State intervention in Mobility-as-a-Service the role of governance in steering emerging mobility services towards inclusive outcomes in London

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State intervention in Mobility-as-a-Service: the role of governance in steering emerging mobility services towards inclusive outcomes in London

by

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Declaration:

Being a dissertation submitted to the faculty of The Built Environment as part of the requirements for the award of the MSc Transport and City Planning at University College London: I declare that this dissertation is entirely my own work and that ideas, data and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

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1. ABSTRACT

The emergence of Mobility-as-a-Service (MaaS) as a transport paradigm offers an alternative to how personal mobility is derived in cities and could alleviate urban congestion, improve air quality, reduce carbon emissions, and, promote seamless and integrated travel. Nevertheless, concerns remain that emerging mobility services lack sufficient consideration of the societal impacts they can produce. The prerequisite for smartphone technology, the high cost of use, the cognitive and physical requirements, and the propensity to operate in wealthier, more accessible locations threatens to exclude certain populations (Lucas *et al*, 2019). This presents a challenge to current regulation surrounding emerging mobility services. This dissertation will focus on the role of governance in ensuring MaaS is inclusive for its users within the context of London. Questionnaire surveys and semi-structured interviews are used to explore stakeholder viewpoints during the initial implementation of MaaS in the UK. The dissertation concludes with recommendations for policy-makers and MaaS operators on how to ensure MaaS can contribute towards an inclusive transport system with areas identified for further research.

2. INTRODUCTION

2.1 Background

Mobility-as-a-Service (MaaS) has received growing attention from planning practitioners, policy-makers, businesses and academics as a way to alleviate urban congestion, improve air quality, reduce carbon emissions, and, provide a seamless and integrated journey (Kamargianni *et al*, 2016). The concept has emerged from the 'as-a-service' business model and focuses mobility around customer preferences (Datson, 2016). More specifically, MaaS is defined as:

> '*A user-centric, intelligent mobility management and distribution system, in which an integrator brings together offerings of multiple mobility service providers and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility*' (Kamargianni *et al* 2018: 3).

This study aligns with this definition, and the potential for MaaS to offer a 'paradigm shift' in how citizens travel. However, concerns remain surrounding data sharing and the contract agreements required between operators and public authorities (Jittrapirom *et al*, 2018a; Hensher, 2017). The most prominent concern, and the focus of this dissertation, is considered the potential impact MaaS may have on those currently excluded from transport services. The Campaign for Better Transport (CfBT, 2017) considers that a poorly-planned MaaS platform could proliferate private service competition for the agile and the affluent leading to more vehicles, while at the same time reinforcing the harmful pattern of social exclusion in poorer, isolated communities. Whereas, a well-planned MaaS platform could contribute to social inclusion by 'filling in the gaps' of existing transport services to offer mobility to those excluded from mainstream options (CfBT, 2017).

Governance, the ability to set, apply and enforce rules, is critical if mobility innovations are to serve the complex socio-economic challenges faced in cities today (Marsden and Reardon 2018a; Marique and Marique, 2018). However, the type of governance required remains unclear within MaaS literature (Smith *et al*, 2018). The lack of an appropriate regulatory framework for mobility innovations means a set of non-state actors are entering an unregulated market (Pangbourne *et al*, 2019). This threatens to widen the gap for those currently excluded from mainstream transport and challenges how governments regulate disruptive mobility innovations (Pangbourne *et al*, 2019). The UK Government's reliance on businesses to reduce public subsidies and stimulate innovation in service provision over the last 30 years suggests non-state actors will have an important role in the future of MaaS (Gray *et al*, 2017).

2.2 Research Question and Objectives

The most appropriate role for governance in the MaaS ecosystem raises the following research question:

"How does the role of governance ensure MaaS contributes to social inclusion in London?"

This dissertation explores the viewpoints of stakeholders within the MaaS ecosystem to ascertain how governance can ensure MaaS contributes towards inclusion within London's transport system. The following research objectives have been derived to assist the research question:

1. To review existing literature on social inclusion and governance pertinent to MaaS.
2. To understand stakeholders' perspectives on the capacity for MaaS to promote social inclusion and the challenges faced when regulating the service.
3. To set out the state intervention required to ensure MaaS contributes towards an inclusive transport system.

2.3 Outline Structure

The study presents the research to be undertaken before critiquing current selected literature including governmental documents at Chapter 3. Thereafter, Chapter 4 details the methodology and justification for the questionnaire and interview surveys. Chapter 5 includes an analysis and discussion of the results while Chapter 6 concludes with recommendations for policy-makers and MaaS Operators.

3. LITERATURE REVIEW

This chapter collates and critiques selected literature pertinent to this study to provide background and identify gaps in research which influences the research question. Being concerned with the governance of new mobility services, this chapter also includes a governmental document review to ground the research question in current governmental practice.

3.1 Socio-Technical Transitions: Smart Mobility

Urban mobility presents a raft of economic, social and environmental considerations (Buscher *et al*, 2014). Having the capacity to become mobile provides opportunities to access the basic necessities of urban living, for example food, work or education (Kwan and Schwanen, 2016). However, unfettered demand for mobility can lead to congestion, air pollution, and social exclusion (Mackett and Thoreau, 2015). This facilitates an unsustainable transport system of ever-increasing auto-mobility (Urry, 2004; Banister, 2008). To combat this scenario, Vergragt and Brown (2007) call for a fundamental rethink in how personal mobility is consumed.

The Transition Theory presented by Geels (2012) considers the 'socio-technical' challenge of rising car-use and carbon emissions. Geels claims an amalgamation of *'technologies, infrastructures, organisations, markets, regulations, and user practices'* currently support the auto-mobility regime (Geels *et al*, 2017, 1242). However, 'niche innovations' in transport technology and user behaviour can combine to transition from auto-mobility towards a new socio-technical regime (Pangbourne *et al*, 2019). Marsden and Reardon (2018a) believe a 'smart mobility' regime is emerging from socio-technological innovations like ubiquitous Internet, mass smartphone usage, peer-to-peer data sharing, real-time information, and, advances in ticketing and payment methods. Docherty *et al* (2018a: 118) highlight four elements of the smart mobility transition:

1) A transition towards usership over ownership of transport
2) The commoditisation of individual journeys and the time they take
3) A transition from modal-centric to user-centric transport
4) As data sharing expands, citizen's transition from users to stakeholders.

Dowling (2018) considers that transport technologies, or 'niche innovations', associated with the smart mobility transition challenge regulation as they are often unaligned with existing governance structure. For example, Metz (2016) stresses 'smarter travel' must champion sustainable and active travel alongside technological innovation. Similarly, Lucas *et al* (2019) contend that the continuing reliance on a car-

dependent transport system may exclude those who cannot engage due to digital, cognitive and physical barriers – a topic discussed further in Section 3.3.

3.2 Mobility-as-a-Service: a New Transport Paradigm?

MaaS is a 'niche innovation' within the smart mobility transition and promises a 'paradigm shift' in the provision of urban mobility (Li and Voege, 2017; Rantasila, 2015). The term refers to the combination of real-time data, wayfinding algorithms, and booking under one digital platform which integrates mobility services and provides a seamless user-centered travel experience; one which can occur across various travel modes (Marsden and Reardon, 2018a; Jittrapirom *et al*, 2018b). This combines public and private transport to remove the need for multiple tickets, offering a single service rather than multiple physical assets (**Figure 3.1**; Utrianen and Pollanen, 2018; Mulley *et al*, 2018). MaaS also introduces the concept of 'bundling', to offer a personalised service based upon travel preferences: for example, bundles could be specialised for families, regular commuters, or those travelling at weekends (Kamargianni *et al*, 2016).

