

Niche innovation dynamics and the urban mobility transition

The case of dockless bike-sharing in London

Russell Cannon

Urban Studies
Master's Programme (Two-Year)
30 Credits
VT2019
Supervisor: Désirée Nilsson

Abstract

This thesis seeks to provide a detailed understanding of the introduction of dockless bike-sharing to London. As part of a wave of new smart and shared mobility services that are aiming to transform the way people move around cities, this emerging form of transport has created disruptions in London since its launch in 2017. This study aims to analyse to what extent dockless bike-sharing aligns or conflicts with the aims and objectives of local authorities governing public space in London. In doing so, it also aims to reveal insights into transformations in contemporary mobility by exploring the dynamics of niche innovations within socio-technical transitions, thus contributing to knowledge in the field of transition studies.

To do this, a qualitative case study methodology was employed using document analysis and interviews with four stakeholders integrally involved in the case study, representing both public authorities and a private sector dockless bike-sharing operator, Mobike.

The findings demonstrate that dockless bike-sharing is well aligned with the city's explicit objectives to reduce car dependency and encourage active travel. It has particular potential to make cycling more accessible by bringing bike-sharing to parts of the city that do not have access to the pre-existing, docked bike-sharing scheme, operated by the central transport authority, Transport for London. Despite this, dockless bike-sharing, as a niche innovation, has struggled to break into the existing urban mobility regime. This can be seen to result from a variety of factors that include a failure to collaborate and build local legitimacy or pay sufficient regard to local conditions during early implementation. Furthermore, dockless bike-sharing's demand for flexible parking has resulted in uses and misuses of public space that have created friction and placed the innovation in conflict with the existing physical urban landscape and the authorities that govern it. Its momentum has been further hindered by London's complex governance structure, a structure which has not proved conducive to the dockless bike-sharing operating model. It is posited that if dockless bike-sharing is to build momentum and achieve its potential to expand the reach of bike-sharing in London, greater support is required from public authorities.

KEYWORDS: mobility, cycling, dockless bike-sharing, sustainability, socio-technical transitions, multi-level perspective, niche innovation

Table of Contents

1. Introduction: a transition in urban mobility	1
1.2 Problem statement.....	4
1.2.1 Research questions.....	4
1.3 Previous Research.....	5
1.4 Structure.....	6
2. A background to bike-sharing	7
2.1 What is bike-sharing?.....	7
2.2 A brief history of bike-sharing	7
2.3 The fourth generation: Dockless.....	9
2.3.1 Use of public space	12
2.3.2 Use of data	13
2.3.3 Sustainability.....	13
2.4 Summary.....	14
3. Theoretical framework.....	15
3.1 Socio-technical transitions	15
3.2 The Multi-Level Perspective (MLP)	16
3.2.1 Applying the MLP to low-carbon transitions in transport.....	17
3.3 Niche dynamics.....	18
3.4 Governance.....	20
3.5 Summary.....	21
4. Research design.....	22
4.1 Why London?	22
4.2 Data sources	22
4.2.1 Document analysis.....	23
4.2.2 Interviews.....	23
4.3 Limitations	24
4.4 Ethical considerations.....	25
5. Dockless bike-sharing in London.....	26

5.1 The London transport context.....	26
5.2 The emergence of dockless bike-sharing in London.....	28
5.3 Local perspective 1: City of London.....	34
5.4 Local perspective 2: Waltham Forest.....	37
5.5 The operator's perspective: Mobike.....	39
6. Analysis	43
6.1 Lack of socio-spatial legitimacy	43
6.2 Public space conflict.....	44
6.3 Regulation and governance	44
6.4 Protective space	45
7. Discussion	47
7.1 Future research.....	48
8. Conclusion.....	49
References.....	51
Appendix A.....	58

Acknowledgement

First and foremost, I would like to express my gratitude to my academic supervisor, Desiree Nilsson, for the support, guidance and feedback you have provided me with during this process. I would also like to thank Helena Bohman, Stephanie Pathak, Mimi Green and Matthew Bevan for the assistance you have given me along the way.

I would like to extend my thanks those that kindly agreed take part in interviews for this research for their insight, expertise and time: Duncan Robertson, Bruce McVean, Mike Beevor and Daniel Gosbee.

Finally, thank you to Sally, for everything. But especially for your patience.

1. Introduction: a transition in urban mobility

In recent years, so-called ‘dockless’ or ‘free-floating’ forms of bike-sharing have rapidly appeared in cities across the world. Emerging in China in 2015, the new generation of bike-sharing schemes have been described as ‘Uber for bikes’, with schemes moving “from East to West as they sweep through urban transportation markets” (CB Insights, 2018, para. 1). With them has come the promise of making it more convenient than ever to share bikes, helping to cut congestion, improve air quality and encourage active travel. As part of a new wave of so-called ‘micromobility’, it has been suggested that dockless bike-sharing services could lead to unprecedented transformations in contemporary mobility and urban lives (Soares Machado, Marie de Salles Hue, Berssaneti, & Quintanilha, 2018).

Since its introduction, however, dockless bike-sharing has become controversial in some locations due to its swift and wide roll-out and its association with a variety of challenges, such as vandalism, misuse of public space and disputes with local authorities (van Waes, Farla, Frenken, de Jong, & Raven, 2018). Such issues have led to a claim that “this green – and taxpayer-free – solution to urban transport issues has turned into a surreal nightmare” (Rushe, 2017, para. 8), requiring cities to develop new rules and conditions for bike services in response (van Waes et al., 2018).

London is one such city. Since the arrival of dockless bike-sharing into the city in 2017, its fortunes have ebbed and flowed, with a number of operators appearing and, in some cases, disappearing, soon after, generating a variety of headlines along the way. Schemes have posed challenges for public authorities and regulators as they seek to embrace the benefits of this innovative, yet disruptive, form of shared mobility, whilst addressing its impacts.



Figure 1: Mobike dockless bikes in Islington, London. Source: Wu, 2017

The emergence of this latest form of bike-sharing is part of wider societal trends. In recent years, a growing environmental consciousness combined with the ubiquity of information and communication technologies has spurred the growth of the so-called sharing economy – an umbrella concept that includes a wide variety of business models that operate in the sphere of collaborative consumption (Cohen & Kietzmann, 2014). The sharing economy has been positioned as a solution to a variety of challenges, holding the promise to not only minimise wasteful consumption but to create stronger social bonds between citizens (Spinney & Lin, 2018). While the notion of collaborative consumption is not a new development, the sharing economy is anticipated to become “even more economically significant, socially disruptive, and culturally relevant in the coming years” (Chan & Zhang, 2018, p. 4).

Within the context of increasing urbanisation, cities have been identified as the ideal setting for this new sharing paradigm, resulting in the vision of the ‘sharing city’ (McLaren & Agyeman, 2015). Whilst this vision is subject to increasing scepticism, being identified as a convenient smokescreen for strategies of capital accumulation that fit neatly within the frame of the neoliberal city (Hall & Ince, 2017, p. 5), it can nonetheless still be seen to have wide and increasing appeal.

One of the ways in which this sharing paradigm has most prominently manifested itself is in new forms of shared mobility. The emergence of shared mobility can be understood as being part of a broader unfolding urban mobility transition towards sustainability, propelled by increasing concerns about the emissions produced by transportation, concerns which have highlighted the need for urgent actions to change to more a sustainable system (Moradi & Vagnoni, 2018). Sometimes dubbed the ‘smart mobility transition’, the transformation in urban mobility is being driven by so-called ‘smart’ mobility innovations that have the potential to challenge the existing regime of automobility and address its negative externalities, such as congestion and pollution. Indeed, in March 2019, the UK Government issued its ‘*Future of Mobility: Urban Strategy*’, describing the UK as being “on the verge of a transport revolution” (Department for Transport, 2019, p. 5) and drawing a comparison between the new technologies that are set to transform everyday journeys today, with the advent of affordable motoring in the 1950s.

Through its many imaginings, the smart mobility transition encompasses a variety of ongoing developments, thus making the concept somewhat hard to define. It is, foremost, an urban vision where technology is the primary driver of change (Spinney & Lin, 2018). Common aspects of the smart mobility vision include automation (relying on ICTs), vehicle electrification (using battery power, hybrid and/or other new technologies), modal integration (supported by integrated multimodal information systems and payment solutions) and, of most relevance here, shared mobility (Docherty, Marsden, & Anable, 2018; Audouin & Finger, 2018). Indeed, shared mobility has been described as one of the ‘pillars’ of the smart transportation system (Audouin & Finger, 2018, p.3).

Shared mobility encompasses many modalities (see Figure 2) and has been defined as “the short-term access to shared vehicles according to the user’s needs and convenience, instead of requiring vehicle ownership” (Soares Machado et al., 2018, p.2). Its rise has been powered by advances in mobile technology and increased access to smartphones and is predicated on the notion of ‘usership’ rather than ownership (ibid.), a notion recognised as one of the key elements of the transition in mobility (Docherty et al., 2018). It is often promoted as having high potential in terms of sustainability, particularly within the context of the increasing contribution of urban areas to global emissions. The potential of shared mobility derives from its ability to offer environmental gains and address social aspects, such as fewer trips, modal shift, distance reduction and less need for parking space, among other benefits (Soares Machado et al., 2018). Through this, it has a disruptive potential to transform the traditional transportation industry and offer a real alternative to individual car ownership (Dudley, Banister, & Schwanen, 2019).

As this introduction has attempted to set out, the latest form of bike-sharing schemes can be viewed as an emergent feature of a currently unfolding transition in urban mobility. It is a feature, however, that offers “an instance of how sharing has become an urban spatial practice promising many new opportunities but also saddled with many intractable problems” (Chan & Zhang, 2018, p. 2).

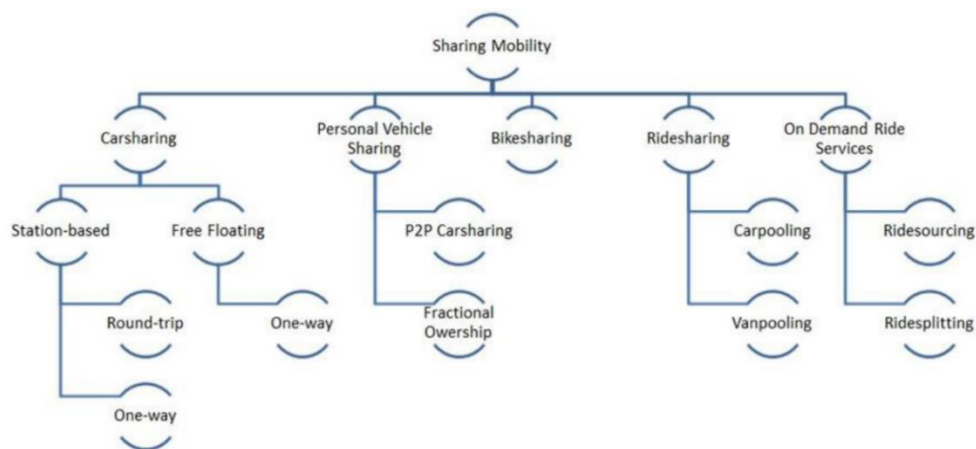


Figure 2: Shared mobility and its modalities. Source: Soares Machado et al., 2018

In recent years, as sustainable development has become an increasing priority in society and stimulated shifts in many industries, interest in transitions in systems such as transport has grown exponentially (Whitmarsh, 2012; Bidmon & Knab, 2018). This has brought with it a proliferation of academic and policy studies. An ongoing research programme on transitions in so-called ‘socio-technical systems’ has proven particularly influential, pioneered by Dutch researchers such as Frank W Geels (2005a; 2005b; 2011; 2012; 2018). This research programme provides a way of exploring how systems of provision, such as the transport system, are formed and stabilised, and how innovations, such as smart or shared mobility solutions, break into them (Docherty et al.,

2018; Dudley et al., 2019). This paper frames dockless bike-sharing as a niche innovation, attempting to disrupt and break into the urban mobility system and seeks to examine the dynamics of this process. Dockless bike-sharing serves as an useful example because of the variety of benefits it offers and its potential to contribute to a more sustainable transport system. Yet, its implementation into a real-life urban setting has caused disruption and presented the potential for conflict between private sector operators and public sector authorities. As such, examining the dynamics of niche innovation associated with this new form of urban mobility is seen as offering useful insights for the field of transition studies.

Research into low-carbon transitions in transport has highlighted the importance of analyzing interactions between industry and policymakers, to better understand the behavior of stakeholders in the transition (Geels, 2012). This paper seeks to do that, by analyzing the extent to which dockless bike-sharing aligns or conflicts with objectives of public authorities. Furthermore, in focusing on dockless bike-sharing as the niche innovation for this case study, this paper also seeks to respond to a call for sustainability scholars to engage with cycling as key area for innovation in urban mobility transitions (Van Waes et al., 2018). Cycling, it is suggested, as a longstanding practice, is often neglected in sustainability transition research in favour of more technology-oriented innovations, such as electric or autonomous vehicles (ibid.). In comparison to the car regime, cycling offers the advantage of typically being more under the direct control of city authorities, who are increasingly seen to be critical actors in sustainability transitions and experimentation (ibid). This makes a cycling related innovation, such as dockless bike-sharing, a particularly fruitful subject to explore using the perspective of city actors.

1.2 Problem statement

A transition in urban mobility is currently underway and bringing with it a variety of innovative transport alternatives. These alternatives are creating disruptions as they attempt to break into the existing mobility system. This is creating both opportunities and challenges for local authorities. This thesis seeks to provide a detailed understanding of the implementation of one such alternative on a city-scale, namely, dockless bike-sharing in London. It seeks to analyse the alignments and conflicts that have arisen between public sector authorities and the private sector operators that have introduced it. In doing so, it also aims to reveal insights into the dynamics of niche innovations within socio-technical transitions, thus contributing to knowledge in this field.

1.2.1 Research questions

The thesis seeks to answer the following research questions:

- To what extent does dockless bike-sharing align or conflict with the aims and objectives of local authorities governing governing public space in London?

- What insights does the case of dockless bike-sharing in London provide into the dynamics of niche innovation within the urban mobility transition?

1.3 Previous Research

A wide variety of studies have emerged in recent years on the topic of shared mobility. Of particular relevance here, **Cohen and Kietzmann (2014)** studied shared mobility business models exploring the optimal relationship between service providers and the local governments to achieve the common objective of sustainable mobility. More recently, a study by **Ganapatia & Reddick (2018)** examines the challenges of the sharing economy for the public sector across three sectors, including mobility. The paper emphasises the paradoxical role that government agencies have in supporting innovation and extracting public benefit from the sharing economy while addressing negative externalities.

Turning specifically to dockless bike-sharing, a number of studies have begun to appear, despite its relatively recent emergence. The majority of studies have focused on the Chinese context, where its impact has been most significant. **Shi et al. (2018)** explore ways of improving the sustainability of dockless bike-sharing in China from a stakeholder-oriented network perspective; **Sun (2018)** addresses the user behaviour and perception; **Yang et al (2019)** assess the sustainable development of dockless bike-sharing in China from an economic perspective; and **Li et al. (2019)** examine activity patterns of systems near local metro stations. From a Singapore context, **Shen et al. (2018)** look at the usage of dockless bike-sharing service, while also providing guidance to urban planners and policy makers for its sustainable promotion. A recently published thesis explores the governance of dockless bike-sharing in a Dutch context, and seeks to provides options for municipalities to successfully implement dockless schemes (**Janmaat, 2019**).

Two recent studies have taken a more critical look at the nature of sharing engendered by dockless bikes. **Spinney & Lin (2018)** cast dockless bikes as ‘hybrid mobiles’ that act as vehicles for the commodification of data and conclude that this form of sharing “represents a retrenchment and extension of capitalist economics” (ibid., p.81). **Chan & Zhang (2018)** use dockless bike-sharing as an example of sharing within the urban environment as part of their study on the socio-spatial dimensions of sharing space. Discussing the errant and irresponsible bicycle sharing behaviours that have been a feature of dockless systems thus far, the authors highlight the issue as one of a deeper problem of sharing urban (public) spaces.

Transitions research is a field in which cycling is often neglected (van Waes et al., 2018). Two recent studies, however, have looked at bike-sharing as a niche innovation within the mobility transition. **Van Waes et al. (2018)**, explore the upscaling potential of different bike-sharing business models in terms of the socio-technical transition. **Dudley et al. (2019)** use the case of a

Mobike dockless scheme in Manchester to explore the dynamics of how the scheme failed as a niche-innovation in terms of the socio-technical transitions framework.

