a nationwide trial of rental e-scooters. The purpose of the Future Transport Zones is to "provide real-world testing for experts, allowing them to work with a range of local bodies such as councils, hospitals, airports and universities to test innovative ways to transport people and goods" (Department for Transport, 2020c, no page). The government announced in March 2019 that the £90 million Future of Transport Zones Fund would be made available to local authorities through a competitive application process[16] (WMCA, 2018). TfGM was one of the seven authorities shortlisted for the Fund in July 2019 but did not receive any funding when the final three recipients were announced in March 2020. The successful applications included a range of trials such as drone deliveries, ticketing integration, and mobility hubs (gov.uk, 2022b).

As explained in the previous section, at the time of the interviews it was illegal to use e-scooters on any public roads, pavements, cycle paths and public footpaths in the UK, as they are covered by the same laws and regulations that apply to all motor vehicles. In March 2020 the DfT announced that trials of e-scooters were going to take place in the four FTZs. However, in May 2020, e-scooter trials were fast-tracked and expanded to all local authorities interested to participate, provided that their proposals were assessed and approved by the DfT. This was part of the government's measures to support a 'green' restart of local travel and help mitigate reduced public transport capacity due to social distancing rules implemented in response to the COVID-19 pandemic. Following a public consultation run by the DfT, emergency regulatory changes permitting 12-month trials came into force in early July 2020. At the time of writing,

[16] A first instalment of £20 million as part of the Fund had been allocated directly to the West Midlands Combined Authority in October 2018.

all trials had been extended and were expected to be completed by March 2022, after when the DfT would decide whether e-scooters should be fully legalised (Hirst, 2021).

The trials are only restricted to rental schemes (i.e. private e-scooters remain illegal), as long as operators meet the requirements set by the DfT, which include vehicle specifications, insurance requirements, and data sharing standards (gov.uk, 2022a). According to the trial rules, local authorities were required to choose the process to procure e-scooter operators for their area, and to set local rules, including limits to fleet size, extent of the trial area, localised speed restrictions, and parking arrangements (including the installation of docks). The classification of e-scooters meant that new rules had to be created for them to be legalised, and with these came opportunities to steer providers. This was a marked difference from the experience that many local authorities across the country had with dockless bike schemes, where they had little power to determine which operators would be allowed in their areas or to shape any operational parameters of the schemes, as demonstrated by the Mobike trial. It is noted that the e-scooter trials were not accompanied by any dedicated funding for their implementation for neither the operators, nor the local authorities.

In Greater Manchester, only two local authorities chose to participate in the trials. Salford City Council, in collaboration with TfGM and the University of Salford, ran a trial in a geofenced area covering part of Salford University's campus, and a 1.6-mile corridor linking the university to Media City, a key employment and residential area in Salford. The trial was later expanded to cover the areas of Ordsall and Salford city centre (Kilbey, 2021; Salford City Council, 2021; Seymour, 2020). Rochdale Borough Council also launched a trial that was geofenced to cover the area around its town centre (Rochdale Borough Council, 2022). Both trials were operated by Lime.

5.2.2.2. TfGM's ambitions

The Future of Transport programme demonstrates the key role that DfT plays in shaping smart mobility, both in terms of setting the policy direction but also in the allocation of funding to local authorities. TfGM's FTZ application provides a vision for the role of smart mobility in Greater Manchester, and sets out how TfGM plans to work with smart mobility providers. The Fund created an opportunity to articulate this vision, which built upon TfGM's experience with smart mobility trials and their insight into the region's transport needs, and aimed to capitalise on the extensive public transport investment in the area. As the interview participants explained, the FTZ application did not seek funding to develop isolated trials of smart mobility services, but for the development of a MaaS ecosystem that would support the delivery of local transport objectives. The application added that "GM will explore how the public and private sector can

best work together to deliver an integrated and inclusive transport system that meets the complex needs of individual customers and delivers the economic, environmental and social goals of our GM Transport Strategy for 2040." (TfGM, 2019, p.2).

The TfGM officers explained that receiving the FTZ funding would allow them to test interventions in a coordinated manner and as part of a programme, which would feed into strategy development and scaling up the deployment of successful services. More broadly, TfGM's proposals sought to *'lay the ground for a cultural shift' (GM7)* in how innovation is used by the organisation by creating a framework where new services can be tested, monitored, and evaluated.

For us in the FMZ it is about building a culture of understanding the role of innovation – within TfGM a lot of the staff do not fully understand the role of innovation. They are not comfortable with things not working, failing is a no-no. But we don't know, consultants probably don't know either. […] Innovation is an opportunity for that culture shift in the organisation, and it is OK to trial things and fail fast, as long as there is a mechanism for that learning to feed into our wider strategy. (GM7)

The FTZ's purpose was to "enable GM to accelerate the integration of existing modes and introduction of new mobility services, (and) to offer highly tailored travel packages which reduce car dependency and social exclusion"(TfGM, 2019, p.2). One of the innovation officers explained that MaaS is an opportunity to aggregate and standardise the fragmented local mobility supply, while also gathering information about the local demand, and connecting these two sides. MaaS would provide TfGM with a granular insight into people's travel needs, which could help with demand management, network planning, and long-term transport strategy development.

Both the FTZ application and the interviews with TfGM officers suggested that transport systems need to satisfy people's rapidly evolving needs and expectations for on-demand mobility. Therefore, the application suggested that the MaaS platform would provide a customer-focused, personalised, integrated, and seamless travel experience, which would combine journey planning, booking, and payment for multimodal journeys in a single interface. More specifically, MaaS is perceived by TfGM as a way to encourage the public to make sustainable travel choices, for example through changing people's perceptions about multimodal trips or by providing them with information about end-to-end travel, including elements such as the cost parking, which would allow them to compare the full cost of different options. As one of TfGM's officers suggested, MaaS is beyond '*just an app'* (GM4). Through service integration, MaaS allows people to make informed choices from a range of travel options, including smart mobility services such as car clubs, but can also provide options that

are customised to the needs of users. As such, MaaS can help address a city's transport challenges, based on the premise that, given all the information, incentives and flexibility, people will make the right transport choice while optimising the use of existing transport capacity.

[i]t makes no sense to ask people to be multimodal now because it is so difficult and they do not have the right information on how to do it. Whereas if you had the information, you'd feel more comfortable – and safer and more secure, which came up as very important during the MaaS trials. With smart mobility we have a real opportunity to change people's perception about new multimodal solutions. Also, if you are on an AV – you can still compare the quality of your journey and time it takes compared to public transport (so people would not choose an AV if it took longer). (GM4)

According to the application, Greater Manchester's MaaS ecosystem consists of an infrastructure and a service component. The infrastructure involves creating mobility hubs, designating dynamic curbside management areas for electric vehicles (flexible use of curbside space that can be booked in advance and does not need to need to be permanently allocated to specific uses through TROs), and enhanced CAV connectivity (through physical and digital connectivity along trial corridors). The infrastructure will enhance and enable services that form part of the MaaS ecosystem. The service component includes integrated mobility options that will be made available to the users through the MaaS platform. The application listed different services that could be part of the MaaS ecosystem, including Demand Responsive Transport, car clubs, e-bike hire, microconsolidation centres, parcel lockers, e-scooters, and van sharing. The MaaS ecosystem would also be inclusive as it would "provide access to digital mobility services through apps, web and voice devices recognising barriers particularly for disabled, elderly and users without bank account"(TfGM, 2019, p.10).

According to the application, services will either be offered on a commercial basis by existing providers and new entrants to the mobility market or will be procured by TfGM when necessary.

"Within the MaaS marketplace, some services and supporting infrastructure will be specified and procured by TfGM and District partners, aligned with our wider Greater Manchester Transport Strategy 2040 delivery aspirations; whilst others will be market-led and allowed to flourish, enabled by Greater Manchester MaaS, and focused particularly around mobility hub locations. This symbiotic approach, specifying some interventions and allowing others to respond to the conditions we set, will be a true test of how a large city-region can establish an appropriate regulatory and collaborative working environment which enables customer-

focused mobility innovation to flourish, whilst also satisfying our wider economic, social and environmental goals" (TfGM, 2019, p.8).

To facilitate this symbiotic approach, TfGM included three Investment and Demonstration Areas (IDAs)[17] as a key element of their FTZ proposal. These are dedicated trial areas in contrasting a. urban, b. suburban and semi-rural geographies, as well as c. a major international gateway[18]. In each IDA, TfGM would procure smart mobility infrastructure, while commercial smart mobility services bespoke to local travel markets would also be introduced, with potential for replication across Greater Manchester. Mobility hubs would become focal points for smart mobility services in each IDA, complementing existing bus, Metrolink and rail interchanges. TfGM suggested that the establishment of three IDAs would enable them to test services in locations or with markets that might not otherwise be targeted by private operators. In addition, this approach would offer the potential for commercially successful locations to cross-subsidise interventions in less commercially viable areas such as the suburban and semi-rural IDA. Finally, the selection of IDAs with different characteristics was considered an equitable approach across the CA, allowing TfGM to work with different communities and to shape services in a way that meets their needs. For example, services could be designed to address issues of digital exclusion of older age groups, who often live in less well-connected and highly car dependent areas.

Complementary to the IDAs is the mobility credits component of the FTZ application, which refers to a fixed travel budget in the form of credit that can be spent on any mode other than the private car in order to promote sustainable travel. Mobility credits would be tailored to the needs of specific groups to provide viable, long-term alternatives to travelling by car, and to support those who would otherwise have limited access to key services and opportunities. TfGM proposed different applications of mobility credits, including providing different levels of subsidy to low-income groups through the MaaS application; family mobility accounts with no or low subsidies; and even multi-user mobility accounts for businesses to manage and support sustainable business travel.

Beyond the MaaS ecosystem, the FTZ proposal also included a proposal for a 'regulatory sandbox', which referred to trial areas where existing rules and regulations may be relaxed for the purposes of testing smart mobility services (for example, at the time of the application TfGM were suggesting the testing of e-scooters in a designated area). This would allow TfGM to make recommendations to the DfT about regulatory and governance changes needed as

[17] The application also refers to them as Investment Development Areas.
[18] The areas proposed were a. central Manchester, Salford and adjacent parts of Trafford, b. the towns of Bolton, Bury and their hinterlands, and c. Manchester Airport and adjacent parts of Manchester and Stockport.

part of the Future of Transport regulatory review. According to TfGM's proposal, "[t]he application of some future mobility solutions is constrained by current governance and regulation processes, which do not reflect the commercial challenges of new mobility options and the complexity of their application to urban streets" (TfGM, 2019, p.8). In their application, TfGM stressed the importance of identifying where regulatory reform is needed, as they anticipated to face complex legal issues relating to the development of a MaaS ecosystem, such as the pricing of services, or the ownership and sharing of data.

Finally, the proposals were accompanied by a monitoring and evaluation plan to support TfGM's 'trial, test and learn' approach. Through the evaluation TfGM aimed to understand the behavioural barriers to adopting smart mobility services, as well as regulatory and commercial barriers to their success. The ultimate ambition of TfGM would be to transfer the insights from the FTZ across the region, the UK, and internationally, establishing themselves as a leading authority in smart mobility and creating an attractive environment for smart mobility players to invest in the region.

In their application, TfGM made clear that their ambitions, and especially the regulatory sandbox, would be impossible to progress at the scale proposed unless they received the FTZ funding.

"Without the any central government funding, under the FMZ programme, the GM FMZ aspirations in their proposed form would be unlikely to progress at all, and certainly not as a coherent programme, or in many of the IDA locations, or in such an agile way. […] [t]he funding and regulatory support offered by the FMZ programme provides funding not currently available to TfGM, as well as reducing the risk of experimenting and trialling more innovative solutions which would stretch the current regulatory framework." (TfGM, 2019, p.31)

The FTZ Fund reflects the wider funding regime that local and regional governments face in the UK. Investment funding is often offered by the central government in a short-term and competitive way for narrowly specified interventions. In addition, government funding is frequently announced without prior notice and with tight bidding times, impacting the authorities' ability to plan for long-term investment. This means that local authorities must develop business cases for specific funds, which may not fully align with their investment priorities, and without a guarantee that the funding will be secured (Urban Transport Group, 2021). Despite their devolved powers, TfGM are also dependent on competitive funding, as is demonstrated by the FTZ Fund. The 5-year Delivery Plan for the Transport Strategy 2040 that was published in January 2021, states that TfGM will continue to seek funding to deliver their FTZ ambitions. However, if funding is not secured in the future, TfGM's smart mobility ambitions may be implemented in an incremental way or services may continue to be

introduced in an ad hoc manner through a mix of initiatives, with TfGM not taking a coordinating role.

As explained, the participants elaborated on the proposals of the FTZ application, which is considered a comprehensive account of their ambition for the region. To a lesser extent, the interviewees also spoke about other plans around smart mobility, which link to the FTZ application. The participant leading on transport strategy mentioned that they were working on a 'future mobility strategy' for Greater Manchester[19], which would become part of the suite of substrategies accompanying the Greater Manchester Transport Strategy 2040. The future mobility strategy would also take into consideration how developments in smart mobility may interact with other policy issues, such as bus franchising. Its development was aimed to be an iterative process, which would start with a draft set of principles that would be tested in practice and evolve over time. The FTZ application was aimed to kickstart this testing process and help identify the governance and regulatory changes needed to implement TfGM's future mobility strategy.

In addition, at the time of the interviews, TfGM were developing their own policy and deployment strategy for passenger and freight CAVs, which aligned with the Greater Manchester Transport Strategy 2040, and with national priorities[20]. TfGM were also exploring how their emerging 'streets for all' policy, which focuses on how road space is allocated to different modes, could support, restrict or steer CAV use through street design. The participants recognised that widespread adoption of privately owned CAVs would not contribute to local strategic objectives. The participant leading on the CAV trials was clear that TfGM want to enable the use of shared electric CAVs for passengers and freight, but stressed the need for reliable, safe and trustworthy CAV services, that can be adopted widely and meet local needs. Nevertheless, the participants admitted that they cannot predict how quickly the CAV market will evolve, so they were working on shaping the local position towards CAVs by 'building on their strengths'. At the time of the interviews, TfGM had commissioned a study exploring where and for whom in Greater Manchester shared CAV services may be relevant, which they would use to steer providers. In addition, TfGM were planning to carry out workshops with citizens to understand their views on CAVs and potential barriers to adoption. Finally, TfGM were focusing on enhancing opportunities for CAV-related education and skills development in the area. For example, they were supporting the University of Salford to develop stronger links with their industry partners, to ensure Salford's students become the future workforce that will lead on the development of CAVs.

[19] The participant leading on transport strategy explained that TfGM were hoping to publish their future mobility strategy by autumn 2019. At the time of writing, it was not publicly available.
[20] This was not publicly available at the time of writing.

5.2.3. Interaction with smart mobility providers

5.2.3.1. Lessons from the Mobike trial

The Mobike trial was the most significant smart mobility scheme that TfGM had been involved in at the time of the interviews, both in terms of scale and duration. As explained above, the trial ended after 15 months of operation, with both Mobike and TfGM citing lack of cooperation as a problem. The introduction of a dockless bike trial in Greater Manchester reflects the broader developments in the UK market in 2018, when mainly Chinese dockless bike companies started expanding their services to Europe. According to the participant from Mobike, their aspiration was to replicate the scheme's success in China and launch in many UK cities as quickly as possible. Manchester was Mobike's second city outside China (first was Singapore) and there was a rush to put a scheme on the ground, as their major competitor, ofo, was also trying to launch in different UK cities.

In China, Mobike launched as a start-up in 2015, and by 2017 it claimed over 100 million registered users across more than 100 cities (Russell, 2017), raising substantial investment from Chinese equity companies. The Chinese bikeshare market 'boom' was from the beginning intensely competitive, partly due to lack of regulation from the government. However, according to Gu et al. (2019) the rapid growth of dockless bikeshare schemes was mainly supply-driven by operators, rather than demand-driven by the users. Intense competition led companies like Mobike to adopt strategies of rapid expansion by effectively making an operating loss, with the aspiration to increase prices when they had captured a sufficiently big part of the market (Dudley et al., 2019). In 2018, and while the Manchester trial was still live, Mobike was acquired by the shopping and delivery company Meituan Dianping, which led to increasing pressure from investors to reach financial sustainability and a shift in strategic decisions (Russell, 2018). Indeed, one of the participants from TfGM attributed Mobike's withdrawal to 'a change at the top'. Eventually, as part of a 'rationalisation to improve efficiency', almost a year after the takeover from Meituan Dianping, all of Mobike's international operations were rolled back and the company continued to operate only in China (Liao, 2019).

In China Mobike have now been acquired by a company called Meituan – they are grouping services under one app and they see bikeshare as a quick way to acquire usage in their ecosystem where you can do everything from ordering food to getting vouchers or even PayNow through your Meituan app. So they are acquiring users that they then move onto the

rest of their ecosystem. Whereas over here (in Manchester) they don't have that – it was just bikes and it did not work. (GM5)

According to Mobike's ex-manager, there are significant differences between the 'end game' of VC-backed micromobility companies and traditional mobility players that were involved in early iterations of bikesharing. Globally, VC investment in micromobility has had a transformational impact on schemes, not just by fuelling the evolution of previous 'non-smart' bikesharing systems to GPS-tracked, electric and dockless, but also by changing how companies work with local governments. For example, the participant from Mobike explained that Chinese micromobility companies tried to expand outside China by launching in multiple cities at the same time, with little or no engagement with local governments, and without significant human resource dedicated to local operations. The same participant suggested that American companies started by using the same tactics, but as local governments started introducing regulations, they realised that collaboration with local authorities is necessary. European micromobility companies, which started later than the Chinese and American ones, learned from past experiences and adopted a slightly different approach, targeting large markets to ensure profit and working more closely with local governments. Across all markets, micromobility companies begin as start-ups that raise significant funding from investors, which fuels their growth. Consequently, in order to survive the fierce competition that independent companies face, they may be acquired by other mobility companies (for example Uber invested in Lime) but also by companies that offer a wider range of services, such as Meituan Dianping. Mergers and acquisitions combine the customer base of companies, offer a seamless experience across different services through the same mobile application, and have the potential to create market oligopolies. For example, as the participant from Mobike explained, while micromobility was not the main business interest of Meituan Dianping, they acquired Mobike for the user base integration, which was also a way for Mobike to survive for a bit longer.

The participant from Mobike explained that, aside from the market developments, VC-backed companies have brought a change in how mobility operations are financed in cities. 'Traditional' public bike hire schemes, such as those of London and Paris, were commissioned and subsidised by cities and they were usually sponsored by different organisations in return for advertising space. The companies that were contracted to operate the services needed to meet operating and performance standards as set by local authorities, accompanied by penalties and incentives to ensure availability of the service, consistent quality, and integration with the wider transport system. As such, the participant from Mobike explained that the operating model Mobike adopted in Manchester was impossible to support strategic transport objectives without investment from local authorities and TfGM.

If a private company wants to come in primarily they are focused on making money. But transport all over the world is subsidised because it does not make money – buses, trains are all subsidised yet bikeshare is still seen as something that isn't, and micromobility the same because private companies have come so fast and the innovation is moving so fast that legislation has not been able to keep up with it. That's the main thing – if cities need to have bikeshare as an integrated part of their network they need to get involved and say we need to have mobility hubs, this how people move, this where the main footfall is – how can we help people for the last part of their journeys? (GM5)

[a]lthough Mobike talked a lot about integration and voucher codes etc., if you want true integration it costs a lot of money and takes a lot of developer time and as this was a free scheme it was not going to be that beneficial for Mobike so it was never really going to work properly. A private operator operating only under a Memorandum of Understanding was never going to integrate completely. (GM5)

Finally, the lack of coordination between TfGM and Mobike also impacted the local communities. According to the participants from TfGM, Mobike's withdrawal created a gap in local transport provision in Manchester and Salford. However, the participants from TfGM added that Mobike did not share sufficient data to help them understand who exactly was affected and to what extent, and TfGM's limited research resources did not allow them to carry out surveys. Nevertheless, the participants from TfGM suggested that the lack of reliability in service provision was a problem for them, indicating that smart mobility services are seen as part of the public transport system and are expected to provide a good level of service, even if they are not publicly provided.

5.2.3.2. Conflicting perspectives on the role of government

As explained in their FTZ Fund application, TfGM proposed a hybrid model of procured and commercially run mobility services operating under a single MaaS ecosystem. Under this model, TfGM would procure key transport services and infrastructure, while providing incentives and facilitating commercially run mobility services in the rest of the network. This hybrid approach was considered to provide a balance between a completely hands-off approach to smart mobility services, and a heavy handed, interventionist role for TfGM. However, the interviews revealed that participants hold different views on the role of innovation in transport and how the public sector should steer it, leaning towards the opposite elements of the hybrid model. In both cases participants agreed that smart mobility services need to play a complementary role to the existing transport system, but they had different views on how this should be achieved.

Steering through regulation

The first perspective is that smart mobility services need to be regulated or controlled, in order to align with local transport objectives. This perspective was mainly advocated by the participant from TfGM leading on transport strategy and by the participant from Mobike. The interviewee leading on TfGM's transport strategy was clear that smart mobility services need to fill the 'gaps' in the local transport system, which include insufficient geographic coverage, as well as coverage during off-peak hours, or to help tackle specific problems, such as reducing the number of short trips taken by car. They explained that this position ensures that new services complement, rather than undermine, the CA's strategic transport objectives about promoting modal shift, reducing people's need to travel, and supporting the transition to electric vehicles, as well as objectives of other policy areas, such as public health and land use planning. In the face of market uncertainty and especially after the experience with Mobike, the same participant explained that it is important for TfGM to have a clear strategic position on the role that smart mobility should play in the wider transport system, which can be used to steer any future developments and lobby for more powers.

This is where I think you need to have a strategic vision of what you're trying to achieve and then identify how new mobility services support that rather than everything being a little bit grey. I am probably relatively sceptical although I can see that we could achieve some really positive outcomes only if the public sector takes quite a strong role. If we take a laissez faire approach, then I think we are not going to achieve many of these outcomes for the city as a whole. And you do need to have the right approach to governance and regulation to achieve that. This is quite hard for the public sector because we don't necessarily understand the operating models and the commercial models - some of these new offers are coming very quickly and we don't have a lot of time to respond. Usually we don't know what regulation we might need after it is already in place and it might be too late. (GM2)

Central to the perspective favouring the regulation of smart mobility services is the role of local authorities in identifying and implementing strategic priorities for transport in their area, and in balancing what works for individuals against the wider public good. This includes addressing externalities of transport, such as inequity and environmental impacts of services. As such, TfGM's strategic overview of transport in the region was seen as a key bargaining tool that can be used to steer providers. The participant leading on transport strategy argued that providers need TfGM's help to understand the local travel market, as in most cases they tend to focus their operations in Manchester city centre and parts of Salford, home to some of their key demographic group targets, such as young professionals. As TfGM have detailed insight into the travel patterns in the CA, including public transport accessibility and car dependency

levels, they can help providers understand where there are new commercial opportunities while also addressing the region's challenges, if targeted solutions are provided.

My view is that many of these services are great at appealing to customers and spotting gaps in the market and really selling them to individuals. Uber in particular has been great at that, hasn't it? They have found a gap in the market but we are trying to balance that kind of customer experience with what works for an entire city and we're trying to keep the city well-functioning and inclusive. We should be able to achieve our environmental outcomes and find the balance between the right thing that suits the customers and the requirements of the city. (GM2)

The participants explained that TfGM can also use their existing powers as leverage in shaping smart mobility. For example, the extensive network of road infrastructure that is owned by TfGM and the districts can be used as a bargaining tool to steer CAVs, and land-use planning powers can be used to cater proactively for shared, electric smart mobility services in new housing and employment developments. Indeed, one of the participants from TfGM explained that they were already working with the Greater Manchester local authorities to train them on how to 'futureproof' new developments. However, the participants stressed the need for additional regulatory powers to steer smart mobility providers. Examples mentioned include the power to enforce traffic offences, and powers to enforce against obstruction of pavements, the rules of which were largely centralised at the time of the interviews. The participants also mentioned the need to introduce minimum licensing standards for PHVs across all Greater Manchester local authorities, and to ensure that these standards are not undermined by vehicles registered in other local authorities and operating in Greater Manchester. This is a commitment included in TfGM's 2040 strategy and in Andy Burnham's re-election manifesto (Burnham, 2021).

At the same time, the participants also talked about the need for national and international regulation for MaaS and CAVs. This regulation should ensure that all services can operate seamlessly across local authorities by following certain ground rules, including rules on data sharing and standardisation, and that operators should not be able to choose where to operate based on how local rules suit them. Nevertheless, the participants recognised that it can be hard to know what rules need to be introduced before a service even emerges in the region, and that by the time they go through the lengthy and complex process of creating and adopting new rules, some services may already be obsolete.

There's a whole load of protocols that need to be established either at an international level or at the national level for a lot of these things. Vehicle manufacturers – what software they put in their car and how do we deal with data security issues. There's a whole load of – how

connected the infrastructure is – we can't just stop at the city boundary. […] So we have to do what we can do locally and be clear on what we want – what outcomes we're trying to achieve -if we're clear on that then it's easier to identify what changes in governance and regulations you might need and how many of these might be local changes and which might need to be done at a national or international level. And then start to lobby for those things to happen. But from our experience those things always take a long time and in the meantime we always have all sorts of disruption coming in – and going. (GM2)

Looking into the future of steering through regulation, the participant from Mobike predicted that current business models in smart mobility will not last long, as capital investment in services will decrease and they will have to achieve commercial viability. They predicted that in future years, the public sector's role will be to dictate the operational terms of services so that they meet local needs, but also to invest in services and infrastructure to help them stay financially sustainable and integrated in the transport network. Such an approach would legitimise the expectation that providers serve local transport objectives, as when services are regulated or subsidised there is an expectation that they will '*do more than make money'* (GM6), and that they will continue to serve the public outside the most profitable part of their operations.

Steering commercially run services

The second perspective on the role of the state argues that smart mobility services should operate on a commercial basis within a flexible regulatory environment. Local authorities and TfGM should incentivise providers to come to Greater Manchester through creating favourable business conditions, which are used to steer smart mobility services to align with local transport objectives. This perspective was advocated by TfGM's innovation officers and the participant from the research organisation focusing on the future of mobility. These participants suggested that this approach provides a balance against the risks of a fully procured and regulated model, as it does not 'tie' TfGM to specific solutions while technology continues to evolve. Allowing smart mobility services to operate mainly on a commercial basis means that TfGM have more time to understand how and if specific technologies work for the region and what are the operational and commercial requirements for successful services, elements that would otherwise be difficult to pre-define in a contract without prior experience of working with a service.