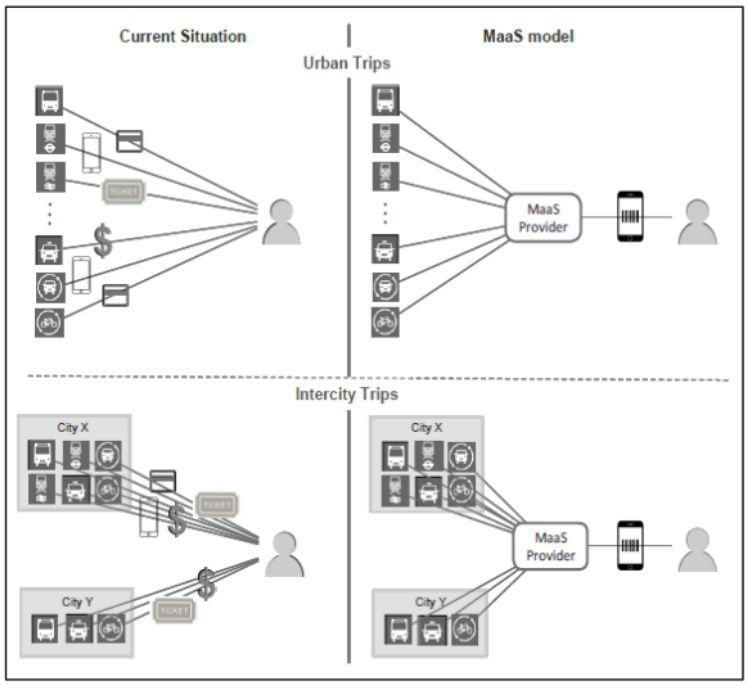

Figure 3.1: With and without MaaS - A Traveller's Perspective (Kamargianni *et al*, 2018)

Pilot studies in Finland (Whim), Sweden (Ubigo) and Germany (Moovel) (Smith *et al*, 2018; Goodall *et al*, 2017) offer limited empirical observations of MaaS across entire cities. Studies by Kamargianni *et al* (2018) and Karlsson *et al* (2016), in London and Gothenburg respectively, suggest a willingness by participants to sell their car for flexible access to car-sharing, leading to a great propensity for sustainable travel. Smith *et al* (2018) identify varying 'levels' of MaaS adoption. For example, they consider UbiGo was employed by the Swedish government to encourage public transport use, whereas Whim formed part of a wider vision of national economic development in Finland. Limited research is available regarding the ability for MaaS to tackle mobility inequalities; the exception being 'Bikes for All', which sought to remove the barriers faced when accessing bike-share schemes in deprived areas of Glasgow (Lucas *et al*, 2019). The outcome of MaaS appears dependent on its conception: as an agent of economic development or sustainability; market-driven or state-driven.

Docherty *et al* (2018) point to the efficiency benefits MaaS offers to congestion when commodifying journeys and reducing the cost of travel, as observed through car-sharing. In contrast, Pangbourne *et al* (2018) believe MaaS is a model controlled by profit-seeking businesses, which maximise returns by encouraging more rather than less mobility, particularly in wealthier locations where demographics benefit from convenient access to transport services and digital technology. The juxtaposition of unfettered, instantaneous mobility on a finite transport system is reflected in the International Transport Forum's MaaS scenario analysis (Enoch, 2018). The model applies several assumptions: replacing all private cars with car-share, a single transport system provider, one or two MaaS operators and imposed car-sharing. Although the model generates a reduction in car use, if one assumption is incomplete, i.e. 50% of private cars are replaced, then a doubling of road traffic was observed, as car-share increases without the benefits of altered travel patterns (Docherty, 2018). Pangbourne *et al* (2019) predict MaaS will increase mobility for those who can afford it whilst increasing automotive movements and worsening transport poverty. Similarly, Gullberg (2017: 4) believes hope for reducing mobility consumption is wrongly placed within packages like MaaS, instead the focus should be on substituting increased mobility with a *'restrained orchestration of proximity and mobility as a means of creating accessibility'*. In other words, Gullberg believes mobility innovations should create the right mobility rather than more. This has influenced research on the ability of MaaS to exclude certain groups, as populations become dependent on privately-run platforms for their travel (Wong *et al*, 2018; Snellen and de Hollander, 2017).

3.3 Social Equity and Mobility-as-a-Service

Social exclusion is a constraints-based process which precludes individuals from accessing aspects of society because of social circumstances (Preston and Raje, 2007). This is exacerbated by the ability to access transports services (Lucas *et al*, 2019). Accessibility can be limited by the proximity of neighbourhoods to transport services; the physical ability of travellers to use transport services; the cost of using transport; or the technological skill required for digital services (Snellen and de Hollander, 2017). A person is transport disadvantaged when these circumstances result in insufficient mobility and reduced accessibility compared with the general population (Lucas, 2012). Therefore, accessibility to services can be framed as a human capability (Pereira *et al*, 2017). Sen's (2009) 'Capability Approach' explores the opportunities a person's capabilities afford when accessing the basic functionings within a society, such as, being safe, having a well-paid job or being well-educated. Sen refers to functionings as the ability to participate effectively in society regardless of physical or social constraints (Nussbaum, 2011). Consequently, mobility is a capability because it satisfies a basic functioning; the ability to physically, socially and financially move from one place to another (Beyazit, 2011). This accords with Gullberg's (2017) observation that opportunities arising from transport are more important than the means of transport itself i.e. mobility is valuable for the opportunities it offers rather than the physical ability to move.

Nevertheless, Beyazit (2011) believes transport increases an individual's capabilities because it distributes socio-economic benefits. The potential to link modes through MaaS increases the capability to access functionings when compared to individual transport services. Atasoy *et al* (2015) point to the fact elderly and disabled transport passengers struggle using conventional public transport because it is not tailored to their needs; a challenge MaaS may assist with. A study undertaken by Lesser (2019) identifies London as having the highest proportion of pensioners living in material deprivation in the UK. The fact that the over-65s will form an increasing proportion of London's population in 2040 means MaaS bundles could have a significant positive impact for encouraging travel by the elderly (GoS, 2019). However, commentators argue MaaS is currently pursued by private operators seeking profitable locations, which means those with specific mobility issues or in poorer neighbourhoods may be excluded from the service and the opportunities it offers (Pangbourne *et al*, 2019; Lucas, 2012). This is supported by Docherty *et al* (2018) who claim the distributional impact of delivering MaaS means its provision is likely to be sporadic, focusing on densely populated areas that guarantee usership.

The distribution of deprivation in London (**Figure 3.2**), however, reflects the difficulty in identifying where MaaS will have its greatest benefit. The provision of good public transport services means non-car

ownership does not preclude inclusion within London, although, those currently excluded may continue to suffer mobility-related exclusion because of poor disabled access at public transport (Kenyon *et al*, 2002). So whilst Inner London boroughs have greater proximity to transport services, it does not mean these are necessarily accessible. Conversely, Outer London borough residents are more likely to require car access because of the dispersed urban environment (Church *et al*, 2000). The distribution of inequalities aligns with the Social Mobility Commission (SMC, 2017) which identifies 'social mobility cold-spots', whereby accessing well-paid jobs is hampered by transport costs, poor accessibility and access to digital technology. Foulser (2017) considers MaaS operators must identify these 'cold-spots' from initial conception to reduce the geographic impact of MaaS.

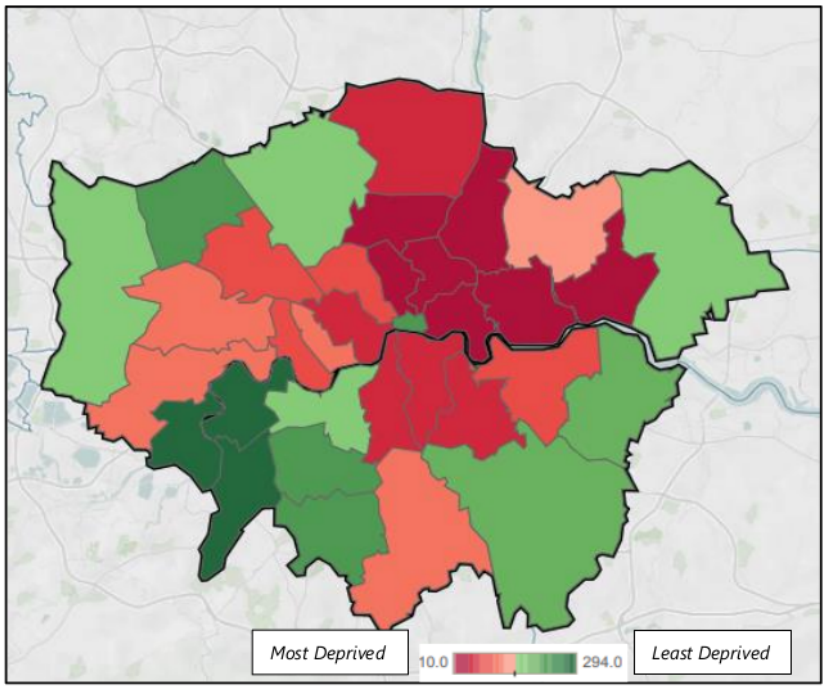

Figure 3.2: 2018 Indices of Multiple Deprivation in London (LC, 2018)

Table 3.1 compares recent publications regarding the impact of poorly-run and well-planned MaaS platforms on social inclusion, and highlights the ability of MaaS to both include and exclude depending on how it is managed. Interestingly, Pereira *et al* (2017) assumes 'accessibility' within mobility services offers human agency i.e. the capability to access and use mobility technologies. Gullberg (2017) believes, however, that the uptake of autonomous vehicles will lead to the sidelining of accessibility within emerging mobility services as greater mobility is promoted by the automotive industry.