1.4 Structure

Having framed the research questions by placing bike-sharing within an unfolding urban mobility transition, this thesis continues as follows. In *part 2*, bike-sharing is illustrated in more detail. Its generational history of is briefly set out in order to introduce dockless bike-sharing, the so-called fourth generation of such schemes. In *part 3*, the theoretical framework is described. The framework utilises ongoing research into transitions in socio-technical systems. Specifically, it employs the multi-level perspective and the insights it offers into the dynamics of niche innovation. In *part 4*, the research design and methods used in the study are presented and discussed. An explanation of the data used in the study is provided and limitations are addressed. *Part 5* constitutes the results of the study and is divided into five sections. First, the national and local transport environment is set out. Following this, the emergence of dockless bike-sharing in a pan-London context is described before taking a more detailed look at two local contexts: The City of London and the London Borough of Waltham Forest. This part concludes with the perspective of an operator, namely Mobike. In *part 6*, these results are analysed using the theoretical framework. This analysis is divided according to themes identified in the empirical data. *Part 7* presents some reflections and observations on the study and suggests some topics for further research. Finally, in *part 8* the study concludes with a return to the research questions set out above.

2. A background to bike-sharing

Cycling is increasingly invoked as a solution to many of the problems of modern-day city life. Increased cycling can improve public health, boost local economies, invigorate commercial districts, decrease carbon dioxide emissions, help alleviate air pollution and even empower socially conscious modes of citizenship (Aldred, 2010; Aldred, Woodcock, & Goodman, 2016). In light of such benefits, it is unsurprising that cycling has become a major component of visions of sustainable urban transport systems in Europe (Sun, 2018) and that bike-sharing has become increasingly commonplace in cities across the globe.

In this part, the question – what is bike-sharing? – is addressed before taking a brief detour through its history in order to set the scene for a description of dockless, bike-sharing’s so-called fourth generation and some related areas of critique.

2.1 What is bike-sharing?

Bike-sharing is defined as the shared use of a bicycle fleet, which is accessible to the public and serves as a form of public transportation (Parkes, Marsden, Shaheen, & Cohen, 2013). A variety of systems and operating models have been deployed to introduce bike-sharing systems to urban areas across the globe. Each has the underlying principle of providing individuals with the opportunity to use bicycles on an as-needed basis without the costs and responsibilities of ownership. Bike-sharing is an example of a product-service system, a business model based upon the creation and capture of value from the efficient utilisation of resources (Bolton & Hannon, 2016). Product-service systems have been described as holding the promise to redirect contemporary production and consumption patterns towards sustainability (Sousa-Zomer, Cantúa, & Cauchick, 2016).

Studies have shown the benefits of bike-sharing as an environmentally friendly, sustainable form of investment that offers cities an opportunity to achieve transport, health and emissions goals. As a result, bike-sharing has been given prominence within urban sustainable mobility strategies and its spread has been rapid and wide compared to other innovations (Mateo-Babiano, Bean, Corcoran, & Pojani, 2016; Soares Machado et al., 2018). It has often been deployed as a solution to the problem of the ‘last-mile’, the short distance between home or work and public transport, a distance which may be too far to walk. Bike-sharing is recognised as having the potential to facilitate this part of the journey and thus help to bridge gaps in existing transportation networks (DeMaio, 2009; Shaheen, Guzman, & Zhang, 2010).

2.2 A brief history of bike-sharing

The history of bike-sharing is generally divided into four generations. The first generation of systems are known as free bike systems, or ‘White Bikes’ after the pioneering scheme first

proposed in Amsterdam in 1965. In these systems, bikes were placed unlocked throughout an area for free use (Shaheen et al., 2010). Such unrestricted systems were built upon a sense of civic responsibility and community and have been described as “utopian bike sharing” (Bonnette, 2007, p.19). Unfortunately, the realities of theft, vandalism and police confiscation meant that Amsterdam’s White Bikes system collapsed within days of launch and that other first generation schemes were doomed to fail (DeMaio, 2009).

The first large-scale second-generation bike-sharing scheme was founded in January 1995 in Copenhagen under the name ‘Bycycken’ (*City Bike*) (Shaheen et al., 2010). The bikes were specially designed for intense utilitarian use and were locked at designated racks, or stations, and accessible with a refundable coin deposit. A series of other coin-deposit systems were subsequently introduced elsewhere in the Nordic region. However, theft of bikes remained an issue, and whilst such systems increased opportunities to cycle, they lacked the level of support and service required to significantly influence people to alter their transportation choices (Bonnette, 2007).

The introduction of smartcard technology to the city of Rennes’s Vélo à la Carte system in 1998 heralded the arrival of third-generation bike-sharing. Third-generation systems sought to overcome the drawbacks of previous versions through the deployment of modern information technology, such as mobile-phone access and electronically-locking racks or bike locks, allowing the system to recognise users and track bicycles (at least to the extent of check-in and check-out at docking stations) (DeMaio, 2009). Typically, third-generation schemes use docking stations, which serve as pick-up and drop-off locations. A ‘network-effect’ is created through the availability of a large number of bikes in multiple nearby locations. Cost-structures vary but many schemes provide bikes for free or at low cost to the user for a short, specified time-period, after which incremental pricing is applied, in order to encourage short, utility-based trips, rather than longer leisure rides. Websites that provide users with real time information on bike and docking station availability are now an integral part of these schemes. Most third-generation schemes are funded through public-private partnerships and are commonly operated by major advertising companies (Bonnette, 2007; Midgley, 2011; Parkes et al., 2013).

The features described above have, to a large extent, solved many of the issues of previous systems. In particular, the incorporation of technology has helped to deter bike theft, a major concern of previous systems (Shaheen et al., 2010). Such advancements have also contributed to the rapid proliferation of bike-sharing schemes across the globe. Indeed, around the turn of the century, there were a mere five schemes, operating in five countries (Denmark, France, Germany, Italy and Portugal) with a total fleet of 4,000 bicycles (Midgley, 2011). While estimates vary (particularly given the transient nature of many recent schemes), it is estimated that in 2018 there were schemes operating in over 1,600 cities, deploying over 18 million bikes worldwide and covering almost every region of the world. Figure 3 illustrates this rapid growth, which, it has

been suggested, has outstripped growth in every other form of urban transport (Midgley, 2011). The recent, notable surge in bike numbers can be attributed to introduction of bike-sharing's fourth generation – dockless.

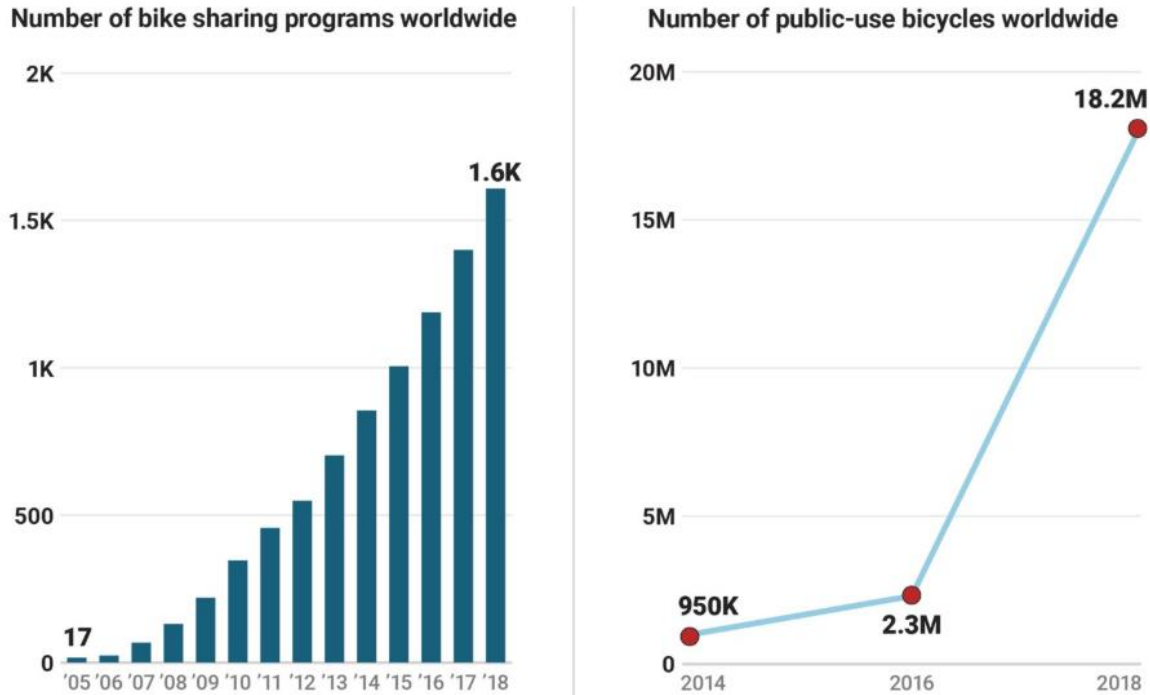


Figure 3: Source of graph: Bhardwaj & Gal, 2018 (Data for 2018 as of May); Data source: MetroBike Bike-Sharing Blog (<https://bike-sharing.blogspot.com/>)

2.3 The fourth generation: Dockless

Even the multitude of advancements introduced in third-generation schemes could not fully solve a limitation to bike-sharing: the location and availability of bikes and docking stations. The literature on bike-sharing highlights that users are frequently motivated by convenience and difficulty finding a docking station with available bikes or spaces for docking can severely limit the convenience of the system. Studies of bike-sharing systems have shown that the proximity of docking stations to the origins and destinations of users is key factor determining the level of use (Bachand-Marleau, Lee, & El-Geneidy, 2012; Fishman, Washington, Haworth, & Mazzei, 2014). Third-generation schemes also frequently suffer from a lack of efficiency referred to as the 'imbalance problem' (Chan & Zhang, 2018, p. 6). This results from individuals in cities having similar travel patterns, especially during peak hours. This similarity results in particular docking stations becoming empty or full at certain times of days, suppressing demand and potentially requiring human resource to carry out redistribution activity (ibid).

Fourth-generation schemes seek to overcome these issues by integrating the functions of the docking station directly into the bike, thus rendering them unnecessary. The value proposition of

the dockless model is that it empowers the user to take and drop a bike anywhere without the use of physical infrastructure, through the use of an app (Spinney & Lin, 2018; van Waes et al., 2018). The bikes used in these schemes have thus also been referred to as ‘free-floating’. The first iteration of such a scheme dates to around the turn of the century, with Deutsche Bahn’s Call a Bike allowing users to unlock and lock bikes via telephone call or SMS. Recent technological improvements, however, in particular the prevalence of smartphones and cashless mobile payment, have spurred a dramatic increase in app-driven dockless bike-sharing schemes (Shen, Zhang, & Zhao, 2018). The key enabler of this innovation is the combination of the digital lock, GPS and smartphone (ibid). The systems work through the embedding of a GPS sensor and communication module directly into the bikes, allowing them to report their location to a central server. Bikes are located across the area of the scheme. Users can easily locate, lock and unlock a bike via a smartphone app and unlock it by scanning the bike’s QR code or near field communication (NFC) technology. Bikes can be parked and locked anywhere, subject to local regulations and any geographical limits set by the scheme in question. Some operators apply such limitations via digital geo-fencing technology through which a geographical area can be bounded or ‘fenced’. It is these advancements that mark out dockless bike-sharing as an innovation (van Waes et al., 2018).

Dockless schemes are usually operated by private firms, on a for-profit platform (Chan & Zhang, 2018). While price structures vary, users typically pay according to the time the bike is used, in addition to a deposit; demand-based pricing may be implemented. Mobile payment and subscription are also typically integrated into the app and a credit system can be established. Pricing may also be structured to incentivise users to park bikes in specified locations (ibid.).

The rise in dockless bike-sharing began in China in 2015 and has since grown rapidly, foremost in China itself. Mobike and ofo emerged as the “principal players” (Dudley, Banister, & Schwanen, 2019, p. 96), joined by approximately sixty competitors (Huang, 2018), fuelled by hundreds of millions of dollars in venture capital as investors bet that one of these bike-sharing firms would become the next Uber (Griffith, 2017). This has resulted in a “race for dominance” (Fannin, 2017, para.3), in which costs must be kept low and subsidies offered in an effort to maintain market share (Bland, 2017). The so-called “bicycle-sharing boom” (ibid.) subsequently spread to other countries, including Singapore, the United States and the United Kingdom, through the expansion of Chinese operators, but also as a result of start-ups emerging elsewhere (CB Insights, 2018). The emergence of this new generation of free-floating bikes has been described as revolutionising the market, increasing access to an affordable, flexible and environmentally friendly form of transport and making bike-sharing services more convenient than ever (Shen et al., 2018). In 2017, the UN awarded leading dockless operator Mobike with their ‘Champions of the Earth’ Award, the highest environmental honour of the United Nations, in the Entrepreneurial

Vision category, citing the contribution of bike-sharing to cutting journeys that contribute to air pollution and climate change (United Nations Environment Programme, 2017).

Such rapid growth of fourth generation bike-sharing was, however, evidently unsustainable. In China, schemes brought with them a huge number of free-floating bikes, saturating Chinese streets. Surplus bikes began to pile-up and block already crowded streets, resulting in “piles of impounded, abandoned, and broken bicycles” (Taylor, 2018, para.1), as cities attempted to manage the problem (see Figure 4). Images of discarded bikes serve to highlight both the extreme, speculative nature of the growth of dockless bike-sharing in China. The industry has suffered as a result and many operators have struggled financially or ceased to operate. Both Mobike and ofo adopted strategies of expanding rapidly by offering subsidised rides, with the result that they have made heavy losses (Dudley et al., 2019). ofo has since ceased to operate, while Mobike, despite a recent takeover that valued the company at around US\$3.7 billion, faces pressure from investors to make its business model more sustainable (ibid.) Despite these issues, bike-sharing remains very popular in China, and will likely continue to grow, just at a more sustainable rate (Taylor, 2018). Whilst the rise of dockless bike-sharing outside of China has been less extreme, it has still been subject to fierce competition and many operators have faced similar issues to those seen in China. Nonetheless, according to Ryan Rzepecki, CEO of bike-sharing operator Jump, competitive demand in the west hasn’t really taken hold yet, so competition for riders is still in its infancy (Teale, 2018).



Figure 4: "A worker untangles a rope amid piled-up bicycles in a lot in Xiamen, Fujian province, China, on December 13, 2017" (Taylor, 2018); Reuters

The growth of dockless bike-sharing is often grouped with other services, such as the shared electric scooters that are appearing in cities across the globe, under the collective banner of ‘micromobility’, or as it is titled in transportation app Citymapper, ‘floating transport’ (Hern, 2018). This is a rapidly evolving market facing a variety of business model challenges, but one which, it is claimed, has the potential to significantly disrupt car dominance. The theory is that increased urbanization leads to a greater number of short distance trips. Such trips are better served by vehicles that are optimized for journey length, utilisation and space allocation, thereby reducing dependence on the individually-owned automobile (Kyrrouz, 2019).

Having only emerged relatively recently, dockless bike-sharing remains a relatively understudied form of urban mobility. Nonetheless, some areas of critique have begun to emerge. A summary of these critiques follows.

2.3.1 Use of public space

While operating on a for-profit basis, dockless bike-sharing schemes depend critically upon the sharing of public spaces (Chan & Zhang, 2018). Operational effectiveness of schemes is based upon users being able to park freely and flexibly, in effect treating the city as one big common docking area (ibid.). Schemes have entered cities often absent of rule or regulation for this use of public space. Indeed, the lack of clear rules for bike parking has been cited as an explanation for the rapid diffusion of schemes which have been operating in an absence of established rules, thus allowing users the freedom to park bikes anywhere (van Waes et al., 2018). Yet, as highlighted earlier, this has created well-publicised headaches for city governments with bikes parked in ways they deem unacceptable, and has frequently cast dockless bike-sharing as an anti-social spatial practice (Chan & Zhang, 2018).

The spatial relations produced by dockless schemes and their rapid growth, it has been suggested, has “led to situations where the commons are not being shared but dominated by bikes” (Spinney & Lin, 2018, p. 67). While this may be true of the Shanghai case-study, elsewhere, even in the case of problematic parking, it is questionable whether public space is dominated by bikes, as such, particularly in comparison to cars. Nonetheless, from a behavioural sense, the use (and misuse) of dockless bikes, and the sometimes-careless way they have been parked, does highlight an apparent lack of concern for public space:

“On a conceptual level, the abandoning of bikes anywhere on the streets is emblematic of the maximisation of private utility (saving time and effort) over collective utility (the ability of other users to easily use the public realm).” (Spinney & Lin, 2018, p. 76)

It is also reminiscent of the fate of lack of civic responsibility that led to the failure of earlier generations of bike-sharing schemes. In their discussion of the spatial practice of dockless bike-

sharing, Chan and Zhang (2018) identify the problem as one of negligent sharing of both bicycles *and* urban (public) spaces, casting the “crucial criterion” of free, flexible and convenient public space parking and retrieval of bikes as “privilege, and not a right, of sharing urban spaces” (ibid., p.6).