[f]or a new service it would be very difficult for us as an authority to define everything we need within a contract and procure. With new technology it is difficult to put any constraints in it. You don't want to run a procurement process, have a service run for 3 or 5 years and in the meantime technologies change so quickly but it is not included in the contract. Having it as a

market with people-driven solutions would be more beneficial than setting all the rules and have operators fight with each other (for it). Having a multitude of operators with services that meet all our objectives and serve more people instead of having restricted services that we have procured. (GM4)

I'm trying to avoid control as much as we can because it's always what we've tried to do, and sure, we get powers, we keep asking for powers to do it. You ask for powers and then you do something, and you find something else and you need more powers – it is a perpetual cycle. Whereas if you influence the market in the right way so that there is a commercial incentive for the mobility operators and for the public good and for the customers to make the right thing then that changes the story as a whole. (GM7)

The participants argued that close engagement with providers allows TfGM to show them that there are mutual benefits in working collaboratively, as TfGM can ensure that local needs are met, while smart mobility providers can grow their business. The participants stressed the importance of building trust with providers by ensuring that they do not appear to be "*the enemy who asks them to do stuff or sanction them*" (GM4) and showing them that TfGM do not want to "*monopolise the market*" (GM4). As such, those supporting a commercial approach to running services suggested that operators should be steered through flexible and 'soft' rules, which enhance an open and collaborative relationship between the public and private sectors. These included voluntary agreements on performance targets and new, agile ways of working with operators. For example, one of the participants cited Turin's micromobility scheme, where providers are initially required to pay a fee to the city to operate, which is returned to them if they achieve predetermined ridership targets. Ultimately, the participants suggested that steering smart mobility providers is a bargaining process, in which TfGM's greatest leverage is the threat of regulation.

"*our conclusion is that there needs to be some form of regulation, it is important and we are missing regulation in this area but regulation is very different from taking over. Our view is that there needs to be positive regulation to force companies to be a lot more open in the way they do business in a city, they have to share the data to identify areas of concern to identify alignment against policy goals – that doesn't necessarily have to be by taking control over the private sector completely. Our view is that it is about having an open system that does allow private sector innovation to continue."* (GM6)

The participants supporting a commercial model saw innovation as an indispensable element of progress. They argued that testing new services is an essential 'learning by doing' opportunity, which provides data and insight to improve local transport. Even if testing fails or if a new service does not meet local strategic objectives, engaging with innovation still makes

the public sector a ‘better customer’ who understands what to ask from the market. However, the participants argued that the public sector and ‘traditional’ public transport operators, such as bus operators, are not accustomed to innovating, and do not understand individuals’ needs and the ‘critical personas’ in the region. As local authorities and public transport operators lack the smart mobility providers’ detailed insight in travel demand patterns, they cannot provide personalised solutions as alternatives to private cars. At the same time, smart mobility services are revolutionising the transport sector by providing ever-evolving on-demand solutions, which have a popularity that local authorities cannot really control.

Life is changing so much, cities have to recognise how much are you actually in control of anything. Yes, you need to have a bit of concern about whether there is going to be a negative or positive impact, but you’ve got to be able to make decisions in any case. If companies can work in a more open manner, we can have more of a common understanding of what is happening in a city, which is positive, because they can adjust. We can’t plan all of this out, we just need to be out there, delivering new services and if we share the data that’s the whole point of living in a data rich world. We should be able to adjust the transport system accordingly if it’s going in the wrong direction – we need the openness. (GM6)

Finally, almost all participants discussed the difficulty of removing a service once people have become accustomed to it, and, more generally, of not meeting the public’s evolving demand for tailored transport solutions. The participants supporting a commercial model saw smart mobility services as an undeniable choice for citizens, which has the potential advantage to replace private car trips without the need for any “sticks”.

A lot of this is necessary because it is good for city policy but a lot of this is actually necessary because cities need to remain relevant to consumer expectations. […] It is a bit like building the business case for delivering WiFi in a city. Why are we doing this? What is the economic benefit? Ultimately, we need to provide WiFi in cities because consumers expect it. (GM6)

5.3. Smart mobility services and sustainable urban transport

5.3.1. The role of smart mobility services in Greater Manchester

Given TfGM’s limited experience of working with smart mobility providers and limited data to evidence the impact of services, this section focuses on the role that smart mobility could play in Greater Manchester and the barriers to holding smart mobility providers accountable for delivering local benefits. As explained, all participants supported that smart mobility should play a complementary role to the core public transport network and fill its gaps. However, the participants could not provide any real clarity when asked how these benefits will be secured.

Firstly, the participants recognised barriers related to the current business models. Overall, they considered that most smart mobility providers are keen to engage with TfGM and understand that the support of the CA and the local authorities is essential for their successful operation. Nevertheless, the participants acknowledged a range of risks, including that without contractual agreements it may be hard to retain services, or that it may be difficult to control and steer powerful monopolies and oligopolies, if they emerge. The latter is a risk also recognised by the Future of Mobility Urban Strategy, which states that monopolies and oligopolies can dictate consumers' choices and limit access to competitors, and suggests that it can be addressed through 'working to deliver the best possible open marketplace for consumers' (Department for Transport, 2019).

We have identified key partners in this sector who share our vision and we can trust to work with us and realise our goals. To the extent that they understand that although they accept the city centre is more profitable they are willing to take on other areas as well. The downside is to what extent can we enforce them doing that. How long are they going to do it for? (GM3)

Furthermore, when asked specifically about the impacts of services, the participants expressed doubts about whether some of them are indeed sustainable transport options, with one of the participants stating that "*lots of mobility providers presenting themselves as 'green' are arguably misleading people*" (GM7). More broadly, the participants argued that local authorities do not understand the complexities of the 'new world' of mobility. This includes shifts such as the rebranding of automotive companies as mobility providers and their expansion into smart mobility services, and the market tactics of VC-backed companies. More specifically, one of the innovation officers interviewed argued that smart mobility operators like Uber have a completely different approach to selling their services compared to traditional public transport operators. While Uber has an extensive customer base, offers on-demand mobility across multiple countries and has moved into the "lifestyle" space, through services such as Uber Eats, public transport operators continue to think just about "going from A to B", without upselling their offer with elements such as dynamic pricing. This creates an uneven playing field where smart mobility providers cannot be managed effectively (for example, the same participant mentioned that even if Uber is regulated, the cost could be passed on to users making TfGM look like "the bad guys") and maintain a competitive advantage over traditional mobility players.

Aside from the wider market context, there are multiple challenges related to the development of a TfGM-led MaaS ecosystem. The following paragraphs discuss these challenges, drawing from the proposals included in the FTZ application and the interviews. The issues identified are centred on three areas: data sharing, provider cooperation, and market competition. On data sharing, the participants explained that, as part of a MaaS ecosystem, all transport

service operators would provide data to TfGM to a specific standard and in a specific format. TfGM would use this granular, real-time data to manage services, inform future policy decisions, and to attract new smart mobility providers to the region by demonstrating that there is sufficient demand for their services to become profitable.

This assumption contradicts some of the lessons that TfGM have learned from working with commercially operated bus services over the last 30 years. Indeed, one of the interviewees who used to work for TfGM focusing on bus network monitoring suggested that "*all of the commercial tensions which ridesharing would come into with a city were actually the same as the tensions I was already dealing with with a private bus network"* (GM6). The participants from TfGM explained that bus operators often do not share their patronage and real time bus location data citing commercial sensitivity reasons. This "*data blindfold*" (GM3) results in a limited overview of the local transport market and user needs by TfGM, and in a bad level of service provided to the public, who are faced with complex bus routes and fares. The possibility that similar challenges may arise in the MaaS space was confirmed by the participant from the research organisation focusing on the future of mobility, who explained that there is a lack of openness in the industry and stated that "*[t]he innovation is led by deep pockets within the tech investment, which means that much of the data is collected by the industry and not shared. […] to really understand the public benefits (of smart mobility services) the data is scant.*" (GM6). Furthermore, the same participant pointed out that a shift to MaaS entails massive practical challenges related to cybersecurity and system resilience, and a need for advanced operational and data processing capabilities, which local authorities are not ready to handle.

On provider cooperation, the participants added that, in a MaaS ecosystem, the MaaS provider(s)[21] would be able to access the data shared by mobility operators, as well as other information such as disruption data, provided they offer a certain level of service. For example, MaaS operators will need to agree that in the event of disruption, their users will be guaranteed at least a taxi home. The creation of MaaS 'packages', i.e. how service options are bundled and priced could be left to the market, as according to one of the participants "*digital marketeers and people that understand marketing (are able) to package MaaS and to sell the solution better' (GM7).* However, TfGM would reserve the right to define or approve the incentive structure that shapes the options offered by the MaaS platforms, to ensure that it aligns with local objectives. In addition, TfGM would gather data on all the transactions carried

[21] The participants stated that TfGM could offer their own MaaS mobile application (app), or allow private MaaS providers to introduce their own apps (possibly more than one). MaaS providers would be invited to use Greater Manchester as a 'shopfront' (GM7), by tailoring their service to the needs of the region and using it as publicity.

out through the MaaS ecosystem to understand which incentives have the biggest impacts on shifting travel behaviour. Finally, on competition, one of the innovation officers suggested that operators could be geofenced in specific areas of Greater Manchester to manage competition, provide a targeted alternative to private cars, and fill gaps in the local network. However, they admitted that if operational standards were too stringent, geofencing providers could lead to gaps in provision. If this happened, the same participant suggested that TfGM would subsidise the services considered essential for the local network. Indeed, they argued that a benefit of the MaaS ecosystem is that it allows TfGM to reduce disruption caused by operators leaving the area, as all services would be provided through a single platform and payment package, and therefore the same service could be easily provided by a replacement operator.

These proposals, even if early stage, demonstrate a strong faith in TfGM's ability to control local operations through data-led policies. However, as is demonstrated by Mobike's departure from Manchester, developments in a city can be determined by a service's performance in other parts of the world, while providers' strategic decisions, such as the shift from dockless bikes to e-scooters, can shape the direction of smart mobility at the global level, with very little say from cities. There is also a broader question about whether more data would lead to better decisions. As one of the participants argued, although detailed data could provide local politicians with the evidence to accelerate the adoption of smart mobility solutions, in reality, many political decisions are not evidence based. Although some of the participants criticised the lack political will to take decisive action that delivers local transport objectives, they failed to capture the complex link between transport policy and the profitability of smart mobility services. Firstly, there is a 'more carrots, no sticks' assumption that smart mobility services can become profitable by serving the unmet demand for public transport, without the need to restrict the use of private cars. At the same time, TfGM's Transport Delivery Plan 2021-2026 already hints at the need to reduce the overall distance and amount of travel in order to meet the region's decarbonisation goal (TfGM, 2021b). In a context where the incentive structure supports a policy of travelling less, it will be very challenging to persuade mobility providers to adopt it, especially if users are disincentivised to choose their services.

5.3.2. Smart mobility services in context

Regardless of TfGM's ambitions, the interviews showed that Greater Manchester's limited devolved powers, and their efforts to secure further devolution, affect how smart mobility services are shaped locally. The idea to integrate all transport services under a MaaS ecosystem is in line with TfGM's efforts to bring buses under local public control and is seen as a means for TfGM to avoid a further breakdown of the already fragmented local transport system, while still offering space for commercial operations. All participants from TfGM

discussed future developments as a function of the (at the time) upcoming decision on whether Greater Manchester would seek to franchise bus services. They argued that if they controlled public transport, they would have more leverage to steer smart mobility services in a way that complements existing provision. At the same time, the fact that TfGM are "an organisation about to take back control" (GM6) was seen as an opportunity to reflect upon how they engage with private sector providers of all mobility services, and redefine their models of collaboration.

Nevertheless, TfGM still lacks the power to shape and fund smart mobility. TfGM's application to secure the FTZ funding is a prime example of how local decisions depend on the central UK government. As explained, the FTZ application proposed a hybrid approach to steering, which is aligned with the Future of mobility: Urban Strategy principle that "the marketplace for mobility must be open to stimulate innovation and give the best deal to consumers" (Department for Transport, 2019, p.8). The alignment with the strategy's principles was a prerequisite for securing the FTZ funding, and applicants were asked to demonstrate the compliance of their proposals with the direction set by the Urban Strategy. This means that TfGM's ambitions are partially shaped by national priorities. Indeed, this was confirmed by one of the TfGM innovation officers, who explained that maintaining a flexible and agile regulatory approach allows TfGM to easily shift their position, should central government decide that they want to change their direction.

As part of the MaaS work we looked at about seven places for TfGM to sit going from the TfL end to the TfWM end and where we can sit in between all those options[22] – whether we can procure service, take revenue, mandate standards etc. and we chose that platform approach because that provides the greatest flexibility for us to occupy the greatest number of those spaces. So if political winds change or if priorities shift at a local regional or national level we are able to reflect that. If we end up having just the platform then we still have some level of interaction with the system. Equally through the platform we could mandate services – it lets us do all of that in the future. (GM3)

According to the same participant, their support for commercially run smart mobility services is not only attributable to aligning with the Urban Strategy. They explained that as national subsidies for transport are falling[23], local public transport services are under pressure to stay commercially viable. As such, TfGM would struggle to support a regulation-focused approach to smart mobility services, as they would not have the appropriate resources to manage it.

[22] This refers to TfL's near-total control of the local transport network through a fully franchised public transport network and ticketing integration via the Oyster card, and TfWM's hands-off approach to a Mobility as a Service trial that was run entirely by MaaS Global.
[23] Refers to conditions before the COVID-19 pandemic.

All authorities are cutting their supporting bus networks because of austerity and as long as that is the case this frames the entire discussion. If as a nation we shifted and focused on decarbonisation and modal shift and decided to put money into this – if you had a sudden change in government perception – and they gave us the money to make it work then we could afford to bring in bikesharing and e-scooter companies and make it work, which would change the dynamic entirely we would not negotiate, we would say we want this service and you should deliver these things for this amount of money. (GM3)

Beyond the challenges related to governance arrangements, the participants from Greater Manchester also revealed that there are practical limitations to the implementation of their smart mobility ambitions, which relate to market developments. For example, when one of the innovation officers was asked why TfGM is proceeding with the full procurement of a bikeshare scheme when their ambition is to create an open MaaS ecosystem, they explained that they expect the MaaS market to take at least 5 years to mature, while the bikeshare scheme is an urgent political priority.

[o]bviously MaaS it is a utopian vision but how we get there is different. And due to the political imperatives amongst others including whether we can get something out of (the experience with) Mobike, the timeline for the bikeshare scheme is pretty imminent. We're hopefully going out in the next couple of months if we want to get something on the ground by spring 2020. For a number of reasons a. we want a bikehire scheme, b. there's an election in May (2020)[24], Chris Boardman has been around for a while and he wants a scheme to demonstrate there's momentum alongside the bee network that we have as well. So what we've got there is that we're looking to emulate the standard bikeshare contracts, which are usually 5 years plus 2 years contract time, or 7 year contracts. And what that gives us is that we can get the bikehire for 7 years and that gives us 7 years during which we can build a MaaS platform and at the end of that programme time we go 'actually, having a single provider doesn't work, what we want is to open it up to be more broad and we have MaaS platform in place that can accept that. Because that's still – what? 2025? 2026? That's pretty close. And MaaS won't probably be that developed by then for all that we want it to be tomorrow. (GM3)

Similarly, the participant from the research organisation focusing on the future of mobility explained that their discussions about MaaS are still at a very early stage of 'getting the right people together'. They added that the industry is not yet in agreement on how to make MaaS work, but there is certainly a need for openness, which will be challenging to achieve.

"Openness has different strands – lots of people like to take ownership of the word – claims that software is open source, or they're providing open data. But we are interested in openness

[24] This election was postponed to May 2021 due to the COVID-19 pandemic.

as a business model, which is very challenging – how do you as an organisation – a city or a start-up – can truly operate in an open way and feel comfortable alongside other companies within the MaaS market. Sounds simple but extremely challenging in fact." (GM6)

5.3.3. Reflections and summary

In Greater Manchester, the lack of powers to shape smart mobility creates multiple layers of uncertainty. Firstly, the CA largely relies on external funding and decisions to control smart mobility services and deliver their ambitions. Secondly, the CA are in the process of seeking new powers, which means that they cannot know how, and if, they will be able to shape the local market. Finally, the smart mobility market itself is evolving rapidly and it is unclear which services will evolve, emerge or fail. In this context of uncertainty, there is little definitive action and a lot of space for speculation. The discussions in Greater Manchester focused largely on what 'could be' rather than on the lessons the participants had already learned. Although there is no framework through which to implement some of the participants' proposals, the interviews in Greater Manchester provided an opportunity to explore the ideological positions underlying the potential approaches to steering smart mobility. The participants' views show a clear divide between the hands-on and hands-off state. The former shapes people's options to balance the individual and public benefit, and therefore steers innovation to meet local needs and shape people's options. The latter prioritises giving people options and information to make the choices that meet their own – and collective – needs. In this case innovation is almost a goal in itself, and shapes the options that are given to citizens.

All participants agreed that, realistically, services need to be introduced through "a blend of commercial innovation and public sector regulation" (GM6). However, there is still a lot of uncertainty about what this blend consists of. While authorities seek clarity, the public also need to adapt. The participants described that there is already a lack of meaningful engagement and participation of the public in shaping the transport system, from small-scale projects such as the Mobike trial, to long-term strategies that seek to overturn car dependency. As such, there remains a risk that in a smart mobility future that is solution-led, rather than problem-led, the public may need to grapple with services that still do not meet their needs, even if they are plentiful.

6. Smart mobility governance in Stockholm

6.1. Stockholm's governance context[25]

6.1.1. Institutional context

Stockholm is the largest local authority in Sweden and is divided into 13 district councils. The City Council is its supreme decision-making authority and has 101 elected members representing different political parties, with the ruling majority usually being a multi-party coalition. The Council has two key decision-making bodies, the Council of Mayors and the City Executive Board, both chaired by the Mayor. The City Executive Board consists of 13 council members from both the majority and the opposition, effectively acting as a cabinet. The City Executive Board expresses an opinion in all matters decided by the Council and is responsible for evaluating and executing its decisions, as well as for the City's financial administration and long-term development. The City Executive Board is supported by the City Executive Office, which helps with managing and coordinating city operations (City of Stockholm, 2022a). The Council of Mayors is elected by the City Council and is responsible for drafting matters for the City Executive Board. It comprises the Mayor, seven majority vice mayors and seven opposition vice-mayors. Each Mayor of the majority is also the head of an office responsible for a certain policy area. At the time of the interviews and the time of writing, Stockholm was governed by a coalition between the Moderate Party, the Liberal Party, the Green Party, the Centre Party, and the Christian Democrats, following the 2018 election. Anna König Jerlmyr from the Moderate Party is the Mayor of Stockholm and Daniel Helldén from the Green Party is the Vice-Mayor leading the Office for Transport (City of Stockholm, 2018; City of Stockholm, 2022b).

The most important responsibilities and powers of the City Council are its ability to set the local income tax structure, and an effective monopoly on land-use planning within its territory (Eriksson, 2016). The annual city budget is one of the City Council's most important responsibilities, determining how taxes will be spent and setting the priorities for each year. The delivery of political decisions is carried out by the City Council's departments and companies, which are managed by the politically governed district councils, and committees and boards that are associated with the Mayoral Offices (City of Stockholm, 2022a; City of Stockholm, 2018; City of Stockholm, 2022b). As will be shown in the sections below,

[25] The cut-off date for this Chapter is 31 January 2022.

responsibility for transport strategy and planning, and for smart mobility, is split across different departments within Stockholm City Council. The participants interviewed worked in the traffic department, the city planning department, the City Executive Office, and at two of the City's companies, Stockholm Parkering and Stokab. Informal discussions also took place with officers from the environment department, who are involved in smart mobility trials.

Region Stockholm (previously Stockholm County Council or Stockholms Läns Landsting) consists of 26 municipalities[26], with the City of Stockholm being the main employment destination and population centre (41% of the region's population lives in the City of Stockholm (Statistics Sweden, 2021b)). The Region can impose income tax on citizens, and is responsible for healthcare, regional land use planning and regional economic development, and for subsidising some cultural activities (Region Stockholm, 2022). In addition, within Region Stockholm, the Regional Public Transport Authority (RTPA), or Trafikförvaltningen in Swedish, is responsible for public transport planning in line with political goals, and the procurement of public transport services, operating under the name SL (Storstockholms Lokaltrafik) (Oldbury, 2021). Public transport planning became the role of regional authorities in Sweden after national legislative reform in 2010. The Public Transport Act came into force in 2012 and challenged the previous governance arrangement, where the majority of local and regional public transport in the country was provided through a competitive tendering regime that was delivered by the then Swedish Counties and their local authorities (Oldbury, 2021; van de Velde and Wallis, 2013). The Public Transport Act introduced partial deregulation of the public transport market, following criticism of the competitive tendering regime and a desire to allow "an increased influence of passengers on the public transport system through their own active choices" (van de Velde and Wallis, 2013, p.29). The Public Transport Act introduced two key changes. Firstly, while competitive tendering continued to play a central role, the Act allowed private operators to deliver commercial public transport services that could openly compete with tendered services. Secondly, the Act gave increased strategic power to public bodies, as demonstrated by the establishment of RPTAs, and created the conditions for strategic public transport planning to be delivered in line with political goals and ambitions. To increase transparency and accountability, the Act mandated that RPTAs produce a strategic Regional Transport Supply Program (RTSP), or Regional Trafikförsörjningsprogram in Swedish, after consultation with neighbouring authorities, other relevant stakeholders, and passengers (van de Velde and Wallis, 2013; Paulsson and Isaksson, 2018).

[26] These are Botkyrka, Danderyd, Ekerö, Haninge, Huddinge, Järfälla, Lidingö, Nacka, Norrtälje, Nykvarn, Nynäshamn, Salem, Sigtuna, Sollentuna, Solna, Stockholm, Sundbyberg, Södertälje, Tyresö, Täby, Upplands-, Bro, Upplands Väsby, Vallentuna, Vaxholm, Värmdö, and Österåker.

At the national level, Swedish public administration is dualistic, meaning government departments (ministries) are being led by a government-appointed minister, but the administrative authorities (or government agencies) under these departments are autonomous. Compared to other countries ministries are relatively small organisations, and each ministry is responsible for a number of government agencies. Every year, the Riksdag (parliament) and the government set out objectives for the agencies' activities and their budget, but ministers have no powers to intervene in an agency's decisions on specific matters (Government Offices of Sweden, 2022c). The Swedish Transport Administration (STA), or Trafikverket in Swedish, is one of the government agencies under the Ministry of Infrastructure, responsible for the strategic planning of all national transport infrastructure (road, rail, maritime and aviation), as well as for building, operating and maintaining public roads and railways (Trafikverket, 2022). The STA was created in 2010, following a government inquiry that found that the integration of different transport agencies[27] and the streamlining and outsourcing of their operations would have significant gains in efficiency and productivity and would provide incentives for private sector innovation (Witzell, 2019).

Finally, to assist the reader, the following paragraphs set in context the remaining organisations that were represented by interview participants.

Drive Sweden is one of 17 strategic innovation programmes focusing on different areas of innovation that is funded by Vinnova, the Swedish Innovation Agency. Vinnova is another government agency that is under the Ministry of Enterprise and Innovation. Drive Sweden aims to bring together public and private actors and academics in the field of smart mobility, and to showcase different smart mobility initiatives.

The Swedish government can commission work directly via committees, when issues are considered difficult to resolve and require extensive analysis and preparation before a proposal can be drafted and submitted to the Riksdag (Government Offices of Sweden, 2022a). One of these committees is the Committee for Technological Innovation and Ethics (KOMET), which was established by the Swedish government in August 2018. Its mission is to help the government identify policy challenges to innovation, contribute to reducing uncertainty surrounding existing regulations, and accelerate policy development linked to 'fourth industrial revolution technologies' (Ministry of Enterprise and Innovation, 2018).

I**n the case of Stockholm, the two core institutions that shape smart mobility are Stockholm City Council and the Region Stockholm.**

[27] The STA took over the operations of the Swedish Road Administration and the Swedish Rail Administration, as well as certain operations of the National Institute for Communication Analysis, the Swedish Maritime Administration and the Swedish Transport Agency (Nationalencyklopedin, 2022).

6.1.2. Policy context

The participants noted a marked shift towards prioritising sustainable transport modes in the recent decade, and especially since 2014, when the Green Party started leading the Office for Transport[28]. Stockholm's latest transport strategy, the Urban Mobility Strategy, was adopted in 2012. The Urban Mobility Strategy does not refer to smart mobility services as they are defined in this research, but focuses on "smarter choices", referring to travel planning and traffic management aimed at reducing the impact and number of trips, which shows the evolving use of the term "smart" (Stockholms stad, 2010). The Urban Mobility Strategy was developed to support the Stockholm City Plan: The Walkable City, which was adopted in 2010 and forecast that between 2012 and 2030 the city's population would reach 1 million inhabitants (from approximately 800,000 in 2010) thus requiring approximately 70,000 new homes to be built (Stockholms stad, 2010). However, the latest housing delivery target is set at 140,000 between 2010 and 2030 (Stockholms stad, 2020b), while the city's population is projected to surpass 1.1 million by 2040 (Statistics Sweden, 2021a). The Urban Mobility Strategy stressed that while increased population density should result in a reduced need to travel, it is crucial to drastically cut the number of trips undertaken by cars, and reallocate road and street space to prioritise walking, cycling and public transport. The Strategy was complemented by a plan to expand public transport and road capacity known as the Stockholm Agreement, a funding deal for the period until 2021 that was negotiated between the Swedish Government, Stockholm County (now Region Stockholm), Stockholm City Council and three the region's other municipalities (Nacka, Solna and Järfälla). The Agreement involves a pledge by the national government to fund the expansion of Stockholm's metro network and, in return, a commitment by the municipalities to construct new housing in the areas adjoining the new metro stations (Stockholms stad, 2013; Oldbury, 2021).

Other, more recent, policies include Stockholm's Environment Programme 2020–2023, which increased the city's earlier decarbonisation ambition to be fossil fuel-free by 2050, by committing to a fossil fuel-free and climate-positive[29] Stockholm by 2040 and a fossil fuel-free Stockholm City Council by 2030 (Stockholms stad, 2020b). The accompanying Climate Action Plan 2020-2023 clearly calls for coordinated local, national and EU-wide action on transport

[28] The participants also described different Stockholm City Council departments as more or less progressive depending on the political party leading them. For context, following the 2018 election, the departments and companies referenced in this chapter were led as follows: Moderates: Mayor's Office, Office for City Planning, Stokab; Green Party: Office for Transport, Stockholm Parkering, Office for Environment and Climate. The next election is planned for September 2022.