Table 3.1: Poorly-Run MaaS vs Well-Planned MaaS: the impact on Social Inclusion

Poorly-run MaaS	Well-planned MaaS
The high cost of MaaS focuses on young, wealthy populations (Li and Voege, 2017)	Concessionary fares for those of pension age, with disabilities or earning under a certain threshold (Mackett and Thoreau, 2015)
Reliance on registration and digitalisation excludes those who struggle with new technologies and accessing banking (Pangbourne *et al*, 2019)	The provision of digitally-connected kiosks in train stations for those without smartphones (HC, 2018a)
Cognitive barriers excludes those who might have never experienced such technology (Lucas *et al*, 2019)	Tailored options for the elderly, those with autism, dementia, or those with sensory-impairments assist in avoiding inaccessible routes (Melis *et al*, 2018; Viaaqio, 2017)
Disengagement of those who choose to walk and cycle from the policy debate (Docherty *et al*, 2018)	Mobility packages include front-end interfaces that prioritise health and well-being (Pangbourne *et al*, 2019)
Reduced or no service in undesirable or unprofitable locations and premium costs in affluent areas or at particular time periods, for example Saturday night (Marsden and Reardon, 2018a)	Minimum acceptable threshold of accessibility to key activities (Lucas 2016; Pereira *et al*, 2017)

In summary, the literature suggests an inclusive MaaS platform would ensure that the opportunities for seamless, on-demand mobility are accessible to all, and that citizens have the capability to make use of the service.

3.4 Why Governance matters for Mobility-as-a-Service

With consumer habits and new technologies redefining how citizens travel in cities; the smart mobility transition appears inevitable (Docherty, 2018). The challenge now faced by the UK Government is how to manage and adequately address the societal impacts of emerging mobility services.

Governance refers to the *'extent to which government has the power to set, apply and enforce… rules'*. (Marsden and Reardon 2018a: 6). However, governance goes beyond policy or state action. Dowling (2018) believes governance is a process of identifying a problem, and formulating and implementing an intervention to achieve a particular outcome. But why does governance matter for MaaS? In Giddens' (2008) opinion, the UK Government remains a key 'enabler' capable of stimulating stakeholder action, and an 'insurer' who guarantees its actions lead to desired outcomes. Marsden and Reardon (2018b) go further by suggesting emerging mobility services require strong governance because they are unlikely to replace the existing mobility regime without changes to the regulatory system they operate within. However, Docherty (2018) highlights the fact the UK Government has struggled to effect simple change to the transport system because governmental instruments fail to predict and manage trends, for example the emergence of non-state actors in transport governance and the shift towards crowd-sourced data. Dowling and Kent (2015) believe the state's capacity to govern now relies on its ability to form effective partnerships with non-state actors. In the UK, the shift towards governance rather than intervention aligns with Geels' (2011) observation that a 'marketisation transition' is underway as expanding consumer choice in transport provides businesses with a greater role in regulation (Docherty *et al*, 2004). Gray *et al* (2017) believe this leads to a split-personality between central and local government; the former advocating innovation through private service competition; the latter tasked with mitigating the negative externalities of congestion, air quality and social exclusion.

The governance structure in London is split between national, regional and local authorities which can lead to uncoordinated policy-making when managing new trends in mobility (Akyelken *et al*, 2018). Furthermore, the emergence of non-state actors within the London transport system has blurred the role of transport regulators and made existing regulation appear vague next to the specific nature of mobility innovations (Akyelken *et al,* 2018). For example, Uber has challenged the regulatory framework set by Transport for London (TfL) and disrupted the provision of mobility by offering smartphone user's access to cheap taxi services. This has weakened the role for traditional 'black cabs' and the demand for night-time buses (Mulley and Kronsell, 2018; Wood *et al*, 2017). Dudley *et al* (2017: 3) explore Uber's ability to exploit out-of-date rules in London to embed its branding in the public consciousness before authorities were able to regulate effectively:

> *'…for regulators… there is a delicate balance… between wishing to encourage innovation and services that apparently have wide public support, with sensitivity to the interests of established operators, to the provision of rules that provide fair competition'*.

When mobility services reach a critical mass then regulation becomes difficult because restrictions are viewed as '*frustrating public demand*' (Dudley *et al*, 2017: 4). This coincides with Docherty *et al* (2018), who consider technological change as outpacing the capacity of governments to respond, which risks locking emerging mobility services into a transition path that exacerbates current social problems – *'once a particular spatial form is created it tends to institutionalise'* and determine future development (Harvey, 2008: 27).

However, Marique and Marique (2018: 188) argue it is not whether digital innovations disrupt social practices, but '*how digital innovation may be best used to serve the complex socio-economic… challenges London faces*'. Therefore, a transition in the way governance steers mobility services is needed to create conditions for inclusion and to effectively manage disruptive innovations (Docherty *et al*, 2018). Reardon and Marsden (2018: 140) consider strong state involvement a prerequisite if the *'most integrated and sustainable visions of smart mobility'* are to be achieved. So whilst state intervention has focused on '*addressing market failure'* (Docherty *et al*, 2004: 258), the specific nature of emerging mobility services requires an equally specific regulatory framework. This accords with Hopkins and Schwanen (2018) who consider smart mobility transitions are impossible when developed through existing market-driven approaches. MaaS must balance public and private regulation to ensure a positive contribution to the quality of life for all (Marique and Marique, 2018).

3.5 Consideration of Mobility-as-a-Service in Governmental Documents

When submitting this dissertation, no regulatory framework had been defined by the UK Government to manage MaaS at the local, regional or national level, but significant research at the national level is underway regarding the implementation of the service. Various mobility innovations have also been advocated in London: GoSutton on-demand bus trials (TfL, 2019); automated vehicle trials in Greenwich (TRL, 2018); and the commitment from the London Assembly (LA, 2018) to guide MaaS. The Department for Transport's (DfT) initial focus was the potential for MaaS to reduce car ownership, provide an efficient transport system and compete in mobility markets (Datson, 2016). Unfortunately, social inclusion was considered a challenge for future policy-makers.

Instead, equity concerns arose during roundtable discussions held by the Government Office for Science (GoS, 2017: 2), with industry stakeholders suggesting MaaS should not be more expensive than current transport and fully inclusive to avoid *'the MaaS and the MaaS-nots'*. A call for evidence by GoS (2019) raised concerns that, without state intervention, future MaaS platforms could increase digital exclusion (CfBT, 2017; TravelSpirit, 2017; Viaaqio, 2017; techUK, 2017). If MaaS is to serve more than the agile and the affluent,

then access must be provided by phone or person, or via a third party who can access the service on behalf of others (CfBT, 2017). The face-to-face element was considered essential for those currently excluded from digital software: the over-65s or those with dementia (Viaaqio, 2017). A governmental study (Enoch, 2018) suggests policymakers are faced with a major challenge when balancing the promised benefit with equity issues.

The lack of overarching strategy for local authorities was identified as a key barrier by GoS (2017) when dealing with disruptive mobility innovations. TravelSpirit (2017) claim an 'Internet of Mobility Framework' is required to govern MaaS, similar to KPMG's 'MaaS Requirement Index' which guides local authorities in deciding the optimum level of regulation to achieve policy goals (Foulser, 2017). The KPMG index is the only framework identified during this study that offers local authorities a platform for decision-making in the MaaS ecosystem. The risk is that, without such frameworks, local authorities are ill-equipped to manage issues pertaining digital exclusion (TechUK, 2018). A Transport Committee (HC, 2018b) reflects this concern, with authorities considered ill-informed of the potential impacts of MaaS. Simon Ho of TravelSpirit suggests *'we are concerned about technological progress bulldozing what transport is really about… providing equitable and sustainable access to all'* (HC, 2018b).

The Transforming Cities Fund challenges transport authorities to create Future Mobility Zones (FMZ) in an attempt to explore smart mobility transitions (DfT, 2018a). It focuses on how technological innovations in ticketing and integration can be implemented within UK cities. Lyons and Davidson (2016: 105), believe, by exploring policymaking pathways, a number of *'divergent plausible future scenarios'* can be considered in the decision-making process which supports Marsden *et al* (2018) who remark that more adaptive approaches to planning are needed to shape future travel. They argue, however, debates are currently undertaken in 'silos' which do not consider various societal impacts. For example, the Inclusive Transport Strategy (DfT, 2018b) considers that dialogue between disabled transport users and mobility providers should occur during 'innovation trials'. Unfortunately, the social repercussions of MaaS do not appear within the FMZ bidding process. However, the Future of Mobility Urban Strategy (DfT, 2019: 8) sets out principles which are to guide mobility innovations in the UK, including issues surrounding social inclusion: *'the benefits of innovation in mobility must be available to all parts of the UK and all segments of society'*. The study indicates a regulatory review of MaaS should include:

- Consideration of how '*new mobility services can enable accessible, inclusive and safe mobility services*';
- Investigate *'the case for the Government to do more to shape the way MaaS platforms emerge, to manage unintended consequences…'*; and
- Recognise that *'legislation and regulation relevant to MaaS is spread across multiple levels of government'*. (DfT, 2019: 54)

The governmental document review confirms that unregulated MaaS models could disadvantage the most vulnerable transport users. However, recognising that state intervention in mobility transitions is lacking does not address the fact MaaS platforms are entering the UK market devoid of effective regulation. A review by Lucas *et al* (2019) concludes that policy interventions are essential in avoiding current inequalities deepening as a result of mobility transitions. The review recommends clarity in the regulatory role of the state and the position of authorities to avoid negative repercussions.