2.3.2 Use of data

Data has been described as the most valuable commodity of the smart city because of the way of it enables the matching of mobility to demand; “In the smart future, data is the knowledge upon which the power to control the marketplace is built” (Docherty et al., 2018, p.121). Dockless bike-sharing is no exception; data is identified as a key resource of the dockless model (van Waes et al., 2018). Schemes harvest data on user types, cycling routes and geographical location which can be used by the operator to adapt the business model (for example to adapt pricing or dynamically relocate bikes), regulate user behaviour (in terms of where to park via geofencing) (ibid), or potentially for marketing purposes. Spinney & Lin’s recent case study of dockless bike-sharing in the Chinese context seeks to provide a critical understanding of what is driving the emergence dockless schemes and how they are reshaping social relations (Spinney & Lin, 2018). The study identifies them as being predicated on the privatisation of the user; a form of sharing in which the smartphone user and the bike-rider are joined together to bring into being a ‘hybrid mobile’ that facilitates the generation and commodification of data (ibid., p.67). This latest generation of bike-sharing systems are described as representing a regressive move with regard to open-source data sharing in a municipal context because of the way in which data is viewed as a resource to be commodified rather than a public resource that can be used to help better understand cyclists’ movement and plan infrastructure accordingly (ibid.) Indeed, the study quotes a Mobike Government Relations Manager describing the data that the company can access through their scheme as “very valuable. We have the name, bank account, ID, workplace, address...; it is a goldmine” (ibid., p.73). This aspect of dockless bike-sharing can thus be seen as being typical of the smart city, a realm in which data is the new currency (Marvin, 2015, p. 150). Accordingly, Spinney & Lin (2018) argue that the primary driver is “not a desire to maximize collective utility or fix urban transport problems, but a desire to combine and monetise user data” (ibid., p.74). The harvesting of such data, the Shanghai case suggests, can be used to leverage and shape the conduct of government because of its value to planning officials. Such an example fits with Doherty et al.’s assertion that harnessing of data by commercial operators represents a critical risk, with the associated with shift in the control of knowledge (and thus power) making the governing of mobility more difficult in the longer term (Docherty et al., 2018).

2.3.3 Sustainability

A further aspect that should be mentioned relates to the environmental relations produced by dockless bike-sharing. Noting that bicycle sharing systems are typically lauded for their

environmental impact, Spinney & Lin question whether the latest manifestation is in fact an environmentally sustainable model of sharing, in light of the competitive strategies adopted by firms that have resulted in the oversupply of bikes and vast wastage highlighted earlier. This use of resources, it is argued, requires further study and scrutiny (Spinney & Lin, 2018).

Furthermore, while transitions towards sustainability, within the transport domain or any other, are likely to be founded upon a transition towards less consumption (Whitmarsh, 2012), it has been noted that smart mobility innovations, whilst claiming sustainability benefits, are often based on the prospect of selling more mobility, rather than less (Pangbourne, Stead, Mladenovic, & Milakis, 2018).

2.4 Summary

In summary, dockless bike-sharing can be seen to be the latest manifestation of an urban transport solution that has become increasingly popular and widespread due to the many benefits it offers and the role it can play in sustainable urban transport strategies. Dockless schemes bring with them the prospect of making the sharing of bikes more convenient than ever and, not only that, they offer the promise of doing so without requiring support from the public purse. While they have spread rapidly across the globe, however, a number of challenges and concerns have become apparent, including those relating to sustainability and the use of public space and data.

3. Theoretical framework

Having earlier set out some of the features of the unfolding transition in urban mobility, this theoretical framework seeks to provide an understanding of the dynamics of transitions and, in particular, of innovations such as dockless bike-sharing. In doing so, the aim is to provide a blueprint for the study (Yin, 2018). This blueprint is grounded in ongoing research on transitions in socio-technical systems. It begins by setting out the concept of socio-technical transitions before exploring the ways in which they evolve through application of the multi-level perspective (MLP). Due to its relevance to dockless bike-sharing, the framework continues by looking at the level at which innovations and radical alternatives can develop and emerge, namely the niche level. The section concludes by addressing the issue of governance.

3.1 Socio-technical transitions

Socio-technical systems are those systems which fulfil societal functions, such as mobility. They are described as a system because they are made up of a cluster of interrelated elements, including not only technology, but also regulation, infrastructure, user practices and cultural meaning, among other elements (Geels, 2005). The socio-technical system for road transport is set out in Figure 5 and helps to demonstrate the way in which transport is more than just technology, it is embedded in society in terms of physical infrastructure, institutions, markets, culture and more. As such, it becomes stabilised and is difficult to change.

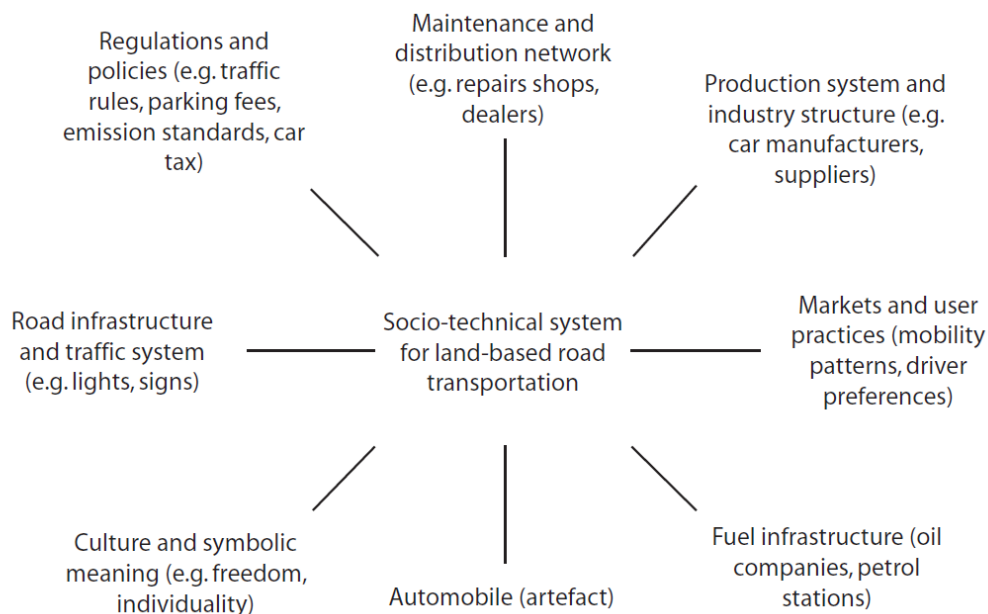


Figure 5: Socio- technical system for road transport. Source: Geels, 2005

Due to the way the transport system is embedded in society, adoption of a technological innovation, such as dockless bike-sharing, requires more than just technical feasibility, but also economic, social and political feasibility (Annema, van den Brink, & Walta, 2013). This is explored further in the part 3.3, which looks in more detail at the dynamics of niche innovation.

That process of change, from one socio-technical system to another, is referred to as a transition. A transition is defined as the process that occurs when, “the dominant way in which a societal need (e.g. the need for transportation, energy, or agriculture) is satisfied, changes fundamentally” (Lachman, 2013, p. 270). Due to the interrelated elements of a socio-technical system, a transition is characterised by a co-evolution technical, economic and behavioural change (Bidmon & Knab, 2018) and must be facilitated by multi-dimensional interactions between industry, technology, markets, policy, culture and civil society (Dudley, 2019). These various groups each have their own interests, problem perceptions, values, preferences, strategies and resources. Accordingly, transitions are viewed as multi-actor processes that involve interactions between these groups, for example, through commercial transactions or political negotiations (Geels, 2005). The socio-technical approach thus provides a way to analyse the role of these multi-actor processes in transitions.

While not bound to the concept of sustainable development, research on transitions has focused on societal challenges related to sustainability (Bidmon & Knab, 2018). This can be seen to follow from the acknowledgement that a shift towards sustainable development can only be achieved by societal transitions; that is, “large-scale and long-term changes of systems that fulfil societal functions such as transport” (ibid., p.903).

3.2 The Multi-Level Perspective (MLP)

The MLP is a prominent framework deployed in the study of transitions and has been described as an ambitious attempt to understand the processes of system innovation and socio-technical transition (Hodson & Marvin, 2010). It was originally developed by Rip and Kemp (1998) and has been elaborated by others, most prominently by Frank W. Geels (2005a; 2005b; 2011; 2012; 2018). The basic premise of the MLP is that transitions are non-linear processes that result from the interplay of developments at three analytical levels: niches, regimes and an exogenous landscape. The particular ‘pathway’ that a transition follows is defined by interactions between the three levels (Foxon et al., 2009). A description of each of these levels now follows.

The *landscape* (macro) level represents the broader political, social and cultural ideologies and values and institutions that form the structure of a society and influence regimes and niches (Foxon et al., 2009). It includes spatial structures (e.g. urban layouts) and macro-economic trends (Geels, 2012).

The *regime* (meso) level is the locus of the established practices and rules of the incumbent system. It represents the dominant cognitive, regulative and normative rules, and includes the institutions in which incumbent technological systems are embedded (Geels, 2004; Bidmon & Knab, 2018). The regime accounts for the stability of the existing socio-technical system and its resistance to change. At the same time, the regime is influenced by developments at the landscape and niche level (Nilsson & Nykvist, 2016).

The *niche* (micro) level is the locus of radical innovation. It acts as a 'protective space' or 'incubation room' in which innovations and radical alternatives can develop and emerge. This space provides opportunity for learning processes to occur, for example with regard to technology, user preferences, regulations and infrastructure, and for actor networks to grow (Geels, 2005; Smith, Voß, & Grin, 2010). Niches also operate as protected spaces in which business models can develop, in which innovations, (and their required regulatory structures) can be experimented with and as sites within which actors create visions and expectations regarding future trajectories (Nilsson & Nykvist, 2016; Sarasini & Linder, 2018). As such, the niche level provides a space in which actors can test radical alternatives to solve societal problems and address landscape pressures (Whitmarsh, 2012). This protection is important because innovations usually cannot compete with the selection environments of the incumbent regime (Dudley, 2019). Niches are characterised by a lack of stability, and may or may not gain the required momentum to become aligned and stabilised in a dominant design (Geels F. W., 2012). Niche protection can be provided in a variety of ways, for example, through subsidies, lead markets, or a "specific cultural milieu of early adoption and experimentation" (Smith et al., 2010, p.441).

In short, niches are understood as sources for transformative ideas and capabilities that provide the seeds for systemic change and are thus crucial for transitions. Whilst initially only technological and small market niches were identified (Geels F. W., 2005), niches have since been more widely defined to also include new rules and legislation, new organisations, new projects, concepts or even ideas (Loorbach, 2007). In order to elaborate further and because of its relevance to this study, the following section turns to the application of the MLP to low-carbon transitions in transport.

3.2.1 Applying the MLP to low-carbon transitions in transport

Geels has applied the MLP to the automobility system as a framework to analyse the drivers, barriers and possible pathways for low-carbon transitions (Geels, 2012). The automobility regime is identified as the dominant regime of the transport domain, positioning other long-standing modes, such as train, bus and cycling, as subaltern regimes. Cycling's subaltern status, it has been suggested elsewhere, has contributed to cyclists being stigmatised and often unwanted, excluded or made invisible in urban space, a space socially and spatially dominated by motor vehicles (Aldred, 2013; Gössling, 2013).

The automobility regime is facing both destabilising and stabilising landscape pressures. Destabilising landscape pressures include public concern and subsequent policy action over climate change, oil production and the change in daily lives brought about by the diffusion of ICT. Elements of the landscape that stabilise the regime include cultural values and preferences, increasing demands for mobility and the physical urban landscape, which has been shaped around the car. The regime is also stabilised by various lock-in mechanisms at the regime level, such as sunk investments, user patterns and consumer preferences, vested interests (of industry and the car lobby) that resist major change, as well as “beliefs from established actors (e.g. transport planners, policy makers, industry actors) that take existing practices for granted and legitimate the status quo” (Geels, 2012, p.478). The lack of priority given to environmental sustainability in transport policies at the national and local levels is noted as a further lock-in mechanism.

Geels concludes that the automobility regime is still dominant and stable, but less so than before, with various promising ‘green’ cultural and socio-spatial niches having emerged in recent years which deviate from ‘normality’ to challenge basic assumptions of the automobility regime (Geels, 2012, p. 475). Public bike-sharing is identified as one such socio-spatial niche which challenges the dominant order and offers possibilities to generate more radical and systematic changes towards sustainability. For such a transition to be realised, however requires several changes, including “a stronger role of local and city governments, stronger innovation strategies by public transport actors, and a willingness of consumers to change mobility routines” (ibid., p.479), as well as a reconfiguration of urban physical urban structures.

Geels’ analysis of the transport system highlights the spatial dimension of the MLP, an aspect previously less elaborated. Both the automobility regime, and the subaltern regimes, have strong local dimensions, particularly at the urban level, for example through urban planning or the provision of subsidies. Local actors can provide support for more radical niche-projects that can form the seeds for future regime transitions (Geels, 2012). Hodson and Marvin (2009; 2010) have sought to conceptualise the role of cities in socio-technical transitions, suggesting that pressures to reconfigure socio-technical regimes at an urban scale are becoming increasingly manifest. Highlighting the way in cities develop the resources, networks, and relationships actively work to shape transitions, the authors describe world cities, such as London, as seeking to position themselves as “transition managers” (Hodson & Marvin, 2009, p. 531).

3.3 Niche dynamics

Having described the different levels of the MLP, I now turn to look in more detail at the dynamics of the niche level. The dynamics of niches are useful for the study of dockless bike-sharing in London because, if an innovation of this type fails to find the necessary protection and support to gain momentum, then it is unlikely to breakthrough and become established at the regime level

and thus generate more radical and systematic changes towards sustainability (Dudley et al., 2019).

External developments at regime and landscape level can open windows for niche breakthrough and diffusion (Smith et al., 2010). For example, increasing concern over climate change can create increased opportunities and support for innovation that seek to address that issue. The potential of such innovations, however, “constrained, enabled and interpreted” through the structures and stabilising mechanisms of the regime (Smith et al., 2010, p.441). It can thus be difficult for innovations and alternatives, such as dockless bike-sharing, to break into the regime. They may, for example, be more expensive than established alternatives, they may require changes in user practices, lack appropriate supporting infrastructure or face a mismatch with existing regulation (Geels, 2012). As result of these stabilising mechanisms, most niche innovations fail to gain the required momentum to become adopted by the regime. It is those innovations which are supported by more actors and receive more resources that are more likely to be nurtured, gain momentum and thus diffuse more widely and be incorporated into regimes or potentially replace them (Geels, 2012; Bolton & Hannon, 2016).

Niches can also interact positively, potentially combining to form trajectories of niche accumulation. For example, in his case-study of the transition to the automobility regime, Geels highlights the role of the bicycle as a market niche which, while ultimately losing importance in its own right, had wider socio-technical impacts, such as giving rise to new user preferences and mobility practices (individuality, flexibility, speed and fun), as well as new manufacturing techniques. These effects acted as a stepping-stone or catalyst in the transition towards automobility (Geels, 2005).

In a study of potential future pathways for transition towards low carbon mobility, Moradi and Vagnoni (2018) used the MLP approach to investigate urban mobility transition dynamics. In doing so, they identified the driving forces that can support niche innovations to grow, develop and gain momentum. The analysis of niche dynamics revealed that the main driving forces are the following:

- “Support by national government, political and upstream regulations;
- Supports by incumbent regime actors and powerful emerging core actors;
- Market share and user acceptance;
- Niche maturity; and
- Compatibility with existing infrastructures”

(Moradi & Vagnoni, 2018, p. 237)

The first two of these forces speak to the importance of the support by public authorities, who, as regime actors have a role to play in the supporting niches but, it should be noted, can also act to restrain and restrict their momentum (Annema et al., 2013, p. 173).

This is supported by the findings of the Van Waes et al. study (2018), which assessed the potential of different bike-sharing models, as niche innovations, to reconfigure an existing regime or to evolve into a new regime. In doing so, they argue that this “transition potential” (ibid., p.1307) is impacted by the way in which they are either supported by or in conflict with the institutions governing public space. The authors show that innovations may align with existing institutions, or may challenge them, highlighting the ability of prevailing institutions to pose barriers to the development and diffusion of innovative business models. Institutional changes through, for example, political, market or regulatory reforms may be necessary for innovations to thrive. Such regulatory reforms may include for example, the formal rules, policies or laws that concern bike parking (ibid.) ‘Institutional work’ (for example through lobbying) by the actors responsible for the business models can serve to gain legitimacy for the innovation in question within the context of the established regime to help encourage such reforms (ibid.). Sarasini and Linder (2018) also demonstrate the importance of legitimacy in their study of the dynamics of innovative mobility services in the sustainability transitions. To gain legitimacy, it is argued, services must demonstrate their ability to fulfil national or local transport policy goals.