[29] The Programme estimates it can reduce the city's carbon emissions to approximately 500,000 tonnes of CO_2e by 2040, which is expected to be offset through carbon capture technologies. Therefore, "fossil fuel-free and climate-positive" effectively refers to net zero carbon.

decarbonisation, and highlights that the city lacks the powers to decarbonise its transport system alone (Stockholms stad, 2020a). In addition, Stockholm adopted its Strategy for Stockholm as a Smart and Connected City in 2017, aiming to stimulate, guide and coordinate digitisation projects (Stockholms stad, 2017). Finally, as will be shown in the sections below, Stockholm's annual budgets play an important role in shaping short-term priorities, including for smart mobility services.

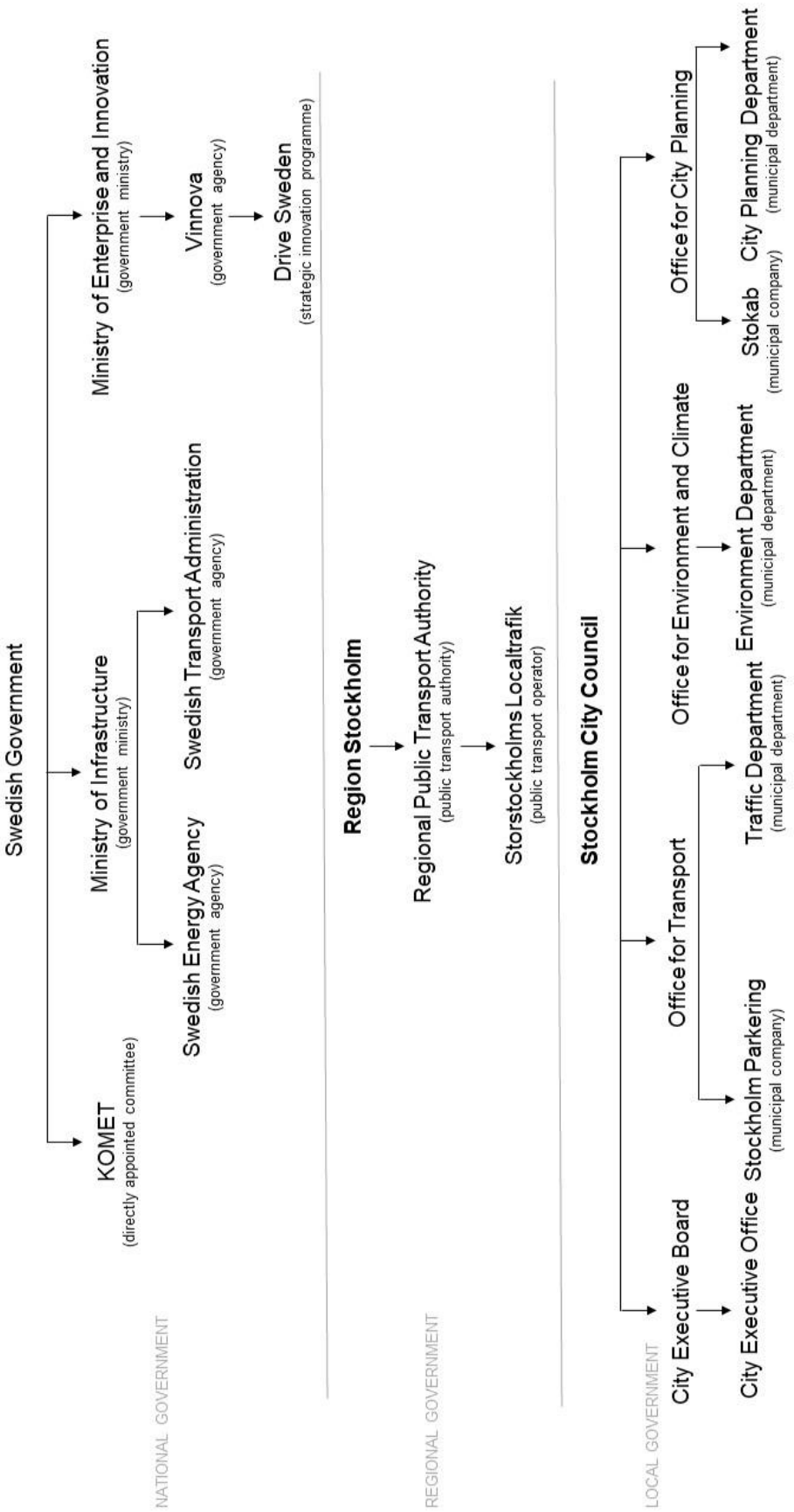


Figure 8 Key government institutions and associated transport bodies referenced in the Stockholm case study. Official description of each transport body in brackets. Core institutions in bold. Designed by the author.

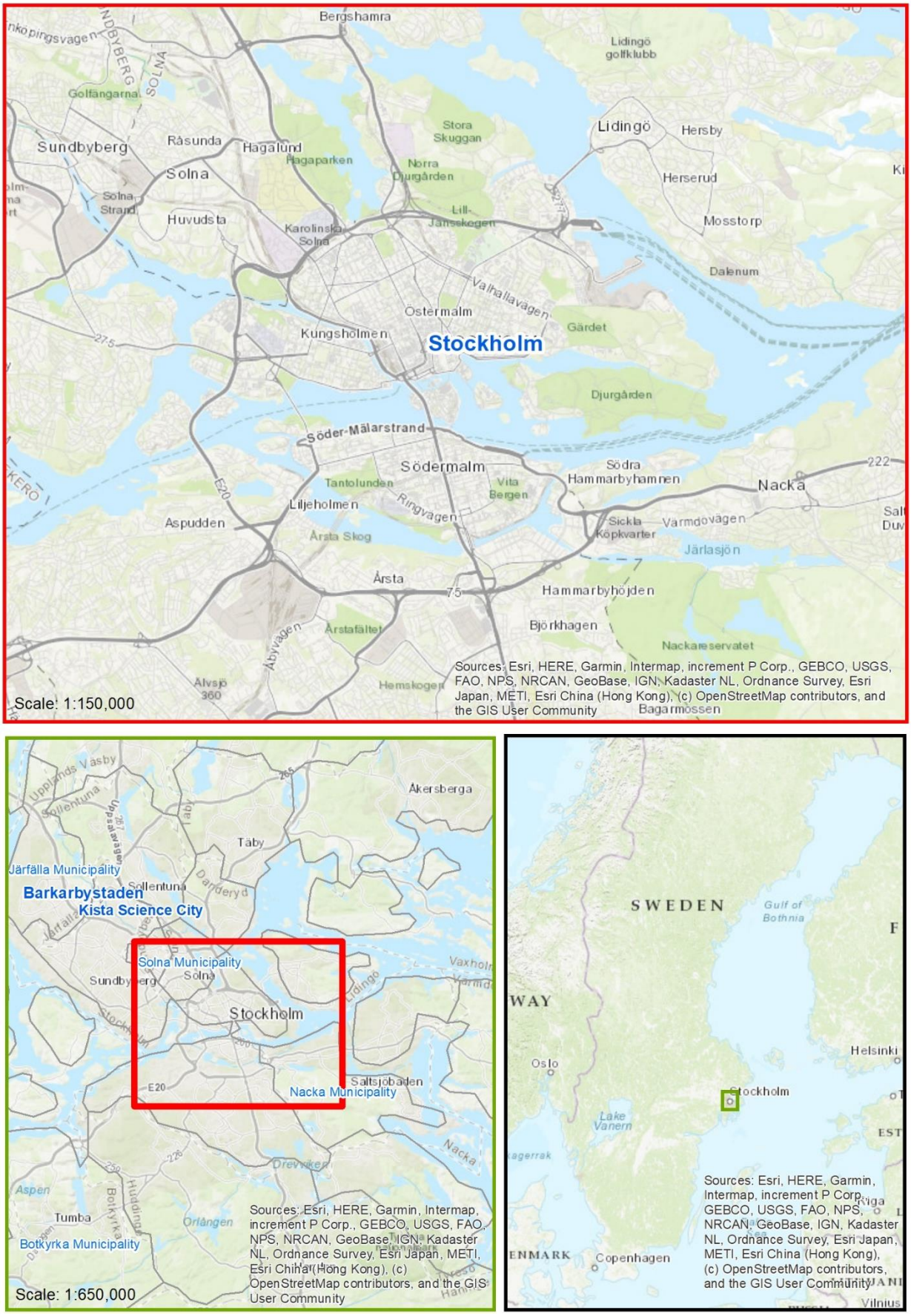


Figure 9 Map of locations referenced in the Stockholm case study. Designed by the author.

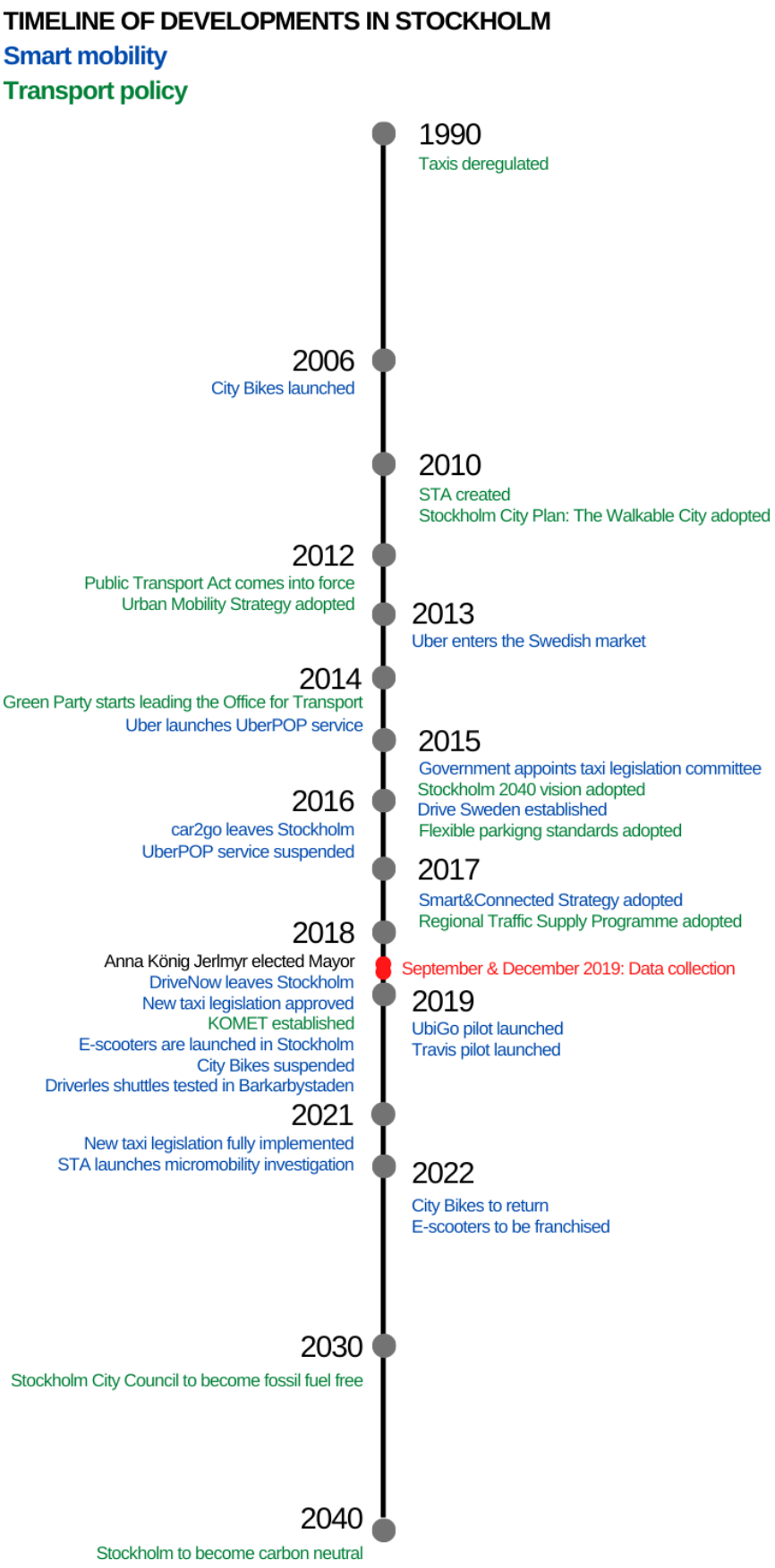


Figure 10 Timeline of developments referenced in the Stockholm case study. Designed by the author.

6.2. Smart mobility in Stockholm

The interviews in Stockholm revealed a fragmented approach towards smart mobility, both within each authority and across different governance levels. In addition, the interviews showed the development of smart mobility services on the ground does not necessarily reflect the local and national ambitions around innovation. Based on the interviews, the Stockholm City Council departments involved in smart mobility initiatives were the traffic department (mainly dealing with operational issues), the city planning department (dealing with mobility hubs in new housing developments), the environment department (dealing with trials of new services), the city executive office (dealing with innovation at council level and trials), as well as Stockholm Parkering (testing mobility hubs in car parks)[30]. In addition, Stockholm Region were running their own trials, mainly focused on MaaS.

Section 2.1 captures the development of smart mobility services in Stockholm separating the analysis between trials led by the public sector (Section 2.1.1) and provider-led introduction of smart mobility services (Section 2.1.2). Section 2.2 discusses how smart mobility is included in policy. Specifically, Section 2.2.1 focuses on Stockholm City Council's innovation and smart mobility policies, Section 2.2.2 discusses smart mobility policies at regional level, and Section 2.2.3 discusses how smart mobility is approached in policies at the national level.

6.2.1. Development of smart mobility services

6.2.1.1. Trials and services led by the local and regional authorities

Stockholm's bikeshare system

Stockholm's well-established public bikeshare scheme, City Bikes, was first launched in 2006. The service was traditionally procured by the city, however, at the time of the interviews and at the time of writing the service was suspended, due to a long legal challenge related to the

[30] At the time of the interviews, Stockholm City Council officers from the traffic, environment, and city planning departments had set up an informal working group that met regularly to share updates and coordinate their work on smart mobility projects. During my second study visit to Stockholm, I was invited to briefly present my research at one of the working group's meetings. The informal discussion that took place with the officers was not recorded. The officers explained that although there is no strategy for smart mobility, other council strategies, such as the climate strategy and the city development plan, as well as priorities set out in each year's budget shape and steer the city's involvement in different smart mobility projects. For example, the latest budget at the time of the interviews required mobility hub pilots. The officers said they were regularly approached by smart mobility providers, who launched their services through light-touch agreements with the Council, such as MoUs. The officers considered these agreements merely as a tool to tell providers what they expect and encourage. Overall, the officers were uncertain regarding the impacts of different types of services and how they could help deliver policy priorities in Stockholm.

procurement of the new provider. City Bikes was suspended in late 2018, and since then two decisions to procure a new provider were challenged by losing bidders (Teller Report, 2019; Roden, 2020). In August 2021, it was announced that the service would return in April 2022 with 5,100 electric bikes offered across the city centre and the city's suburbs (Carey, 2021). As explained below, the suspension of the bikeshare scheme coincided with the introduction of the first e-scooters in the city, which had the potential to serve some of the unmet demand. However, the participant from Stockholm City's traffic department stated that e-scooters were not considered to offer the same type of service as the shared bikes, as they were mainly offered in the centre of Stockholm. It is noted that EU-Bike, a dockless bike service available in the city at the time of the interviews, was also considered by the interviewees to have a limited impact.

Stockholm Parkering's mobility hubs

At the time of the interviews, Stockholm Parkering (SP)[31], the council-owned company that manage and operate Stockholm's off-street parking, were piloting mobility hubs in three of their underground car parks[32] in central Stockholm, with plans to expand and test hubs at the street level. SP took a proactive approach, inviting providers to join the hubs, and consequently adjusted the hubs' design based on the lessons they learned. The participant from SP explained that they wanted to facilitate the creation of mobility hubs, a much-discussed concept that had not yet been applied widely in Sweden. SP's pilots involved renting unutilised space in car parks to different service providers, with each mobility hub providing some mix of secure bike storage, delivery lockers, carsharing, and shared cargo bikes, as well as EV charging facilities.

When discussing the lessons learned from working with smart mobility providers, the participant from SP explained that visibility was a priority for some services, such as e-scooters or carshare operators that charge customers by the minute. Therefore, providers were not interested in joining underground mobility hubs, even if that facilitated multimodal trips or vehicle charging. As such, the mobility hubs suffered from some inefficiencies in facilitating seamless and demand-responsive travel, and SP's experience points to the key role local authorities can play in allocating road and public space to different modes.

"[t]hey (the e-scooter companies) have these 'hunters' […], free-roaming, non-employed people who charge e-scooters for a certain fee, not sure what the model is. They actually come and pick up the scooters at our facilities, charge them somewhere else and then return them. Very stupid. We have suggested to put charging equipment and then the customers

[31] The traffic department are responsible for on-street parking while SP manage and operate 65,000 spaces in car parks across Stockholm.
[32] According to policy, all car parks in central Stockholm need to be underground.

could also have a discount if they parked in the right spot and charged the scooter but they have not gone with that." (St6)

More broadly, the participant from SP discussed the commercial viability of smart mobility services, based on the demand levels they observed at the hubs. They argued that demand was not sufficient to justify phasing out car parking spaces to expand the hubs, and therefore SP would continue to use only 'dead space' in their car parks. They considered that commercial viability of smart mobility services could not be achieved while private cars remained affordable and readily available for most people. More specifically, they added that mobility services could not outperform the private car for two purposes that SP had found to be very important for Stockholmers: flexible use for leisure purposes (for example visiting countryhouses or taking children to sports activities), and the ability to carry large loads for personal reasons (such as a house move). As such, the participant from SP saw smart mobility services as a hype, with businesses often failing to establish commercial viability and quickly exiting the local market.

Trials funded by the European Union

Stockholm City Council led several EU-funded sustainable mobility projects, as part of the CIVITAS ECCENTRIC programme. The programme aims to support sustainable mobility options for people and places that are often overlooked by urban mobility policies, focusing on areas outside city centres. The projects in Stockholm were led either independently by the City of Stockholm or by consortia, and included promoting car-light lifestyles through MaaS (see further detail about the UbiGo trial below) and peer-to-peer carsharing; allowing residents and businesses to access and trial electric vehicles (e-cargo bikes, e-bikes, electric vans) with the possibility of buying them after the trial period; and developing an electric vehicle charging infrastructure masterplan for Stockholm. These projects were mainly led by officers in the Council's environment department, so no interviews took place with them. As is demonstrated in the following sections, despite the breadth in the projects' themes, they were criticised by participants for not being scaled up beyond the trial stage (Stockholms stad, 2019c).

MaaS pilots

At the time of the interviews, a small but growing team within Stockholm Region were working on smart mobility, specifically focusing on several MaaS pilots. These involved offering different types of "combined mobility" options to test how they encourage trial participants to use more public transport, and to understand which models are commercially viable. The first pilot involved a monthly subscription to a package of mobility options (including public transport) for households, and was offered by UbiGo, a MaaS provider that had previously ran similar trials in Gothenburg (Sochor et al., 2014). The UbiGo pilot was launched in February

2019 in central Stockholm, and the participant from Stockholm Region said the number of people who had signed up was '*in the hundreds'* (St2). As explained above, Stockholm City Council were also a partner in the UbiGo pilot. The second pilot was launched in October 2019 through a partnership with the bus operator Nobina and involved a Maas platform called Travis. Travis offered a pay-as-you go model, where users could see a variety of travel options on the app, alongside information on their cost, travel time and environmental impact. At the time of the interviews, the Travis app only offered integrated payment for public transport options, while users were directed to different applications or websites if they wanted to use other services shown on the app, such as taxis.

It is noted that the Travis MaaS pilot was part of a set of interventions focusing on 'modern mobility' introduced in partnership with Nobina in a new urban area called Barkarbystaden, in Järfälla municipality, which was brought forward as part of the Stockholm Agreement. Barkarbystaden is under development and is expected to be completed by 2032. At the time of the interviews, some houses with limited or no parking spaces had already been delivered and occupied. The modern mobility interventions focused on new residents, who were anyway expected to have low car ownership levels, and visitors to the Barkarbystaden, and were aimed at shaping their travel behaviour. Other interventions tested in the area involved small, driverless shuttles launched in October 2018, and a Bus Rapid Transit (BRT) service that approximated the route of a planned metro extension to Barkarbystaden[33] (Oldbury and Isaksson, 2021; Oldbury, 2021).

Both MaaS pilots described above were open for anyone to join but were initially focused on specific areas to ensure the availability of their mobility options within a realistic geographic range. The pilots relied on providing people with information as an incentive to make more sustainable travel choices, rather than financial benefits. The participant from Stockholm Region explained that the pricing of public transport remained essentially the same when offered through the MaaS app. The impact of the UbiGo pilot was monitored through the MaaS app transactions and through travel diaries completed by the trial participants. The results of the trial showed that participants were early adopters of new services but often dropped out after a short period, usually citing that they could not yet give up their personal cars. The users who continued to use the service were either already car-free, or were using it instead of buying a second car. The users were choosing car or ride sharing for approximately 10% of their trips, with the rest being public transport. Although the data is limited due to the low take up of the service, the participant from Stockholm Region argued that the results of the trial

[33] Oldbury and Isaksson (2021) explain that the original ambition was to have a long-distance autonomous bus that approximated the planned metro extension, but this is not technologically possible, so the BRT was taken forward as an alternative.

were broadly positive, as car trips were being replaced by other options in the MaaS ecosystem.

Finally, the urban planning consultants interviewed noted that the Swedish Transport Administration and the Energy Agency in Sweden were also testing small-scale MaaS concepts, aiming to develop in-house insight.

6.2.1.2. Provider-led introduction of smart mobility services

E-scooters

E-scooters have been in operation in Stockholm since August 2018. In Swedish law, e-scooters are classified in the same way as bicycles and therefore there were no restrictions for operators to launch, or for e-scooters to be used on the streets. The participant from Stockholm's traffic department explained that smart mobility providers usually launched their services without any consultation with them, while other participants stated that authorities in Stockholm were caught by surprise when e-scooters started appearing on the city's streets. In addition, two participants, from Drive Sweden and the city executive office, argued that at least some of the micromobility companies were unwilling to cooperate with them or share their data, adopting a "typical Silicon Valley mentality" (St9). However, the participant from Stockholm Region suggested they maintained a good relationship with e-scooter operators and were getting sufficient data to help them understand how e-scooters interact with public transport.

The participant from Stockholm's traffic department explained that there was local political pressure to work with e-scooter providers and find ways to address emerging issues, such as safety concerns, as e-scooters were seen as a positive development in principle. The City of Stockholm had introduced a template Memorandum of Understanding (MoU), which all e-scooter providers agreed to sign voluntarily, specifying high-level rules around parking and user communications, and proposing certain access and parking restrictions, which providers were encouraged to introduce themselves through geofencing (Stockholms stad, 2019a). The City had also demarcated e-scooter parking areas on footways, and providers were offering their users incentives for good parking behaviour. The participant from the traffic department was unclear on whether these measures were effective but suggested that, as they still needed to understand the impacts of e-scooters, it was preferrable to not introduce any strict rules and emphasised the importance of personal responsibility when using an e-scooter.

But a little bit is see and learn, and see what happens. If you do many new things in public areas, people get really angry in the beginning and then you find a balance – sometimes things

eventually work and people are happy and sometimes they don't work and then you need to introduce a regulation. But I don't think you should do it directly. (St1)

By November 2021, there were 8 e-scooter operators and a total of 23,000 dockless e-scooters in Stockholm. At the time of writing the city had started to take a more restrictive approach, acknowledging that voluntary agreements were not working (Lång, 2021). However, efforts to control e-scooters were complicated by legal and political challenges. Firstly, in June 2021, the Swedish Transport Agency completed an investigation into micromobility, which argued that there are already tools available to the local and police authorities to manage e-scooters, and therefore did not propose any new regulatory powers. In addition, the investigation argued that e-scooters should continue to be legally classified in the same way as bicycles, which meant that any amendments to the legislation to restrict e-scooters would also impact bicycles, which did not need to be regulated in terms of where they are parked or ridden. Eventually, following cross-party criticism, a fatality involving an e-scooter, and efforts to control the impacts of street clutter by fining users, the City of Stockholm decided to regulate e-scooters and address the "chaotic" conditions on the streets (TT, 2021).

The proposed restrictions involved reducing the total number of operators to three through a permit application process, cutting the total number of e-scooters permitted in the city to up to 12,000, and introducing a fee of SEK 1,400 (approximately £110[34]) per e-scooter per year payable by operators to the city (TT, 2021). The fee would be implemented as a police permit, which is generally required in Swedish municipalities when private actors seek to use public areas. These permits are typically used for outdoor seating at restaurants and cafes, or other street events, and therefore sought to address the issue of parking, rather than any instances of inappropriate riding (Lång, 2021). The proposals were met with opposition by e-scooter operators (except for Swedish Voi), who claimed that there was no transparency regarding how the three operators would be selected, and that the introduction of the permit fee was illegal. Providers also claimed that Stockholm's proposed fee was comparatively much higher that other cities', with Tier's policy manager arguing that "[a]fter all, we contribute with a non-subsidized, climate-neutral mobility service that helps the city achieve its climate goals" (Lång, 2021). The new rules were initially expected to be implemented from July 2021, but were postponed to January 2022 (Lång, 2021; TT, 2021). At the time of writing, the new rules were expected to take effect from February 2022, but had been amended to allow all 8 operators that had applied for a permit to operate in the city, with a capped fleet of 1,500 e-scooters each. This was expected to be a short-term arrangement as, from January 2023, the city aspired to procure e-scooters through a concession agreement. There was no clarity on

[34] The average exchange rate for 2021 was 1 SEK = 0.08 GBP.

whether this would also involve a financial contribution by the city towards the scheme (Mattson, 2021). Overall, the proposed measures in Stockholm appear to focus on addressing the e-scooters' negative impacts, but not yet on shaping their role in relation to other parts of the transport system.

Carsharing

At the time of writing there were at least three carsharing operators in Stockholm. Car clubs as businesses are licensed nationally in Sweden and do not need to seek approval by local authorities to operate in a city. In Sweden, national legislation on parking does not provide for car club or car sharing parking spaces on street or allow for different pricing arrangements for shared cars[35]. The participant from Stockholm's traffic department explained that this arrangement causes problems for carsharing operators as it is expensive and leads to them receiving a lot of parking tickets, which in turn creates challenges for the city. In the recent years, Stockholm saw at least two carsharing operators, car2go and DriveNow, stop their operations in 2016 and 2018 respectively, citing insufficient use of their services, coupled with an unsustainable economic situation resulting from congestion charges and parking fees (Jelica, 2018).