3.6 Summary

The literature review frames inclusive transport as providing users mobility, and by extension the capability, to access the services they require regardless of social circumstances. A gap in the literature is identified concerning the governance of MaaS when ensuring social inclusion and highlights the confusing relationship of governance in the UK, tasked with balancing effective state intervention alongside stimulating innovation. This has postponed research into the unforeseen societal implications MaaS could have for transport users (Pangbourne *et al*, 2018). A thorough evidence-based assessment of new mobility services has outlined the requirement for a regulatory framework to manage the relationship between state and non-state actors. Nevertheless, the most suitable form of state intervention in MaaS remains unidentified.

4. METHODOLOGY & DATA COLLECTION

This chapter sets out the research strategy, including how the research objectives will be met, the methodology adopted, the rationale for its use as well as the ethical considerations of the study.

4.1 Research Question and Objectives

The literature review and subsequent governmental document review reveal a research gap surrounding the role of governance in MaaS. This led to the following research question:

"How does the role of governance ensure MaaS contributes to social inclusion in London?"

The research question was broken down into three research objectives. How the methodology will achieve these objectives is detailed within **Table 4.1**.

Table 4.1: Research Objectives and Methodology

Research Objectives		Methodology
1	To review existing literature on social inclusion and governance relating to MaaS.	A dual literature / governmental review will explore whether current literature on social inclusion in MaaS is reflected in governmental practice. This was demonstrated in Section 2 and is supplemented through the interviews and questionnaires.
2	To understand stakeholders' perspectives on the capacity for MaaS to promote social inclusion and the challenges faced when regulating the service.	A questionnaire survey and interviews will be undertaken with MaaS stakeholders to understand whether MaaS can contribute to social inclusion and via what measures, as well as the perceived challenges when regulating MaaS
3	To set out the state intervention required to ensure MaaS contributes towards an inclusive transport system.	This will be achieved by presenting the results of the questionnaire and interviews.

4.2 Method of Data Collection

Data collection began with a governmental document review (included under the literature review to inform the research question) before semi-structured interviews and questionnaires were undertaken with MaaS stakeholders. An example of the survey questionnaire and a list of the interview questions is included in **Appendix A**.

A combination of both qualitative and quantitative data allowed a thematic analysis of stakeholder's opinions while providing flexibility to expand upon questions and explore trends that emerged. The questionnaire survey was considered an effective technique to collect data from a range of respondents efficiently with the semi-structured interviews providing an opportunity to expand upon certain topics with selected respondents.

4.2.1 *Data Collection: Questionnaire Survey*

A web-based survey questionnaire was created via 'SurveyMonkey' – an online survey platform which offers convenience to respondents and is accessible via digital platforms. The questionnaire was divided into themes: social equity in MaaS; the ability of MaaS to promote social inclusion; the regulatory framework required; questions regarding profession; and a summary to offer details for undertaking the semi-structured interviews. In total, 18 questions were included:

- 5 open questions;
- 4 multiple choice questions; and
- 11 Likert scale / matrix / ranked questions

The multiple choice / matrix questions enabled the collection of large amounts of data and were complemented by open-ended questions to allow respondents to provide greater consideration and answer with freedom. The use of Likert scales were considered an important tool that permitted themes to emerge alongside collecting individual analysis. The study contacted 189 people within the following categories:

- 146 local authorities, regional authorities and national authorities;
- 22 academics;
- 15 non-governmental organisations; and
- 6 MaaS operators.

A request was also sent to the mailing lists of the University Transport Study Group (UTSG) and the Intelligent Transport Systems (ITS) association which provided access to various 'smart mobility' academics, researchers and practitioners. An example email request is included at **Appendix B**. The potential responses received from public authorities was significantly affected with 58 automatic replies received. In total, 43 responses were received (22.8% response rate) as indicated at **Table 4.2**.

Table 4.2: Summary of Questionnaire Respondents

Respondent Group	Number of Respondents
Inner London Boroughs	5
Outer London Boroughs	6
Regional Authorities	2
Central Government	1
Academics	19
Non-Profit Organisations	2
MaaS Operators*	4
Prefer not to say	4
**Single respondent recorded as MaaS technology provider*	

Well-designed pilot studies can assist in presenting the best research process and avoiding unnecessary pitfalls (Van Teijlingen and Hundley, 2002). Therefore, a pilot study was undertaken by colleagues at Caneparo Associates, a transport planning consultancy, to limit respondents answering incorrectly. The pilot study demonstrated that certain questions should be set as compulsory, particularly those using the Likert Scale where multiple answers are required and therefore, segments of information could be missed.

4.3 Data Collection: Interviews

The semi-structured interview questions remained flexible to offer interviewees an opportunity to explore topics where they had more insight than others. Questions were grouped around themes: opinions of MaaS; equity in MaaS; smart technology's role in alleviating social issues; the ownership of MaaS models; and the governance of MaaS. Interviews were undertaken individually via telephone using a digital recorder before the data was anonymised and coded. The benefit of one-to-one semi-structured interviews is that it allows the interviewer to delve deeper into matters that emerge during the dialogue (Di Cicco-Bloom and Crabtree, 2006).

The selection parameters for those contacted was either through the questionnaire (respondents indicating they wish to be contacted further) or via a detailed internet search to identify senior officials working at Central Government. Those identified for the interviews were selected from the groups detailed in **Table 4.3**.

Table 4.3: Summary of Interview Respondents

Respondent Group	Number of Respondents
Inner London Boroughs	1
Outer London Boroughs	1
Regional Authorities	3
Central Government	3
Academics	1
Non-Profit Organisations	1

A number of senior officials at Central Government did not wish to fill out the questionnaire and, instead, opted for interviews which allowed in-depth discussions with those tasked with implementing future regulatory frameworks. Unfortunately, no contact could be made with MaaS Operators.

4.4 Research Limitations

There are three limitations of this research design. Firstly, the interviewees selected may not necessarily reflect the viewpoints of the key stakeholders explored (Akyelken et al, 2018). Secondly, a high proportion of academics responded to the questionnaire, reflecting the engagement of this group and the fact MaaS remains predominately within the remit of research. This may also highlight that other stakeholders are unengaged or unaware of MaaS when compared to academics. To compensate, the interviews focused on national and regional authorities to gain greater insight from these underrepresented groups. Finally, the sample size could be larger to highlight the diverse viewpoints of stakeholders, albeit this is limited by the lack of stakeholders with in-depth knowledge of MaaS. The lack of MaaS operator and regional government engagement limited the study of their viewpoints. In particular, the TfL innovations team refused to comment which might highlight that discussions of MaaS are of lesser strategic importance than to national government regulators and local authorities who will be faced with shaping the outcome, and dealing with the effects, of MaaS (Gray et al, 2017). Thus, the study may misrepresent TfL in the debate surrounding effective governance.

4.5 Research Strengths

The multi-faceted approach undertaken within the research design facilitated an analysis of both quantitative (questionnaires) and qualitative (interviews) perspective. This benefited the research, in part because during the research period (December 2018 to August 2019), the UK Government published a number of reports outlining their initial stance on emerging mobility services (GoS, 2019; DfT, 2019). By remaining flexible, the research was able to respond to the latest governmental reports and explore the topic most overlooked in current state intervention strategies – the societal impact of an unregulated mobility services.

4.6 Ethical Considerations

Throughout this dissertation, the researcher ensured ethical standards were adhered to. Confidentiality of research data is a principal concern and anonymity of participants will be respected throughout the study. All respondents within the questionnaires and interviews were made aware that discussions would be used for this academic work with all responses anonymised. This dissertation is the researchers own work and does not include misleading information. An example consent form and interview guide for the semi-structured interviews is included at **Appendix C**.

4.7 Bias

When managed ineffectively, bias can impact the reliability and validity of data with personal beliefs influencing how data is collected, analysed and discussed. The wording of questions can be a source of bias, as well as the potential underlying bias encountered when undertaking interviews (Kothari, 2004), particularly when studying topics surrounding social inclusion and effective governance. To mitigate the potential for bias, no leading questions were presented and respondents were not pressed to answer any questions during the interviews.