Cohen and Kietzmann’s study of shared mobility business models adds support to the theory that alignment with regime actors, such as the institutions governing public space, impacts the transition potential of innovations (Cohen & Kietzmann, 2014). Shared mobility solutions, it is suggested, have been developed to address deficiencies in public infrastructure and public transit systems, systems which are historically within the purview of public authorities. In advancing these shared mobility solutions, both the public and private sector have a common interest in sustainability. This common interest, however, does not always lead to harmony, instead “giving rise to agency conflicts that can reduce the positive sustainability impact of their individual and collective interests” (Cohen & Kietzmann, 2014, p. 280). The nature of the relationship in a given case may give rise to greater opportunity for agency conflicts, or conversely, enhanced service delivery. The extent to which innovations respond to and fit with local conditions has also been posited as factor affecting their ability to flourish (Dudley, 2019). This highlights that niche innovations are embedded in different socio-spatial contexts and thus affected by the nature of the local environment, place-specific norms, values and networks.

3.4 Governance

Due to the importance of the role of public authorities in this case, the theoretical framework is concluded by looking at the role of governance in the urban mobility transition. The state (at varying levels of government) is heavily involved in the regulation, management and ownership of transport activities. This is, in part, because the many economic and social benefits that derive from transport require management of a complex combination of mobility, infrastructure and services (Docherty & Shaw, 2019). It also because of a need to manage transport’s negative externalities. The strategies and policies that territorial governments adopt over time shape the

development of transport infrastructure and services in a variety of ways at a variety of spatial scales (ibid). The unfolding transition in mobility, however, is bringing with it new actors, networks and technologies which are “fundamentally challenging the extant regime and how transport is governed” (Doherty et al., 2018, p.123). While most smart mobility visions see the role of the state as a mere passive facilitator of innovation, public authorities in fact have significant agency in the transitions towards sustainable mobility (Doherty et al, 2018). Geels highlights the role of public authorities as being required to “to address public goods and internalize negative externalities, to change economic frame conditions, and to support ‘green’ niches” (Geels, 2011, p. 25).

Studies have argued that ‘adaptive capacity’ is an important feature of governing in the changing circumstances of transition (Smith et al., 2005). In their study of the prospects and challenges of the sharing economy for the public sector, Ganapati and Reddick (2018), highlight the importance of adaptive governance, wherein public agencies must respond flexibly to quickly implement policies and adapt to the changing environment. They identify that public agencies have a role to support innovation, while addressing its downsides. It is argued that the responsibility of public agencies in this adaptation is to enhance public value. Public value has been identified elsewhere as a key governance aim for the state’s role in the smart mobility transition and as a useful means to understand the real-world policy implications involved in governing the smart transition (Doherty et al., 2018).

3.5 Summary

In summary, this theoretical framework deployed research on transitions in socio-technical systems to help understand the way in which the transport technology is embedded in society through a variety of interrelated elements. Transitions, which are required to facilitate the shift towards sustainability, are thus multi-dimensional, co-evolutionary processes. The MLP, in utilising the concepts of niches, regimes and landscapes, provides a conceptual framework for exploring how transitions evolve and, specifically, how innovations, such as dockless bike-sharing, break into the established system. The MLP acts as a “heuristic framework that guides the analyst’s attention to relevant questions and issues” (Geels, 2012, p.474) and it is used in this way here, as a means to investigate the dynamics of a niche innovation within the urban mobility system.

4. Research design

The thesis employs a qualitative case study methodology, where dockless bike-sharing in London is the object of study. A single case design is used; the study is exploratory in nature. While the spatial boundary of the case-study is London as a whole, particular focus is given to those areas of London in which a more detailed understanding has been developed via access to city actors, i.e. the City of London and Waltham Forest.

The case study is a detailed examination of a single example (Abercrombie et al 1984). According to Yin (2018), the case study is a particularly useful method for providing an in-depth understanding of a complex, contemporary social phenomenon within its real-world context. The case study also offers the advantage enabling the researcher to ““close-in” on real-life situations and test views directly in relation to phenomena as they unfold in practice” (Flyvbjerg, 2006, p.235). As such it is considered an advantageous method for understanding the deployment of a still-emerging form of mobility within a real-world urban landscape. One of the rationales for the choosing a single case arises when the case represents an unusual circumstance (Yin, 2018). Given the recent and highly dynamic nature of dockless bike-sharing in London, a single-case study is considered to offer a useful methodology to address the research questions posed

4.1 Why London?

Dockless bike-sharing in London has been chosen as the case study through information-oriented selection, based on an expectation that it would offer a particularly rich problematic (Flyvbjerg, 2006). The case offered an opportunity to examine the dynamics of an innovation implemented in a real-world context. Whilst new forms of bike-sharing have been deployed in cities across the world in recent years, the nature of its emergence in a ‘world-city’ such as London, which is aiming to shift towards a more sustainable transport system, was perceived as making it an unusual case. As discovered during the research process, London’s complex governance structure also adds to its ‘extreme’ nature as a case. London was also selected on the basis that because of the author’s own familiar with it and its institutions, access could be made to a larger amount of information than potential alternatives.

4.2 Data sources

A principle of case study research is that researchers should use multiple sources of evidence (Yin, 2018). The use of multiple sources relates the basic motive for doing case study research described above: to provide in-depth understanding of a social phenomenon within its real-world context (ibid.). Furthermore, the use of multiple sources is recommended as a means of increasing the confirmability and credibility of a research project (Shenton, 2004). This study relies primarily on qualitative data in the form of expert interviews and document analysis.

4.2.1 Document analysis

Publicly available documents, such as reports, strategies and plans were gathered via the internet and analysed in order to provide a comprehensive basis of understanding of the context of the case and the distinctive nature of the development and governance of dockless bike-sharing in London. The documents also served to help corroborate and augment the evidence gathered through interview. During the document analysis process, the author, context and purpose of each document has been duly considered (Petty, Thomson & Stew, 2012). The relevant publications are referenced wherever they have been directly used as evidence.

4.2.2 Interviews

Four semi-structured stakeholder interviews were conducted with stakeholders integrally involved in the case study (see Figure 6). Due to the nature of their involvement in the case, each of the interviewees can be regarded as a critical actor in the case. All interviews took place in July 2019 and lasted between 45 minutes and two hours.

Figure 6: List of interviewees

<i>Interview no.</i>	<i>Interviewee</i>	<i>Position</i>	<i>Organisation</i>
<i>1</i>	<i>Mike Beevor</i>	<i>Senior Policy Manager, Transport Innovation</i>	<i>Transport for London</i>
<i>2</i>	<i>Bruce McVean</i>	<i>Strategic Transportation Group Manager</i>	<i>City of London Corporation</i>
<i>3</i>	<i>Daniel Gosbee</i>	<i>Technician</i>	<i>London Borough of Waltham Forest</i>
<i>4</i>	<i>Duncan Robertson</i>	<i>Head of Business Strategy and Government Affairs</i>	<i>Mobike</i>

Interviews are a particularly useful method for “suggesting explanations (i.e. the “hows” and “whys”) of key events, as well as insights reflecting participants’ relativist perspectives” (Yin, 2018, p. 118) and were used as such here. They enabled the gathering of detail and insight into the underlying dynamics of dockless bike-sharing in London, as well as views on the conflicts and alignments of interests between the various parties that were not obtainable via published documents. Semi-structured interviews comprise of “a few pre-determined areas of interest with possible prompts to help guide the conversation” (Petty et al., 2012, p.3) and were considered appropriate for the purpose of this research because they are designed to ensure that key questions are covered, while giving interviewees an opportunity to expand certain aspects and “place their experience within a wider personal, institutional and narrative context” (Dudley, 2019, p.101). It also allows the researcher to develop new questions based on the ideas formed during the interview

(Moradi & Vagnoni, 2018); this approach was used throughout the interviews. An interview guide was used to conduct each interview (see Appendix A). The interview guides contain lists of questions and topics, but allow a great deal of leeway for the interview to be conducted flexibly (Bryman, 2008). All interviews were conducted in person. Two of the interviews were recorded and subsequently transcribed and the remaining two interviews were recorded via hand-written contemporaneous notes. The interview evidence was subsequently analysed in order to identify material that would answer the research questions. This was done by searching for patterns and concepts that would provide insight to help address the research questions. The insights were subsequently categorised according to themes. These themes are reflected in the analysis section in part 6.

With regard to the strategy used to identify interviewees, purposive sampling was used. Purposive sampling is strategic; people who are relevant to the research question are chosen (Bryman, 2008). The eight London Boroughs (including the City of London) to have had a formalised dockless presence within their boundaries were identified through desk research. They, along with the central transport authority, Transport for London (TfL), were contacted to request an interview. From this, three interviews were arranged. One borough council responded to say that they did not have time to take part, while five borough councils did not respond at all. In addition, an interview was arranged with Mobike, the only private operator to be contacted for this study. The representatives of the City of London and Mobike were previously known to the author in a professional capacity.

4.3 Limitations

It is acknowledged that analytic conclusions from a single case study are not as powerful as those from a multiple-case design (Yin, 2018). The single case study design has been chosen here for the reasons set out above, allied with the desire to provide the appropriate level of depth and detail and with time and expense limitations in mind. Other cases, of course, might reveal differences in the implementation of dockless bike-sharing. It is not claimed, however, that the findings of this research are directly relevant to all niche-innovations, technologies or socio-technical regimes. Rather, paraphrasing Bolton and Hannon (2016), the investigation constitutes a qualitative exploratory study, intended to provide insights into the relationship between a novel business model [dockless bike-sharing] and a sustainability transition [i.e. shift towards a more sustainable transport system in London]. These insights, it is hoped nonetheless, contribute to the wider understanding the nature of niche dynamics in the urban mobility transition.

The partiality of interview data has also been identified as a weakness of case studies based on such (Yin, 2018). Critical appraisal of interview accounts, and triangulating them for accuracy with other case material, have been used here as measures to counter this (Dudley et al., 2019).

The study could also be criticised for not obtaining input interview evidence from a wider range of participants, in particular from private sector operators. While interviews were sought with a wider range of participants, the interviews that were arranged are considered to effectively serve the purposes of the study. As the integrated transport authority for London, TfL can provide a holistic view of bike-sharing in London and the way in which it aligns with the city's strategy and commitments on transport in London. The two local authority participants, The City of London and Waltham Forest, provide a useful contrast. The former being centrally located, with very high density and footfall, the latter an outer London borough, with very different spatial restrictions. With regard to private sector operators, while additional interviews with other operators would have been advantageous, it is considered that Mobike, as one of the companies that first initiated dockless bike-sharing worldwide and due to their experience of operating in London compared to other operators, offer extremely valuable insights for the purposes of this study. As set out in Figure 9, along with Mobike, seven other operators have operated in London; of these three have ceased to operate and four have only started relatively recently.

4.4 Ethical considerations

Conducting interviews raises ethical considerations that arise throughout the research process (Kvale, 1996). In this research, steps have been taken to address ethical issues. Prior to consenting to participate in the research, all interviewees were informed about the overall purpose of the research, as well the nature of research question. This was reiterated at the beginning of the interview. Interviewees were also informed that they would be sent a copy of the research so that they can verify the findings and analysis and raise any concerns, clarifications or objections that they may have. Bearing in mind the importance of confidentiality, material identifying the interviewees is only published following their explicit consent being given, having had the opportunity to review the full research findings.

5. Dockless bike-sharing in London

In this section, the results of the study are set out. These results come from the secondary data sources and the views of interviewees. They are first placed in the context of the London transport system and the city's visions and aims for that system. Dockless bike-sharing in London is then detailed from a variety of viewpoints in turn.

5.1 The London transport context

Transport for London (TfL) is the integrated transport authority responsible for meeting the Mayor's strategy and commitments on transport in London (TfL, u.d.). It has responsibility for the city's public transport network and its network of main roads, or 'red routes'. Local land use decisions, however, come under the responsibility of the London's borough councils, of which there are 32, and the City of London (jointly represented by London Councils). This includes responsibility for all roads, other than red routes, within their boundaries (accounting 95% of the city's roads). The decision-making process and management structure of London's roads is thus decentralised. As a result, London governance systems and transport policy-making processes have been described as significantly complex, particularly for schemes where there is a high dependence on public parking space, as this is mainly controlled by the London Boroughs (Akyelken, Banister, & Givoni, 2018).

The overarching vision for the future of transport in London is set out in The Mayor's Transport Strategy (GLA, 2018). The most recent version published in March 2018 sets out the need to "fundamentally change the way people choose to move around" the city, as the current trends are causing problems (ibid., p.7). Car dependency is highlighted as contributing to pollution, congestion, danger and poor public health. The strategy acknowledges that "some parts of London have been planned around car use for so long that there are no decent alternatives" (ibid., p.7), emphasising the way automobility has influenced city planning. London's streets are some of the most congested in the world, too often becoming "places for cars, not people" (ibid., p.13). Car transport accounted for 35 per cent of all trips in 2017 and is thus the most commonly used mode of transport in London (see Figure 7). Cycling levels in London have more than doubled since 2000, including a 25 per cent increase between 2012 and 2017. This follows a range of pro-cycling policy measures introduced in recent years, including those introduced under the previous Mayor Boris Johnson's 'Vision for Cycling' (Greater London Authority (GLA), 2013), such as 'Cycle Superhighway' routes and local-area 'Mini-Holland' improvement schemes. Despite these measures, however, cycling's share of the transport mix, remains "stubbornly low" (TfL, 2018, p. 4), with only 2 per cent of daily trips in London being made by bike in 2017.

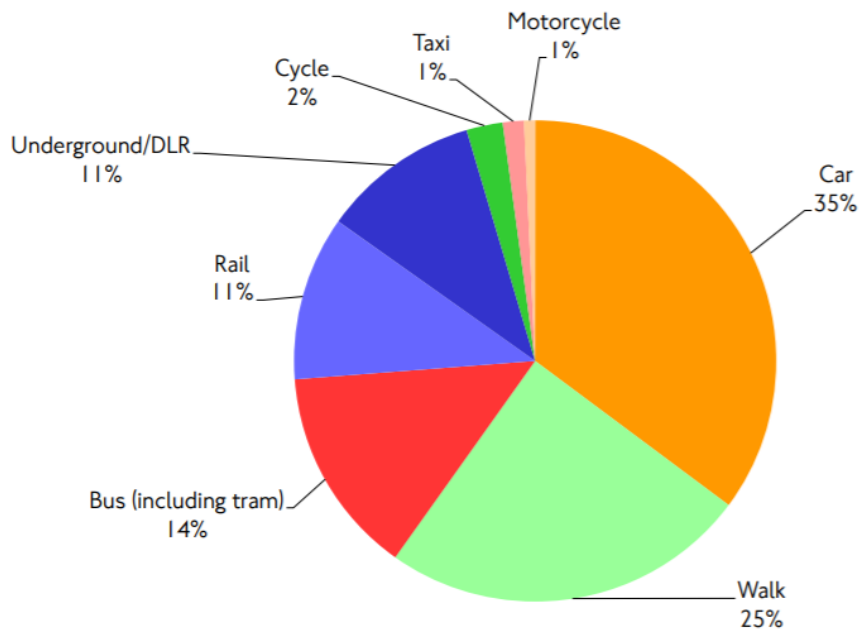


Figure 7: Modal shares of daily trips in London, 2017. Source: TfL, 2018

The plan to help reduce car dependency is to make walking, cycling and ‘green’ public transport the most appealing and practical choices, with an aim of 80 per cent of all trips in the city to be made on foot, by cycle or using public transport by 2041 (from 63% in 2015). Allied to this is an aim for all Londoners to do at least 20 minutes of active travel, i.e. walking or cycling, each day, an amount of activity that brings with it a variety of health benefits. To help achieve this, the city will adopt a “new type of thinking” (GLA, 2018, p. 36), through a ‘Healthy Streets’ framework which aims to make human health and experience central to city planning by reducing car dependency and increasing active and sustainable travel and which aims to “put people at the heart of street design and the public realm” (Interview 1). The framework is based upon ten evidence-based indicators which are used to assess the experience of being on London’s streets. Cycling is a fundamental element of the framework: “A successful transport system encourages and enables more people to walk and cycle more often” (GLA, 2018, p. 37). The city’s strategy can be seen as one of encouraging the individual to reap the varied benefits of active travel, in turn benefiting the city in the form of a more efficient and sustainable transport system.