Stockholm Parkering facilitates the provision of dedicated spaces for shared cars in their car parks, for example through reserving parking near the car park entrance and allowing 24-hour access for car club members. Indeed, the participant from Stockholm Parkering stated that the carsharing provider M (Volvo's carsharing service) is one of their biggest clients, renting approximately 200 spaces in their facilities. However, change in legislation that would also allow on-street parking provision needs to be introduced at the national level. The participant from Stockholm's traffic department suggested that there are broader questions to answer around this potential change, including whether road pricing would be a more effective way to support carsharing, and whether carsharing does indeed lead to an overall reduction in car use.

Ridesharing services

During the interviews, the participants did not reference any issues regarding ridesharing services. The participant from Stockholm's traffic department and one of the participants from the city executive office speculated that services like Uber are strictly regulated, like standard taxis, and suggested that they do not increase congestion issues in the city. However, when factchecked, it emerged that the interview statements did not reflect the development of

[35] Local authorities have the power to decide where there will be on-street parking charges and how much it will cost, but these must apply to all cars.

ridesharing regulation in Sweden. According to Thelen (2018), the taxi market in Sweden was deregulated in 1990, which removed limits on the number of taxis operating in an area, permitted price competition across providers, and allowed drivers to work as freelancers. This meant that Uber did not face any significant issues when it entered the Swedish market in 2013, as key matters such as labour rights were addressed by default. Uber largely fit the pre-existing designation as a 'taxi operator' and therefore had to follow rules regarding driver licencing, cars bearing special licence plates, listing prices on the rear window, and being fit with a taximeter (Thelen, 2018).

Nevertheless, Uber still faced legal challenges in Sweden. In 2014, Uber launched as a pilot their UberPOP service, which was offered by individuals without a taxi driver licence and cars without taximeters. The UberPOP pilot was suspended in May 2016, after it was found to be illegal by an appeals court in Stockholm, which upheld one of several rulings in lower courts that UberPOP drivers were breaking the law by driving without taxi permits (Reuters, 2016). In addition, taxation of Uber emerged as point of conflict in Sweden. In short, taximeters had no function in Uber cars, which created a major regulatory challenge for Swedish tax authorities that were using taximeter records to track the drivers' earnings. In addition, because Uber maintains its European headquarters in the Netherlands, there was no way for Swedish authorities to access a record of Uber transactions (Thelen, 2018). Thelen (2018) explains that taxi unions and tax authorities coalesced in this case, as Uber's competitive advantage over the existing taxi market was precisely that drivers could evade taxes. This fed into a broader discourse in Sweden that "was much more about preserving community norms of fairness and defending a system of social protection that only works if everyone chips in" (Thelen, 2018, p.948).

In 2015, following the regulatory challenges posed by Uber and cross-party political interest, the Swedish government appointed a committee to make recommendations on changes needed in taxi legislation. The committee produced its report in 2016, which proposed that the law is amended to introduce a new category of taxis that is exempt from the requirement for a taximeter, but should be affiliated with a dispatch centre, which will register data on each ride and organise the booking, fares, payments, and the route, and will be able to provide this information to the Swedish Tax Agency (Alsos et al., 2020). The report made no proposals regarding the employment status of drivers, and left existing licensing rules in place. Based on the recommendations, the Swedish parliament approved a new category of taxis that was exempt from the taximeter requirement in 2018. The amendments to the taxi regulation were implemented in September 2020 and January 2021 (Alsos et al., 2020). This regulatory result adjusts existing regulations to include companies like Uber in a framework aimed at reconciling their continued operation with the "Swedish model" (Thelen, 2018), and is seen as reflective

of the Swedish government's commitment to facilitate transport innovation and welcome new players (Alsos et al., 2020).

6.2.2. Smart mobility policy

This section provides a summary of the innovation and smart mobility policies that were identified through the interviews. The first part discusses smart mobility and innovation in Stockholm City Council, and the second part focuses on smart mobility policies led by the Swedish Government. The role of smart mobility in regional policy is discussed in section 2.3, alongside a detailed analysis of the interaction between transport authorities and smart mobility providers.

6.2.2.1. Smart mobility and innovation policy in Stockholm City Council

The interviews revealed that smart mobility services in Stockholm are shaped through a range of policies and interventions led by different departments of the Council, which are often siloed. This section is not considered a detailed account of all Stockholm City Council policies that relate to smart mobility and draws mainly from the interviews. The first part of this section focuses on the Council's broader innovation agenda, while the second part is an in-depth analysis of the effort to integrate smart mobility services in new parking policy.

Innovation policy

The three participants from the city executive office discussed the role of innovation in Stockholm and the barriers to adopting innovative practices and policies. They explained that Mayor König Jerlmyr and Stockholm City Council's CEO had set a new direction to work closely with private sector and academic partners on innovation projects, which was supported across the political spectrum. To deliver this direction, the city executive office had a growing team leading on innovation and digitisation initiatives, including the implementation of the "Strategy for Stockholm as a Smart and Connected City", which was adopted in 2017, and various programmes in partnership with Vinnova and industry and academic partners. These include the Mistra SAMS programme, and the Urban ICT Arena, which is a test bed area hosting trials including autonomous buses and cars (Mistra SAMS, 2022; Stockholms stad, 2017; Urban ICT Arena, 2022). In addition, the city's commitment to innovation is embedded in the latest long-term vision, Stockholm 2040, which was adopted in 2015, as well as in the city's most recent annual budgets. More specifically, Stockholm's Budget 2020 identified "smart ecosystems for communication and transport", as one of the three major challenges that should be the focus of innovation projects, alongside care and nursing, and climate-positive development (Stockholms stad, 2019b).

The participants from the city executive office argued that Stockholm needs to use the private sector's capabilities to address key future challenges, such as its ageing and growing population and the climate crisis. They added that collaborations with academia and the private sector, especially key Swedish actors such as Scania and Volvo, can steer research and development towards addressing Stockholm's needs. Indeed, the participant working as innovation director argued that the Council are in a unique position to convene and lead different external partners, as they are seen as a trusted neutral actor. Therefore, they added that Stockholm should be promoted as a testing platform for new solutions. While some of these will be 'green failures', openness to innovation allows the city to assess different options before scaling up the solutions that address local challenges. Approximately 80% of the city executive office's smart city projects focused on different aspects of mobility at the time of the interviews. These mainly related to traffic and infrastructure management and monitoring, and data collection to promote efficient road space use and public transport prioritisation. However, the participants envisaged broader applications for the future, contributing to combined efforts towards vehicle electrification, expanding public transport capacity, and reducing vehicle kilometres travelled.

However, the participants from the city executive office referenced multiple barriers to working in the way described above. Firstly, they argued that there are long-standing siloes within Stockholm City Council, leading to a fragmented approach to innovation and a "*Kafkaesque*" (St12) lack of coordination when working with external partners. Siloes are reinforced by the annual budgets, which allocate spending by department, while the numerous decision-making bodies in Stockholm, led by both politicians and civil servants, bring further complexity. This means that multidisciplinary problems are often not addressed through innovative, multidisciplinary solutions. Furthermore, the participants argued that innovation projects are not coordinated between municipalities and at the regional level to maximise their impact.

The participants also argued that Stockholm City Council lacks a tradition of working with the private sector and do not have an internal culture of innovation. Firstly, the pressure to deliver on short- and medium-term objectives set in annual budgets leaves little space for innovation and the iterative process of testing, tweaking, and even failing it requires. Secondly, the participants argued that officers themselves, especially at middle management level, are resistant to change. At the time of the interviews, the participants were involved in the Vinnova-funded "Innovation Platform for Sustainable Stockholm" project (Vinnova, 2022), which aimed to strengthen the city's innovation capacity by training staff in leadership positions to work beyond their siloes, communicate better across internal networks, and ensure that lessons from innovation projects become embedded in the Council's practices.

"make actors more engaged in how to work with innovation – not only being part in innovation projects but also to take a broader responsibility in the scale (up) and reflection that is needed in how we organise ourselves in relation to new technologies and how we learn from new ways of managing our own organisation to actually make the most of these innovation projects […] But what we can see in the field of innovation is that new technologies and new ways of doing things tend to sort of end – the use of all these learnings ends when projects end, they can't see the scaling up of many of the results that could have a positive impact on sustainable development and the (United Nations) Sustainable Development Goals." (St12)

The participants from the city executive office also discussed Stockholm City Council's work on transport innovation, in line with the statements considered above. The participants saw great benefit in flexible, data-driven initiatives that in turn provide detailed data on the citizens' travel needs. They also shared their aspiration that the data collected by the city could be shared with, and in some cases sold to, smart mobility providers to help optimise their operations while financing Stockholm's smart city work. In order to make the most of smart mobility, the participants argued that the city has the responsibility to adopt legislation that facilitates the introduction and expansion of innovative mobility solutions, especially where existing legislation limits the scope of some applications, such as in the case of parking for shared cars. At the same time, they suggested that the city needs to be faster in creating rules that address any negative impacts when innovations are 'imposed' on the city, such as in the case of e-scooters.

However, the participants from the city executive office stressed that, in the absence of a unifying strategy on transport innovation, initiatives are largely project-based rather than part of a coordinated programme that prioritises and helps scale up the solutions that will resolve long-standing issues, such as cross-modal integration. The participants from the city executive office argued that actors within the council do not understand the value of "*discussing what you need before you start doing things about it*" (St12), and that trials are "*solutions to the symptoms, not the source of the problem*" (St5a). Indeed, one of the participants suggested that because the role of innovation in transport decarbonisation is unclear, climate strategies tend to include more well-established options of vehicle electrification compared to newer, more nuanced approaches such as shared services and reducing car use. Furthermore, there are still practical barriers to embracing transport innovation. Focusing on data sharing, the participants explained that it remains an unclear issue, as providers are not always keen to share their data, while on the city's side there was still uncertainty about which department should house private providers' data, and whether the Council have the capacity to safely store and manage it. This was confirmed by the urban planning consultants interviewed, who argued that local authorities have not yet decided how to deal with open data, and are not

thinking critically about potential dangers and opportunities created data openness, such as quality issues or lack of representation of certain social groups in mobility databases. Overall, while the participants from the city executive office saw the introduction of smart mobility services as a positive development, they still considered it a niche.

Mobility hubs in new housing developments

This section provides an analysis of Stockholm City Council's efforts to integrate smart mobility services in new housing developments as an alternative to resident parking provision, while at the same time shifting the responsibility of reducing the residents' car ownership levels to private developers. The analysis draws mainly from two interviews where the participants discussed lessons learned from the design, implementation, and monitoring of the new parking policy. The first interviewee was an officer from Stockholm's city planning department (St4), and the other interview was with two transport planning consultants who have extensive experience both as negotiators for developers and as advisors for Swedish local authorities developing new parking policies (St10a, St10b). The analysis demonstrates in practice some of the challenges discussed earlier in this section.

For context, minimum parking standards for new housing have been in place in Swedish cities throughout the second half of the 20th century. The interviewees explained that minimum parking standards often led to an oversupply of spaces and, as spaces in Stockholm had to be provided underground, it was often cheaper for developers to build fewer apartments than construct an additional level of underground parking. This is confirmed by Andersson et al. (2016), who show that the cost of parking construction has led to a reduction of the housing supply and increase in rents in areas of Stockholm. Given that only 50% of households in Stockholm own a car, the consultants interviewed described this increase in prices as a subsidy for car owners. By 2015, Stockholm City Council had started permitting reduced parking provision in new developments on a case-by-case basis. Following a requirement set in the city's 2014 budget, minimum parking standards were officially replaced by flexible parking standards in 2015, aiming to reduce car ownership and facilitate the shift to sustainable transport modes. The flexible parking standards determine a range of parking spaces to be provided per household (between 0.3 and 0.6 spaces per dwelling). The final provision is decided following a negotiation between the housing developers and the city, depending on factors such as proximity to transport services and amenities.

In addition to the flexible standards, developers can achieve a further reduction in parking spaces built, if they choose to subsidise mobility services for the residents of a new development for a set period (usually 5 years). These services, also referred to as mobility hubs, include car clubs, shared bikes and cargo bikes, or even public transport passes.

Developers can choose to work with three loosely defined "levels of ambition" for providing mobility services, with the most ambitious level leading to a 25% reduction in required parking provision. However, the participant from the city planning department explained that when the agreed number of spaces is already low, a 25% reduction makes little difference, so developers in Stockholm often do not see providing smart mobility services as a worthwhile investment.

The consultants interviewed and the available literature provide an early insight into the impact of the new parking policy in Stockholm. Although the evidence suggests that reduced parking provision in combination with mobility services indeed reduce car ownership, shifting to a car-free lifestyle is a complex and long process. The consultants, who have been following the new parking policy since its inception in 2012, explained that parking availability is only one of the factors considered when residents decide to give up their cars, along with a spectrum of everyday life conditions. At the same time, they argued that while some developers try to provide high quality mobility services to their residents, this is certainly not the case for every development. Equally, smart mobility providers are often not interested in adjusting their services to meet the residents' needs or attract their interest, while their financial interests also come into play. This means that the process of establishing mobility hubs is often consumed by negotiating operational aspects and thus loses its focus on reducing car ownership. For example, the consultants interviewed explained that carsharing providers prefer to run open car clubs, where access to the club is subsidised for the residents of a new development but the cars are parked in public car parks and can be accessed by anyone. This model can potentially help more people live car-free, but there was also evidence that it limits availability for residents and reduces their confidence and willingness to permanently give up their cars.

While the consultants interviewed had a detailed understanding of the implementation process of the new parking policy, the discussion with the participant from the city planning department highlighted the City Council's hands-off approach to introducing and monitoring services.

[w]e are leaving it to the developers to propose what services they will work with. We have something like a leaflet with examples of what they could work with, but we also know that the market is changing quickly. […] we have given the initiative to the developers, but it's not been that easy to get good propositions […] it's like a checkbox exercise. I can understand that because this is not their primary interest. The municipality that's neighbouring to Stockholm have learned from our experience and they are deciding themselves what the services should be- for each level of rebate there are specific mobility services they should deliver. (St4)

[*w]e are not sure about how we should ask them (the developers) to show us the contract with the car club so that they really are doing what they promise. We don't have any option to check*

that they are doing anything. And we also don't know the effects of these mobility services – do they make any difference at all? Now it is a trial-and-error stage. (St4)

The interviewee from the city planning department acknowledged that Stockholm's new parking policy needed to evolve to ensure that the appropriate set of services that matches the surrounding transport network is selected for each development, while stressing that "*[N]ot every solution works for everyone" (St4)* and that services need to be monitored and adapted to the residents' needs after they have moved in their new houses. They argued that such an approach would ensure that services become a viable alternative to the private car and can help establish long-term behavioural change, which in turn supports the commercial viability of services beyond the subsidy period. Nevertheless, the same participant added that developers and smart mobility providers do not always meet the city's needs and expectations, acknowledging a clear need for the city to steer the market.

The consultants interviewed criticised City Council's market-reliant approach to the new parking policy. While they identified practical limitations to this approach, such as high staff turnover, officers feeling comfortable working in their own siloes, and pressure to deliver more developments to address the city's housing crisis, the consultants clearly argued that the City Council are consciously choosing to not steer developers and smart mobility providers.

No one talks about steering. They always talk about how the new mobility service will steer transport planning and town planning. They are very mentally reactive – passive. If you say that to them they will be upset because they are working hard – but they are not doing the right things. […] To steer is something ugly! […] They steer only when there is an immediate problem. (St10a)

6.2.2.2. National focus on smart mobility

The Swedish government is funding programmes focusing on transport innovation that align with national priorities about innovation set by successive governments. The programmes aim to address key social challenges, especially rapid decarbonisation, through transport technology, while increasing the country's competitiveness, and usually draw on the Swedish tradition of collaboration between the public sector, businesses and academia (Government Offices of Sweden, 2022b; Ministry of Enterprise and Innovation, 2018). Drive Sweden and KOMET, which employ two of the interviewees, are two such programmes focusing on transport.

KOMET is part of the Government Offices of Sweden and was formed as a three-year programme in 2018. Its purpose is to identify policy and regulatory challenges to innovative technologies and make recommendations to the Swedish government about how to ensure

that "*innovation is not stopped by regulation too soon*" (St7) and policy keeps up with new technologies. In addition, aims to maintain the Sweden's competitiveness at a global level, while balancing technological progress against responsible development and harnessing innovation to achieve broad societal goals, particularly decarbonisation. Transport is one of KOMET's areas of focus, alongside health and life sciences, and the digital transformation of the industry (Ministry of Enterprise and Innovation, 2018). While KOMET advise the Swedish government, their position is also informed by local developments, including the initiatives of Drive Sweden.

Drive Sweden is one of Sweden's 17 Strategic Innovation Programmes. It started in 2015 and is co-funded for a 12-year period by VINNOVA, the Swedish Innovation Agency; Formas, the Swedish Research Council; and the Swedish Energy Agency. The participants described Drive Sweden as a platform for knowledge exchange and cross-sectoral collaboration around smart mobility. Their projects focus on research, demonstrating and showcasing of smart mobility initiatives, and citizen engagement. For example, Drive Sweden were involved in an autonomous shuttle demonstration project in Kista Science City, an Information and Communications Technology cluster area in Stockholm, which then informed the autonomous bus deployment in Barkarbystaden. The projects are partly funded by Drive Sweden, with at least 50% match funding provided by participating companies. The match funding is usually provided in the form of human resource, with the partners' staff helping Drive Sweden's deliver networking activities, while also having an opportunity to shape the direction of their projects. Both KOMET and Drive Sweden are governed by a committee or board that brings together representatives of the national government, businesses and academia.

The participants from Drive Sweden and KOMET saw smart mobility services as both essential in addressing key challenges in Swedish society, and as an inescapable future development. This inevitable rise of smart mobility is reflected in the statements of the participant from Drive Sweden: "*new mobility services will have an impact on existing regulations and policies*", "*how future cities will be with new types of mobility*", "*what needs to change in the infrastructure of roads because we are starting to connect to vehicles*" (St9). As such, the interviewees suggested that the role of the state is to facilitate the success of innovation and steer services towards sustainable transport goals at once.

The participants stressed that there is a greater need for facilitation and echoed the interviewees from Stockholm City Council's executive office when arguing that policy change is often too slow to accommodate innovation, and often too late, as the market moves on before the policy catches up. For example, the participant from Drive Sweden argued that the carsharing services Car2Go and DriveNow left Stockholm primarily because of the city's hostile parking policies (although the analysis in Chapter 4 shows that the departure was a

commercial decision made at a global level). Both participants suggested that cities should enable innovation by experimenting more widely with flexible policies, testing and adopting new technologies, and preparing to address any problems new services may cause. While participants were clear that it was not within their remit to suggest which solutions could work, there was an underlying assumption that innovation is an inherently positive addition to the urban ecosystem, while any potential issues can be addressed by using light-handed policies. For example, both participants praised the potential of MaaS to support seamless multimodal journeys, and suggested that ticketing regulation should be amended to mandate that public transport operators allow their tickets to be sold by third parties, a key barrier to ticketing integration across Sweden.

I am not saying that public funding should fund a new app for getting all the tickets you need but if you have a company that has this idea of how to build an app where you can plan and pay for your journey in a seamless way then why not? And probably this company will also earn some money so you have a new business model as well. So if the regulation is making it hard for the inventor to do this because the big mass transit commuter companies don't have to make it possible for their tickets to be sold by someone else, maybe it is a question to look into. But as you say, how does this then help us deliver 'the society that we want' and is it sustainable? (St7)

At the same time, the participants acknowledged a "*combination of policy and business model problems*" (St9) with smart mobility services, and suggested that Stockholm needs a "*masterplan for innovation*" (St9) that clearly sets out the expectations of smart mobility services. While the participants argued that "*technology will come anyway and will go in the wrong direction*" (St7) if it is not steered, their interpretation of steering did not necessarily involve introducing regulation. They argued that the smart mobility space is still too dynamic to regulate or procure, and cities risk being tied up to solutions or rules that quickly become obsolete if they move too soon. Indeed, the participants saw proactive steering as necessary ahead of the advent of autonomous vehicles, which were considered a potential threat to public transport, and less urgent for micromobility services that were already present on the streets of Stockholm.

Nevertheless, the participants drew on some clear policy challenges in the smart mobility space. Firstly, they argued that smart mobility services should be supported by policies that actively restrict single occupancy private car use through measures such as taxation. In addition, data sharing was described as a key policy challenge and argued that the creation of successful, optimised services will only be enabled through data openness. The participants saw open data sharing as a win-win approach for the private and public sector, and acknowledged that some level of data sharing will ultimately become mandatory. However,

echoing the concerns of the participants from the city executive office, the interviewee from Drive Sweden explained that there is still no framework for data sharing, and questions such as who would own and manage the shared data remain unanswered. It is also noted that the participant from Drive Sweden argued that local authorities should not put an undue burden on providers by requesting data that they will eventually not use.

6.2.3. Interaction with smart mobility providers

In Stockholm, all interviewees working for public organisations broadly argued that in order to support innovation, the smart mobility market should be allowed to operate with minimal regulation, unless services creates local issues. However, the participants did not appear to acknowledge the potential implications of smart mobility market developments on the dynamics of local transport service provision. For example, the participant from Stockholm's traffic department argued that e-scooters could continue to exist with virtually no enforcement, similarly to private bicycles, as regulation may impact the profitability of services. The same participant explained that, a year after they were established, the e-scooter operator Voi were part of the partnership winning the tender to supply the city with a bikeshare scheme. The participant acknowledged that this was a marked shift in the mix of providers who usually bid to operate the bikeshare service, but did not comment on the potential implications it could have in relation to Voi's e-scooter service, which was already active in the city. If Voi's partnership went ahead[36], it would offer them a significant competitive advantage compared to other e-scooter operators in the city.

In the case of MaaS, the participant from Drive Sweden estimated that global MaaS solutions would become the norm in the future, offering integrated options across multiple cities in the world. When questioned about how and if MaaS packages would be regulated, they were clear that while platforms will be global, the rules that determine how travel options are costed and promoted within the MaaS ecosystem will be determined locally. The MaaS providers will be "*just the aggregator*" (St9), so local services will be able to enter the MaaS ecosystem and compete with global providers of the same type of service. Indeed, when asked about the challenges that cities are already facing in regulating global smart mobility companies, the participant described similar regulatory challenges in the future as a "*non-issue*" (St9).

[36] The Voi/ UPI tender was one of the two winning tenders that was challenged legally and eventually did not provide the service.

I would like to have all the options wherever I am in the world. Then you'd also have the policies behind that to regulate the pricing and availability to dictate how options will be presented to me. Local policies will have to steer me in the right direction. (St9)

Even if Google managed to set up a system operating in 50 different countries, then they still would not operate it in the same way in Stockholm as it does in other cities. It will come down to the pricing of different options such as Uber cars, Volvo option, whatever. The search algorithm should not direct you to the options that are not sustainable – maybe you can set up your own priorities – maybe, I have not thought about this before. But the underlying component of a transportation system will be that governed by local policies for sure. (St9)

Smart mobility in Stockholm Region

Stockholm Region's position at the time of the interviews and the developments by the time of writing, demonstrate an openness towards providers and the region's willingness to create a space for smart mobility services to exist alongside the public transport network. During the interviews, the participant from Stockholm Region explained that their preferred approach to MaaS pilots was to participate as partners rather than lead on them, as this extended what they could test as a public agency from a legal perspective, diversified the way public transport is offered to citizens, and created opportunities to expand their customer base. Therefore, Stockholm Region partnered with the MaaS providers for the pilots, and then the MaaS providers partnered with other mobility services, such as taxi, e-scooter and carshare operators. Stockholm Region and the MaaS operator would then work collaboratively to promote the service. The participant from Stockholm Region explained that this approach contributes to the delivery of local objectives, even if it means that new services compete with the public transport network.

"If you don't have public transport that is so attractive, with many lines and high frequency then you're struggling with that and you need more users, you see everything else as a competitor. […] I think you also can see it in different ways. On the other hand, if there are solutions that the customers like and solve the problems for them then public transport is not – if someone else solves the problems that we seek to solve then it is of course a bit of a loss for us but why not?" (St2)

When the participant from Stockholm Region was interviewed in August 2019, they confirmed that none of their policies at the time took into consideration the role of smart mobility services. The latest Regional Transport Supply Programme (Trafikförsörjningsprogram in Swedish) that was published in 2017 focuses on public transport investment needs until 2030 and does not make any specific reference to smart mobility services. The document uses the term 'smart' to describe a transport system that is environmentally friendly, safe and resource efficient

(Region Stockholm, 2017). In 2021, Stockholm Region published their draft 2050 strategic transport plan (or Kollektivtrafikplan) for consultation. The Kollektivtrafikplan proposes a set of measures to achieve the objectives of the regional development plan for Stockholm Region (RUFS 2050), which was adopted in 2018, and outlines the long-term direction for the region's transport system.

The Kollektivtrafikplan includes three different transport scenarios for the future, which capture uncertainties in areas such as the economy, policy, and technology and their potential impacts on the delivery of the plan. Transport innovation is considered in all three scenarios as one of the uncertainty factors. In the first "more of the same" scenario, smart mobility continues to capture a small share of the travel market and only has a marginal impact on public transport. In the second "more individual travel, less public transport" scenario, new transport technologies focus on clean fuels and contribute to increasing the share of car travel. Finally, the third scenario refers to a "more smart mobility, less bus traffic" future, where shared mobility services, walking, and cycling increase their modal share, while both car ownership and car travel decline as a result of fiscal and access restrictions and travel substitution by remote working and education. The plan suggests that in the third scenario the focus of public transport provision and improvements needs to shift from peak hours and key corridors leading to urban centres to a wider coverage during the day and better connections within and between municipalities. The plan predicts that demand for local bus services will decrease in the latter scenario, and notes a need to improve the integration between public transport and walking, cycling and shared mobility solutions, clearly demarcating a space for smart mobility and MaaS applications (Region Stockholm, 2021).

Although the Kollektivtrafikplan introduces the three scenarios to discuss future uncertainties, it does not assess in detail the implications of the parallel provision of transport services by public and private actors. Research by Oldbury and Isaksson (2021) assesses the governance implication of such parallel provision by examining the introduction of driverless shuttles in Barkarbystaden. The introduction of driverless shuttles, a MaaS trial, and a BRT service in Barkarbystaden were primarily enabled though a pre-emptive clause included in the procurement contract of the local bus operator by Stockholm Region, which gave more responsibility and freedom to the operator to introduce new services that meet the needs of the new urban area. As Oldbury and Isaksson explain, Stockholm Region wanted to define *what* they wanted to achieve, and leave space for the operator to come up with *how* it can be done. As such, the bus operator Nobina, who was awarded the contract for operating the bus services in the area surrounding Barkarbystaden in 2015, was the main actor responsible for assessing what types of services would meet the strategic priorities for the area, and then went on to provide these services. This meant that Stockholm Region and the local

municipality did not simply facilitate innovation, but empowered Nobina, previously a "conventional" public transport operator, to take a strategic role in planning smart mobility services. Oldbury and Isaksson explain that Nobina saw services tested in Barkarbystaden, especially the combination of driverless shuttles and the BRT, as building blocks in a *new type of transport system*, not just one-off trials. As such, the case of Barkarbystaden highlights that, even in a collaborative context, public and private actors may have different ambitions for the development of the transport system. As such, a scenario of parallel provision may lead to strategic conflicts between private and public actors and requires "public actors to move beyond the role of opening up for these developments to actively setting a strategic agenda" about the long-term role of smart mobility (Oldbury and Isaksson, 2021, p.8).