4.8 Data Analysis and Presentation

4.8.1 Quantitative Analysis: Questionnaire

The questionnaire data was analysed using descriptive statistics whereby the mean score was used to rank the significant factors that influenced each respondent group. The means were derived through a Likert scale to ascertain respondent's viewpoints. Each respondent group's results are detailed separately to reflect the differing opinions between stakeholders. The mean score, standard deviation and standard error are displayed for each.

As the data is non-parametric and cross-group analysis is required, the Kuskal-Wallis test has been undertaken. The P value was understood as follows:

- P>0.05 = no significance within the data distribution to suggest the respondent groups answers differ statistically.
- P<0.05 = significance within the data distribution suggests the respondent groups answers differ statistically.

Dunn's Multiple Comparison test compares the means of each respondent to one another to identify whether the groups suggest any differing views statistically. When no statistical difference is identified within the data, it suggests that the groups responded similarly and, therefore, an analysis of 'All Respondents' is undertaken. The skewness towards a rank is included to assess the varying degrees of non-symmetrical responses. **Appendix D** provides a detailed analysis of the Kruskal-Wallis test results when comparing each respondent group to one another for the relevant questions.

The fact only 1 questionnaire was completed under the category 'Central Government' means this has been removed from the study and referred to anecdotally alongside the in-depth interviews with senior Central Government officials.

4.8.2 Qualitative Analysis: Interviews

A qualitative data analysis was undertaken through coding of the semi-structured interviews to identify themes regarding stakeholder perceptions. The data was coded using the qualitative software, NVivo. Segments of responses were manually assigned to one or more codes. Matching text segments are then tagged with the same code and compared together (Glaser and Laudel, 2013). The data codes were taken from the literature review and from themes that emerged during analysis, particularly stakeholder opinions regarding the impact of MaaS on regulation. **Table 4.4** provides an example of the data-coding with detailed interview results included at **Appendix E**.

Table 4.4: Qualitative Data Coding

Code	Theme Description
ELD	Access for the elderly
COS +/-	Cost of MaaS
DIS	Disruptive technology / market disruptor
SvFM	State vs free-market intervention
SUB	Subsidies
OWN-MAAS	MaaS ownership models
TIME	Timing of regulation for social inclusion
TA-MAAS	Tailored MaaS
DAT	Data sharing
SCA-IM	Scale of implementation
PU-EN	Public engagement in MaaS
KN-GA	Knowledge gap
COM-VI	Commercial viability

Althought the interviewees do not represent the shared view of stakeholders, when combined with the governmental document review and questionnaires, their thoughts were helpful in understanding how smart mobility, social exclusion and governance are depicted in the public realm (Akyelken *et al*, 2018). The discursive approach also assisted in separating what is normative, what the respondents think *should* happen with MaaS, and what is cognitive, what the respondents think *can* happen when MaaS is implemented. Akyelken *et al* (2018) considers this as an important distinction when exploring emerging mobility services.

5. ANALYSIS & DISCUSSION OF FINDINGS

This chapter analyses the data collected through the questionnaire and semi-structured interviews which supports the research question.

5.1 Perceptions of Social Exclusion in Mobility-as-a-Service

To explore whether MaaS has the capacity to contribute towards social inclusion, respondents were asked whether MaaS includes or excludes users alongside the measures needed to ensure social inclusion.

5.1.1 Impact of Mobility-as-a-Service on Transport Poverty

Question 2.1 asked respondents to consider the extent to which they agree with the following quote from Pangbourne *et al* (2019: 24)

> *"Under MaaS, there is a strong potential for increased mobility among those who can pay for it. This runs counter to the need to reduce overall automotive movement... and does not address the needs of those experiencing transport poverty"*

Table 5.1: Extent to which Respondents agree with Pangbourne's statement on MaaS

	Academics	Inner London Borough	Outer London Borough	MaaS Operator	Regional Authority	NGO	All Respondents
Agree	21.1%	60.0%	16.7%	33.3%	100.0%	0.0%	28.9%
Somewhat Agree	57.9%	0.0%	83.3%	0.0%	0.0%	100.0%	47.6%
Neither agree or disagree	10.5%	40.0%	0.0%	0.0%	0.0%	0.0%	11.9%
Somewhat disagree	5.3%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%
Disagree	5.3%	0.0%	0.0%	66.7%	0.0%	0.0%	7.1%
Total	21.1%	60.0%	16.7%	33.3%	100.0%	0.0%	100%
Median Score	4	5	4	1	5	4	4
Mean	3.84	4.2	4.17	2.33	5	4	3.92
Std. Deviation	1.015	1.095	0.4082	2.309	-	-	-
Std. Error	0.2327	0.4899	0.1667	1.333	-	-	-
Skewness	-1.436	-0.6086	2.449	1.732	-	-	-
Kuskal-Wallis Test	P Value = 0.3519						

Respondents from Inner and Outer London Boroughs (mean 4.20 and 4.17 respectively) and Regional Authorities (mean 5.00) agreed most strongly with Pangbourne's statement, whilst MaaS operators indicated the lowest mean score of 2.33. In total, 76.3% of respondents agreed, 10.5% neither agreed nor disagreed, and 13.2% disagreed with the statement (Table 5.1). The Kurskal-Wallis test indicates no significant difference between the responses ($P > 0.9999$). The All Respondents category generally highlights agreement that MaaS has the potential to exclude those within transport poverty. Respondents provided various critiques (**Table 5.2**), divided between the potential impact MaaS could have for those who cannot afford it (cognitive) and the future capacity for MaaS to address transport poverty (normative).

Table 5.2: Respondents critique on Pangbourne's statement

Cognitive (can happen)	Normative (should happen)
Increased mobility for those who can afford it	**Addressing the cause of transport poverty**
"The business model… involves MaaS providers gaining increased revenue from the money that a user spends on their mobility needs."	*"Service fees can be basically anything. Some modes can be heavily subsidised to allow low income users to access them."*
"Drivers of ride-hailing services are incentivised to cluster in areas of high-demand. It is thus unlikely that MaaS will address transport poverty."	*"…the packages will gain ground in the coming years and will open up transport opportunities to wider groups."*
"…if MaaS is pushed by the market then it will be first available for those who can pay for it."	*"MaaS needs critical mass to be viable - so measures may be needed to ensure users in less dense areas are not socially excluded by future provision."*

The most repeated descriptions for future users of MaaS within the interviews were: *"professionals"*, *"elites"* and *"businessmen"*. This infers that current MaaS models are viewed by respondents as serving those who can currently afford unfettered mobility; consistent with the observations of Pangbourne *et al* (2019). However, comments within **Table 5.2** suggest this may be a temporary situation; one which will be addressed as the platform gains *"critical mass"* and can provide a broader consideration of transport users. This challenges Hopkins and Schwanen's (2018) contention that societal change cannot be achieved within the current market-driven mobility system.

5.1.2 Measures to achieve Social Inclusion through Mobility-as-a-Service

The questionnaire (Question 1.1) asked respondents to rank potential measures within MaaS which could promote social inclusion, with 7 being the most important and 1 being the least (**Figure 5.1**; **Appendix D**).