With regard to specific cycling policies, the strategy proposes a number of measures to encourage cycling and realise what is described as its “huge untapped potential” (GLA, 2018, p. 48), including installing safe, high quality cycle routes and providing more secure, accessible cycle parking. With regard to bike-sharing, the strategy seeks to reinforce bike-sharing as “an integral part of London’s cycling infrastructure and public transport network” (GLA, 2018, p. 59) through a proposal seeking to increase the use the TfL Cycle Hire scheme, and to explore the potential of new models of cycle hire, stating: “New ‘dockless’ cycle hire schemes can extend access to hired cycles to areas outside TfL’s Cycle Hire scheme, increasing opportunities for Londoners to get around by cycle. However, it is essential that any new business models like this are deployed in a

way that does not make London's streets less accessible or less attractive places to walk, cycle and spend time" (GLA, 2018, p. 59). This is framed by an acknowledgement that "new economic models based on shared access rather than private ownership will continue to evolve" and that the city's transport strategy will need to adapt in order to engage with these trends (GLA, 2018, p. 17).

The proposals set out in the strategy are expanded upon in more detail in a set of action plans. The Cycling action plan, published in 2018, sets out TfL's strategy to make London "the world's best big city for cycling" (TfL, 2018, p.3). The plan, which is developed by TfL but expected to be lead by London's boroughs at a local level, is described as demonstrating a step-change in the city's approach to cycling. The plan sets out a range of actions designed to increase cycling levels in London, including expansion of the London-wide cycle network. Citing that "almost half of Londoners do not have access to a cycle in their home, and some trips that would be perfect for cycling, such as a quick hop to the office following a longer rail journey, are made more difficult by lack of access to a cycle" (ibid., p.82), the plan states that TfL is taking action to address this by both delivering and shaping bike-sharing services in London (ibid, p. 82). This includes improving TfL's own Cycle Hire scheme, Santander Cycles (popularly known as 'Boris Bikes'). The scheme, now its eighth year, provides a third-generation docking-station based system, with 11,500 bikes at 766 docking stations across London, predominantly in 12 boroughs central and inner London (TfL, 2019). In 2017, the scheme recorded its highest total number of hires in a calendar year (TfL, 2018). It is operated on behalf of TfL by a third-party operator and funded via a combination of customer-generate income, sponsorship and TfL subsidy (TfL, 2017). The action describes dockless bike-sharing as representing a great opportunity to make cycling more accessible and attractive for Londoners (TfL, 2018, p.82). The introduction of this new form of mobility to London is the subject of the following section.

5.2 The emergence of dockless bike-sharing in London

Dockless bike-sharing arrived in London in July 2017, when a large number of yellow dockless bikes landed unannounced on the streets of Hammersmith and Fulham, courtesy of Singaporean start-up oBike. Launched without the knowledge of the local authorities, oBike adopted a "launch and defend strategy" (Interview 1). The scheme also arrived absent of user education or guidance, resulting in misuse of bikes and public space; it appeared to be a "business model with no guidance associated with it at all" (ibid). oBike's approach drew a sharp response from the local Council, which told the company within days of launch to remove its "obstructive" bicycles from the borough's streets until a consultation on the scheme could place and issuing removal notices on bikes (Morrison, 2017, para.1). London's Walking and Cycling Commissioner, Will Norman, said, following oBike's arrival:

"We need dock-less bike operators to work with TfL and borough councils to ensure these bikes work for all Londoners and don't impact negatively on other cyclists, road users and pedestrians. These schemes have real potential to make cycling more accessible for many more Londoners but it is vital that they are introduced in a way that suits our capital." (Edwards, 2017, para.20-21)

Reflecting on the nature of oBike's launch in London, the Transport Committee of the London Assembly described it as "highly disruptive" (GLA , 2018, p.27), and had shown TfL to be have been unprepared for new use of technology in the private sector (ibid.).

Despite the early setbacks of dockless bike-sharing's introduction to London, a number of other operators soon followed (see Figure 9). Chinese firms Mobike and ofo and Irish company Urbo all commenced business in different parts of London, introducing thousands of bikes to the streets. Beset by a variety of issues, including bike theft, vandalism and economic viability, the latter two, along with oBike, have subsequently ceased operating in London. Thus, of the early movers, only Mobike are still operating, albeit within a reduced service area. New entrants to the market have nonetheless continued to emerge, now offering electric bikes, an indicator of the way the market is already evolving. Lime, the mobility company known in many cities for their shared scooters, launched its electric bike-sharing service in London in December 2018. In May, Uber introduced its own electric dockless bike-sharing scheme branded 'Jump'. Uber's incorporation of bikes into its smart mobility offering is, according to the company themselves, part of a scaling up of alternatives that reduce personal vehicle use in cities, in alignment with what cities are trying to do (Bliss, 2018). It is also, the company acknowledges, about meeting demand for all kinds of trips and becoming an "“everything company” for transportation" (ibid., para.7). Most recently, Freebike was selected by the City of London Corporation to bring its electric bikes to central London.



Figure 8: Jump bike, parked on the pavement in the City of London. Source: Author's own

Dockless bike-sharing operators in London (as of August 2019)

	Currently operating					Ceased operating		
Name	Mobike	Lime	JUMP	Freebike	Beryl	oBike	Ofo	Urbo
Launched	Jul-17	Dec-18	May-19	Jun-19	Jun-19	Jul-17	Sep-17	Nov-17
Ceased operating	n/a	n/a	n/a	n/a	n/a	Nov-17	Jan-19	Jul-18
Approximate number of bikes	1600	1000	350	200	350	1500	Approx. 200	250
Colours	Orange	Green / Yellow	Bright Red	Bright Yellow	Turqu -oise	Silver / Yellow	Yellow	Silver / Green
Bike Type	Pedal	Electric Assist	Electric Assist	Optional Electric Assist	Pedal	Pedal	Pedal	Pedal
London Area	Inner, West	Inner, NW, SE	Inner	Inner	North	All London	North: Hackney, Islington & City	North east: Waltham Forest

Figure 9: Dockless bike-sharing operators in London (as of August 2019). Source of data: Oliver O'Brien, Suprageography, <https://oobrien.com/>

It is evident that dockless bike-sharing has been seen by London authorities as an opportunity to extend bike-sharing services beyond the current boundaries of the TfL Cycle Hire scheme. Shortly after its arrival, London Councils described it as “an example of new technology and private funding that could create real transport benefits for London” (Mortimer, 2017, para.12) and as presenting “an opportunity for boroughs without Santander Cycle Hire to bring privately funded cycle hire to their area” (ibid., para.9) The Cycling action plan describes dockless bike-sharing as representing an opportunity to make cycling more accessible, “especially in areas such as outer London, where providing Santander Cycles is less feasible” (TfL, 2018, p. 82). Mike Beever, Senior Policy Manager, Transport Innovation at TfL, notes the potential of private sector bike-sharing schemes to help deliver MTS targets, in particular the target of 80% of journeys to be made by cycling or walking, by making bikes more available across London:

“If there is a private sector opportunity to expand bike hire to every London borough, then there’s a great opportunity there to get more people riding bikes – so there are some really tangible, positive opportunities here and we welcome those. The question is - how do you make those work for everybody?” (Interview 1)

At the heart of this question, is the use of public space, “it boils down to making sure that public space is usable for everybody – that’s the bottom line” (Interview 1). Dockless bike-sharing operation in London have been perceived as adding street clutter (Steer, 2019). Mike Beever refers to the prospect of dockless schemes making public spaces unsafe or unusable, for example for people with disabilities or using pushchairs: “you suddenly have got a pavement strewn full of bicycles and you have got a problem” (Interview 1). For TfL, this represents a challenge that is important to solve both politically and in terms of safety, its primary concern as an organisation: “It’s up to us to assert the rights of the public and to help councils to do the same where those businesses are operated from the public realm” (Interview 1): Asserting such rights however, has proven difficult within what has been described as a “a regulatory grey area” (Steer, 2019).

Under current legislation, dockless bike-sharing operators do not require consent or licence to operate because they do not place infrastructure on London’s roads. Authorities, therefore, lack regulatory powers for this new presence on their streets. Instead, wishing to manage the influx, the only grounds upon which borough councils could rely was to remove bikes for causing nuisance, obstruction or danger, relying to do so legislation dating back to the Highways Act 1980. Having not been designed for these purposes, it is clear that such regulation is not fit for purpose; “It treats bikes as clutter rather than as transport” (McIntyre & Kollwe, 2019, para.33). As such, dockless bike-sharing services have been described as having “exposed the outdated levers that local government has to manage their presence on London’s streets” (Steer, 2019, para.2). Mike Beever acknowledges the issue faced by London’s authorities:

“There is a gap...The question is, what should we do about that gap, now that there’s something new that’s in it? And that’s the exam question now facing public sectors authorities who are thinking about how cities run.” (Interview 1)

Seeking to fill this gap, in September 2017, TfL issued a ‘Dockless bike share code of practice For Operators in London’ (TfL, 2018). The Code of Practice (CoP) was developed in collaboration with the London boroughs and sets out the ‘blueprint’ for safe and responsible operations based on experience up to that point which, in light of the way oBike had entered and operated in London, were deemed necessary (Interview 1). Indeed, the oBike scheme is described as having proved “useful because it enabled us to immediately get a snapshot of what bad looked like. If you know what bad looks like you can have a better first attempt at what good looks like” (Interview 1). This was thus reflected in the first version of the CoP, which sought to set out what a safe and responsible version of dockless operations look like (interview 1).

Having obtained more operational experience, the CoP was updated and reissued in September 2018. It sets out a variety of “requirements and recommendations that Operators are expected to follow as part of delivering safe and effective schemes in the Capital” (TfL, 2018, p. 3). These include the instruction for operators to engage with relevant authorities prior to launching a scheme, and the requirement that schemes are operated to as not to cause disruption, with the instruction that they must not restrict or affect the use or enjoyment of footways or other public spaces, as well requirements on safety standards and customer experience and education. The latest version was updated to explicitly include electrically assisted bicycles. Whilst the CoP is a guidance document, and therefore lacks regulatory force, it has introduced some basic parameters and, in Mike Beevor’s view, has proven quite useful in helping to “control the market” (Interview 1).

The CoP also contains the requirement that operators must share anonymised trip data with the local authority and with TfL “to help enhance the cycling network” (TfL, 2018, p.12). TfL are very interested in accessing the data produced through dockless bike-sharing schemes because of its potential to provide a pan-London digital overview of travel patterns and cycling corridors and assist in the authority’s decision-making process:

“what better way to inform your investments decisions about junction safety improvement than by getting as much cycling data as possible about where the flows of people are – we don’t have that at the moment” (*Interview 1*).

TfL is not getting a feed of data from operators currently, but this data is being shared with local authorities. Whilst this is not viewed as a large data gap at present, “as the sector grows, as we assume it will, that will be a more pressing gap to fill” (Interview 1).

The CoP has, however, given rise to some unwanted consequences that boroughs and their elected councillors have raised concerns over (Interview 1). Whilst the CoP led to more engagement between councils and bike-sharing operators, in the absence of pan-London scheme each council can, and does, take its own position with regard to the management of dockless schemes. Each have placed separate requirements upon operators and/or run separate selection processes; there is an absence of coordination (Interview 2). The localised, borough-by-borough, nature of this governance structure has placed arbitrary boundaries upon bike usage:

“...you can have two neighbouring boroughs, where cyclists are being asked to confine their journeys to within the London borough where the council has approved the bike company. And that is counterintuitive, if you want to expand people’s willingness and ability to cycle” (Interview 1)

The current system thus contributes to a “patchwork of provision” which does adequately provide for users’ needs (Interview 2). It also presents a challenge for dockless operators, with local boroughs placing different criteria upon the business model, some extensively than others. This is recognised at TfL: “you need 10 different versions of your company to operate in 10 different versions of the city which is not really sustainable for business” (Interview 1) and has led to the London Assembly Transport Committee to conclude that London’s local government landscape poses a significant obstacle to the growth and take-up of dockless services (GLA , 2018).

In addition to the CoP, CoMoUK, a trade body which aims to play a leading role in the UK’s transition to integrated mobility solutions (CoMoUK, u.d.), oversees the accreditation and monitoring of shared mobility in the UK, including dockless bike-sharing. CoMoUK’s accreditation criteria require operators to never operate in an area where the local authority has not given permission (McVean, 2019). Like the CoP, however, this accreditation scheme is voluntary.

Thus, there is, a lack of enforceable regulatory power available to local authorities to manage dockless bike-sharing operators, as well an acknowledgement that the current borough-by-borough structure inhibits the dockless model. In light of this, TfL and London Councils are now together to introduce a pan-London operating and regulatory framework, supported by a new bylaw.

The bylaw is intended to “to create a simpler system for both dockless operators and users” (TfL, 2018, p.56) and will likely allow borough authorities to exert some control dockless bike-sharing operations by designating approved parking areas or ‘virtual docking stations’ (McVean, Dockless Cycle Hire, 2019). Operators whose bikes are left outside of such areas could be penalised, thus allowing borough authorities to restrict parking provision and steer the behaviour of operators (Interview 2). The bylaw proposal is being explored in the absence of any national initiative, with

central government having indicated that there is no appetite for legislation on the issue (McVean, Dockless Cycle Hire, 2019). Mike Beevor explains further:

“[The bylaw] is the next step. The regulatory work that I’ve been doing is built around...responsible parking and about parking in agreed places where the Councillors can say yay or nay, and that is the thing that’s missing in regulatory terms, in legislative terms, because of there are no instructions about where you can and can’t park bikes – this would create that.” (Interview 1)

In short, the bylaw is deemed necessary in order to give local councils “safeguards over their public space” (interview 1), whilst also creating a governance structure more conducive to the operating model: “what happens if we get rid of those borough boundary lines? Because that’s what will need to happen for these business models to succeed and get more people riding bikes” (ibid.).

At present, however, there is uncertainty about the likely impact of the bylaw (Interview 2). The extent to which it will restrict the dockless bike-sharing business model will depend on how much parking space councils want to make available, something that Mike Beevor acknowledges will vary between local boroughs; “there is naturally a tension there between companies that want to get on with it and win market share and councils that might be more cautious” (Interview 1). Indeed, despite the pan-London nature of the bylaw, local differences will remain, as Mike Beevor explains:

“There will be councils that say,...’we are pretty relaxed about this and we have got loads of space because we’re in outer London and you can basically park where you like’ but there will be some councils in central London that have not got very much space in them and a very high footfall, who will be very nervous about giving up too much space” (Interview 1)

This local difference is reflected in the dockless bike-sharing experiences of the City of London Corporation and the Waltham Forest Council, which are examined in the following sections.

5.3 Local perspective 1: City of London

The City of London is the main business and financial district in the centre of London (GLA, n.d.). Often referred to as the ‘Square Mile’, the area is the smallest local government district in London, but home to the second largest number of jobs. Whilst having a small number of residents, it therefore has an extremely high daily footfall. TfL Cycle Hire operates within the City of London.

The City of London formally adopted a policy on dockless bike-sharing operations within its borders in October 2017. This policy allows dockless bikes on its streets but does not allow

operators to actively deploy bikes, i.e. bikes can be made available for hire if left in the City by a customer but cannot be deployed by an operator (McVean, 2019). The policy was adopted on the basis that “the street layout and extremely high footfall in the City means that highway in the City is an unsuitable location for dockless cycle hire operations to be based” (McVean, 2019, p. 10) and was formed in response to pressure from the City’s Councillors (Interview 2). Mobike and ofo have both operated in the City in accordance with this policy. Both operators agreed not to place bikes directly on City streets, but users were able end rides in the City and those bikes are then available for onward hire (McVean, 2018). As described above, dockless bike-sharing schemes do not require the express consent of the authorities to operate on London’s streets. Therefore, the aforementioned arrangements were voluntary in nature (ibid.).

The policy had mixed success. Whilst it did limit negative public space impacts, the popularity of the City as a destination meant bikes of operators without a formal agreement, such as Lime, were nonetheless left within the city. Operators lobbied the City to change approach (Interview 2). Bruce McVean, Strategic Transportation Group Manager at the City of London Corporation, the presence of dockless bikes in the city showed that there was a demand for them, and the view was thus “let’s facilitate it” (Interview 2). In June 2019, the City therefore commenced a six-month trial to test a new approach to the management of dockless bike-sharing. The aim of the trial is to help inform the City Corporation’s future approach and acts as means to test the effectiveness of the regulatory powers coming into force under the aforementioned byelaw, particularly in terms of user compliance and how operators respond to bikes left outside of agreed locations (McVean, 2019). In proposing the trial, the City acknowledges the interests that must be balanced:

“There is a possible reputational risk to the City Corporation if innovative approaches to enable more cycling and increasing sustainable and healthy transport modes are not carefully considered. There are also possible reputational risks if potential adverse impacts of dockless cycle hire operations are not carefully managed.” (McVean, 2019, p.7)

The trial allows operators who meet specific selection criteria to deploy a fixed number of bikes within the Square Mile. Appropriate parking locations, where bikes can be left for hire by operators or customers, are marked for use (see Figure 10). These locations are adjacent to existing cycle parking facilities and have been identified “having regard to the City Corporation’s highway authority responsibilities to highway users, its traffic authority responsibilities for network management and its equality duties” (McVean, 2019, p. 4). 250 spaces have been made available. The trial represents a controlled loosening of the previous policy in that it allows bikes to be deployed in the City, but only within approved, limited areas.