6.3. Smart mobility and sustainable urban transport

6.3.1. The role of smart mobility services in Stockholm

This section discusses the interviewees' views on the role of smart mobility services in Stockholm's transport system, and how they can positively contribute to delivering local transport objectives. The participants from Stockholm City Council and Stockholm Region had different perspectives on the role of smart mobility services, reflecting the remit of the two organisations. Most participants argued that smart mobility services could improve local transport options and reduce car dependence in the future, but there was essentially no evidence in the interviews that services were already providing these benefits.

The participant from Stockholm City's traffic department explained that, to accommodate the city's rapid growth while decarbonising transport, road space will need to serve trips in the most efficient and sustainable way possible, which means that public transport and active modes need to be prioritised over private, single-occupancy cars. This is reflected in the city's heavy investment in expanding walking and cycling infrastructure. Similarly, another priority for the city was to ensure new housing is built in well-connected areas to avoid urban sprawl and increased car dependence. As such, the participant from Stockholm's traffic department saw the solutions to the city's challenges primarily in sustainable transport and land use planning, rather than innovation. Nevertheless, according to the same participant, smart mobility services had been a 'big question' for the city in the recent years, and there was political support for individual trials. The participant saw smart mobility supporting the city's objectives in the future by helping diversify mobility options for the city's suburbs, and, crucially, serving long-distance, leisure trips, which account for the largest share of kilometres

travelled by car but have traditionally not been targeted by commuting-centred transport policies.

[o]ur basic agenda from the politicians is to have a good infrastructure for people moving on bikes – we are the responsible (authority) for maintaining and developing the infrastructure. […] If you look at MaaS, we don't see that we should have a platform where we should combine these opportunities. (St1)

The participant from Stockholm City Council's traffic department focused on the role of e-scooters, as they are entirely in the city's remit and were a "hot topic" at the time of the interviews. They clearly explained that smart mobility services such as e-scooters are not making a positive difference as part of Stockholm's *transport system* as they are only offered in the city centre, where there are already many mobility options, and they make up a very small share of the total trips taken in Stockholm. Indeed, they could not see how e-scooter operators could be commercially successful in Stockholm, given that they all offered a very similar service, at a similar price, and competing in the same geographic area.

I think in Stockholm it (smart mobility) is nice to have and is an interesting option and if companies can live on this then it's good. But we don't see it as something that would save our transport system. (St1)

At the same time, many of the participants commented on the negative impacts of the large number of e-scooters on Stockholm's public realm and the road safety challenges they create. In the absence of Stockholm-specific evidence, they questioned the e-scooters' advertised benefits and suitability for different types of users and uses, such as parents with young children and shopping. Participants were especially sceptical about e-scooters' potential to replace car trips, and argued that, anecdotally, they mostly replace walking and public transport trips. This was confirmed by the participant from Stockholm Region, who explained that the operators' data shows that e-scooters mainly replace walking (either full trips, or the first/ last mile to public transport), public transport, or taxi trips. As explained in the earlier sections, at the time of the interviews Stockholm City Council maintained a hands-off approach to e-scooters, while more recent regulatory proposals do not appear to be accompanied by comprehensive accountability arrangements ensuring that e-scooters support local transport objectives.

But anyway, I don't think we know anything about this (how smart mobility services can be used) really and we need to do this kind of research and think about it. A lot of the companies sometimes show research from the Unites States where the scooters will lower car use but I think these are completely different types of cities than Stockholm. In Stockholm we have a

lot of public transport and walking so I don't know, it will be really interesting to see if it is the car trips they take away. But I don't think so. (St1)

The participant from Stockholm Region discussed the role of smart mobility services in relation to the public transport network and focused largely on the potential for service integration under a MaaS model. Like most participants, the interviewee from Stockholm Region expressed strong confidence in the local public transport system. They argued that there are very limited gaps in the public transport network and that mobility services such as e-scooters could help alleviate some of the pressure on the public transport network by taking away peak hour trips. The participant from Stockholm Region assessed that public transport will continue to play an essential role in the future and that smart mobility services and MaaS should complement the local public transport network. Indeed, they stated that a good public transport system provides better conditions to support smart mobility services, which could in turn help increase the use of public transport by diversifying the offer of alternatives to the private car and facilitating car-free or car-light lifestyles. Equally, the participant was open to the idea of new, private services attracting a share of trips that are served by public transport if they address local challenges. For example, they considered that existing services, such as buses connecting rural areas that often serve convoluted routes at low occupancy, would be better off being replaced by demand responsive, autonomous minibuses that could be provided by the private sector, a view that is reflected in the Kollektivtrafikplan, which was published almost two years after the interviews. The same participant explained that, ideally, in the future there would be multiple MaaS platforms that provide a choice of competitive mobility packages in the region, the same way telecommunication companies offer mobile phone plans. They also hoped that there would be a standardised Application Programming Interface (API)[37] (IBM, 2021) across all of Sweden's public transport agencies, so that MaaS providers could offer seamless travel across the entire country.

Nevertheless, the participant from Stockholm Region recognised there are challenges and uncertainties associated with smart mobility. For example, following the autonomous shuttle trials in Barkarbystaden, they realised that autonomous vehicle technology is not yet sufficiently developed to operate safely, efficiently and at scale in an urban environment, while the cost of integrating autonomous vehicles with existing transport systems can, for now, be prohibitive. Focusing on MaaS, they recognised that their trials had a small customer base, and appealed mainly to people who already lived in well-connected areas and did not own a car, did not want to buy a second car, and, in any case, had the disposable income to spend

[37] An API enables companies to open up their applications' data and functionality to external third-party developers, business partners, and internal departments within their companies. This allows services and products to communicate with each other and leverage each other's data and functionality through a documented interface.

on a new mobility option. As such, MaaS provided opportunities for more mobility – and access to a car – to people who already lived car-free or car-light lifestyles, instead of helping them reduce their car use. Finally, the participant from Stockholm Region recognised that market conditions are not yet favourable for MaaS operators, and their profit margins are very small. Echoing the participant from SP, they argued that the cost of owning and using private cars would need to increase significantly before shared smart mobility services, and therefore MaaS, could be profitable. Furthermore, they recognised that restricting smart mobility services to specific types of trips or geographic areas to serve specific needs, would further impact the services' commercial sustainability, especially in an open market context.

I don't see anyone that actually makes substantial profit and I don't see how they would make lots of profit if we continued the same way as we do things today because public transport is already subsidised with a lot of money. We can't give them 10% of something (i.e. profit) for them to sell a ticket, it is not possible. […] taxi companies don't want to give them anything either just to handle the payment part. If you really count into that (the platform arrangement) maybe you can get into the single % level (of profit), because you also have the cost for selling tickets of course, if someone else can do that for us and leave us without that cost then maybe they can get 1% or something. But on the other hand, as soon as they take the payment for the customer then they need to pay MasterCard or VISA, and that will cost them too. (St2)

6.3.2. Smart mobility services in context

This section discusses smart mobility developments in relation the wider governance context of Stockholm and Sweden. The local and regional transport authorities' interaction with smart mobility services reflects national innovation policy traditions, which follow the triple helix model of innovation that encourages collaboration between academia, industry and government to foster economic and social development (Etzkowitz and Leydesdorff, 1995; Fogelberg and Thorpenberg, 2012; Jacob, 2016). For example, organisations such as Drive Sweden demonstrate the commitment to support collaborative working across the three sectors. Adopting and supporting smart mobility, and innovation in general, was also perceived as an element of supporting a national, regional, and local drive to increase competitiveness (Swedish Institute, 2022). Indeed, Sweden is regularly described as an "innovation leader" and features at the top of global and European rankings such as the European Innovation Scoreboard (European Commission, 2021), or the mobility-focused Urban Mobility Readiness Index (Oliver Wyman Forum, 2022).

"*Sweden is at the top of the list of innovative countries in the world and we want to stay there*." (St7)

In this context, smart is translated as sustainable, and constant innovation is considered an essential element to achieve local objectives. This is clearly expressed in Stockholm's Smart & Connected Strategy, which states that a smart city "utilises digitalisation and new technology to simplify and improve the life for its residents, its visitors and business. In the smart city, new smart services are constantly created to make the city even better. A smart city is a sustainable city. The smart city is made possible through connectivity, publicly accessible data, IT platforms that can communicate with each other, sensors and other technologies" (Stockholms stad, 2017, p.5). However, the urban planning consultants interviewed pointed out that the private sector's response does not necessarily match the local ambitions.

"The money right now – if you see where the funding comes from in the projects that we do – it comes a lot from the national authorities. We don't have the big private money invested in this yet, but the government have a vision on what we can do. It is not impossible -we have a strong sustainability focus, and talented digital solutions companies, but we are not there yet." (St11b)

In addition, there appears to be a gap between the high-level, pro-innovation narrative for the *future* of mobility, and the insights of participants delivering innovation projects in the present. The interviewees involved in the development of the MaaS pilots and the introduction of mobility hubs consistently stated that the success of smart mobility services is a function of policies that concern car ownership and use. The interviews showed that despite the ambition to promote smart mobility, services are still in an unequal competition with private cars. At the same time, there are multiple challenges in introducing and sustaining services, including legal challenges, identifying suitable business models, and deciding who gets priority in the public space. As is demonstrated by the case of introducing mobility hubs in new housing developments, the mere availability of smart mobility services is not sufficient to deliver the desired objectives around reducing car use and ownership. Finally, the participants interviewed clearly described where there are gaps and weaknesses in Stockholm's transport network, and which trips need to be captured by new transport options, but did not provide any evidence that smart mobility services address these needs. Instead, they argued that services most often target central Stockholm, an area that is already walkable and very well served by public transport. In addition, the participants referred to some emerging negative impacts of transport services, such as the street clutter and safety issues caused by e-scooters.

Despite the evidence that introducing smart mobility services does not automatically address the city's challenges, and may indeed have some negative impacts, the interviews also show that Stockholm City Council and Stockholm Region enable smart mobility service introduction and provider competition, and refrain from steering services towards meeting local objectives.

In addition, the delayed attempt to regulate e-scooters shows that the role of the state is limited to fixing market failures. Combined with the participants' views that citizens should be given the choice of smart mobility services, but that their "*job is to not tell people what to do*" (St1), this clearly shows a neoliberal approach to smart mobility governance. This reflects Sweden's national shift towards neoliberal principles in transport policymaking, which has been documented in the literature (for example in: Johansson et al., 2018; Witzell, 2019), and is also demonstrated by efforts to deregulate elements of the transport system that are referenced in this chapter, such as the deregulation of taxis (1990) and the Public Transport Act (2012). The urban planning consultants interviewed also confirmed the national government's hands-off approach to smart mobility.

"I don't think they (i.e. the national government) are trying to empower them (i.e. local authorities) really. I think they are trying to get them to find solutions together with private companies. Not empowerment or steering. I have not seen that. More of an enabling role." (St11b)

These findings echo the research of Wallsten et al. (2021), who explored the smart mobility governing strategies followed by local authorities in the Stockholm region, focusing on the municipalities of Stockholm and Botkyrka. They conclude that "municipalities' current approaches for governing smart mobility can primarily be summarized as aligned with the approaches of Enablement and Laissez-faire. These strategies also reflect central themes in a broader political discourse and a dominant political orientation toward neoliberalism. Both approaches have the effect that market actors with commercial interests are more or less consciously given a central role in shaping the constitution of smart mobility" (Wallsten et al., 2021, p.11).

6.3.3. Reflections and summary

The interviews in Stockholm showed a clear commitment to not impede, and very often facilitate, the adoption of smart mobility services. Although there are different problems related to different types of services, there is a prevalent faith in smart mobility, which appears to stem from a well-established faith in innovation as a driver of progress. The participants from the core institutions also showed an unwillingness to steer services, despite evidence that services either do not deliver the anticipated benefits, or even create undesirable results. In addition, where there were assumptions that services will need to be regulated, the participants failed to provide a clear explanation of how accountability arrangements would be shaped to ensure the delivery of local objectives. At the same time, internal siloes and an apparent all-encompassing focus on delivering the annual objectives set in the city's budgets,

appear to pose additional challenges to developing a comprehensive approach to steering smart mobility. Stockholm's existing public transport system provides an excellent level of service, while the city has adopted ambitious policies to deliver a more accessible and sustainable network, and address key challenges such as the climate emergency. However, the interviews raise questions about how smart mobility fits in the city's future, especially if it is to serve a large part of the market, as is envisaged by Stockholm Region.

So where does this leave Stockholm's citizens? Only one of the transport planning consultants interviewed argued that the introduction of new types of demand responsive and highly personalised mobility is an opportunity to bring people closer to decision making, and allow them to shape their mobility options in new engagement spaces created as part of the collaborative relationship between the local government and operators. However, they argued that to achieve this, there is an urgent need to bring together different actors and perspectives to collectively shape the future of mobility in the city. In the absence of such open conversations, there is a danger that new services will reflect the needs of a small part of the population and will not meet local objectives, such as the need to reduce how much people travel. This risk was perhaps best reflected in the interview with the participant from Drive Sweden who, in discussing a future where smart mobility services become inevitably prevalent, referred to their and their peers' hypermobile lifestyles. Their statements provided an insight into a narrative that sees smart mobility services as a way to painlessly maintain the status quo, as they could offer similar convenience to private cars and would compensate for the lack of comfort through "*optimum mobility for everyone*" that "*won't make people angry and will be widely accepted*" (St9).

I have seen that first hand myself, having a board meeting in Gothenburg and when it is time to go home, my Stockholm visitors ask me how they need to get a public transport ticket to the airport or the train station, and when I tell them they need an app they say they'd prefer to take a taxi. Of course, that may not have a huge negative impact on sustainability compared to all travel but still it does not make sense in a modern digitalised world across different countries. (St9)

[m]aybe that's because I am too much of a traveller myself and I want things as convenient as possible. (St9)

I think mobility is so ingrained in human life – people are always on the move. To me this is about travelling more efficiently and shared. […] I don't think we will travel less because of this, we may travel more but that travel could happen in a more sustainable way. (St9)

7. Comparative analysis, discussion and conclusions

7.1. Introduction

Chapters 4, 5 and 6 provided a holistic and in-depth analysis of how smart mobility services have developed in each context and why, and what this means for sustainable mobility. The analysis in this chapter combines and compares the insight of the three case studies and draws from the literature and theories discussed in Chapter 2 to provide detailed responses to the research questions set out in Section 2.5.

Section 7.2 provides a short profile of each case study, followed by in depth responses to the research questions in Section 7.3. Finally, Section 7.4 concludes this chapter by discussing the role of smart mobility in relation to the system of automobility.

7.2. Summary profiles of case studies

7.2.1. Seattle

Through a combination of the city's own openness and the providers' attraction to its demographics and business environment, Seattle has traditionally been an early adopter of smart mobility, with the first carsharing services in the city dating to the early 2000s. The Seattle Department of Transportation (SDOT) is regulating through permit systems providers offering carsharing, bikesharing and e-scooter sharing services, while the TNCs operating in the city are licensed by the City of Seattle and King County (KC). In addition, at the time of the interviews, King County Metro (KCM) had completed several small-scale, targeted pilots that complemented the local public transport network. Seattle's institutions at the local (City of Seattle and SDOT) and regional level (KC and KCM) have extensive powers and autonomy, which have allowed them to introduce new, targeted policies and rules for smart mobility services, which in the case of TNCs have involved lengthy legal challenges. SDOT have also set their strategic position towards smart mobility services in their New Mobility Playbook, which signals that the city is open to new services but expects them to comply with local rules.

Seattle is the case study where, compared to the other two, the participants demonstrated the most extensive experience in managing and steering smart mobility services. The participants showed a broad ideological alignment regarding the role of the state in relation to smart mobility, advocating proactive steering through regulation of services. The Seattle case study

provides an insightful assessment of the benefits and challenges of two methods of steering services: permit schemes and full procurement. While the former is flexible and involves no cost for the local authority, it effectively offers no levers that the local authority can use to control providers. Conversely, procuring smart mobility services allows the local authorities to closely manage services and their impacts, but can be very challenging to negotiate with providers and requires financial investment by the authorities. In addition, the participants in Seattle showed a nuanced understanding of the smart mobility market dynamics and explained the role of venture capital investment in shaping services. The interviews provide a clear insight into the practices and priorities of different smart mobility providers, and highlight the conflicts between the often volatile smart mobility market and the provision of mobility as a public service. Finally, the participants in Seattle provided a critical assessment of the impacts of smart mobility services, explaining that their benefits are yet to materialise and pointing at some key weaknesses.

7.2.2. Greater Manchester

Greater Manchester's experience with smart mobility involves a combination of small-scale trials focusing on MaaS and AV applications, and interacting with provider-led carsharing, bikesharing, and ridesharing services. Given the limited scale of smart mobility applications, discussions with the participants from Greater Manchester focused more their aspirations for smart mobility, rather than the lessons learned from their experiences. At the time of the interviews, TfGM were in the process of articulating their smart mobility vision for a funding application to the DfT, which proposed integrating smart mobility services with the local transport network in order fill gaps in local transport provision under a MaaS ecosystem. However, this application was unsuccessful, and it appears that the majority of its proposals will not be taken forward without this funding. This is a sign of Greater Manchester's efforts to shape smart mobility being bound by their limited regulatory and financial autonomy, as transport governance in the United Kingdom is heavily centralised. Indeed, the DfT have developed a national strategic position towards smart mobility services, and are expected to make regulatory changes that will also apply to Greater Manchester. Nevertheless, in the recent years more powers have been devolved to the Greater Manchester Combined Authority (GMCA). The flagship change for transport is GMCA's 2021 decision to bring the deregulated bus market under local control, a major shift in local transport powers, which the participants argued would also influence their future position on smart mobility[38] (BBC, 2022).

[38] After the cut-off date of Chapter 5, a judge ruled that the decision to bring Greater Manchester's bus network back under public control was lawful, dismissing a judicial review request that was brought

In discussing the future of smart mobility in Greater Manchester, the participants expressed diverging views on how the state should deal with services. Some of the participants argued that smart mobility should be steered through regulation so that services help meet specific local needs. However, others argued that regulation would impede innovation and discourage investment in the region. They suggested smart mobility services can still meet local needs if providers are supported through investment in infrastructure, such as mobility hubs, are integrated with the local transport system, and steered through collaboration. While this view contradicts the lessons that TfGM have learned from trying to work collaboratively with bus operators in a deregulated market, and indeed the lessons from the Mobike bikeshare pilot, the participants considered that a collaborative approach is mutually beneficial for providers and local authorities, and can help change people's travel behaviour. In fact, most participants demonstrated a strong faith in the ability of smart mobility services, particularly MaaS, to transform the way people travel, arguing that it has the potential provide on-demand, tailored mobility and that, as long as people are provided with all the information, they will make the "right" travel decision.

7.2.3. Stockholm

Stockholm's experience with smart mobility services involves several small-scale trials focusing on MaaS, AVs, shared electric vehicles and mobility hubs, and interacting with provider-led ridesharing, carsharing, and e-scooter sharing services. In addition, the provision of smart mobility services is integrated in mainstream policy as an alternative to providing parking spaces in new housing developments in the City of Stockholm. Stockholm Region have also run their own smart mobility pilots, which were focused on MaaS and AV applications. At the national level, the strategic innovation programme Drive Sweden and the parliament-appointed committee KOMET were both exploring how smart mobility services can be supported through trials and changes in legislation, demonstrating little doubt that smart mobility services will also be aligned with local objectives. Interventions in Stockholm were fragmented across different organisations, which partly reflects the organisations' different remits, but is also indicative of long-standing siloes in Swedish governance.

The participants in Stockholm advocated a hands-off approach to managing smart mobility services, stressed that innovation should not be suppressed, and argued that it is not the local authorities' role to tell people what to do, but rather to give them sustainable transport options to choose from. In particular, Stockholm Region's pilots and policy positions show that they

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forward by two bus operators, Stagecoach and Rotala. The request argued that the process followed by GMCA in assessing the impact of COVID-19 on the franchise plans did not meet legal requirements.

are willing to allow smart mobility providers an active role in shaping the future of transport in Stockholm, albeit they forecast that the local public transport network will remain the key mobility choice in Stockholm. This market-oriented approach reflects a wider shift towards neoliberal policies across Sweden. The participants also linked the openness to new services to maintaining Sweden's reputation as a country leading on innovation. Similarly to Greater Manchester, the narrative about the future benefits of smart mobility was often contradicted by the challenges experienced by the participants involved in implementing trials in the present. For example, the City of Stockholm and the national government have faced challenges with e-scooters and ridesharing respectively, and have introduced rules and regulation that address the issues caused by the services, while facilitating their continued operation. Finally, the participants in Stockholm discussed the role of smart mobility in relation to the private car and stressed that the commercial viability of services depends on the introduction of policies restricting car ownership and use. Nevertheless, despite their astute observations on service profitability, participants in Stockholm showed a limited understanding of the global smart mobility market dynamics.

7.3. Revisiting the research questions

Section 2.5 outlines the research questions as these were identified following the literature review. This original set, which is listed below, focused only on the role of local authorities in steering smart mobility services.

Research question 1: How have cities governed smart mobility so far?

Research question 2: What are the cities' plans for smart mobility?

Research question 3: How could cities hold smart mobility providers accountable for contributing to local sustainable transport objectives?

However, through the data collection and thematic analysis of the interviews, it became clear that the participants provided a much broader picture about what shapes smart mobility beyond state intervention. As such, a fourth research question, named here research question zero, is added in this chapter to capture the contextual factors that shape smart mobility services. In Section 7.3.1 research question zero is phrased as "what shapes smart mobility services in a city?" to capture that the way smart mobility services develop in a city is affected by the pre-existing institutional context and powers, and the local policy traditions. In addition, smart mobility services are shaped by providers' corporate decisions and strategies that are unrelated to the local context. The first and second research questions are then grouped together and answered in Section 7.3.2. The response to research question zero sets the framework within which local authorities make their decisions on how to steer smart mobility.

Cities then deploy different steering methods, which are grouped under the conceptual categories of experimentation, not steering, enabling policy, and proactive policy. The analysis shows that these categories often overlap, and their definition is not clearly set. Finally, the third research question, which asks how smart mobility providers can be held accountable for contributing to local sustainable transport objectives, is answered in Section 7.3.3.

The analysis in this chapter is informed by the literature reviewed and theories discussed in Chapter 2, and is complemented by additional literature that focuses on the themes identified in the interview data and therefore was not studied as part of the initial review. More specifically, Section 7.3.1 draws from theories of governance to analyse the context of each case study and how it shapes smart mobility services. However, this research does not draw from one specific governance theory, and it does not use a specific analysis framework. Instead, as explained in Section 2.2.1, the analysis adopts an open understanding of governance as a complex process of interaction between government and non-government actors (Rhodes, 2006), which is shaped by the policies, forms of organisation and politics in each location (Treib et al., 2007). Governance is also understood as a process that evolves over time and reflects the sociopolitical and economic developments in each context (Bevir, 2013). Therefore, the analysis aims to capture the variety and contingency of smart mobility governance in the three cities, while also paying attention to issues of power, resources and legitimacy (Marsden and Reardon, 2017). Furthermore, the discussion takes into consideration the literature on urban and regional governance and the theories on multi-level governance to analyse the interaction between global, national, regional and local actors (Bache et al., 2016). However, maintaining an open understanding of governance, the analysis does not adopt the Type I and Type II taxonomy of the MLG concept, as it is considered limiting in capturing the complexity and nuances of the interplay between actors at different levels and their role in shaping smart mobility governance.

An open, nuanced interpretation of governance arrangements and the dynamics of interaction between different actors allows for a deeper understanding of the processes through which smart mobility is shaped in each city. For example, in Seattle the tradition of progressive local policies, alongside with the traditionally close relationships between the city and large technology companies have both shaped how smart mobility services are adopted. In Greater Manchester, the limited locally managed financial resources and the processes of removing and regaining local powers have impacted how and whether smart mobility services can be steered. Finally, in Stockholm, policies set at the national level have limited the local authorities' ability to steer smart mobility services, while trials and experiments with smart mobility services gained additional legitimacy due to Sweden's strong tradition in innovation policy.

As explained in Section 2.5, the first and second research questions aim to provide an insight into the governance of smart mobility in different contexts that is more granular compared to the current literature, which either provides a general discussion of the governance of smart mobility or examines individual types of services and issues. However, the analysis in Section 7.3.2 does not aim to identify a set process of change in local governance in response to smart mobility. While the innovative nature of smart mobility services is acknowledged, the discussion does not use the Multi-level Perspective (MLP) outlined in Section 2.3.3 as an analytical framework. As explained in Section 2.3.3, this research acknowledges the concepts of niches, regimes and landscapes as a point of departure in understanding the idea of a smart mobility transition, however the MLP is not considered an appropriate framework to analyse the adoption services and evolution of local governance in each context. As the analysis demonstrates, different types of services can evolve in different ways in the same city (see carsharing and ridesharing in Seattle), or the same services can evolve in different ways in different cities (see Uber in Greater Manchester and Stockholm). In addition, change does not occur in a set way, with niches breaking into regimes when the landscape creates favourable conditions for a transition. Instead, change is a complex process that reflects the local context and policy priorities, and is also shaped by the actions of smart mobility providers (Hodson et al., 2017).

Therefore, Section 7.3.2 uses a simple conceptual framework for the analysis of authorities' response to smart mobility services, mainly drawing from Wallsten et al. (2021) and reflecting the themes identified in interviews. Acknowledging that local authorities are unlikely to strictly adopt only one approach to deal with smart mobility services, Section 7.3.2 provides an open discussion of four policy positions (experimentation, not steering, enabling, and proactive policy), and also analyses the role of smart mobility in transport strategies. The discussion is complemented by further literature on innovation governance, which has not been included in Chapter 2. This literature explores the themes identified in the interview data and supports a critical analysis of the weaknesses and risks of steering approaches adopted by local authorities.