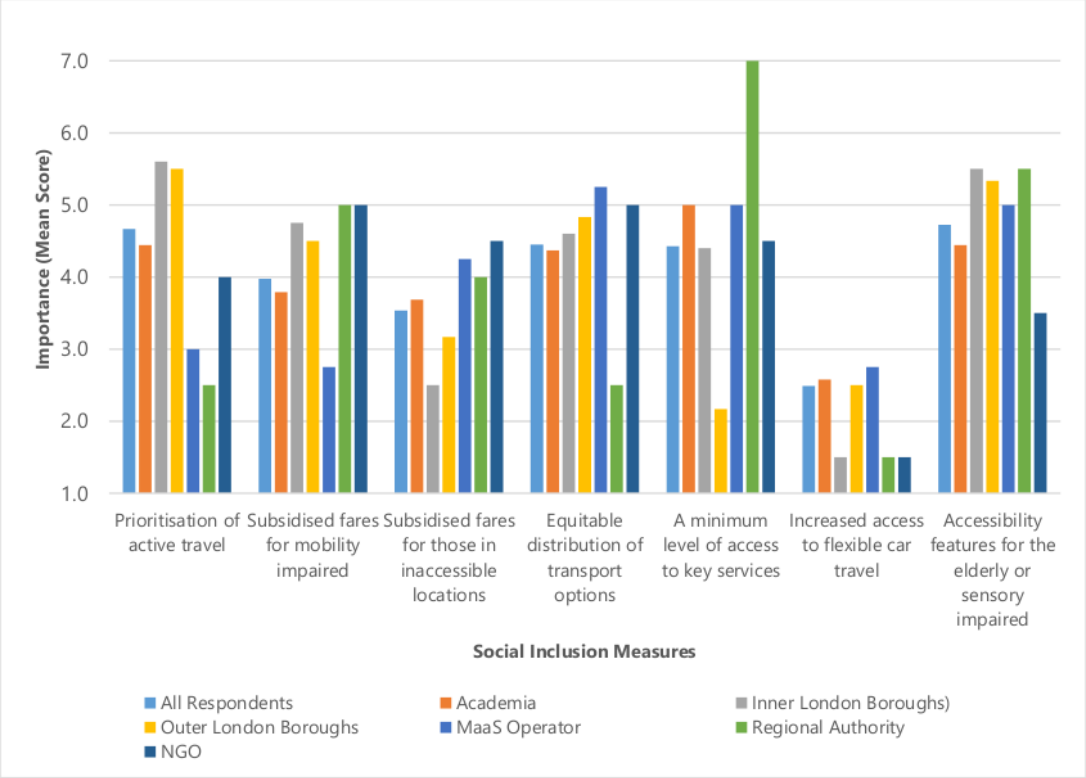

Figure 5.1: Social Support through MaaS – A comparison of Mean Scores

The results offer no evidence to suggest that respondents had differing views towards the benefits of MaaS ($P > 0.9999$). 'All Respondents' scored flexible car travel (mean 2.5) as the least important measure to be included within MaaS to promote social inclusion. This could be interpreted as officials refraining from promoting car-use for those who currently do not have access to a car; or that access to flexible car services for those on restricted incomes is not considered important for social inclusion. This was reinforced during the interviews, where an Outer London Borough respondent suggested that the ability to reduce car ownership was the greatest benefit of MaaS:

> *"If they* [MaaS Operators] *can pull together all these packages, it begins to make it apparent that the cost of owning a car, compared to just buying transport as and when you need it, is large"* (Outer London Borough)

This suggests a link between the current necessity to own a car in Outer London to fulfill a person's capabilities, and the cost burden this places on those in inaccessible locations, and accords with a study (Kamargianni *et al*, 2016) into the willingness of future users to sell their car if other options were available.

Figure 5.1 also indicate that prioritising active modes (mean 3.33) and accessibility features for the elderly or the sensory impaired (mean 3.28) were the most important measures to promote social inclusion. It can be surmised that active travel and healthier lifestyles present an important element of social inclusion, one which is seldom addressed in transport equity literature (Metz, 2016). The importance of accessibility features in MaaS also confirms an observation by Atasoy *et al* (2015) that the elderly struggle to use conventional public transport because it lacks tailored measures to assist them. The interviews identified the elderly, the sensory impaired, and the 'un-phoned' as groups most likely to be excluded from digital innovations. However, digital exclusion was considered resolvable via the design of MaaS platforms, with an Outer London Borough official referencing how contactless payment assists those who do not understand the transport system by simplifying payment. Similarly, a central government official appeared optimistic that MaaS could benefit the elderly: *"imagine an older person who is not tech savvy having a device they [sic] just speak to: 'please organise a trip to Tesco'"*, however, this is reliant on the person being able to afford the device.

5.1.3 Applying the Capabilities Approach to Mobility-as-a-Service

To further understand whether MaaS has the capacity to influence social inclusion, Question 3.1 asked respondents to consider the following:

> *"An individual's capability to interact with their environment influences the level of accessibility they [sic] can achieve (Pereira et al, 2017). To what extent could MaaS positively impact an individual's capability to access activities within a city?"*

Table 5.3: Extent to which Respondents agree with MaaS offering Capabilities

	Academics	Inner London Borough	Outer London Borough	MaaS Operator	Regional Authority	NGO	All Respondents
A great deal	22.2%	40.0%	0.0%	33.3%	0%	50%	19.5%
A lot	38.9%	20.0%	50.0%	66.6%	50%	50%	39.%
A moderate amount	16.7%	20.0%	33.3%	0%	50%	0%	24.4%
A little	22.2%	0%	16.7%	0%	0%	0%	14.6%
Not at all	0.0%	20.0%	0%	0%	0%	0%	2.4%
Total	100%	100%	100%	100%	100%	100%	100%
Median Score	4	4	3.5	4	3.5	4.5	4
Mean	3.611	3.6	3.333	4.333	3.5	4.5	3.59
Std. Deviation	1.092	1.673	0.8165	0.5774	0.7071	0.7071	-
Std. Error	0.2574	0.7483	0.3333	0.3333	0.5	0.5	-
Skewness	-0.3192	-1.089	-0.8573	1.732	-	-	-
Kuskal-Wallis Test	P Value = 0.5824						

The results in **Table 5.3** highlight that all respondents rated MaaS as having the ability to offer greater capabilities, with MaaS Operators (mean 4.33) and NGO's (mean 4.50) responding the most positively. Whilst it is unsurprising MaaS Operators agree their own platforms will contribute to greater access across cities, a greater variation in responses was identified from Academics, as observed within **Table 5.4** which divides comments from respondents into the positive, negative or neutral influence they expect MaaS to have when improving user's capabilities.

Table 5.4: Respondents Comments on MaaS offering Capabilities

Positive Influence	Neutral Influence	Negative Influence
"Finding the individuals needs and offering new solutions can contribute to greater access" (MaaS Operator)	*"The impacts can be positive or negative depending on different contexts"* (Academic)	*"It has much to do with environment, this will not be changed by MaaS"* (Academic)
"MaaS can support mobility when public transport has a low level of service" (Academic)	*"This cannot be generalised across a population and will differ from individual to individual"* (Academic)	*"MaaS alone.... can only have a limited impact itself"* (Central Government)
"For those who have a membership, accessibility is greatly increased due to the number of options offered by MaaS platforms" (Regional Authority)	*"work trips might not change that much (there may already be good commuter trips) while social events may not have easy access so could change more"* (Academic)	*"MaaS has the potential to push the world further away, increasing distances between activities and enabling greater dispersion of activities and, therefore, less accessibility"* (Academic)

The ability to offer choice was considered the most positive influence MaaS could have for an individual's capabilities. This was balanced against those who believed external forces, such as 'where you live', would influence an individual's capabilities more because MaaS has the potential to reinforce current spatial inequalities through greater mobility rather than accessibility (Gullberg, 2017). A third group considered it was more important to focus on the individuals requirements before suggesting whether MaaS can offer greater opportunities. This aligns with DfT (2018) recommendations for dialogue between disabled transport users and mobility innovators before designing the interface of new services. In summary, whilst the majority of respondents believed MaaS has the potential to provide greater capabilities to its users, and by extension greater social inclusion, it is evident respondents believe MaaS Operators must consider what their platform will be providing increased mobility towards.

5.2 Perceptions of State Intervention in Mobility-as-a-Service

To explore the challenges faced when regulating MaaS, respondents were asked whether current governmental practice is sufficient to ensure social inclusion; what the key challenges are when seeking inclusive measures; when state intervention should occur; and in what form?

5.2.1 Is current governmental practice sufficient?

Figure 5.2 demonstrates that 43.2% of respondents believe current governmental practice is insufficient to ensure social inclusion with only 5.4% considering it to be sufficient. This may affirm Akyelken *et al's* (2018) observation that current regulation is considered vague when applied to the specific nature of mobility innovations.

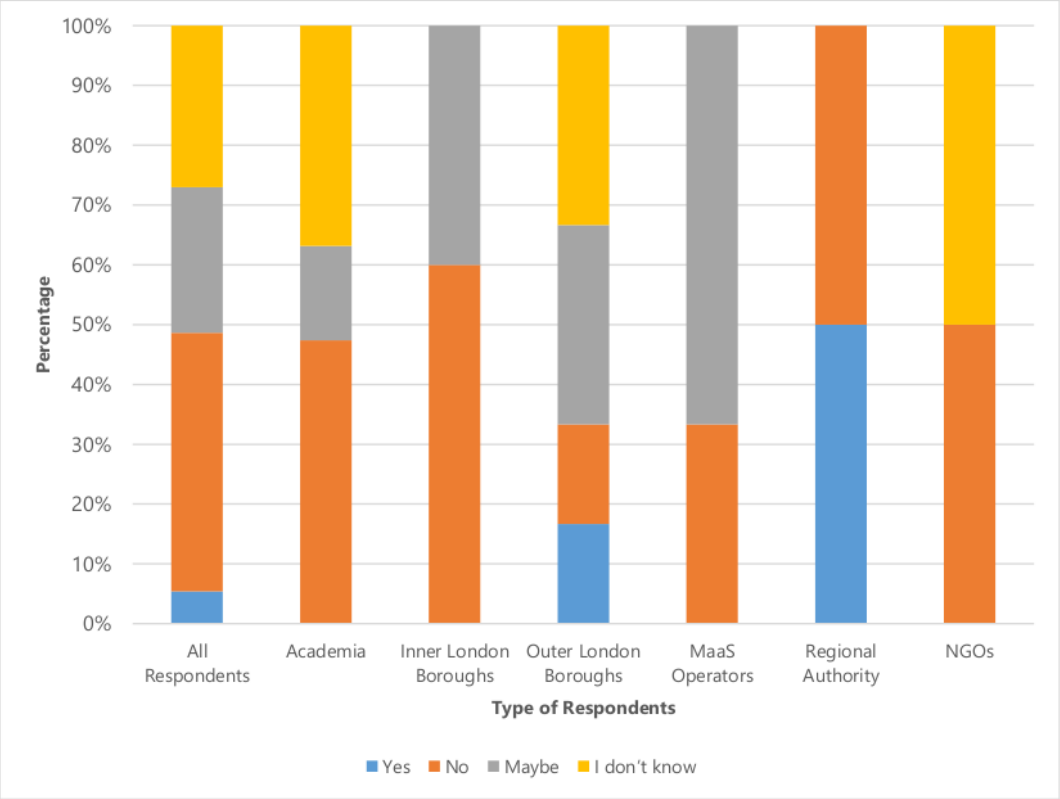

Figure 5.2: Is current governmental practice sufficient to ensure social inclusion within MaaS?