Figure 10: 'Virtual docking station' in the City of London. Photo: Author's own.

In addition to the aforementioned parking restrictions, a number of additional requirements are placed upon operators taking part in the trial. These requirements include having appropriate processes in place to remove excess bikes or redistribute inappropriately parked bikes within a fixed period of time. A further requirement is for the operator to share data with the City Corporation on a monthly basis, including data on bicycle usage, response times for dealing with complaints or bikes left outside of agreed areas and user demographic data (McVean, 2019). McVean highlights the value placed on different types of data by the private and public sector. From a public authority perspective, the benefit is to obtain anonymised data that can be used for planning purposes and management purposes (Interview 2).

Following an open call and selection process, in which seven operators took part, Freebike and Beryl were selected to take part in the trial and each afforded space for 150 bikes. It is anticipated that more space will be required in future. However, with the City already under pressure to find additional space for 'traditional' cycle parking, finding this space represents a challenge (Interview 2). This was reflected in Mike Beever's expectation that "central London boroughs will not make enormous amounts of parking space available because they've got to manage space – and they can't create any more of it" (Interview 1).

Part of the task for the City is in managing the 'tidal flow' patterns of cycling in the city, an issue also faced by the TfL Cycle Hire scheme (Interview 2). The pattern is one of users wishing to bring bikes into the City in the morning rush hour and requiring bikes in the City during the evening rush hour. This usage is thus not self-regulating, and puts extra demand on both space

and resources, serving as an example of the imbalance problem highlighted earlier. Another issue that has become apparent is that of terminology (Interview 2). In such a novel and emerging form of mobility as this, a common vocabulary is still to be established. Terms such as ‘operating area’, ‘deploy’ or even ‘ride’ can mean one thing to one authority or operator and one thing to another (ibid.).

The success of the trial, which is due to complete in December 2019, will be assessed against four metrics: rider parking compliance; the time taken by the operator to respond to an inappropriately parked bike; number of complaints, and ridership numbers (McVean, 2019).

5.4 Local perspective 2: Waltham Forest

An outer London borough located in the North East of the city, Waltham Forest is an urban area with a young, growing, multicultural community. In 2014 the borough secured funding from TfL to turn Waltham Forest into a ‘Mini-Holland’ borough and radically improve its cycling infrastructure. The intention to develop Mini-Holland programmes in London’s outer suburbs was part of Mayor Boris Johnson’s ‘Vision for Cycling in London’ (TfL, 2013). Described in that document as the most transformative of the Vision’s policies, the Mini-Hollands were so called because “the idea, over time, is that these places will become every bit as cycle-friendly as their Dutch equivalents” (GLA, 2013, p. 16). They would be a “fantastic opportunity for these boroughs to achieve dramatic change – not just for cyclists, but for everyone who lives and works there” (GLA, 2013, p. 16), with the main focus on cycle trips replacing short car trips within the target boroughs. The works carried out thus far have included a substantial town centre redesigns, installation of a network of safe and direct cycle routes, as well as several cycle parking ‘superhubs’ at local railway stations. The borough has no TfL Cycle Hire presence within its borders.

Waltham Forest has taken a proactive approach to dockless bike-sharing and in October 2017 became the first London borough to sign a Memorandum of Understanding with an operator, namely Urbo. In doing so, thirty-four bike parking ‘stations’ were created in an effort to facilitate dockless bike-sharing, some physical (using markings and Urbo-branded signs) (see Figure 11), and some virtual, while freedom to park bikes anywhere was nonetheless permitted. The Council viewed the scheme as helping to make cycling convenient and accessible, offering affordable sustainable transport for the borough (McDonnell, 2017). In April 2018, however, Urbo withdrew operations from Waltham Forest (and the rest of the UK shortly after), for financial reasons (Interview 3).



Figure 11: 'Virtual docking station' in Waltham Forest. Source: O'Brien, 2017

In June 2018, the Borough became the first to officially launch a scheme with ofo. While Urbo had been proactive in redistributing bikes and providing the council the reliable data reports, the Council found this not to be the case with ofo (Interview 3). In November 2018, ofo withdrew operations from the borough, becoming the second dockless operator to have signed an agreement to provide dockless bike-sharing before ceasing operations within six months. ofo informed the council they were withdrawing operations from the borough, as well as other outer London boroughs, in order to constrain focus on central London during the winter months, when bike usage would reduce. By January 2019, however, the company had withdrawn operations from London all together (Interview 3). This followed its withdrawal from other UK cities due to reported issues with usage levels and vandalism (McIntyre & Kollwe, 2019).

Following the ofo's withdrawal, the Borough did not actively look for another dockless bike-sharing operator. Conversations have taken place with a variety of dockless operators but have not yet lead to the launch of a public scheme. A small-scale staff pool bike scheme with operator Freebike for Council staff has been introduced with a view to a launch of a full public scheme. Daniel Gosbee, Technician at the London Borough of Waltham, reports that the authority have had a positive relationship with Freebike, who, as well as providing the staff scheme, have supported cycling events in the borough (Interview 3), and that there is excitement over the dockless electric-bike market which may be well-suited to the geography and topography of the borough.

The Borough's experience with dockless bike-sharing is notably different to that of the City of London. Whilst parking and vandalism issues have occurred, they are not seen as a big issue and they are satisfied with the responsiveness of operators when rogue bikes appear. Its greater size, in comparison to the City of London, also means that it can take a relaxed approach:

“As an outer London borough we've got completely different challenges and expectations than the City of London...they might think that we're too relaxed, our outlook might be damaging to what they want.” (Interview 3)

This relaxed approach means that the Borough is less inclined to restrict parking areas upon the potential introduction of the incoming bylaw:

“...it's about choice, people want to take [bikes] home, take them to the cinema, take them shopping, to the centre, that's what we want as a council, we want people to be walking and cycling and being more active as part of their transport and travel.” (Interview 3)

Daniel Gosbee is aware that the current patchwork nature of the dockless provision and governance is problematic for the provision of dockless cycle hire, acknowledging that while residents simply want to make journeys from their start point to their end point, regardless of borough boundaries, “Councils see themselves as islands” (Interview 3). Furthermore, the attitude taken in each borough towards bike-sharing varies, something Gosbee notes is not necessarily dictated by location and size. For example, Waltham Forest's neighbouring outer London borough, Havering, have taken a markedly different approach to dockless, “they just want them gone” (ibid.). Ensuring a consistent approach to dockless bike-sharing across London's many local authorities is evidently problematic: “One of the biggest problems in London is that we are all different boroughs, we're all different councils. ... We are different cities in many respects” (ibid.)

5.5 The operator's perspective: Mobike

Founded in Beijing in 2015, Mobike is the world's largest bicycle hire company by number of vehicles (Aouf, 2018) and has a stated mission to reduce traffic congestion and to contribute to greener and smarter cities (Mobike, u.d.). Since launching in London in 2017, the company has made a big transition in its business model in London (Interview 4). The initial approach upon entering the London market was to work closely with local authorities. A Memorandum of Understanding was signed Ealing Borough Council, the first area of London in which the company operated. Since then the company slowly expanded its operations and number of bikes available across the capital, signing formal agreements with a number of borough councils. In Islington, a request was made, and agreed to, that Mobike make a contribution toward cycling initiatives in the borough. To an extent, relationships between Mobike and local authorities proceeded on the

basis of trust; in light of the absence of enforceable regulation, normal procurement and licensing processes were not fit for purpose for the dockless business model (Interview 4). During the initial launch phase, Mobike deployed tens of thousands of bikes onto the streets – not, in its view, a ‘flood’ of bikes as was variously reported but at the appropriate density for the service they aimed to provide. The London market at this point was “fierce, extremely competitive” (Interview 4), with other firms, such as oBike and ofo also operating and aiming for quick expansion. With dockless bike-sharing having emerged in China, nobody really knew how the system would work in a European context. Duncan Robertson, Head of Business Strategy and Government Affairs at Mobike, acknowledges that the operator, in its early stages, both overpromised and underestimated the challenge of operating in a city like London (ibid.).

Within this environment, and in order to operate a sustainable business, indeed to “survive” (Interview 4), Mobike had to consider not adhering to what Robertson refers to as the soft law” of the CoP and CoMoUK accreditation (ibid.). With no law or regulation that prevents them operating as they see fit for business purposes, the company makes a “strategic call” on how close to adhere to a local authority’s desire to enter into an agreement. For example, the cost of agreement with Islington highlighted above, became financially unjustifiable and the agreement thus fell, while Mobike continued to operate in the borough (ibid.).



Figure 12: Mobike dockless bikes in Islington, London, stationed next to a Santander Cycles docking station. Source: Wu, 2017

The company has subsequently reduced its operating area which had become unmanageable, withdrawing operations from areas that were less profitable. Instead, it has focused on two zones of operation, aiming for sufficient density of bikes and utilisation of bikes within them (see Figure

13). Mobike is aware of the need to balance its own desire to provide increased bike density with the potential for negative reactions from residents, as bikes may be perceived by some to clutter streets not designed for their presence (Interview 4).



Figure 13: Current Mobike Operating Area in London. Source: mobike.com

The patchwork nature of London’s “particularly complex governance structure” (Interview 4) has proven problematic for Mobike, with multiple authorities having different strategies and taking different approaches to bike-sharing. Whilst, in theory the aims of each borough reflect the aims of the MTS, thus ensuring a level of consistency, in reality boroughs have shown varying levels of commitment to removing barriers to cycling, with some very committed and others less so. For some, it is merely a “box-ticking exercise” (ibid.). The approach taken by each borough affects the operators’ ability to function within their boundaries. For example, Mobike has expressed that the City of London’s requirement that bikes causing nuisance or obstruction be removed within 90 minutes as a challenge for any operator to meet (McVean, 2019). There is also conflict between borough boundaries and the way in which people actually want to use bikes. From Mobike’s perspective, operating in an environment with a single authority, or a more coordinated approach from authorities would be beneficial. Whilst the proposed bylaw is, in part, designed to remove the borough-by-borough arrangements, Robertson notes that boroughs will have retain the ability to limit operations through their approach to cycle parking and will still likely take different approaches. For the virtual docking station approach to work effectively, a significant number would be required in order to provide the required density (Interview 4).

Furthermore, there may be a misconception from some Councils that following the introduction of the bylaw, dockless firms will have the freedom to operate all across London and will thus do so. In reality, the profit motive will drive operators to operate in central areas. As such, the “egalitarian goal” of the bylaw will fail (Interview 4). Robertson notes that one of the recent entrants to the London market, Freebike, appear to have learnt lessons from previous operators,

servicing only a small, central, geofenced area. From Mobike's perspective, if the desire from London authorities is for dockless bike-sharing to help expand bike-sharing across London, then there is a need to develop a mechanism to balance the operators' need to work in the central, profitable areas, with an incentivisation for them to also provide services in less profitable or higher risk areas, for example through risk mitigation (sharing the risk of lost or vandalised bikes), or subsidy, something that TfL do not appear keen to provide. If market forces work 'naturally', however, then only central areas may ultimately be served because the profit margins of dockless operations are so low (Interview 4). Mobike's operations in the borough of Hackney provide a useful example. The local council's preference was that Mobike operate across the whole borough, thus serving its goals of inclusivity and breaking down barriers to cycling for all residents. Parts of Hackney, however, became particularly problematic for Mobike in terms of bikes being lost or vandalised and thus represented a risk. Without the Council taking any of the risk upon themselves for services to be operated across these areas, it was not sustainable for Mobike to serve them (Interview 4).

Looking forward, Mobike acknowledge the need for an open relationship with local authorities in London and that "dialogue is essential" (Interview 4). This dialogue can help to strike a balance between the business pressures faced by the dockless bike-sharing operator and the local authority receiving the type of service that they want. Despite the previous contraction of its services in London, Mobike hopes to expand its operating area in the future and to grow its user base. The company is "still learning, but almost there" (ibid). With regard to the future of dockless bike-sharing, Robertson acknowledges that the future is hard to predict and that the market is likely to continue to realign. From the TfL perspective, the future is also hard to predict and a question remains as to whether a viable business model can be found:

"It might all go away... Everybody that's doing this might say...there's no money to be made here, this is not a viable business.... This might completely change the way cities run and in 20 years people will wonder how they ever got by without it... There are new choices being given to people in cities about how they make their choices – how much will they adopt them?" (Interview 1)

6. Analysis

This part presents the analytical findings of the case study. Here, the results presented in the previous section are interpreted through the lens of the theoretical concepts set out in part 3. The section is divided according to themes that have emerged through analysis of the results, although there is much overlap between the themes.

The case of dockless bike-sharing in London demonstrates ways in which niche innovation can struggle to incorporate easily into an existing socio-technical configuration and can thus struggle to break through and into a regime. London's institutions and actors portray a strong discursive intent to encourage active travel and improve conditions for cycling - to fundamentally change the way people choose to move around in the city. This can be seen to reflect broader landscape conditions, such as the need to address climate change and public concern over air quality. Such an intent would appear to open a window for innovation that can help to fulfil these local policy goals. In this sense, dockless bike-sharing is well aligned with the stated aims and objectives of the city's transport strategy. In particular it is seen as means to bring bike-sharing to parts of London where it has not been possible to extend Santander Cycles. This is reflected in the proactivity and positivity that Waltham Forest has shown towards dockless bikes. Furthermore, authorities recognise the potential benefit of access to data produced through dockless bike-sharing, data that can be used to assist in planning cycling infrastructure. However, as an innovation, dockless bike-sharing has evidently struggled to gain momentum and establish itself in the London transport system. This can be attributed to a number of factors that are set out below.

6.1 Lack of socio-spatial legitimacy

The way in which dockless bike-sharing was launched in London by oBike, without the knowledge of, or collaboration with, local authorities, meant that it did so without having established its ability to help fulfil local transport policy goals. It failed to build local support in advance of launch and appeared to not adequately account for the local conditions into which the innovation was being inserted. This was reflected in Mobike's acknowledgement that, having developed its model in China, it had underestimated the challenges of operating in London. In this early stage, the Chinese models were, to extent, being supplanted into a foreign context without sufficient regard for local conditions. The niche, at this point at least, lacked legitimacy. The impacts of the scheme on the built environment intensified the need for collaboration between the operator and public authorities, collaboration which had been absent. The rapid and competitive nature of the innovation's arrival in London appears to have further served undermine its legitimacy. Dockless bike-sharing models appear to have subsequently undergone a learning process and operators have more proactively worked to gain legitimacy, taking part in 'institutional work', but it is evident that these aspects have hindered the innovation's momentum.

6.2 Public space conflict

The primary factor that has hindered momentum is dockless bike-sharing's need for flexible parking, which runs counter to the expected and culturally approved, use of public space, even if it is not unlawful, and requires new user practices. Use and misuse of the dockless bikes in public space has been a source of friction, both between city users and between public and private sector actors. London wants to increase cycling by making it more accessible, but the results show that ensuring public space is safe and accessible for all users is a more fundamental objective. Dockless bikes have been considered to pose a risk in this regard, placing operators in conflict with public authorities.

The conflict over public space centres on use of the pavement, a shared space and a limited resource upon which dockless bikes are adding extra pressure. In this regard, dockless schemes are being introduced into the established regime, a regime which is spatially dominated by cars. As the city's transport strategy acknowledges, planning in London has historically been car focused (GLA, 2018), reducing alternatives and, it might be added, reducing public space for such alternatives. The physical urban landscape has been designed based on the existing car-based regime, and this acts as a stabilising mechanism that restricts a radical alternative that has different infrastructural needs and thus lacks compatibility with it.

Returning to the notion of cycling as a subaltern regime, this can be seen to be particularly so in London, where the cycling mode share is only two percent and cycling, as TfL acknowledge, cycling is not normalised (TfL, 2018). Dockless bike-sharing has made cycling much more visible and present in urban space, generating friction. Potential changes as regime level, in the form of more and better cycling infrastructure, may serve to create a more conducive environment in which dockless bike-sharing can gather momentum.