Finally, Sections 7.3.3 and 7.4 use the literature on accountability from Chapter 2 as a departure point to discuss how accountability regimes can be shaped for smart mobility services to contribute to sustainable transport objectives and particularly to help address the climate emergency. The six-question framework developed by Mashaw (2006) is used to structure the analysis of current and future accountability regimes for smart mobility, and provide an open and nuanced discussion of the governance and accountability challenges that emerge in different contexts. This section goes beyond the existing smart mobility literature that considers accountability by largely focusing on the regulation of services to

manage their externalities. Again, the analysis uses additional literature that is linked to the themes identified in the interview data, and also supports the development of broader critical reflections on this research. More specifically, the analysis draws from Ndubisi et al. (2016) and relational contract theory to emphasise the importance of reciprocal relationships and mutual trust between private and the public actors in successfully serving the public interest. While the importance of collaboration is referenced in Chapter 2 (Section 2.2.2 and Section 2.3.1), Ndubisi et al. (2016) focus specifically on non-ownership services and the sharing economy. Finally, the discussion focuses on the broader role of innovation in relation to public objectives and asks when and whether novelty is actually an improvement, what role innovation plays in processes of societal change, and, crucially, how chasing the "next best thing" impacts the limits of this planet (Ferreira et al., 2020; Vinsel and Russell, 2020).

7.3.1. Research question 0: What shapes smart mobility services in a city?

The analysis identifies two key factors that affect how smart mobility is shaped in a city: the local governance context and smart mobility market developments. This discussion draws mainly from the sections discussing the institutional and policy context, and the development of smart mobility services in Chapters 4, 5 and 6, while references to specific sections are also provided in brackets in the text.

7.3.1.1. Local governance context: institutions, powers and policy traditions

Institutional context and powers

This research shows that the development of smart mobility services in each city is strongly affected by the pre-existing governance arrangements and local context. The institutional and policy contexts shape the available avenues of introduction for smart mobility services in each city, and define the space within which services can be steered. From the outset, services are dealt with by existing institutions who decide how, and whether, to use their existing powers to shape smart mobility. While the institutions adapt, usually by creating new teams or programmes, such as in the case of SDOT or Stockholm Region, or even through creating new institutions such as the Vinnova-funded Drive Sweden, smart mobility is affected by the governance structure where it "lands". The analysis below strongly reflects the research by Hodson et al. (2017, p.1) who stress the importance of local context and argue that "urban transitions are not about technological or social innovation per se, but about how multiple innovations are experimented with, combined and reconfigured in existing urban contexts and how such processes are governed. There are potentially many ways in which urban

sustainable mobility can be reconfigured contextually. Innovation is in the particular form of reconfiguration rather than individual technologies."

There are significant differences in the institutional contexts and distribution of powers of the three cities examined, which underline the steering efforts that are discussed in the next section. Seattle's charter city status provides legislative and tax raising powers, which are used by SDOT to determine the parameters of the city's smart mobility pilots and fund the New Mobility Programme. Similarly, KCM and KC use their powers to develop their smart mobility trials and amend relevant local legislation in ways that complement the existing public transport network and assets, whilst addressing local challenges (Section 4.2.1.2). Historical governance arrangements for taxis were also transferred to TNCs, with KC and Seattle City Council taking regulatory action together. TNC regulation in Seattle also provides a glimpse into multilevel governance challenges in the United States. Although the historical collaboration and policy alignment between the City of Seattle and KC became stronger in their efforts to steer TNCs, they faced challenges at the state level. In the United States, legal precedents set in other parts of the country can be used to determine local developments, and smart mobility providers lobby for favourable legislation at the state level to pre-empt local action. TNC legislation also reveals the historical power imbalance between urban and rural areas in Washington State, which demonstrates that, in a multilevel governance context, steering services may have implications beyond the cities where they operate, and that the governance of smart mobility is not merely a local matter, even if it is enacted locally (Section 4.2.2.2).

The effect of multilevel governance and power distribution is even more pronounced in the case of Greater Manchester. The UK's heavily centralised transport governance means that TfGM and the local authorities in Greater Manchester effectively share local transport policymaking with the central government, reflecting Peck (2001) who explains that devolution to local authorities does not come with real power, as institutional coordination and ideological control remain firmly located at the centre of the government. As such, local authorities often lack the power to raise funds and introduce new, dedicated rules for smart mobility. Smart mobility services in Greater Manchester are generally regulated under pre-existing national or local rules, which are designed to accommodate older types of services or operational models. For example, ridesharing companies are regulated as Private Hire Vehicles (PHVs), while shared e-scooters are considered illegal based on legislation that was introduced well before their emergence (Weston, 2021)[39] (Section 5.2.1.3). The authorities in Greater Manchester also depend on central government funding, for which they often compete with their

[39] Perhaps a more appropriate wording would be the "current incarnation of scooters" as examples of motorised scooters date back to the early 20th century.

counterparts from other parts of the country (Urban Transport Group, 2021). TfGM's unsuccessful application for the Future Transport Zone (FTZ) funding demonstrates this dependence and how it can shape local developments: while the FTZ is the most elaborate articulation of TfGM's smart mobility vision, only a very small part of it made it to its five-year transport strategy delivery plan when the funding was not secured (Section 5.2.2.2). Opportunities to steer smart mobility in Greater Manchester are further limited due to transport deregulation over the last three decades in the UK, particularly for the public transport and taxi markets.

Similarly to Seattle, authorities in Stockholm have tax raising powers, which allow them to set their own development priorities, mainly through the annual budget process. Stockholm Region also maintain strong control over the operation and strategic planning of the local public transport network. However, similarly to Greater Manchester, the rules that govern smart mobility services are often determined at the national level, limiting the local authorities' steering capacity. For example, the classification of e-scooters under the same national law as bicycles significantly limits local authorities' ability to steer operators (Section 6.2.1.2). Again, many of these rules precede the emergence of smart mobility services and are not entirely fit for purpose. In Stockholm smart mobility developments are spread across multiple institutions at the local, regional, and national level, including new institutions that specifically focus on smart mobility (Drive Sweden) and innovation (KOMET), which the participants attributed to a tradition of polyphony in Swedish governance. In addition, in the case of Stockholm City Council, there are several departments within the organisation that work with different aspects of smart mobility, reflecting long-standing siloes within the organisation (Section 6.2.2.1).

The case studies show that the legislative and financial autonomy of cities plays an important role in how smart mobility services can be governed. In addition, smart mobility can be shaped concurrently and in a fragmented way by multiple actors across different levels of government, creating policy alignment challenges as there is often not a settled view of what smart mobility is and what it should achieve.

Policy traditions

While institutional and power arrangements determine the available opportunities for steering smart mobility services, smart mobility is also shaped by how, and if, cities choose to use their powers. This research shows that this choice is influenced by the pre-existing policy context, and by the policy positions and politics of working with innovation and the private sector.

In Seattle, the "Amazon boom" and the city's tradition in headquartering large, successful corporations, have created an attractive environment for businesses and an expectation to be

on the cutting edge of innovation. This local support for innovation is combined with a broader drive to inject American smart mobility companies – funded by American venture capital - in local markets. At the same time, the city, alongside its Pacific Northwest neighbours, is considered liberal and strongly regulated, with high standards for environmental protection and citizen engagement, although it is lagging behind Stockholm and Greater Manchester in its decarbonisation ambition. Both these traditions are reflected in smart mobility developments. Seattle was an early adopter of most services, which have been actively promoted as sustainable transport options, as well as an attractive environment for providers. However, Seattle's liberal principles clash with its status as a tech hub. Efforts to tax and regulate technology companies to address the city's homelessness crisis that was fuelled by the influx of highly skilled individuals driving up housing costs, have become a massive political issue since the early 2010s. This political context is reflected in decisions about smart mobility services. For example, pressure to adopt collective bargaining for TNC drivers adheres to the city's pro-union politics, while Mayor Durkan's cautious adoption of e-scooters banked on the city's reputation as a highly regulated environment, which deterred providers from doing a rogue launch, even if there were effectively no rules in place to stop them.

Policy traditions are also reflected in the actions of KCM, who explained that testing and adopting smart mobility services was a natural step for them as they had always tried innovative ways of complementing the local public transport network. Finally, the case of TNC regulation demonstrates an understanding that the State of Washington is more permissive and market-oriented than the City of Seattle and KC, as is shown by TNCs' calculated decision to put forward pre-emptive legislation at the state level. This reflects findings from research in San Francisco (Flores and Rayle, 2017) and Seoul (Hong and Lee, 2018), which also shows that state and national governments are more permissive than cities, perhaps because they do not face the direct consequences of these decisions.

In Greater Manchester, the efforts to steer smart mobility are made in the context of the relatively recent devolutionary processes and the decision to bring the deregulated bus market back under local public control. The politics of "taking back control" are also reflected in targeted actions related to smart mobility, such as Mayor Burnham's commitment to introduce minimum licensing standards for PHVs across Greater Manchester's 10 boroughs (Burnham, 2021). As the outcomes of this process of change were uncertain at the time of the interviews, the participants presented TfGM's potential position towards smart mobility as a function of the final decision on franchising. The FTZ application and the interviews showed that TfGM's preferred position would be a hybrid approach to steering, including elements of regulation as well as substantial freedoms for the operators. While this approach is seen as reflective of the region's transport being in a phase of transition, it also mirrors the GMCA's parallel ambitions

to regain control of local governance and attract investment and innovation to further establish their position as a key economic centre in the North of England (Greater Manchester Local Enterprise Partnership, 2022). Nevertheless, smart mobility developments in Greater Manchester are still shaped by the pre-devolution policy context, characterised by a lack of autonomy and lack of funding. Over the last decade, local and regional authorities in England have sustained extensive funding cuts (Institute for Government, 2022). Therefore, any decision to take a strong regulatory approach towards smart mobility services may have unsustainable financial implications for TfGM. A collaborative relationship with smart mobility providers that is based on mutual understanding rather than set rules carries a lower risk for the local authority and gives the benefit of a "free" service, as is shown by the rationale behind the introduction of Mobike. Finally, as is demonstrated by the FTZ application, it is in TfGM's and the GMCA's interest to maintain a relative alignment with the national policy as well as flexibility in their policy positions, as this increases the likelihood of securing government funding and support, and provides resilience in case there is a change in central government.

In Stockholm, the city's reputation as an innovation leader, and the broader, national shift towards neoliberal policies are reflected in smart mobility governance. Sweden and Stockholm have a strong tradition of fostering innovation, with large corporations such as Ericsson, Volvo, and Scania being major players in their respective industries. The triple helix model of innovation, where government, academia and industry work together to deliver innovation, is reflected in multi-partner smart mobility testbeds such as the Urban ICT Arena in Kista, while the traditions of collaboration and mutual trust between actors were praised by interviewees. In this pro-innovation context, there is a prevailing assumption that "smart equals sustainable", and therefore innovation is closely aligned with the city's objectives for transport. At the same time, the wider shift towards laissez-faire policies contributes to the creation of an environment where national, regional and local governments prefer to enable innovation and only intervene to fix market failures, if and when they appear (Wallsten et al., 2021). The wider neoliberal context is also reflected in the participants' statements that their role is to ensure there are options for the public to choose, but not to steer them towards specific choices. The resulting enabling approach is demonstrated by the eventual regulation of e-scooters in Stockholm and the new legislation to accommodate ridesharing companies, while Stockholm Region's vision about MaaS and the integration of smart mobility services in new housing developments show a clear willingness to create a space for innovation in the local transport market.

The three case studies show that the position taken on smart mobility governance can be highly political, reflecting pre-existing policy traditions of each place. There is also a strong link between smart mobility policies and the ideological positions regarding

the role of the state and the role of innovation, which may vary between government levels.

7.3.1.2. Corporate decisions and strategies

It is not surprising that smart mobility services are shaped by existing governance contexts. This research shows that smart mobility providers are also aware of the importance of local governance in the cities where they operate, and can make calculated decisions about their operations according to each context.

It is important to clarify that it is not suggested that all providers deploy the same practices, or that providers' practices are the same across all types of services. The diversity in the providers' practices is perhaps most clearly demonstrated through KCM's efforts to procure an operator for their first-last mile trials, where the goals of the trial were a better fit for Via's business model compared to Lyft's (Section 4.2.3.2). However, certain patterns in providers' behaviour become evident, especially among new players that are backed by VC. The case studies show that the local context influences the tactics providers deploy. As the participants from SDOT explained, providers make calculated decisions on where to launch and how, based on the regulatory approach a place is likely to deploy. As e-scooter providers did not launch in Seattle while SDOT were preparing the permit specifications, the multiple providers who did launch in Stockholm may have taken the city's hands-off approach as an opportunity to capture a share of the local market before it is regulated. If this was their tactic, it appears to have paid off, as when Stockholm City Council decided to control the local e-scooter market, they were forced to abandon their idea to limit the number of operators permitted in the city (Section 6.2.1.2).

The case of e-scooters in Stockholm demonstrates that once operators have launched in a city, they can take tactical action to increase their leverage. The clearest example of this approach is provided by TNCs' tactics. In their efforts to overturn the city of Seattle's early regulatory attempts, TNCs deftly deployed the city's own rules to suspend the ordinance and put it up for public vote in a referendum. In addition, TNC regulation demonstrates that even when there is willingness to find common ground between TNCs and local authorities, this is not always possible. In fact, when TNCs put forward their bill to the State of Washington, they did not simply try to pre-empt local action by pushing for state-wide legislation, but they actively sought to undermine the local authorities' steering capacity by advocating for their powers to be removed or scaled back. It is evident across the case studies and from the literature (see for example Dudley et al., 2017) that TNCs take advantage of regulatory gaps to disrupt the local markets and create a base of drivers and customers, which gives them public legitimacy

and power that they then deploy along with aggressive lobbying to promote their side of the legal arguments. As a result, the case studies show that TNCs play an important role in shaping the rules that eventually regulate them and even in reshaping the local power balance (Section 4.2.2.2).

Furthermore, this research demonstrates that smart mobility governance is not only shaped by the interaction between cities and smart mobility providers, but also by market developments that are completely unrelated to each city's local context. The three cities are either dealing with or considering the same types of services, often offered by the same operators. While there are examples of political decisions that do steer the market, such as Mayor Durkan's delay in adopting e-scooters and – at least at the time of the interviews - the generally lower political interest in MaaS applications in the United States, the set of options that are made available to cities is determined by the smart mobility market. These operators prefer to present one-size-fits-all solutions that appeal to the same sustainable mobility narrative.

The market's influence in shaping the availability of services can be traced through the case studies, as they make it possible to roughly follow the global micromobility developments over the last few years. Before the mid-2010s, most bikeshare schemes were mainly docked and procured by local authorities, often sponsored by companies in return for advertising space, as was the case in Stockholm. Mobike is an early example of the rush of Chinese dockless bikeshare providers to capture the European markets following their rapid expansion in China. Seattle's dockless bikeshare pilot demonstrates the entry of American players such as Lime in the micromobility market, followed by the withdrawal of Chinese players, demonstrated by the end of Mobike's pilot in Greater Manchester. The interviews then capture the market's shift from bikesharing to e-scooters through the developments preceding the launch of the e-scooter pilot in Seattle. Finally, the oversupply of e-scooters in Stockholm reflects the rise of European e-scooter operators. Although these observations merit a deeper analysis, they are certainly evidence that changes in micromobility show homogeneity at a global level.

Further proving the influence of market forces, the case studies provide an insight into the decisions providers make to attract further VC investment. For example, the shift from shared bikes to e-scooters, as well as 'rogue' launches which demonstrate that cities cannot stop a service, were both actions attributed to providers' willingness to make bold moves to meet the investors' preferences as well as attract their attention. Consequently, decisions about where to launch a service may be completely unrelated to its potential transport impacts in a city. For example, Browne (2020) reports that European e-scooter companies outperformed their American counterparts in 2020's funding rounds, as "[i]ndustry executives and investors say Europe is a better fit for such vehicles than the U.S." (Browne, 2022, no page). However,

research on the impacts of e-scooters across multiple cities consistently shows that e-scooters have a much higher potential to replace car trips in North America than in Europe, where they overwhelmingly replace walking, cycling and travelling by public transport (see for example Wang et al., 2022). In addition, many participants argued that services often operate at loss, and the case studies show that providers are willing to make swift changes in their operations once they decide to focus on profit-making. For example, the periods when Seattle had no free-floating carsharing and bikesharing services are the result of corporate decisions made by companies at the global scale, which are unrelated to local developments but have a knock-on effect on cities who are left without a service having once had one. Similar developments can also be identified in other places, for example in Lime's mass withdrawal from all Latin American markets in 2020 to "focus on profitability" (Markovich, 2020).

While it is expected that smart mobility providers are guided by their commercial interests, these can leave cities at the mercy of decisions based on global capital flows that have nothing to do with local transport, rendering irrelevant any efforts to steer services. However, it is key that in all the examples provided above, cities are not making any financial contribution towards services: it is only private capital that feeds into services that are provided to cities "for free". While cities spend a considerable amount of revenue funding and human resources in their efforts to steer services, they often lack the capital funding to invest in new service provision. **Smart mobility services come with the appeal of a "free" service that requires no capital investment and have no cost implications related to their development and operations, playing into the neoliberal principles of service outsourcing and marketisation.**

7.3.2. Research questions 1 and 2: How do cities steer smart mobility services?

The previous section discussed how smart mobility governance is shaped by existing urban governance arrangements and corporate strategies. These set the framework within which cities take new, direct policy decisions that aim to steer smart mobility services – or not. Of course, the reality of smart mobility policymaking is far more complex than a binary decision to steer or not to steer, with multiple factors contributing to the cities' actions, which change and adapt over time. The following sections discuss how the cities' policy approaches are shaped, mainly drawing from the sections discussing smart mobility policies and the cities' relationships with smart mobility providers in Chapters 4, 5, and 6. References to specific sections are also provided in the text.

7.3.2.1. Experimenting with smart mobility

Across all three case studies, participants regarded trials and experiments with different forms of smart mobility to be essential to the process of developing a localised understanding of the impacts of new services. Trials were also considered a way for local authorities to "keep up" with the rapid changes in the smart mobility space without committing to a long-term solution that could soon become obsolete. In addition, testing new concepts and services was aligned with the idea of being open to innovation, according to which cities benefit form a rolling process of testing, learning, and scaling up the solutions that work for them. These findings echo the research by Eneqvist et al. (2021) who also found that Stockholm City Council's approach to innovation is focused on promoting the city as a testbed for experimentation and uses the institutional capacity to apply experimental results at a larger scale as a means to legitimise the testing. Finally, trials were often a locus of collaboration, bringing together government actors, providers, and research organisations, reflecting Krosnell and Mukhtar-Landgren's (2020) argument that smart mobility testing and trials form part of a larger trend of experimental governance, which is underpinned by assumptions that authorities need to embrace extraordinary solutions, test them in the "real world", and use the expertise of multiple actors in order to address extraordinary problems, such as the decarbonisation of transport. More broadly, Krosnell and Mukhtar-Landgren add that trials are seen to increase the "innovation capacity, growth and competitiveness and (for municipalities) the possibility to create a positive image for the city" (Kronsell and Mukhtar-Landgren, 2020, p.129), which also aligns with the findings of the case studies.

Across the three case studies, early-stage trials focused on learning from experiments with different services and technologies, or even specific aspects of them, as did TfGM's MaaS trials that focused on individual elements of a MaaS ecosystem. Other examples include TfGM's AV trials, and Stockholm's CIVITAS ECCENTRIC projects, which focused on small geographic areas or population groups. Participants in all three cities explained that their first attempts at trialling services were more opportunistic than deliberate. Such trials were mostly introduced through readily available funding opportunities provided by supranational networks such as the European Commission, for example in the case of the CIVITAS ECCENTRIC programme; central government funding, for instance from Innovate UK; or other supranational institutions, such as UITP. This demonstrates that there is broad interest across higher levels of governance, which is perhaps a sign of technological optimism on their part about how local transport issues can be resolved. At the same time, this one-off subsidy to test new solutions may mask funding limitations, as local authorities still need to secure additional funding if they wish to scale up their trials.

Crucially, although the trials were framed as a staged introduction to smart mobility services, in all three cases the cities were concurrently dealing with full-scale deployment of smart mobility services that had been launched independently by providers, with Uber being a shared example across the three locations. The examples of small-scale trials carried out in the three cities did not appear to build the authorities' capacity to deal with smart mobility providers or steer smart mobility services. While the participants explained that they did learn some lessons, the trials were generally not reflective of the challenges of dealing with providers in open market conditions. Aparicio (2020) also provides a similar insight through examining the evaluation of the CIVITAS ECCENTRIC programme in Madrid. He finds that the evaluation of trials focuses on delivering localised efficiencies rather than overall effectiveness, failing to assess how innovation projects fit within the wider institutional structures and public policy objectives of the cities. As such, trials are isolated and only work within their narrow boundaries and terms of experimentation, while Aparicio argues that "[i]t is only in a context of transformative change that mobility measures can yield the expected results in terms of sustainability" (Aparicio, 2020, p.167).

It is notable that there was no consistency in how trials and pilots were defined by authorities in the three cities. As mentioned above, many trials were implemented in small geographic areas or with small groups of people. However, Mobike's bikeshare operation in Greater Manchester was also described as a trial by the participants, while SDOT's permit schemes were described as pilots, causing debate among Seattle's council members (Seattle City Council Insight, 2020a). It is considered that in these cases the use of the terms trial and pilot is linked to the narrative about learning and experimentation that was described earlier in this section, as both schemes were subject to annual review. For clarity, the Mobike trial, SDOT's pilots, and KCM's pilots are further discussed in the following sections where the analysis focuses on the steering methods the cities used in each case.

7.3.2.2. Not steering

Before discussing what constitutes a "not steering", enabling, or proactive policy, it is important to clarify that, as Wallsten et al. (2021) explain, local authorities are unlikely to adopt only one approach to dealing with smart mobility services. Instead, they adjust and blend different approaches depending on each context, and can also change their position towards the same service over time. For example, Stockholm City Council initially took a "not steering" policy position towards e-scooters, which evolved to an enabling approach with the signing of an MoU with all smart mobility providers, and then became a stronger regulatory position that has some proactive elements. In addition, it is not the suggestion of this research that there is an absolute definition for an authority's approach. For example, Stockholm Parkering's mobility

hubs can be considered as both enabling, as Stockholm Parkering adjusted their operations to accommodate smart mobility services, and also proactive, as the goal of the hubs was to facilitate multimodal trips (Section 6.2.1.1). As such, echoing Wallsten et al. (2021), the approaches to steering are used as a conceptual tool, which builds upon the existing literature and the pilot interviews conducted as part of this research.

The case studies demonstrate that cities may either be unable to steer services, or may make a conscious decision to not do it. The lack of appropriate provisions in regulation or the lack of powers at the local level are the main reasons behind the inability of cities to act, which often becomes evident when providers launch without consultation with the local authorities. For example, TNCs were unregulated for the first years of their operation in Seattle because there was no legal framework to control them. The inability to regulate may even be related to aspects of providers' operations, where existing rules are not entirely fit for purpose. For example, while car clubs need to be licensed in Stockholm, it is impossible to facilitate on-street parking for them due to the existing legislation, which is set at the national level. This reveals a lack of alignment between different government levels as, even though the Swedish national government has taken direct action to accommodate other smart mobility services by amending the existing legislation, such as in the case of ridesharing services, they have not done the same for car clubs.

Cities also choose to not steer smart mobility services. As explained earlier in this chapter, the cities' approach towards smart mobility reflects their pre-existing political landscape and governance traditions. There is a clear link between the arguments about whether smart mobility services should be steered and ideological views on the role of the state. The arguments for a hands-off approach align with the neoliberal narrative on the role of the state, where the market can be self-regulated through competition, the state should only intervene in the case of market failures, and citizens shape the market through their choices. This approach was particularly prevalent in Stockholm, demonstrated by the complete lack of engagement between the City Council and the dockless bikeshare provider EU-Bike, and the initial wait-and-see approach to e-scooters. However, considering that market failures in transport provision have been long established, a hands-off approach can also be seen as a conscious decision to not require a more equitable provision of smart mobility services across different social groups and areas of the city.

The decision to not take any steering action is also closely linked to a view of innovation as an inevitability that cities cannot control. As such, regulation and steering, aside from hindrance, are also pointless, as by the time governments have gone through their official processes of regulation (or, as is explained later in this section, procurement), a smart mobility service may have been overtaken by the next market development. In addition, given that

creating rules takes effort and money, and services are so disruptive, there is a risk that efforts to steer them will be a waste of valuable resources. In this narrative, it is not just the rapid pace of innovation that cities should yield to, but also the innovation itself. Calls for passive acceptance of new services involve an assumption that they are inherently good, both because they are presented as sustainable and efficient alternatives to private cars, and because they offer people the benefit of *more choice*.

The interviews show that there is also an element of stalling in arguing that cities should not steer smart mobility. As was demonstrated in the interview with the participant from Drive Sweden, regulation is not considered necessary for what is already on the ground, but it will be in the future, when CAVs and MaaS become the norm, which is seen as inevitable. When this time comes, it is assumed that governments will have enough leverage to regulate global players at the local level (Section 6.2.3). However, as explained in the previous section, it is already evident the global nature of providers, their financial backers, and the leverage they gain through precedents set in the cities where they operate, often with limited or no regulation, make it harder for local authorities to introduce local rules. This is clearly evident in participants' argument that it is difficult to take a service away from people once it has been introduced in a city, and, more tangibly, in Stockholm City Council's eventual efforts to regulate e-scooters where providers opposed the city's fees, arguing that they were "almost three times as high as the corresponding fees in Paris, and seven times higher than those in Rome and Düsseldorf" (Lång, 2021, no page).

However, it is noted that arguments around not hindering innovation were not always interpreted as a passive acceptance of market developments. For example, the participant from KC argued that while TNCs should not be excessively regulated, they should always align with key local standards, such as vehicle accessibility. This demonstrates that there are different ways of treating innovation in local policymaking, echoing Vinsel and Russell who argue that there is a need to "decouple "innovation" from "technology", and to think hard about what we want from technology in the first place" (Vinsel and Russell, 2020, p.29), an argument that is revisited in the response to the third research question.

7.3.2.3. Enabling policy

The three case studies show that local authorities often take an enabling policy approach towards smart mobility services. This means that they allow services to be accommodated in existing regulatory environments, for example through signing an MoU, making small changes in legislation or even using their convening power to support providers, but without making any significant efforts to steer them. The rationale behind enabling services is closely aligned

to those of experimentation and not steering that were described in the previous sections. The participants expressed their faith in the benefits of services and argued that cities should "collaborate rather than regulate" as the market is changing rapidly and there is still a lot to learn about smart mobility. Welcoming services in a city is also associated with attracting new investment and creating new jobs, thus contributing to the cities' economic development ambitions. Some of the participants who supported an enabling policy approach, especially in Greater Manchester, expressed the belief that cities lack the capacity to produce and deliver innovation, unlike the private sector, and therefore smart mobility services can only be introduced in a collaborative manner. While this view adds legitimacy to enabling policy, there is evidence in this research and in the innovation literature (see for example Mazzucato, 2018) that clearly demonstrates the public sector's capability to innovate, not just in terms of supporting technologies but also in integrating them in public policy. For example, this can be demonstrated through KCM's involvement in establishing carsharing in Seattle in the early 2000s and through Stockholm's bikeshare scheme that was launched in 2006.