5.2.2 What are the key challenges when seeking inclusion through Mobility-as-a-Service?

To explore why governmental practice was considered insufficient, questions sought respondent's view on the challenges faced when regulating MaaS and the type of state intervention required. The themes which emerged predominately focused on the timing of state intervention, and the relationship between the market and the state when regulating innovations; the results of which are discussed within the following paragraphs.

Question 7.1 asked respondents the extent of which different challenges could impact the delivery of inclusion within MaaS (**Figure 5.3**; **Appendix D**). The results present no significant difference between responses (P>0.9999). Therefore, the 'All Respondents' group was analysed and revealed 'knowledge of smart mobility' and the availability of 'funding for subsidies' as the two greatest perceived challenges facing the governance of MaaS.

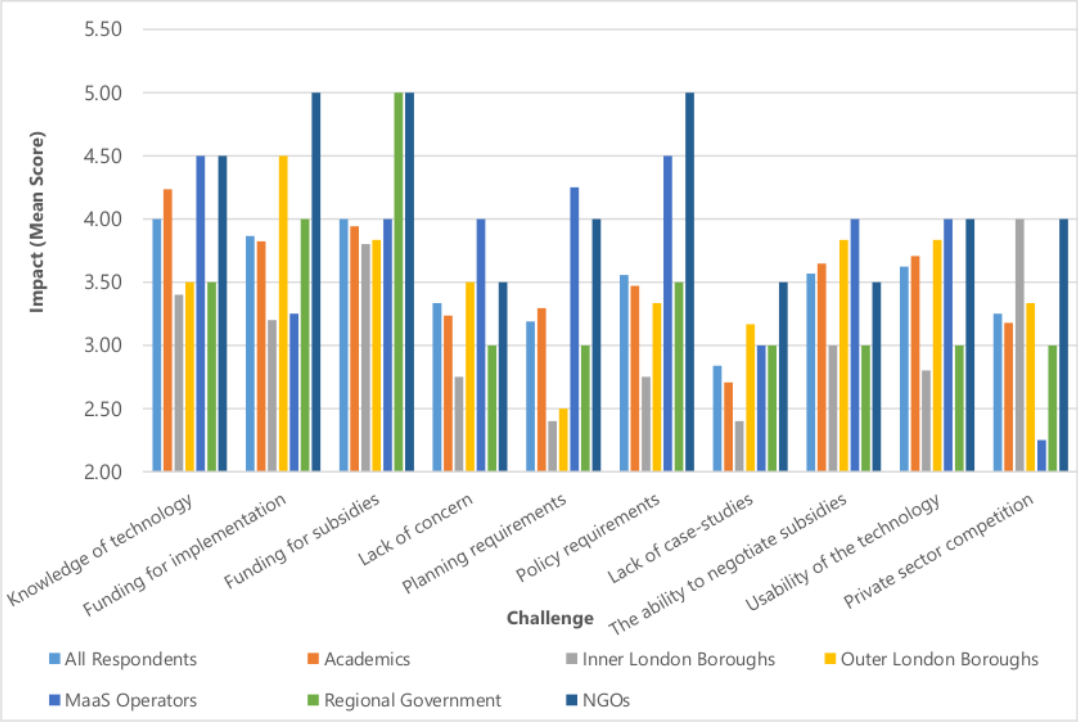

Figure 5.3: The extent to which challenges impact social inclusion within MaaS

Figure 5.3 corresponds with the governmental document review in Section 3.5 by suggesting further research is required into the effect emerging mobility services can have on certain populations. It could be suggested that the reason subsidies were not considered an important measure to promote social inclusion could be the difficulty in obtaining funding (**Figure 5.1**). A central government official argued the 'blunt' manner in which subsidies are currently provided must be replaced:

> *"You can imagine subsidies where we give you this amount of MaaS credit annually. If you decide to use this on single occupancy vehicle trips to the shops, where you are travelling at peak time, maybe that credit doesn't stretch very far. Whereas, when you are making more socially valuable trips, that credit could stretch a lot further"* (Central Government Official).

A 'scaled subsidy' would require a departure from the current tendency of UK Government to rely on commercial entities to reduce public subsidies and stimulate innovation by requiring direct state intervention in mobility services (Gray et al, 2017).

In support of the questionnaires, a further six common challenges emerged from the data coding regarding the regulation of MaaS towards social inclusion (**Table 5.5**; **Appendix E**).

Table 5.5: Analysis of the challenges faced when regulating MaaS to ensure social inclusion

Challenge	Description
Geographic	The ability to implement social inclusion at various scales and contexts.
Commercial	Balancing viability with social equity alongside the lack of funding for state intervention.
Market Disruptor	Ability of MaaS to disrupt the market and challenge current transport provision
Data Sharing	Lack of data sharing by MaaS operators limits research into where regulation is required.
Infrastructure	The ability of MaaS to improve social inclusion is limited by the availability of appropriate infrastructure
Knowledge	A lack of appreciation within governmental tiers regarding the capabilities of MaaS.
Public Engagement	Misrepresentation of groups from the decision-making, design and management of MaaS poses a risk to social equity.

Table 5.5 highlights lack of funding and a gap in knowledge as key challenges. Although the questionnaire responses consider the lack of case-studies unimportant (**Figure 5.3**; mean 2.84), the need for evidence gathering and undertaking research was expressed by all Central Government officials as an important step towards social inclusion:

> *"We first need the evidence base before pushing forward policies, and it is really hard for all emerging technologies and business models to have that strong evidence base".*

> *"Future of Mobility Funding has been announced so we can understand how these services develop".*

These contrasting opinions reflect the debate between Docherty *et al* (2018), who suggest without immediate action new mobility services may embark upon transition paths which solidify current social problems, and the DfT (2019), who consider further research is needed before action can be taken. It would, therefore, appear that the emerging theme facing regulators is *when* the most effective action can be

undertaken to address social inclusion whilst at the same time allowing MaaS operators to grow in the mobility market.

5.2.3 When should state intervention occur in Mobility-as-a-Service?

The majority of respondent (other than Regional Authority) believe regulation should be implemented immediately rather than waiting for the technology to develop or for case-studies to emerge (**Figure 5.4**). However, when asked whether MaaS platforms are currently inclusive, a Central Government official considered it was *"too early to make a proper assessment"* because MaaS platforms were limited by the infrastructure available, referring to the lack of disabled access in London underground stations; a situation considered beyond the remit of MaaS operators. Furthermore, a Regional Authority official conveyed a sense of inevitability that, for MaaS to be commercially viable, it should refrain from inclusive measures initially: "[MaaS Operators] *need financial and social uplift and propulsion towards success, and you don't get that unfortunately by spreading your net wider*".