6.3 Regulation and governance

As discussed earlier, mismatch with existing regulation can act as a mechanism that hinders innovation. In this case, however, operators have thus far largely been able to bypass regulatory constraints, with authorities reliant upon outdated levers not designed for this new form of mobility. The CoP was introduced in an effort to help steer the development of dockless bike-sharing and now, largely due to the public space conflict, regulation is set to be introduced, intended to give local authorities safeguards over the use of public space. This can be seen as an example of adaptive governance, as the authorities seek to adjust to the presence of dockless bikes. It is argued that the nature of the adaptation has primarily been focused on managing negative externalities. However, in framing this as asserting the right of the public (interview 1), a notion

of ensuring public value is delivered can be seen as a driving force, albeit one that may act to further restrict the innovation.

The incoming regulation presents a mismatch with dockless bike-sharing optimal operating model. The extent to which its introduction further restricts its momentum will depend on how it is interpreted at a local level. Nonetheless, the introduction of the bylaw can be seen as an example of the ability of prevailing institutions to pose barriers to the development and diffusion of niche innovation (van Waes et al., 2018). The proposed introduction of parking limitations by public authorities, and the restriction this will place on the operating model, highlights the incumbent regime configurations through which a niche innovation is constrained, and interpreted. It would be misguided to assume that all boroughs will only use the powers contained within the forthcoming bylaw for the genuine purpose of managing negative externalities. Rather, it is possible that some may use this power to restrict a subaltern practice which they do not support. This may serve to exacerbate the way in which London's complex governance structure has thus far hindered the diffusion of dockless bike-sharing in London. While on a city-scale a strong priority given to policies to support cycling, this is interpreted variably at a local level in London. The complex London governance structure, through which the regulation will be interpreted at a local level, poses a significant obstacle to the growth of dockless services.

6.4 Protective space

Innovations which receive more protection are more likely gain momentum and diffuse more widely. Hindered by London's complex governance structure, dockless bike-sharing has only received geographically limited, partial support. To an extent, investment capital has acted as a form of protected space for dockless bike-sharing, shielding it from market forces for a time. However, as evidenced by the operators that have ceased operating thus far in London and the doubt over whether a viable formula exists to make dockless bike-sharing a viable business, protective space requires more than market support.

In MLP terms, dockless bike-sharing requires greater protective space for business models to develop and for it to gain momentum as a niche innovation. For example, public authorities could provide support through subsidy or risk-mitigation in order to enable operators to provide services in higher-risk or less lucrative areas, thus allowing dockless schemes to diffuse more widely. This would perhaps facilitate dockless bike-sharing to operate in outer London areas such as Waltham Forest, where thus far the model has not proved resilient or viable. Such an approach would help to shield the niche and would arguably create more public value by ensuring more of the public are served by the innovation. While London's third-generation scheme has been provided with the aid of public subsidy, fourth generation schemes have thus, far, operated independently. Given the potential of the dockless bike-sharing in making cycling and its associated benefits more

accessible, and the financial fragility of the schemes, this is something that public authorities may need to reconsider in the future if dockless bike-sharing is to be truly able to support the transport objectives with which it aligns.

7. Discussion

This thesis aimed to provide a detailed understanding of the implementation dockless bike-sharing in London. This has been achieved through analysis of documentary evidence and insight from stakeholders integrally involved in the case. Of course, with any complex, multi-actor process such as this, additional stakeholder input can offer alternative viewpoints, but it is hoped that the range offered here has enabled fulfilment of this aim.

The thesis further aimed to contribute to knowledge on the dynamics and governance of niche innovations within the field of socio-technical transitions. It has done this by examining the niche dynamics of an emerging form of mobility thus far relatively understudied. The results support the notion that niche innovation can struggle to incorporate easily into an existing socio-technical configuration such as the transport system. It also supports previous research on bike-sharing which suggests that conflict with institutions governing public space can hinder momentum (van Waes et al., 2018), as well that which shows the importance of socio-spatial conditions and working to gain legitimacy (Dudley, 2019). It is hoped that the research has added to knowledge in the field by revealing the niche dynamics of a disruptive, private-sector led innovation, and added insight into the challenges created by the unfolding urban mobility transition. In doing so, it has also responded to calls for scholars to engage with cycling as key area for innovation in urban mobility transitions

Dockless bike-sharing in London is still very much in the evolutionary phase and has proven to be business defined by a lack of stability. As such, this study has only captured its dynamics at this moment in time and it remains to be seen whether its momentum will speed up or slow down. Much will depend on the role of local authorities and how they facilitate how constrain dockless bike-sharing through implementation of the forthcoming regulation. The willingness of consumers to change mobility practices will also be significant. This study has not been able to sufficiently investigate the role that dockless bike-sharing might play in instigating norm shifts. Potentially, through interactions and accumulations with other smart and shared mobility innovations – particularly as part of the rapidly developing micromobility field, bike-sharing may lead to wider changes in norms and values that could lead a wider socio-technical transition. It is worth remembering the role of the bicycle in the transition to the automobility regime, acting as a catalyst while ultimately losing importance in its own right (Geels, 2005). It may be that dockless bike-sharing will itself lose momentum, but its introduction could nonetheless play a part in a larger system change (Geels, 2011).

7.1 Future research

There are a variety of aspects that would be worthy of future research. Firstly, given the developing nature of this form of urban mobility, this case study could be revisited again in the future, perhaps order to investigate its impact of regulation, once implemented. The case study, it is acknowledged, has not taken sufficient account of the user perspective. Thus, an analysis that takes account of user needs and preferences would add to the understanding of the cultural impact of this type of innovation. Further research could also investigate the introduction of dockless bike-sharing within a more normalised cycling culture to reveal whether similar frictions would be revealed or whether such a culture would enable it to fit within regime more easily.

8. Conclusion

Dockless bike-sharing is part of a new wave of smart and shared mobility services that are aiming to transform the way people move around cities. As an innovation, it holds the potential to make cycling more accessible to more people and offers cities an opportunity to achieve transport, health and emissions goals. Its introduction to the streets of London, however, has been disruptive and created challenges for the local authorities. These authorities, in turn, have sought to restrict and regulate in order to steer the direction that this new form of mobility will take, and to reassert stability in the transport system. It remains to be seen what effect this regulation will have but much will depend on how it is implemented at a local level given the nature of London's complex governance structure.

Finally, returning briefly to the research questions that were set out at the beginning of this thesis, the following can be stated:

To what extent does dockless bike-sharing align or conflict with the aims and objectives of local authorities governing governing public space in London?

Dockless bike-sharing aligns with the city's objective to reduce car dependency and encourage active travel by offering a form of mobility that can facilitate this. It is viewed as having the potential to make cycling more accessible, particularly by bringing bike-sharing to parts of the city that do not currently have a TfL Cycle Hire presence. Furthermore, it has potential as a valuable data source that can support cycling infrastructure investment decisions.

The implementation of dockless schemes has, however, conflicted with the public authorities' need to ensure public space is safe and accessible for all users. Bikes have been viewed as adding street clutter to limited shared spaces and have thus been a source of friction, both between city users and between public and private sector actors.

What insights does the case of dockless bike-sharing in London provide into the dynamics of niche innovation within the urban mobility transition?

The case has illustrated a number of ways in which a niche innovation can struggle to incorporate easily into an existing socio-technical configuration. In particular, it has been shown that those that introduced early versions of the innovation failed to collaborate and build local legitimacy or pay sufficient regard to local conditions, resulting in stifled early momentum. Furthermore, dockless bike-sharing's demand for flexible parking requires user practices and use of space that does not easily incorporate into the existing physical urban landscape, thus creating conflict and friction which has acted to stifle its momentum. This has contributed to the innovation only

receiving partial, geographically-limited support from public authorities, compounded by London's complex governance structure, a structure which has not proved supportive dockless bike-sharing operating model. It is posited that if dockless bike-sharing is to build momentum as a niche and achieve its potential to expand the reach of bike-sharing in London, greater support is required from public authorities.

References

- Akyelken, N., Banister, D., & Givoni, M. (2018). The Sustainability of Shared Mobility in London: The Dilemma for Governance. *Sustainability*, 10(420). doi:10.3390/su10020420
- Aldred, R. (2010). On the outside: Constructing cycling citizenship. *Social & Cultural Geography*, 35-52.
- Aldred, R. (2013). Incompetent or Too Competent? Negotiating Everyday Cycling Identities in a Motor Dominated Society. *Mobilities*, 8:2, 8(2), 252-271.
- Aldred, R., Woodcock, J., & Goodman, A. (2016). Does More Cycling Mean More Diversity in Cycling? *Transport Reviews*, 36(1), 28-44. doi:10.1080/01441647.2015.1014451
- Amit, R., & Zott, C. (2012). Creating value through business model innovation. *MIT Sloan Manag. Rev*, 53, 41-49.
- Annema, J. A., van den Brink, R., & Walta, L. (2013). Transport technology to reduce transport's negative impacts. In B. v. Wee, J. A. Annema, & D. Banister, *The transport system and transport policy : an introduction* (pp. 163-206). Cheltenham, UK: Edward Elgar.
- Aouf, R. S. (2018, August 13). *dezeen*. Retrieved from Mobike launches electric bike for dockless sharing: <https://www.dezeen.com/2018/08/13/electric-mobike-dockless-share-bike/>
- Audouin, M., & Finger, M. (2018). The development of Mobility-as-a-Service in the Helsinki metropolitan area: A multi-level governance analysis. *Research in Transportation Business & Management*, 27, 24-35.
- Bachand-Marleau, J., Lee, B. H., & El-Geneidy, A. M. (2012). Better Understanding of Factors Influencing Likelihood of Using Shared Bicycle Systems and Frequency of Use. *Transportation Research Record*, 2314, 66-71.
- Bachand-Marleau, J., Lee, B., & El-Geneidy, A. (2012). Better understanding of factors influencing likelihood of using shared bicycle systems and frequency of use. *Transportation Research Record: Journal of the Transportation Research Board*, 2314, 66-71.
- Bhardwaj, P., & Gal, S. (2018, 3 July). *The number of bike-sharing programs worldwide has doubled since 2014 — and the number of public bikes has increased almost 20-fold*. Retrieved from Business Insider: <https://www.businessinsider.com/bike-sharing-programs-doubled-since-2014-public-bikes-charts-2018-7?r=US&IR=T>
- Bidmon, C. M., & Knab, S. F. (2018). The three roles of business models in societal transitions: New linkages between business model and transition research. *Journal of Cleaner Production*, 178, 903-916.
- Bland, B. (2017, May 5). *China's bicycle-sharing boom poses hazards for manufacturers*. Retrieved from FINANCIAL TIMES: <https://www.ft.com/content/bfba9f6e-299c-11e7-9ec8-168383da43b7>
- Bliss, L. (2018, April 11). *Uber Pivots to On-Demand Everything*. Retrieved from CityLab: <https://www.citylab.com/transportation/2018/04/uber-pivots-to-on-demand-everything/557528/>
- Bolton, R., & Hannon, M. (2016). Governing sustainability transitions through business model innovation: Towards a systems understanding. *Research Policy* 45 , 45, 1731–1742.
- Bonnette, B. (2007). The Implentation of a Public-Use Bicycle Program in Philadelphia . *Thesis, University of Pennsylvania*.
- Bryman, A. (2008). *Social Research Methods* (Third ed.). Oxford, UK: Oxford University Press.

- CB Insights. (2018, March 22). *The Global Bike-Share Boom: Dockless Models Look To Solve Urban Commutes & Transit Access*. Retrieved from CB Insights, Research Briefs: <https://www.cbinsights.com/research/bike-sharing-boom/>
- Chan, J. K., & Zhang, Y. (2018). Sharing Space: Urban Sharing, Sharing a Living Space, and Shared Social Spaces. *Space and Culture*, 1-13.
- Cohen, B., & Kietzmann, J. (2014). Ride On! Mobility Business Models for the Sharing Economy. *Organization & Environment*, Vol. 27(3), 279-296.
- CoMoUK. (n.d.). *About Us*. Retrieved from CoMoUK: <https://como.org.uk/about/>
- DeMaio, P. (2009). Bike-sharing: History, Impacts, Models of Provision, and Future. *Journal of Public Transportation*, 12(4), 41-56.
- Department for Transport. (2019). *Future of Mobility: Urban Strategy: Moving Britain Ahead*. Department for Transport. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/786654/future-of-mobility-strategy.pdf
- Docherty, I., & Shaw, J. (2019). Governance, Transport. *International Encyclopedia of Human Geography*, 615–621.
- Docherty, I., Marsden, G., & Anable, J. (2018). The governance of smart mobility. *Transportation Research Part A* 115, 114-125.
- Doganova, L., & Eyquem-Renault, M. 1.–1. (2009). What do business models do?. Innovation devices in technology entrepreneurship. *Res. Policy*(38), 1559–1570.
- Dudley, G., Banister, D., & Schwanen, T. (2017). The Rise of Uber and Regulating the Disruptive Innovator. *The Political Quarterly*, 88, 492-499.
- Dudley, G., Banister, D., & Schwanen, T. (2019). The Dynamics of Public Participation in New Technology Transitions: The Case of Dockless Bicycle Hire in Manchester. *Built Environment*, 45(1), 93-111.
- Dudley, G., Banister, D., & Schwanen, T. (2019, July 8). *The Sharing Economy and Blurring in Public-Private Relationships*. Retrieved from Alexandrine Press: https://www.alexandrinepress.co.uk/sharing_economy_transport
- Edwards, T. (2017, July 14). *Anger at new bike hire scheme*. Retrieved from BBC: <https://www.bbc.com/news/uk-england-london-40611659>
- Eisenhardt, K. M. (1989). Agency Theory: An Assessment And Review. *The Academy of Management Review*, 14.
- Fannin, R. (2017, March 2017). *Bike Sharing Apps In China Pop Up As Latest Startup And Unicorn Craze*. Retrieved May 20, 2019, from Forbes: <https://www.forbes.com/sites/rebeccafannin/2017/03/28/bike-sharing-apps-in-china-pop-up-as-latest-startup-and-unicorn-craze/#178636711bcc>
- Fannin, R. (2017, March 28). *Bike Sharing Apps In China Pop Up As Latest Startup And Unicorn Craze*. Retrieved from Forbes: <https://www.forbes.com/sites/rebeccafannin/2017/03/28/bike-sharing-apps-in-china-pop-up-as-latest-startup-and-unicorn-craze/#100485e1bcce>
- Fishman, E., Washington, S., Haworth, N., & Mazzei, A. (2014). Brisbane, Barriers to bike-sharing: an analysis from Melbourne and Brisbane. *Journal of Transport Geography*.
- Florida, R. (2012). *The Rise of the Creative Class, Revisited*. New York: Basic Book.
- Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 1(2), 219-245.
- Foxon, T. J., Hammond, G. P., Pearson, P. J., Burgess, J., & Hargreaves, T. (2009). Transition pathways for a UK low carbon energy system: exploring different governance patterns.

- Paper for 1st European Conference on Sustainability Transitions: "Dynamics and Governance of Transitions to Sustainability", Amsterdam, The Netherlands.*
- Ganapatia, S., & Reddick, C. G. (2018). Prospects and challenges of sharing economy for the public sector. *Government Information Quarterly* 35, 77–87.
- Geels, F. (2005). *Technological Transitions and System Innovations: A Co- Evolutionary and Socio-Technical Analysis*. Cheltenham, UK: Edward Elgar.
- Geels, F. W. (2005). The dynamics of transitions in socio-technical systems: A multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). *Technology Analysis & Strategic Management*, 17(4), 445–476.
- Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, 1, 24–40.
- Geels, F. W. (2012). A socio-technical analysis of low-carbon transitions: introducing the multi-level perspective into transport studies. *Journal of Transport Geography*, 24, 471–482.
- Geels, F. W. (2018). Disruption and low-carbon system transformation: Progress and new challenges in socio-technical transitions research and the Multi-Level Perspective. *Energy Research & Social Science*, 37, 224–231.
- GLA . (2018). *Future transport: How is London responding to technological innovation?* London Assembly: Transport Committee.
- GLA. (2018). *Mayor's Transport Strategy*. Retrieved from <https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf>
- GLA. (n.d.). *City of London*. Retrieved from Mayor of London: <https://www.london.gov.uk/in-my-area/city-london>
- Gössling, S. (2013). Urban transport transitions: Copenhagen, City of Cyclists. *Journal of Transport Geography*, 33, 196–206.
- Greater London Authority. (2013). *The Mayor's Vision for Cycling in London: An Olympic Legacy for Londoners*. Greater London Authority. Retrieved from https://www.london.gov.uk/sites/default/files/cycling_vision_gla_template_final.pdf
- Griffith, E. (2017, October 16). *Why Investors Are Betting That Bike Sharing Is The Next Uber*. Retrieved from Wired: <https://www.wired.com/story/why-investors-are-betting-that-bike-sharing-is-the-next-uber/>
- Haas, B. (2017, November 25). *Chinese bike share graveyard a monument to industry's 'arrogance'*. Retrieved May 20, 2019, from The Guardian: <https://www.theguardian.com/uk-news/2017/nov/25/chinas-bike-share-graveyard-a-monument-to-industrys-arrogance>
- Hall, S., & Ince, A. (2017). Introduction: Sharing economies in Times of Crisis. In S. Hall, & A. (. Ince, *Sharing Economies in Times of Crisis: practices, Politics and Possibilities*. London: Routledge.
- Hern, A. (2018, July 11). *The future will be dockless: could a city really run on 'floating transport'?* Retrieved from The Guardian: <https://www.theguardian.com/cities/2018/jul/11/future-dockless-city-really-run-floating-transport-apps-scooters-bikes>
- Hodson, M., & Marvin, S. (2009). Cities mediating technological transitions: understanding visions, intermediation and consequences. *Technology Analysis & Strategic Management*, 21:4, , DOI: 10.1080/09537320902819213, 21(4), 515–534.
- Hodson, M., & Marvin, S. (2010). Can cities shape socio-technical transitions and how would we know if they were? *Research Policy*, 39, 477–485.
- Hoffmann, M. L., & Lugo, A. (2014, May). Who is 'World Class'? Transportation Justice and Bicycle Policy. *Urbanities*, 4(1), 45–61.