In the case of the enabling approach, a common characteristic across the range of examples that can be described as such is that authorities do not expect services to contribute to local objectives, or, if there are some expectations and requests from providers, these are non-binding, are not being monitored, and there are no standards to be met. For example, the MoU that was signed between Mobike and authorities in Greater Manchester outlines the expectations of the service but was entirely voluntary for either side to adhere to it, offering no leverage to the local authorities. More examples of enabling policies can be found in Stockholm. For example, it could be argued that the introduction of mobility hubs as an alternative to building parking spaces in new housing developments is an enabling approach, as it creates a "space" for smart mobility services but does not outline what is expected of them. Instead, the responsibility for reducing the use of cars by residents is shifted to developers and smart mobility providers. Stockholm Region's approach to smart mobility services is also considered a characteristic example of an enabling approach. As Oldbury and Isaksson (2021) explain and is demonstrated by the Region's latest strategic plans, the region enables smart mobility providers in a way that gives them a central role in shaping their own role in future transport systems.

Nevertheless, the three case studies also show that enabling is not always a conscious decision. Pre-existing legislation, particularly in places such as Greater Manchester and Stockholm that have limited regulatory autonomy, can randomly enable the legal introduction of services (or hinder it, such as in the case of e-scooters in the UK). This legislation is often the result of earlier deregulation efforts. For example, the deregulation of the taxi market in Sweden in 1990s, already allowed drivers to work as freelancers for ridesharing platforms,

removing regulatory barriers related to labour rights. As demonstrated in the earlier chapters, pre-existing regulation is usually not fit for purpose yet sets a precedent for services, which is hard to reverse if the authorities decide to take a different or stronger regulatory stance.

Finally, TfGM's FTZ application proposed an enabling *and reciprocal* relationship with smart mobility providers, albeit it was accompanied by little detail on how it would work and how key risks could be avoided. In their application, TfGM proposed to enable smart mobility services through light-touch or no regulation, and through investing in infrastructure or even subsidising services to ensure their success as part of the wider transport network. In return, the application assumed that providers will join TfGM in efforts to deliver better, tailored, and on-demand mobility options for everyone. Although the lack of detail in TfGM's proposal raises many questions about the feasibility of the model proposed, especially in the absence of funding, it does make a recommendation that progresses enabling into a partnership. TfGM suggest that services should not simply be allowed to operate and then left to their own means, but instead be backed by reciprocal measures that support their operations and success in the local context. The concept of a reciprocal relationship is further discussed in the next section.

7.3.2.4. Proactive policy

Finally, the case studies show that cities can take a proactive approach to smart mobility policy. Proactive policymaking is identified in isolated examples in Greater Manchester and Stockholm, and was the dominant approach in Seattle. The arguments for state intervention lean towards welfarist principles, where the state shapes the available transport choices in a way that meets the objectives they have set. The transport governance literature also argues that policymakers have a responsibility to shape their actions accordingly to deliver local priorities, even in the face of uncertainty (Lyons and Davidson, 2016), while Pangbourne et al. (2020) stress that cities need to consider any unanticipated societal and environmental implications and how to prevent them when governing smart mobility services. However, this research shows that proactive policymaking can be a complex and incomplete process, and the governance of smart mobility services is often the product of negotiation between public actors and private providers.

Examples of proactive policymaking include the procurement of a carshare provider by Stockport City Council as a way to replace the use of private cars for corporate travel, and, more extensively, KCM's pilots. In both cases, the local authorities used existing powers to procure smart mobility services to deliver specific objectives. Especially in the case of KCM, all applications had a targeted scope, which aimed to enhance the public transport network

and make KCM's assets work better, and even address the temporary impact of roadworks in downtown Seattle (Section 4.2.1.2). The interviewees considered procurement as the most hands-on approach authorities can take to steers services, but KCM's experience shows that, even when local authorities have the funding to commission a service, the process may involve considerable negotiations with providers, and it might be impossible to find common ground. In addition, a shift towards a public procurement model would mean that global smart mobility providers would need to adapt to the varying needs of cities, which conflicts with their one-size-fits-all model and increases their operating costs. In the case of KCM, vehicle accessibility standards and data sharing emerged as major points of disagreement, both of which were important for KCM from a policymaking perspective. This demonstrates that, while smart mobility services can be steered to meet the cities' needs in new, agile ways and fill gaps in local networks, not all providers are interested in doing so. In some cases, providers would simply prefer to operate under free market conditions and, inevitably, compete with public transport services.

Proactive policymaking is also identified in political decisions, and in the adaptation to market developments. For example, the participants linked the introduction of a franchised bikeshare scheme following the departure of Mobike from Greater Manchester to Mayor Burnham's willingness to demonstrate his commitment to promoting cycling ahead of his bid for re-election (Section 5.3.2). In addition, it was Mayor Durkan's decision to amend the collective bargaining ordinance of the previous administration, thereby resolving the deadlock in the regulation of TNCs in Seattle by giving the city ownership of setting a minimum wage for drivers (Section 4.2.2.2). In terms of policy adaptation, this is demonstrated in SDOT's timely introduction of the New Mobility Playbook, and the decision to shift the focus of the New Mobility Programme from CAVs to micromobility, in line with the market direction (Section 4.2.2.1). The authorities in Seattle showed an ability to stay attuned to market developments that stands out from the other two case studies. This is clearly demonstrated in KC's proactive efforts to support the incumbent taxi and for hire industries who lost a large share of their trade to TNCs, although there were no similar efforts from Seattle City Council.

However, the regulation of TNCs in Seattle also demonstrates that even when local authorities make intense efforts to proactively regulate providers, there are still barriers to steering. The multiplicity of issues touched by TNC regulation and the providers' fierce resistance to being regulated show that regulating smart mobility often goes beyond transport. In fact, in Seattle, efforts to find compromise on policy issues around licensing, insurance, and labour rights were made at the expense of transport policy priorities, as is demonstrated by the concessions made on issues of data sharing, and the fact that the adopted minimum wage definition did not have the potential to reduce congestion, like it did in New York City. Also, despite the

extensive efforts to regulate TNCs at the local, regional and state level, providers still managed to completely reshape the local taxi industry, nearly eclipsing incumbent actors (Section 4.2.2.2). This shows that in some cases, smart mobility services can be so disruptive that there is no clear path to genuinely proactive regulation, and that the process of policymaking still creates winners and losers, especially when there is an imbalance in the negotiating powers of different players.

Finally, SDOT's permit system, another proactive policy approach, provides valuable lessons on the limits to steering. SDOT's permits set out fees and detailed rules for providers, such as data sharing requirements, parking standards for micromobility services, and equity focus areas where providers must deploy a certain percentage of their fleet. As the participants from SDOT explained, the permits involved no financial commitment towards the services which meant that SDOT had no leverage if providers wanted to stop their operations. In fact, SDOT's New Mobility Programme is funded by the permits, so the volatility of the market directly impacts SDOT's ability to take proactive action. Furthermore, the participants admitted that local rules, however prescriptive, were unlikely to shape providers' operating decisions, which are made based on their global performance. In addition, the fact that providers are providing a service "for free" under the permit model, sets a precedent and makes it difficult for policymakers to make a case to local politicians to invest in smart mobility services in arrangements that give SDOT more leverage, such as a franchising model.

Overall, this research shows that taking a proactive policy approach towards smart mobility services is not necessarily the same as steering. Firstly, as is demonstrated in Seattle, policies themselves are often the product of compromise with providers and other government actors. More broadly, policies are largely directed to operational elements of the services and to addressing their negative impacts, instead of genuinely steering the services towards addressing specific needs of the cities and producing positive outcomes. In addition, local authorities are steering the products of the market, rather than the market itself. While there is some indication that cities communicate to the market what kind of solutions they need, as was mentioned by the participant from the Seattle Mayor's office, this is certainly not the norm (Section 4.2.1.1).

7.3.2.5. Smart mobility in transport strategy

The case studies show that smart mobility services are still treated as niches and taking limited space in the cities' strategic transport plans. In Seattle, the participants explained that at the time of the interviews they were only just starting to develop multimodal transport plans where smart mobility services would also be included. Nevertheless, there is evidence that in Seattle

individual smart mobility policies are being linked to wider strategic objectives in the city. For example, Mayor Durkan's Fare Share legislation package proposed that TNC taxes will be spent on transit-oriented affordable housing to help address the city's homelessness crisis. In Greater Manchester, the 2040 Transport Strategy and Delivery Plan only made a short reference to the role of smart mobility services in the future and included limited specific actions such as the introduction of a bikeshare scheme and the standardisation of PHV licensing across the region. This is despite the development of an extensive smart mobility vision in the FTZ Fund application, which shows that the delivery of that vision was conditional upon securing the funding. Indeed, the FTZ vison never became an official policy, nor has it been consulted on with the public and providers. Finally in Stockholm, the City of Stockholm's Smart and Connected Strategy was vague about the types of interventions needed, while Stockholm Region's Kollektivtrafikplan 2050 consultation document is the only example of a strategy that considers smart mobility a key part of a future transport network and discusses the associated risks for public transport services. This limited integration in strategic plans is anticipated, as it is partially related to challenges in strategy development. For example, across the three cities the development cycles of strategic plans are over 5 years, which is too long to capture the dynamic pace of smart mobility developments. In addition, as was evident in Seattle, strategies are often created in modal siloes, meaning that even when cities develop smart mobility strategies, such as SDOT's New Mobility Programme, the role of services is not considered as part of the transport system.

The limited integration of smart mobility services in transport strategies indicates that they are still not considered part of mainstream transport provision, despite the persistent narratives about imminent connected, electric, and automated transport futures, which are supported by providers and others in the transport industry (see for example Viechniki et al., 2015; pwc, 2022). Even more importantly, the participants consistently saw the role of smart mobility services as complementary to public transport, filling in gaps in provision, serving 'unmet demand', and optimising the use of the network, with some participants clearly stating that the services are a "nice to have" and that it is the providers' responsibility to survive financially while serving a small part of the market. As such, the participants did not see smart mobility services as leading a sustainable mobility transition nor as the driver for it. Instead, they saw smart mobility playing a small role in the public sector's efforts to transform the transport system using more "traditional" tools, such as investment in infrastructure, reallocation of road space, and supporting vehicle electrification.

However, conditions on the ground provide little evidence that smart mobility services are indeed filling the gaps and playing a complementary role to the transport system. Instead, the participants consistently referred to services being concentrated in city centres where there

are already multiple travel options. In fact, in some cases, different types of services seem to be competing with each other for the same share of the market. For example, when car2go left Seattle, they argued that ridesharing services had an impact on the demand for carsharing (Nickelsburg, 2019a). Research on TNC operations in the United States provides a good example of how smart mobility services do not necessarily fulfil the role envisaged by local authorities. A study across seven major US cities showed that the use of TNCs reduced the overall use of public transport by 6%, by attracting users from bus services (a 6% reduction) and light rail services (a 3% reduction). However, the study also showed a complementarity between TNCs and commuter rail, of which the use increased by 3%. Crucially, the same study showed that 49% to 61% of TNC trips would have not been made at all, or would have been made by walking, cycling, or public transport, demonstrating that not only do services not complement public transport, but they also effectively replace free walking and cycling trips (Clewlow and Mishra, 2017).

Overall, this section demonstrates that the local authorities' efforts to steer smart mobility services are often not taking account of the services' business models and the providers' practices. This means that services cannot be steered effectively, neither to avoid their negative impacts nor to capture any potential benefits. In addition, smart mobility services continue to be governed as a niche, with limited evidence of integration in strategic plans. In the meantime, services continue to grow and establish themselves, providing travel options for at least a part of the urban populations. **If services continue to be steered ineffectively, this research suggests that there is a significant risk that smart mobility services will become a parallel system to traditional public transport provision, which will compete with public transport, undermine the public sector's steering capacity and, as a result, strategic objectives.** The next section discusses this risk in more detail and suggests how it could be addressed.

7.3.3. Research question 3: How can smart mobility providers be held accountable for contributing to sustainable transport objectives?

To respond to this research question, the analysis returns to Mashaw's (2006) six foundational questions (Mashaw, 2006): to whom is accountability owed; by whom is it owed; for what is accountability owed; what is the process and how is it created; what are the standards that need to be met; and what happens if the accountable party fails to meet these standards. These questions are used to structure the response, which draws from the sections discussing the role of smart mobility services in sustainable urban transport in Chapters 4, 5 and 6, builds on the previous sections of this chapter, and incorporates critical reflections on this research.

7.3.3.1. Who is accountable to whom?

A need for partnerships and new tools

The previous sections of this chapter show that smart mobility services are only partially shaped by local authorities' policy decisions. However, whatever policy approach the three local authorities took towards smart mobility, services were expected to have a positive impact on local transport. Benefits including car trip replacement and better first-last mile connections are expected to manifest, as the providers promise, whatever the urban form, local transport infrastructure or modal split in a city. As such, as is demonstrated in Section 7.3.2, steering smart mobility services can be framed as an attempt to make smart mobility providers accountable to public authorities. This section argues that smart mobility services should not be expected to have the same type of impacts, let alone positive impacts, in every city they are introduced. In addition, it is suggested that seeing smart mobility providers as "the regulated" and public authorities as "the regulator" does not amount to a genuinely collaborative relationship. As is clearly demonstrated by SDOT's permit model, local authorities can make demands of smart mobility providers, who may in turn accept them, but this arrangement is very volatile and gives local authorities little leverage and flexibility to steer services. In addition, this arrangement provides little resilience when dealing with conflicts, risk and uncertainty, as cities only have the blunt tool to ban providers that do not meet local needs.

There is a need for new accountability arrangements based on partnerships, where providers and cities identify mutual benefits and develop two-sided reciprocal relationships. This proposal is also supported in the broader governance literature. Ndubisi et al. (2016) explain that relationships around non-ownership services, such as shared mobility, carry uncertainties, power asymmetries and risks for both the providers and the users of the services, a complexity that cannot be managed solely through contractual relationships. The authors propose that, beyond the contractual framework, there is a need for trust and commitment from both sides to invest in and maintain a good relationship. Drawing from relational contract theory, Ndubisi et al. (2016, p.257) argue that contracts are only one element of the relationship between two sides and are complemented by a "set of social arrangements to orchestrate activities, align interests, and resolve conflicts". The authors identify good communication and information sharing, good interpersonal relationships, and acknowledging mutual interests as key elements of a trusted and committed relationship, reflecting key principles of network governance (see for example Keast, 2016; Powell, 1990). As such, the two sides become co-creating parties and commit to the long-term prosperity of their relationship, tolerating short-term sacrifices, sharing risks, and showing mutual

understanding in the case of conflict. Mulgan (2017) echoes these messages in his examination of accountability in multi-level governance contexts, arguing that relationships based on mutual trust and genuine commitment to the public interest are less likely to be subject to accountability deficiencies.

Ndubisi et al. (2016, p.262) propose that "managers and researchers need to look at the interplay of contracts and relationships in unlocking the value of non-ownership and the sharing economy". As such, it is worth reflecting on the extent to which cities should reasonably expect to draw benefits from relationships that they put very little in. In the case of smart mobility, contracts include the rules and regulations that shape and steer services, which are largely aimed at addressing the negative externalities caused by smart mobility operations. However, these externalities can also be mitigated by investing in services in a way that delivers mutual benefits for cities and providers. This research argues that cities need to "give back" to smart mobility providers, but to do so they need better processes and tools. Supporting smart mobility services involves integrating smart mobility services in the public space and transport infrastructure. TfGM's FTZ application includes elements of such a relationship, although it lacks detail and there was no evidence during the interviews that the proposal marked a shift in TfGM's thinking and approach to accountability, as no progress has been made without the FTZ funding.

An example of a reciprocal relationship that draws from TfGM's application is the introduction of parking infrastructure for micromobility, or mobility hubs in strategic locations. These can be a way of mitigating issues of street clutter created by dockless services, while at the same time improving the public perception about services and facilitating multimodal trips. In fact, the importance of dedicated infrastructure is also recognised by micromobility providers. For example, in their policy recommendations following one year of operations in the UK, Voi urged local authorities to invest further in *micromobility* infrastructure to accommodate e-scooters, e-bikes, cycling, walking and more (Voi, 2021). Furthermore, cities can invest or partly invest in services themselves where they can help meet specific needs in locations that are not commercially attractive, similarly to the approach taken in KCM's pilots, or to introduce incentives to ensure availability of the services and consistent quality. In addition, cities need to dedicate appropriate resources to stay attuned to market developments and understand where, and if, services may fit in their local context. This takes more than simply managing a service and its potentially negative implications, and entails understanding the commercial viability of services and the business models that can be deployed to deliver local objectives. **In other words, if cities see a role for smart mobility services in their transport systems, then they need to be open to the idea of providing subsidies, as already happens with other *forms of public transport*.**

Finally, to build partnerships with providers cities need more nuanced tools. Barriers posed by local administrative processes, including the inflexible methods of procuring services, were mentioned multiple times during the interviews. These barriers are also discussed in Aparicio (2020) and Wallsten et al. (2021), while the case of Mobike in Greater Manchester is an example of the vast difference between the deployment times of provider-led and franchised schemes. However, smart mobility services should not be seen as a faster way to introduce a service by avoiding official – and democratic – processes of procurement and consultation. Instead, local authorities need to amend their own rules to build in nuance and speed that allow them to work more flexibly with smart mobility providers. **New ways of working with smart mobility providers should not be limited to testing environments or temporary pilots but should become the norm, allowing cities to build partnerships with providers, develop a timely understanding of the impacts of smart mobility, and capitalise on any potential benefits.** Better, faster processes will also allow cities to keep up with innovation that is relevant to them, create incentives for smart mobility providers, and demonstrate the elusive openness to the market that was discussed by participants.

Broader accountability considerations and equity

Nevertheless, it remains important to remember the bottom line: cities are accountable to their citizens. This means that while partnerships, trust and commitment are important, they can only be pursued with the smart mobility providers who are willing to consider joining cities in delivering benefits to all their citizens. This research shows that, at the moment, this is not often the case. Smart mobility services are usually not introduced through democratic processes and consensus and, especially when they are unregulated, there are few provisions in place to ensure they are equitable. The public are perceived as customers of the services whose will is demonstrated only through their purchasing power. This leaves citizens who do not use, or indeed oppose the services, having to deal with them as a fait accompli. Crucially, there is a danger that the services themselves are designed to appeal to a narrow part of the population who are young, well-educated, already highly mobile and wealthy. Indeed, there is evidence that services are mainly used by these social groups, offering them more mobility opportunities, rather than increasing accessibility for those who have limited options (see for example Christoforou et al., 2021; Clewlow and Mishra, 2017). Further evidence on the inequitable distribution of the benefits of smart mobility services comes from a longitudinal panel study examining the use of TNCs in California, perhaps the most saturated market in the world. The study showed that even within the age groups that are most likely to use TNCs, 84% were monomodal car drivers, indicating that smart mobility services are being used by a small share of the total population (Circella et al., 2021). As Willis (2020) explains with clarity, more, not less, democracy is needed when authorities seek to introduce transformative

changes in society. Therefore, it is the responsibility of local authorities to ensure that services are accessed equitably and embedded in participatory decision-making processes, and, consequently, that discussions with citizens reach a broad audience and focus on long-term outcomes rather than short-term outputs of smart mobility services (Aparicio, 2020).

In contrast, providers are, in most cases, accountable to their investors. The way leading smart mobility providers operate today shows how the flow of capital shapes mobility choices and pursues the standardisation of global mobility offer. As Docherty (2018) explains, smart mobility providers maximise their returns by maximising the use of their services resulting in more, not less, mobility. Linking smart mobility platforms to other forms of consumption, such as food shopping, has the potential to further embed mobility in hyperconsumption as platforms shape people's needs *and* how to get to them. The work of Cohen and Gössling (2015) is highly relevant here. They explain that societal perspectives on mobility have been shaped in such a way that the "brighter" side of hypermobility - the frequency of movement, numbers of places visited, and the speed and mode of transport - is glamourised through powerful discourses assigning status and network capital to travel. However, the "darker" side of hypermobility – the negative socioeconomic and environmental impacts - remains largely overlooked. Smart mobility providers certainly capitalise on these perspectives by claiming they can provide more, but also more efficient, travel and, as the participant from Drive Sweden demonstrated when they repeated this claim, are being believed.

To summarise, while this research makes a case for collaboration between cities and smart mobility providers, it also demonstrates that the cities' accountability to their citizens and providers' accountability to their investors are sometimes incompatible. In fact, the case studies indicate that cities may find themselves being held accountable for dealing with the fallout of providers' failures, as smart mobility services give a false perception of public service. This condition was described by Cammack (1998, p.250) who explained that in "an economic and social system shaped by liberal economic forces operating at a global level which states have limited capacity to resist […] [s]tates will take a more direct role in the management of their citizens in order to compensate for their increasing inability to manage the broader social and political environment". **As such, it should be acknowledged that in some cases it will be impossible build accountability arrangements that help cities capture the potential benefits of smart mobility services provided by global providers.**

7.3.3.2. Accountability for what? Governing with intent

This section focuses on the next three foundational questions about accountability: for what is accountability owed; what is the process and how is it created; what are the standards that

need to be met. Smart mobility comes with a rhetoric that claims services will drive the transition towards a smarter *and* more sustainable transport future. However, this is not the conclusion of this research. The impacts of smart mobility services in the three cities examined are rather unspectacular, unclear, or even negative, and the pace of their adoption seems more like a quiet, undirected and gradual transformation than a revolution. While the participants talked extensively about their experiences with smart mobility, their efforts to steer services, and their ambitions and expectations, it is notable that in none of the three case studies did participants talk about smart mobility services that make a marked difference in delivering local objectives. While there were examples of small-scale applications of smart mobility that have delivered positive results, such as deployment of a car club for business travel by Salford City Council (Section 5.2.1.1), there were no examples of provider-led services operating across whole cities that deliver dramatic benefits. Moreover, in the case of AVs and MaaS, the services are at a very early stage of their development, and therefore there is still a lot of uncertainty about whether and when they will be adopted broadly. In fact, the participants anticipated that it would years before MaaS and AVs are established in the market, which means that if even if their benefits materialise, they will not be helping cities soon.

The continued support of smart mobility despite the lack of large-scale benefits from services, combined with expectation of “better innovations” around MaaS and AVs are considered examples of technological optimism about solutions that *will* come and painlessly make transport systems more sustainable, masking the need for transformational contextual change for such a shift to happen. These perceptions align with what Lamb et al. (2020) describe as the “push for non-transformative solutions” category of discourse of climate delay. Lamb et al. (2020, p.4) argue that “[t]he push towards incremental solutions tends to avoid all options that are most threatening to existing power structures and practices. In doing so, these discourses leverage narrow definitions of success, positive framings and entrepreneurial values above transformative efforts and binding standards. When not confronted with scientific deliberation and debate on appropriate policy options, they provide cover for ongoing unsustainable activities and hinder strong near-term climate action”. Combined with the inequitable distribution of benefits of smart mobility services that was discussed earlier in this chapter, the optimism about the benefits of smart mobility is considered a risk that needs to be addressed in the governance of smart mobility.

To ensure that smart mobility services do contribute to sustainable transport objectives, it is proposed that cities need to govern smart mobility *with intent*. This means that services need to be deployed or permitted with clear objectives and an understanding of their anticipated impacts. This is not to say that cities should set strictly

defined targets even for services that they are not familiar with, but rather that they should deploy smart mobility with a prior, mode agnostic idea of what success looks like. To treat smart mobility as a tool rather than as a goal in itself, it is key to **reject the assumption that all innovation delivers public benefits**. The interviews demonstrated a strong, and sometimes unshakeable, faith in innovation and an acceptance that there is a need to continuously innovate to meet people's evolving demands from mobility. Innovation is perceived as progress, but research shows that people's demands are shaped and presented by the market, and that in reality only a small share of a city's population uses smart mobility services. In addition, innovation is perceived as a sustainable solution by default, but this research shows that the mere presence of innovation does not automatically address the cities' challenges and, crucially, may exacerbate existing issues such as congestion.

Smart mobility is not a "cutting the Gordian knot" type of solution to bypass transport problems rather than work through them. There are few examples in the literature that discuss how smart mobility governance should deal with the excessive focus on innovation. For example, Ferreira et al. (2020, p.1) use the case of AVs as an illustration of an imposed innovation that has little rapport with the problem it is meant to address, arguing that "the car industry is presenting driving automation as an innovation with the potential to restore the vitality of the private vehicles market while creating effective means to dismiss alternatives to car dominance." More broadly, the same authors also explore how innovation is used as a supranational policy by the EU. They find that the emphasis on innovation creates a narrowly defined, risk-based, and divisive path for development that focuses on efficiency and behavioural change, digitalisation, and smart technologies, and effectively ignores EU's self-set goals of sustainability, social inclusion, and economic growth (von Schönfeld and Ferreira, 2021). Broader literature that critically explores innovation from a historical and social perspective, also provides valuable insights about what constitutes innovation, whether novelty is actually an improvement, the role innovation plays in processes of societal change, and, crucially, how chasing the "next best thing" impacts the limits of this planet (see for example Vinsel and Russell, 2020; Sveiby et al., 2012).

Having established that innovation is not a panacea, governing with intent involves specifying what purpose smart mobility services are meant to serve and the scale and pace of change they are meant to deliver. **Cities need to deploy place-based and problem-led solutions, and not one-size-fits-all solution-led services.** As demonstrated in this research and stated in the literature, cities have different "starting points" in their transitions, different capacities to act, different demographic, socio-economic, political and cultural contexts, different transport systems and infrastructure, and therefore different needs in their route to sustainability (Docherty et al., 2018). Indeed, the participants in each city could easily articulate the local

challenges that they were looking to address, both in the transport system itself and in how it is governed. For example, in Seattle, the participants focused on providing viable alternatives to car trips, especially in areas where public transport is sparse; in Greater Manchester there was a strong focus on the imbalance of public transport provision between urban and rural areas of the region; and in Stockholm the participants focused on leisure trips and travel for children's activities, which are especially car-dependent. Developing links between these gaps and smart mobility can be achieved through leadership from the local authorities and through partnerships, as discussed earlier in this chapter.