- Huang, F. (2018, December 31). *The Rise and Fall of China's Cycling Empires*. Retrieved from Foreign Policy: <https://foreignpolicy.com/2018/12/31/a-billion-bicyclists-can-be-wrong-china-business-bikeshare/>
- Janmaat, Y. (2019). *Governance of Dockless Bicycle Sharing: An exploration of governance mechanisms for coping with the disruptive phenomenon of dockless bicycle sharing systems by identifying public values*. Delft University of Technology. Retrieved June 22, 2019, from <https://repository.tudelft.nl/islandora/object/uuid:0c032d0d-e9ad-4af8-bc37-3c027d6ce8da?collection=education>
- Kvale, S. (1996). *Interviews*. London: SAGE Publications.
- Kyrouz, M. (2019, March 7). *Micromobility: A Small Idea Seeking Big Change*. Retrieved from Medium: <https://medium.com/smart-cars-a-podcast-about-autonomous-vehicles/micromobility-152417de8ca1>
- Lachman, D. A. (2013). A survey and review of approaches to study transitions. *Energy Policy*, 58, 269–276.
- Lancaster, C. (2018, May 30). *London's Dockless Bike Boom: The Future of Urban Transport or a Plague on Our Pavements?* Retrieved July 6, 2019, from culture trip: <https://theculturetrip.com/europe/united-kingdom/england/london/articles/londons-dockless-bike-boom-the-future-of-urban-transport-or-a-plague-on-our-pavements/>
- Le Vine, S., & Polak, J. (2015). Introduction to special issue: new directions in shared-mobility research. *Transportation (2015)*, 42, 407-411.
- Li, Y., Zhu, Z., & Guo, X. (2019). Operating Characteristics of Dockless Bike-Sharing Systems near Metro Stations: Case Study in Nanjing City, China. *Sustainability*, Vol 11, Iss 8, 11(8).
- Loorbach, D. (2007). *Transition Management: New Mode of Governance for Sustainable Development*. Amsterdam, The Netherlands: Erasmus University Amsterdam.
- Marvin, S. (2015). *Smart Urbanism : Utopian Vision or False Dawn?* London: Routledge.
- Mateo-Babiano, I., Bean, R., Corcoran, J., & Pojani, D. (2016). How does our natural and built environment affect the use of bicycle sharing. *Transportation Research Part A* 94 , 295-307.
- McDonnell, P. (2017, September 06). *Dockless bike hire scheme to launch in Waltham Forest*. Retrieved from Transport Xtra: <https://www.transportxtra.com/publications/local-transport-today/news/54559/dockless-bike-hire-scheme-to-launch-in-waltham-forest/>
- McIntyre, N., & Kollwe, J. (2019, February 22). *Life cycle: is it the end for Britain's dockless bike schemes?* Retrieved from The Guardian: <https://www.theguardian.com/cities/2019/feb/22/life-cycle-is-it-the-end-for-britains-dockless-bike-schemes>
- McLaren, D., & Agyeman, J. (2015). *Sharing Cities*. Cambridge, Massachusetts: The MIT Press.
- McVean, B. (2018). *Dockless Cycle Hire Review*. London: City of London Corporation. Retrieved from <http://democracy.cityoflondon.gov.uk/documents/s100525/Dockless%20Cycle%20Hire%20Report%20SW%20PT%20Sept18.pdf>
- McVean, B. (2019). *Dockless Cycle Hire*. London: City of London. Retrieved May 16, 2019, from <http://democracy.cityoflondon.gov.uk/documents/s111732/Dockless%20Cycle%20Hire%20PT%20180319%20FINAL.pdf>
- McVean, B. (2019). *Dockless Cycle Hire Update*. City Of London Corporation. Retrieved from <http://democracy.cityoflondon.gov.uk/documents/s119227/Dockless%20Cycle%20Hire%20SW%20PT%20July%202019%20FINAL.pdf>

- Midgley, P. (2011). *Bicycle-Sharing Schemes: Enhancing Sustainable Mobility in Urban Areas*. Global Transport Knowledge Partnership, Background Paper No. 8.
- Mobike. (n.d.). *What is Mobike*. Retrieved from Mobike: <https://mobike.com/global/faq>
- Moradi, A., & Vagnoni, E. (2018). A multi-level perspective analysis of urban mobility system dynamics: What are the future transition pathways. *Technological Forecasting & Social Change* 126, 126, 231-243.
- Morrison, S. (2017, July 14). *New 'Boris Bike' rivals oBike told to remove 'obstructive' bicycles from streets days after launching scheme*. Retrieved from Evening Standard: <https://www.standard.co.uk/news/london/new-boris-bike-rivals-obike-told-to-remove-obstructive-bicycles-from-streets-days-after-launching-a3588336.html>
- Mortimer, O. (2017, July 21). *Dockless Cycle Hire Scheme*. Retrieved from London Councils: <https://www.londoncouncils.gov.uk/node/32256>
- Nilsson, M., & Nykvist, B. (2016). Governing the electric vehicle transition – Near term interventions to support a green energy economy. *Applied Energy*, 179, 1360–1371.
- O'Brien, O. (2017, November 2). <https://oobrien.com/2017/11/five-bikeshares-in-london/> *Five Bikeshares in London*. Retrieved from Suprageography: <https://oobrien.com/2017/11/five-bikeshares-in-london/>
- Pangbourne, K., Stead, D., Mladenovic, M., & Milakis, D. (2018). The case of mobility as a service: A critical reflection on challenges for urban transport and mobility governance. In G. Marsden, & L. (. Reardon, *Governance of the smart mobility transition* (pp. 33-48). Bingley: Emerald Publishing Limited.
- Parkes, S. D., Marsden, G., Shaheen, S. A., & Cohen, A. P. (2013). Understanding the diffusion of public bike-sharing systems: evidence from Europe and North America. *Journal of Transport Geography*, 31, 94–103.
- Petty, N. J., Thomson, O. P., & Stew, G. (2012). Ready for a paradigm shift? Part 2: Introducing qualitative research methodologies and methods. *Manual Therapy*, 1-7.
- Rip, A., & Kemp, R. (1998). Technological Change. In S. Rayner, & E. (. Malone, *Human Choice and Climate Change. Volume 2* (pp. 327-399). Columbus, Ohio: Battelle Press.
- Rushe, D. (2017, Nov 5). *Why we can't have nice things: dockless bikes and the tragedy of the commons*. Retrieved from The Guardian: <https://www.theguardian.com/politics/2017/nov/05/why-we-cant-have-nice-things-dockless-bikes-and-the-tragedy-of-the-commons>
- Sarasini, S., & Linder, M. (2018). Integrating a business model perspective into transition theory: The example of new mobility services. *Environmental Innovation and Societal Transitions*, 27, 16-31.
- Schwanen, T. (2016). Innovations to transform personal mobility. In D. Hopkins, & J. (. Higham, *Low Carbon Mobility Transitions*. Oxford: Goodfellow Publishers.
- Shaheen, S., Guzman, S., & Zhang, H. (2010). Bike-sharing in Europe, the Americas, and Asia: Past, Present, and Future. *Transportation Research Record*.
- Shen, Y., Zhang, X., & Zhao, J. (2018). Understanding the usage of dockless bike sharing in Singapore. *International Journal of Sustainable Transportation*, 12:9,, 686-700. doi:10.1080/15568318.2018.1429696
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative. *Education for Information* 22, 22, 63-75.
- Shi, J.-g., Si, H., Wu, G. S., & Lan, J. (2018). Critical Factors to Achieve Dockless Bike-Sharing Sustainability in China: A Stakeholder-Oriented Network Perspective. *Sustainability*, 10(6). doi:10.3390/su10062090

- Smith, A., Stirling, A., & Berkhout, F. (2005). The governance of sustainable socio-technical transitions. *Research Policy*, 34, 1491-1510.
- Smith, A., Voß, J.-P., & Grin, J. (2010). Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research Policy* 39, 39, 435-448.
- Soares Machado, C. A., Marie de Salles Hue, N. P., Berssaneti, F. T., & Quintanilha, J. A. (2018). An Overview of Shared Mobility. *SUSTAINABILITY*, 10(12).
- Sousa-Zomer, T. T., Cantúa, V. Z., & Cauchick, P. A. (2016). Product-Service Systems as Sustainable Alternatives to Mobility: A Comparative Analysis of Two Bike-Sharing Systems. *Brazilian Journal of Operations & Production Management*, 13, 264-275.
- Spinney, J., & Lin, W.-I. (2018). Are you being shared? Mobility, data and social relations in Shanghai's Public Bike Sharing 2.0 sector. *Applied Mobilities*, 3(1), 66–83.
- Steer. (2019, April 10). *Dockless bike share: a regulatory grey area*. Retrieved May 16, 2019, from <https://www.steergroup.com/insights/dockless-bike-share-regulatory-grey-area>
- Sun, Y. (2018). Sharing and Riding: How the Dockless Bike Sharing Scheme in China Shapes the City. *Urban Science*. doi:10.3390/urbansci2030068
- Taylor, A. (2018, March 22). *The Bike-Share Oversupply in China: Huge Piles of Abandoned and Broken Bicycles*. Retrieved May 19, 2019, from The Atlantic: <https://www.theatlantic.com/photo/2018/03/bike-share-oversupply-in-china-huge-piles-of-abandoned-and-broken-bicycles/556268/>
- Teale, C. (2018, October 5). *Targeting 1T annual trips worldwide, dockless companies see room to grow*. Retrieved July 6, 2019, from Smart Cities Dive: <https://www.smartcitiesdive.com/news/dockless-companies-one-trillion-trips-worldwide/538948/>
- TfL. (2017). *Santander Cycles*. TfL. Retrieved from <http://content.tfl.gov.uk/santander-cycles-transparency-to-end-of-september-2017.pdf>
- TfL. (2018). *Cycling action plan: Making London the world's best big city for cycling*. Retrieved from <http://content.tfl.gov.uk/cycling-action-plan.pdf>
- TfL. (2018, September). *Dockless bike share code of practice for Operators in London*. Retrieved from <http://content.tfl.gov.uk/dockless-bike-share-code-of-practice.pdf>
- TfL. (2018). *Travel in London: Report 11*. TfL. Retrieved from <http://content.tfl.gov.uk/travel-in-london-report-11.pdf>
- TfL. (2019). *Find a docking station*. Retrieved from Transport for London: <https://tfl.gov.uk/modes/cycling/santander-cycles/find-a-docking-station>
- TfL. (n.d.). *What we do*. Retrieved May 01, 2019, from Transport for London: <https://tfl.gov.uk/corporate/about-tfl/what-we-do>
- United Nations Environment Programme. (2017). *Mobike*. Retrieved May 19, 2019, from UN environment: <http://web.unep.org/championsofearth/laureates/2017/mobike>
- van Waes, A., Farla, J., Frenken, K., de Jong, J. P., & Raven, R. (2018). Business model innovation and socio-technical transitions. A new prospective framework with an application to bike sharing. *Journal of Cleaner Production*, 195, 1300-1312.
- Whitmarsh, L. (2012). How useful is the Multi-Level Perspective for transport and sustainability research? *Journal of Transport Geography*, 24, 483-487.
- Wu, Q. (2017, December 11). *Mobike expanded its scheme to Islington area : opportunities and challenges of dockless bike in London*. Retrieved from Westminster World: <http://westminsterworld.com/mobike-expanded-its-scheme-to-islington-area%E2%BC%9Aopportunities-and-challenges-of-dockless-bike-in-london/>
- Yang, T., Li, Y., & Zhou, S. (2019). System Dynamics Modeling of Dockless Bike-Sharing Program Operations: A Case Study of Mobike in Beijing, China. *Sustainability*, 11.

- Yin, R. K. (2018). *Case study research and applications : design and methods*. Los Angeles: SAGE.
- Zarif, R., Pankratz, D. M., & Kelman, B. (2019, April 15). *Small is beautiful: Making micromobility work for citizens, cities, and service providers*. Retrieved from Deloitte: <https://www2.deloitte.com/insights/us/en/focus/future-of-mobility/micro-mobility-is-the-future-of-urban-transportation.html>

Appendix A

Guide for Interview 1: Mike Beevor, Senior Policy Manager, Transport Innovation, Transport for London (TfL)

Topic area	Guiding interview questions
The role of TfL	What was TfL's initial reaction and response to the arrival dockless bike-sharing in London? What is TfL's role in relation to dockless bike-sharing?
Benefits / Alignments	In what ways does dockless bike-sharing align with TfL's aims and objectives? What do you see as the benefits of dockless bike-sharing? How does TfL ensure these benefits are realised?
Challenges / Conflicts	In what ways does dockless bike-sharing conflict with TfL's aims and objectives? What challenges does dockless bike-sharing present? How does TfL respond to these challenges? How does the CoP / proposed bylaw address these challenges? Has the CoP been effective in helping TfL / boroughs access dockless bike-sharing data? Does dockless bike-sharing align / conflict with the TfL Cycle Hire Scheme?
The dockless bike-sharing business model / market	How does TfL view the future of the dockless bike-sharing market in London?

Guide for Interview 2: Bruce McVean, Strategic Transportation Group Manager, City of London Corporation

Topic area	Guiding interview questions
Bike-sharing in the City of London	What has been the City's approach / response to dockless bike-sharing? What has been the effect of the CoP?
Benefits / Alignments	In what ways does dockless bike-sharing align with the City's aims and objectives? What do you see as the benefits of dockless bike-sharing? How does the City ensure these benefits are realised?
Challenges / Conflicts	In what ways does dockless bike-sharing conflict with the City's aims and objectives? What challenges does dockless bike-sharing present? How does the City respond to these challenges? How does the CoP / proposed bylaw address these challenges?

Proposed trial scheme	Is the trial approach designed to encourage or discourage bike-sharing? To what extent that does implementation of the trial approach place limitations on the dockless business model?
Regulation	What do you expect to be the impact of the proposed pan-London bylaw?

Guide for Interview 3: Daniel Gosbee, Technician, London Borough of Waltham Forest

Topic area	Guiding interview questions
Bike-sharing in Waltham Forest	What has been the Waltham Forest's approach / response to dockless bike-sharing? What has been the effect of the CoP?
Benefits / Alignments	In what ways does dockless bike-sharing align with the Borough's aims and objectives? Is it complementary to the Mini-Holland scheme? What do you see as the benefits of dockless bike-sharing? How does the Borough ensure these benefits are realised?
Challenges / Conflicts	In what ways does dockless bike-sharing conflict with the Borough's aims and objectives? What challenges does dockless bike-sharing present? How does the CoP / proposed bylaw address these challenges? How does the City respond to these challenges? Why have dockless firms started, yet ceased, to operate in Waltham Forest?
Regulation	What do you expect to be the impact of the proposed pan-London bylaw?
Next steps	What is the next step for dockless in Waltham Forest?

Guide for Interview 4: Duncan Robertson, Head of Business Strategy and Government Affairs, Mobike

Topic area	Guiding interview questions
Business model	Please explain the dockless bike-sharing business model? In what ways has it changed / developed?
Approach / developments	What has been Mobike's approach to working in London? How has this changed / developed since you started operating here? What has been Mobike's approach to working with local authorities? Have local authorities been supportive of dockless bike-sharing? Do they see it primarily as a benefit or a challenge? What factors have hindered dockless bike-sharing's momentum since it launched in London? What factors have encouraged its momentum?

Regulation	<p>What has been the effect of the CoP on the business model?</p> <p>What do you anticipate being the effect of the proposed incoming bylaw?</p>
The dockless market	<p>What are your reflections on the development of the dockless market in London thus far?</p> <p>In what ways do you expect it to evolve?</p>