To ensure that smart mobility services help address local issues and deliver public value, it is necessary to monitor and measure their impacts. As Marsden (2022) explains, monitoring and measuring the impacts of services requires a degree of realism and proportionality about what can be considered a direct impact of smart mobility services. Monitoring frameworks should be carefully considered to include indicators that reflect local needs and priorities and assess the impact of smart mobility services on users and the wider transport system. However, the assessment of impacts should not be limited to what benefits the cities but, in the context of partnerships discussed earlier in this chapter, should also assess whether services are commercially viable to deliver public value and whether they need to be regulated differently or supported by a subsidy.

Inevitably, the discussion comes to the thorny issue of data sharing. The participants across the three cities mentioned repeatedly that data sharing is limited, both due to the providers' unwillingness to be open, and because of practical barriers such as data storage and protection. It is acknowledged that there is an extensive body of literature on data sharing standards and procedures, which this research does not explore in depth. Efforts to standardise data sharing have progressed over the duration of this PhD, with the development of tools such as the Mobility Data Specification by the Open Mobility Foundation (Open Mobility Foundation, 2022), and guidance such as the Privacy Principles for Mobility Data developed by the New Urban Mobility Alliance (NUMO, 2021)[40]. However, this analysis focuses whether and to what extent cities would shape their decisions based on in-depth analyses of mobility data. The persistent design of transport policies around travel to work and peak hour traffic, despite the abundance of data showing they form only a small share of total travel, is a prime example of transport policy not being data-led. Data provides opportunities to improve policy but may also be a reason for stalling. Echoing Marsden (2022), this research argues that the approach to collecting and sharing data should also be a partnership between

[40] In fact, harnessing and interpreting data from smart mobility services is being treated as a "gap in the market". A surprising number of new, VC-backed companies such as Populus and Ride Report are offering cities platforms to manage smart mobility data and use them in policymaking.

cities and providers, in which both sides fund surveys that robustly demonstrate impacts and value of smart mobility services, covering the travel needs of smart mobility users *and non-users*.

However, it is stressed that accountability for smart mobility services should be part of a wider accountability regime, where cities take coordinated, place-based and problem-led action across policy areas to achieve the scale and pace of change that corresponds to the goals they have set for themselves. As explained in the literature review, accountability in transport policy can be fuzzy, especially in multi-level governance environments (Bache et al., 2014). Therefore, there is a broader need for a clearer articulation of how sustainable mobility outcomes are shared across different levels of government, and between them and multiple smart mobility providers. Finally, it is argued that in order to steer smart mobility services effectively, **cities need to expand their capacity to imagine different futures, breaking away from the status quo and thinking beyond modal, departmental and institutional siloes.** As Lyons and Davidson (2016) explain, there is a greater need for *regime-testing* thinking where policymakers question the nature of the world as we have known it and realise that they are shaping the future, rather than responding to a pre-determined development trajectory.

7.3.3.3. What happens if smart mobility fails? Saying no

The final foundational question about accountability is what happens if accountability standards are not met. The previous sections discuss the importance of creating accountability arrangements that allow the benefits of smart mobility to materialise by supporting and steering providers, and establishing processes and standards to address negative impacts. Based on these arrangements, cities should be able to see whether services fit the local needs before they are introduced in a city, or, while they are in operation, if they continue to delivery public benefit. If this is not the case, cities should ask themselves whether the public resources that go into dealing with a particular service are better spent elsewhere. While the interviews showed that ensuring accountability and defining what is the benefit of a service are complex processes, they also demonstrated the cities' hesitancy to say no to a service, regardless of its impact. This research argues that in creating accountability arrangements that help shape smart mobility, cities should also create processes that allow them to question and reject the services that do not meet local needs. **Working in partnership with smart mobility providers can be a valuable tool in the cities' efforts to deliver transformative changes in mobility – but it needs to work. Otherwise, smart mobility can become more of a distraction than a disruption, taking up resources and space in the public discourse that are disproportionate to the benefits it delivers.**

7.4. The elephant on the road: smart mobility in the system of automobility

Chapters 4 to 7 in this thesis discuss extensively how smart mobility services are governed, how cities develop policies to steer them, and how better accountability arrangements can help manage the risks and capture the benefits of smart mobility to deliver local transport objectives. However, it would be a mistake to consider the insights of this thesis in isolation from the wider system of automobility. In this closing section, this research argues that smart mobility services cannot achieve their full potential while the transport system remains dominated by the private car.

The relationship between smart mobility and automobility was partially captured in the interviews, which show that the success of services is, among other factors, a function of reducing car ownership and dependence. Firstly, as the participants from Stockholm explained, it is a financial matter. Smart mobility services are currently serving only a small part of the mobility market and their long-term commercial viability can only be secured if they start replacing a large share of current car trips. In addition, as it was made clear in Seattle, there are double standards between cars and smart mobility services, where smart mobility services are being scrutinised for all aspects of their operations, including road safety, impacts on congestion, and creating street clutter, when these are conditions that are broadly accepted as an inevitable aspect of automobility. Smart mobility also depends on existing transport systems to succeed operationally as its mere existence is not enough to shift people's behaviour and travel needs. This was aptly illustrated by one of the participants in Stockholm who explained that it is pointless to place shared bikes in housing developments that are not connected to high quality cycling infrastructure. All these examples point to the dominance of automobility in the transport system and highlight the need for a paradigm shift.

The complexity of the systemic shift towards a "post-car" era is well-documented in the literature. Key contributions such as Urry (2004) explain with clarity that the dominance of automobility and the reversal of the conditions that have helped establish and sustain it are far from just a transport policy matter. Car dominance is supported by the economic value of the automotive manufacturing and associated industries such as vehicle parts and repairs, road building and maintenance, and, of course, oil. Individual patterns of consumption and cultural expectations around the car as a status symbol further establish its dominance. Furthermore, car dependence is often built into the future through land use and economic appraisal policies, which favour low density, single use developments and aim to minimise travel time respectively (Mattioli et al., 2020; Banister, 2008). These are changes that need to take place across the local, regional and national levels of government, across national

governments, in collaboration with businesses, academia, and grassroots activists, and with the buy-in of citizens.

As such, it is perhaps naïve to assume that a non-systemic solution such as smart mobility, which effectively entails providing additional mobility options using new business models and internet-enabled platforms, can topple automobility. Smart mobility services are not leading the transition to sustainable transport. However, if governed with intent, they can be valuable tools for transport authorities in their efforts to achieve the rapid and radical changes needed as part of a just transition to a decarbonised, post-car transport system. This PhD was conceptualised soon after the signing of the Paris Agreement and is being finalised a few months after the signing of the Glasgow Climate Pact. Over this period, the world has become ever more painfully aware that the climate emergency is here, and that the window of opportunity for action to avoid a climate disaster is closing very soon. It only feels appropriate to conclude by reiterating where this research fits in the context of transport decarbonisation, along with a call for rapid, purposeful action.

8. Research implications

8.1. Original contributions of this research

This research makes several original contributions to the academic literature through examining and comparing what shapes smart mobility services in Seattle, Greater Manchester and Stockholm.

First, the three in-depth case studies in Seattle, Greater Manchester and Stockholm provide new evidence on what influences how cities approach smart mobility governance. The case studies take a holistic approach to examining smart mobility governance in each location, going beyond the existing literature which either provides a generic discussion on smart mobility (for example Docherty et al., 2018; Wallsten et al., 2021) or focuses on specific types of services in different contexts (for example Pangbourne et al., 2020).

The findings highlight the **important role of legislative and financial autonomy of cities in governing smart mobility services**. In addition, this research shows that **smart mobility can be shaped concurrently and in a fragmented way by multiple actors across different levels of government, creating policy alignment challenges**, as there is often not a settled view of what smart mobility is and what it should achieve. At the same time, the three case studies show that **smart mobility governance reflects pre-existing policy traditions**. There is a strong link between smart mobility policies and ideological positions regarding the role of the state and the role of innovation, which may vary between government levels. In addition, the comparison between Seattle and the two European case studies highlights the different understandings of smart mobility market dynamics among the local authorities, and how this shapes their approach to governing services.

This research also provides an account of smart mobility providers' practices and **demonstrates the market's key role in shaping the governance of smart mobility in each city**. Providers make calculated decisions on how to maximise their commercial interests depending on the regulatory context of each city. This means that cities can be at the mercy of decisions based on global capital flows that have nothing to do with local transport, rendering irrelevant any efforts to steer services.

Furthermore, this research adds original findings to the body of literature that explores how cities govern smart mobility services (for example Wallsten et al., 2021; Oldbury and Isaksson, 2021). In particular, the findings in this thesis align with research on experimentation, which

shows that while cities consider experimentation essential to understand how to govern innovation, trials and pilots are often not scaled up and lack legitimacy (for example Eneqvist et al., 2021). Furthermore, echoing Wallsten et al. (2021), this research provides evidence on different cities' policy positions to governing smart mobility, ranging from completely hands off, to enabling, and proactive policymaking. Cities may take no action to steer smart mobility services, or adopt an enabling approach due to the lack of appropriate tools or as a conscious choice. Importantly, this research demonstrates that proactive policymaking does not necessarily result in the effective steering of smart mobility services. **In fact, in most cases, cities steer the products of the market and try to address their negative impacts, rather than steering the market itself and capturing its positive impacts.**

Furthermore, this research demonstrates that **services are still being treated as a niche and are not fully integrated in the cities' mainstream strategies and priorities**. At the same time, **the impacts of smart mobility services are disjointed and unspectacular, and do not align with the providers' promise to be the driver behind the transformation of the transport system**.

The key original contribution of this research is the introduction of the concept of accountability regimes in the study of smart mobility governance. This research explores how accountability regimes can be shaped to ensure that smart mobility services make a positive contribution to local sustainable transport objectives (Section 7.3.3). It also shows that effective steering is not the result of regulation alone but of reciprocal relations with providers, where cities need to be prepared to invest in smart mobility services if they want to capture their benefits, echoing recent contributions to the literature on the governance of smart mobility (for example Marsden, 2022; Creutzig, 2021; Ruhrort, 2020). To do so, cities need better tools and more flexibility, nuance and speed built in their local policy and administrative processes, including in the procurement of services and development of partnerships with providers. However, this research also stresses that some smart mobility providers, particularly those operating at a global scale, are often not interested in entering collaborative relationships with cities, and instead oppose the rules aiming to ensure they provide public value, reflecting the challenges described in the literature on public accountability (for example Papadopoulos, 2016).

This research demonstrates that to ensure that smart mobility services contribute to sustainable transport objectives, cities need to govern smart mobility *with intent.* Cities need to reject the assumption that all innovation delivers public benefits. Instead, they should deploy place-based and problem-led solutions, and have a pre-existing, mode agonistic idea of what services are expected to deliver. Cities also need to monitor and measure the impacts of services to ensure they do deliver local benefits. If this is not the case, cities should consider

rejecting smart mobility services. This research warns that without appropriate steering of smart mobility services they could become a parallel system to traditional public transport provision, which will compete with public transport, undermine the public sector's steering capacity and, as a result, hamper efforts to deliver strategic objectives.

Finally, this research sets smart mobility governance in the context of broader transport governance and argues that **smart mobility services cannot transform the transport system and people's mobility, unless they are deployed alongside transformational transport policies that aim to reverse the dominance of automobility and decarbonise the transport system in an equitable manner**.

8.2. Research limitations

This section discusses the practical and methodological limitations of this research. From a practical perspective, as the data collection relied on local authority officers and other stakeholders agreeing to be interviewed, there were some who did not respond to interview invitations. Notably, no interviews were carried out with officers from TfGM's transport policy team or with Stockholm City Council's environment department. In addition, no interviews were carried out with organisations beyond the local and regional government levels that were relevant to smart mobility developments in each city, such as the Washington State Department of Transportation in Seattle, and the Department for Transport in Greater Manchester. Their perspectives could have complemented the existing analysis and provided more detail to explain the authorities' actions.

In addition, a methodological limitation of this research is that it does not include interviews with smart mobility providers. While the data collected does provide an insight into providers' practices, speaking directly with them could have contributed to a more nuanced analysis of their perspectives and allowed an insightful comparison with the views of local authorities. Finally, this research could benefit from a quantitative element focusing on the impacts of individual trials. This could have made the discussion about smart mobility and sustainable transport more robust and case-specific. However, as explained in detail in the previous chapters, data is a thorny issue in smart mobility. An assessment of the impacts of smart mobility across the three case studies would require consistent data on the performance of services and on baseline transport conditions in each city. As such, after careful consideration, it was assessed that expanding the research with a quantitative element would lead to an unmanageable workload.

Another practical limitation was the language barrier in developing the Stockholm case study. While the interviews were conducted in English with almost no difficulty, many of the

documents used in the analysis were in Swedish. In the cases of Seattle and GM it was easy to build a picture of the local context and cross-reference the participants' statements by browsing through the authorities' websites, council meeting records, and articles in the local press. However, for the Stockholm case study, searches had to be more targeted as it was impossible to go through multiple websites, articles and documents where the text was in Swedish. To ensure that the analysis provides an accurate representation of the local picture, Chapter 6 was reviewed by members of the Mistra SAMS research programme in Stockholm, who kindly offered their help and recommended minor corrections to better reflect the local context.

Practical and methodological limitations are also related to the part-time nature of this PhD. As explained in the introduction, this research was carried out over a 5.5-year period. This meant that the approach to the research questions and analysis would need to be sufficiently open to remain relevant until the end of the PhD. Nevertheless, the interviews are a snapshot in time and the nature of this PhD expanded the "gap" between data collection and writing. As is already demonstrated in Chapters 4, 5 and 6, in some instances the authorities' position evolved between the time of the interviews (May 2019-January 2020) and the time of writing (March 2021-April 2022). For example, at the time of writing, Stockholm City Council had changed their hands-off approach to e-scooters and were seeking to introduce restrictive regulation. While important developments that took place between the interviews and writing each chapter were captured in this thesis through a mix of council records, news articles, and newly published research, the analysis could have been more robust with more recent or follow-up data (see discussion about follow-up interviews below). There is also no doubt that by the time this PhD is examined some of the cities' positions will have evolved even further, considering how quickly the smart mobility space evolves.

It should also be acknowledged that this research does not discuss the impacts of the COVID-19 pandemic on the case studies and smart mobility more broadly. Careful consideration was given to the possibility of carrying out targeted follow-up interviews and their potential added value. To allow this research to end near its 5-year target, any additional data collection would need to be planned and take place before the end of 2020. As the pandemic was still "new" at the time, and it was clear that more disruption was on the way, it was decided that there would be limited added value, especially as this research aims to make long-term conclusions.

8.3. Recommendations for policymakers

In line with the purpose of this research, the recommendations for policymakers aim to capture the complexities of smart mobility governance and the challenges of developing robust

accountability arrangements. Reflecting these complexities and challenges, the recommendations are not provided in a weighted or hierarchical order. Instead, the recommendations are grouped in three categories, which correspond to three priority areas for action, which are interlinked and reflect the need to approach smart mobility steering as a process embedded in each governance context and contingent upon local conditions of power, resources and legitimacy. The focus on each priority area complements and challenges the findings and recommendations in the existing literature. Firstly, *governing with intent* challenges any assumption that smart mobility services can have positive impacts in every context, and calls for innovation to be perceived as a tool rather than an end in itself. Secondly, *creating robust accountability regimes* complements the existing literature, which largely centres on regulatory approaches to manage the externalities of smart mobility services. To do this, the recommendations focus on how to ensure that services have positive impacts and meet the needs of each location. Finally, *paying attention to the governance context* focuses on the interplay between institutional structures, conflicting values of different actors, and broader local conditions in shaping transport governance, issues that are not sufficiently addressed in the empirical study of transport policy (Marsden and Reardon, 2017).

As a policy officer myself, I understand that the reality of policymaking often entails complexities such as time and financial constraints, complex interactions with politicians, and, as was also demonstrated through the interviews, taking decisions that are not entirely based on evidence or best practice. Therefore, the recommendations below take into consideration these realities. In addition, this research shows that transport policy is not just shaped by those who bear the official title of policymaker. As such, the recommendations are equally relevant for transport policy officers, politicians, and policy advisors to smart mobility providers.

Governing with intent

1. First, policymakers should refuse, as much as possible, the idea that smart mobility services as a form of innovation are an inevitable, imposed “solution”. While the diversification of mobility options is necessary in a post-car future, this does not mean that all individual options should be accepted without scrutiny. **Smart mobility services are a tool to achieve a goal, not a goal in themselves.**

2. Smart mobility policies need to be incorporated in local transport strategies that clearly identify the scale and pace of change required in each location. The strategies should identify where, if anywhere, each type of smart mobility service can contribute to local objectives, and whose needs they are expected to serve. These expectations should be proportionate to the potential of individual services to bring about change, acknowledging that transport challenges require system-wide interventions to be addressed. Although it is acknowledged that it is not

possible to be entirely prescriptive about the use every type of mobility service, **policymakers should still have a pre-determined idea of what would constitute a successful deployment of smart mobility in each context**.

3. Data matters before and after a service is introduced. **Robust baseline information should be used to understand where there are problems, so that services can be specifically designed to address them.** Without a good understanding of existing conditions, smart mobility data alone can provide little actual insight about the impact of services (Section 7.3.3.2).

Creating robust accountability regimes

4. **There is a need for new accountability arrangements based on partnerships, where smart mobility providers and cities identify mutual benefits and develop two-sided reciprocal relationships.** To develop genuine partnerships, cities need to reflect on how much they "give back" to smart mobility providers. If cities see a role for smart mobility services in their transport systems, then they need to be open to the idea of providing subsidies, as already happens with other forms of public transport. When existing administrative processes do not allow for the development of flexible, targeted partnerships, then cities need to create new tools and processes to work with smart mobility providers.

5. After a service is introduced, data collection and monitoring are essential to understand whether services are delivering their intended impacts and to ensure public accountability (Papadopoulos, 2016). As such, **policymakers need to insist and ensure that qualitative and quantitative data is collected to understand how services are used and by whom**. Data metrics and indicators should be agreed with providers and should be tailored to the needs of each city, instead of simply relying on usage-led metrics such as number of trips and number of users.

6. Smart mobility services need to be accompanied by proportional accountability arrangements at the local, regional and national levels. This means that **policymakers need to consider what happens when services do not deliver their intended impacts**.

- Where the benefits of services in the local context are seen as outweighing any negative impacts, but they are not of the desired scale, careful consideration should be given to making financial contributions towards smart mobility services. Contributions should be transparent and proportionate to the expected positive impacts of services.
- Where services are seen as having negative impacts, policymakers should consider whether targeted regulation and steering can help address any challenges so that services can deliver their potential. However, where there is evidence that the negative

impacts of smart mobility still outweigh any potential benefits, cities should be prepared to reject services and strongly regulate against them, as much as this is possible.

Paying attention to the governance context

7. **Policy alignment across government levels is crucial in shaping robust accountability regimes**, so different levels of government need to consider how their interests can be aligned and where conflicts may exist, and work collaboratively in capturing the benefits of smart mobility services.

8. Finally, there will be cases where providers are not interested in partnering with cities to meet policy objectives, and would rather operate freely, capturing as big a part of the travel market – and beyond- as possible. **Therefore, policymakers need to understand the global dynamics of the smart mobility market and providers' business models, funding mechanisms and motivations, and any risks these pose to achieving sustainable transport objectives.**

8.4. Recommendations for future research

It is recommended that future research expands on the findings of this PhD and explores areas that have not been examined in this thesis.

1. Drawing from the method and findings of this PhD, future research should examine how smart mobility services are introduced, adopted, interact with each other, and evolve in relation to different governance contexts. Taking a holistic approach to examining smart mobility governance will expand the understanding of the impact of each local context in shaping services themselves as well as the interaction between private and public actors.

2. Future research should also shed light on the conditions that support the success of smart mobility services, whether current business models are financially viable, and how smart mobility services can become more attractive options compared to car ownership and use across different social groups.

3. In addition, future research should explore new ways that the state can coordinate networks of actors in smart mobility and the broader transport sector in order to leverage the benefits of innovation, aligning with proposition for a *decentred narrative* of present-day governance made by Bevir (2013). More specifically, the research can explore how public and private actors can develop partnerships to deliver targeted benefits that meet local needs and make a positive contribution towards transport decarbonisation.

4. In examining new ways of collaboration and partnerships, future research should continue to focus on accountability arrangements and specifically explore how and under which

conditions providers agree to enter partnerships and, equally, how local authorities can use and increase their leverage to attract providers that are willing to tailor their services to local needs.

5. More specifically, future research should explore how the state can invest in different types of services and identify innovative, agile approaches to subsidising smart mobility. New research can also explore which types of providers are willing to collaborate with local authorities and therefore are well-placed to be subsidised.

6. This research provided only partial insight into providers' perspectives. It is recommended that future research on the governance of smart mobility should acknowledge the important role providers play in shaping smart mobility developments and further explore their perspectives and agendas.

7. Future research should investigate in more depth how different types of smart mobility providers perceive their role in transport systems, and how their accountability to their own stakeholders aligns, if it does, with the potential development of partnerships with local authorities.

8. It is recommended that future research should also explore the implications of the involvement of new players in transport. More specifically, future research should investigate who invests in smart mobility services, how their interests are represented in global transport developments, and how providers' lobbying efforts raise the profile of specific services in different contexts.

9. Finally, it is recommended that future research focuses further on who are the winners and losers of the smart mobility transition. This includes exploring the impacts of smart mobility services on "traditional" transport providers, such as bus operators and the taxi industries, and, crucially, understanding how different social groups will be affected if smart mobility services become an integral part of public transport systems. Further research should also explore how citizens can be engaged in a meaningful and deliberative ways in shaping transport futures that include smart mobility services.

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Appendix A – Interview materials

Institute for Transport Studies
FACULTY OF ENVIRONMENT

UNIVERSITY OF LEEDS

Participant consent form for the research project: The governance of the smart mobility transition	Add your initials next to the statement if you agree
I confirm that I have read and understood the information sheet dated February 2019 explaining the above research project and that I have had the opportunity to ask questions about the project.	
I agree to participate in this interview. Should I not wish to answer any particular question or questions during the interview, I am free to decline.	
I understand that my participation is voluntary and that I am free to withdraw from this research within two weeks from the interview date without having to give any reason, by contacting the PhD researcher via email (ts13im@leeds.ac.uk) or on the phone (+44 77523 77008). If I request withdrawal all the recordings, notes and transcripts of the interview, and any other data I have provided will be deleted from all storage devices or will be destroyed.	
I understand that my name will not be linked with the research materials, and I will not be named in the report(s), presentation(s) or publication(s) that result from this research.	
I agree to be quoted anonymously in report(s), publication(s) and presentation(s) that result from the research.	
I understand that despite those protocols and because of the nature of my position, I might still be identifiable by others who are familiar with my organisation/ authority/ department in the report(s), presentation(s) or publication(s) that result from this research.	
I agree for the data collected from me to be stored safely until the completion of this research and any relevant report(s), presentation(s) or publications(s) that result from the research.	
I understand that relevant sections of the data collected during the study, may be looked at by auditors from the University of Leeds where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records.	

Name of participant	
Participant's signature	
Date	
Name of lead researcher:	
Signature*	
Date*	

*To be signed and dated in the presence of the participant.
Once this has been signed by all parties the participant will receive a copy of the signed and dated participant consent form and the information sheet. A copy of the signed and dated consent form will be kept with the project's main documents which will be stored in a secure location.

Dear participant,

I am pleased to invite you to participate in an interview for my PhD research project entitled 'The governance of the smart mobility transition', which I am currently undertaking at the Institute for Transport Studies, University of Leeds. Before you decide if you want to participate, please take the time to read carefully the following information.

The research project

This research focuses on 'smart mobility' services, which refer to new and emerging mobility services, such as ridesharing and Mobility as a Service applications. The purpose of my research is to investigate how cities deal with smart mobility, what shapes their approach and, in particular, how they ensure that smart mobility delivers public value and supports long-term sustainability. More specifically, I am interested in understanding the ways in which cities can ensure that smart mobility benefits are harnessed to deliver better transport services for all, and how private providers can be steered to do the same.

This research will use Greater Manchester, Lyon, Stockholm, and Seattle as case studies to develop an insight into and compare different contexts and approaches.

Your participation

You have been identified as a potential participant because of your involvement in developing your organisation's response to smart mobility. It is expected that your input will be valuable in the development of this research. Although your participation will most likely not have immediate benefits for you or your organisation, it is hoped that this research will provide some insight into the governance of smart mobility, filling an identified gap in the existing academic literature and providing useful information to public officials like yourself. Following the completion of this set of interviews, it is possible to arrange for the findings to be presented at your organisation.

Your participation will involve an unstructured interview that will last up to 1.5 hour, where you will be asked to answer questions in your professional capacity that will focus on the role of smart mobility services in Stockholm, your organisation's relationship with them, and your future smart mobility plans. If you decide to take part, you will be given this information sheet to keep and you will be asked to sign a consent form before the interview starts. If you wish, the consent form can be sent to you ahead of the interview. You can still withdraw completely or ask for sections of the interview to not be used in the research outputs in the two weeks following the interview. If you refuse to participate or withdraw, you do not have to explain why.

Anonymity and data protection

The information you will provide during the interview is expected to be used in my PhD thesis, conference presentations and/ or academic publications developed as part of this research.

The interview will be recorded using a recording device and notes may be kept in a handwritten form, without making reference to your name. No one outside the research project will be allowed access to the original recordings or notes. To protect your anonymity, your name and other personal details will not be disclosed in any publication or presentation, and pseudonyms will be used instead. Your responses will be used either in aggregate form or in quotations. In quotations, your name will not appear and you will be referred to as 'participant from organisation X'. It is noted, however, that despite these protocols followed to protect your anonymity, it might be still possible that you are identifiable by persons who are familiar with your organisation and its structure.

UK and EU data protection laws will be fully complied with as part of this research. All electronic data will be temporarily stored in an encrypted folder on a personal device and will be transferred as soon as possible to a secure location on the University's server, which can only be accessed using my personal log in details. Paper copies of the consent form or any handwritten notes taken during the interview will also be stored safely in a locker on the University of Leeds campus.

Please make sure you have read and understood this information. If you have any questions regarding your participation or the research project, please feel free to contact me or my supervisors Professor Greg Marsden (g.r.marsden@its.leeds.ac.uk or +44 (0)113 34 35358) or Dr Kate Pangbourne (k.j.pangbourne@leeds.ac.uk or +44 (0)113 34 31552).

Thank you very much for taking the time to read through this information. I look forward to your response.

Kindest regards,

Ioanna Moscholidou
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This study has been reviewed and given a favourable opinion by the University of Leeds Research Ethics Committee on 25 September 2018, with reference AREA 17-171.