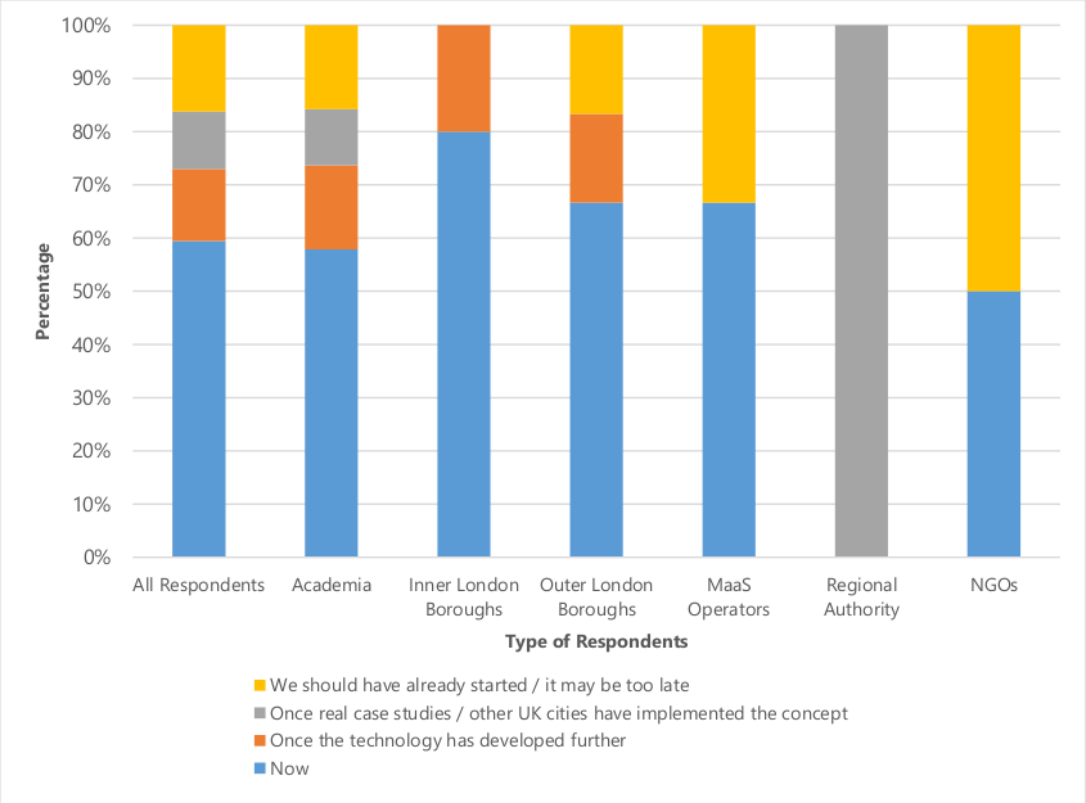

Figure 5.4: When should regulation be implemented?

Although conceding it is too early to consider social measures, similar to Pereira *et al*'s (2017) call for a basic threshold of service within inaccessible locations, an Academic suggests *"there is a precautionary principle that* [central government] *could have applied which says 'thus far and no further'"*. For instance, to prevent an uneven distribution of services, a Central Government official recommended subsidies to encourage MaaS operators into 'undesirable' areas. The majority of respondents were in opposition to this viewpoint and generally accorded with the 'wait and see' approach adopted by the DfT (2019). Interestingly, while NGO respondents within the questionnaire generally believe it may be too late regulate MaaS, an NGO official during the interview specified *"trying to intervene before there is a problem is a very risky strategy because you can get a whole series of unintended consequences"*. This challenges the literature, which considers the deliberate hands-off approach is blind to the potential negative externalities (Docherty, 2018). The NGO respondent suggested governmental organisations do understand the threat of unregulated MaaS but consider the time for state intervention has not yet come. It would appear that whilst governance has identified a problem, how to formulate and implement an defective intervention remains unknown (Dowling 2018).

5.2.4 How should State Intervention occur in Mobility-as-a-Service?

As MaaS is a product to be bought by users, many of the respondents viewed the type of state intervention as dependent on debates between interventionism versus free-market economics (**Table 5.6)**.

The interviews divided state intervention into three categories:

- Privately-operated MaaS platforms with state regulation,
- State-operated MaaS platforms to 'fill in the gaps' left by private operators, and
- Public-private partnerships in MaaS platforms

Table 5.6: Perspectives on regulating MaaS

The need for regulation	The problem with regulation
"A whole melting pot of MaaS providers aren't under any obligations." (Regional Authority)	*"we don't want to say anything too quickly because it could stifle innovation"* (Central Government)
"Without some form of regulation you will end up with a race to the bottom" (Outer Borough)	*"…the state's best role in a MaaS ecosystem is providing infrastructure assets". (*NGO)
"Lack of regulation will lead to fragmented markets that try and sell people what will benefit the company" (Outer Borough)	*"Companies have done a sensible approach – how do we get a minimum viable product in the market? Later down the line how do we reach a larger audience?"* (Central Government)
"What I see is businesses smelling an opportunity and trying to get in with that network" (Academic)	*"… regulation is only one tool. It is about understanding what is the most appropriate tool to use to effect the change we want to see"* (Central Government)

Those in favour of regulation thought it essential in avoiding the abuse of the transport system by profit-driven businesses (Pangbourne *et al*, 2019). This is reflected by Regional Authority commentary which compares MaaS to current regulatory frameworks: *"TfL are under legislation, statuary obligations and political pressure to operate in a way which is accessible to everyone, it is obliged to offer services to all Londoners"*. Furthermore, one Academic suggested *"it is hard to change things later when you are starting from no holds barred"*; as spatial forms can institutionalise once created (Harvey, 2008). Another Academic challenges the argument that regulation hinders businesses because regulation acts as *"free insurance for everybody because it levels the playing field*". In opposition, Central Government officials confirm comments by Geels (2011) regarding a 'marketisation transition' as increasing consumer choice means a greater role for non-state actors in decision-making, with one Central Government official concerned with 'stifling' innovation with regulation. The fact regulation was viewed as only one 'tool' to be used by Central Government could align with Marique and Marique (2018) who believe the outcome rather than the ability to restrict and control digital innovation is crucial when seeking positive outcomes. This accords with a Central Government official who argued well-targeted subsidies to encourage MaaS operators into undesirable areas would be as effective as regulation of the MaaS operators themselves.

The respondents offer no conclusive evidence that a single form of state intervention is considered more preferable than another. Therefore, respondents were asked explicitly at Question 14. whether informative guidance (principles which guide designers but allow freedom) or prescriptive guidance (that must be complied with) is required (**Figure 5.5**). Whilst respondents are divided over the level of state intervention, the questionnaire results indicate at least 86.5% of respondents consider that some form of compulsory guidance is needed.

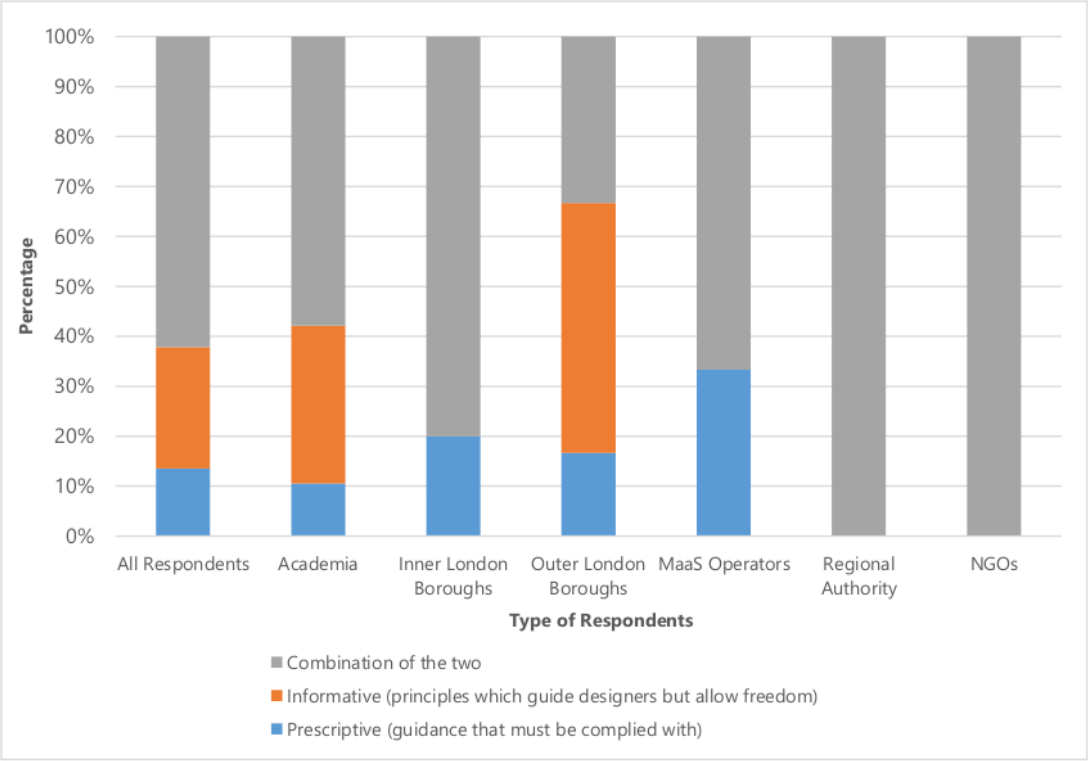

Figure 5.5: In what form should regulation be given?

To further explore whether direct state intervention in MaaS platforms is important to stakeholders, respondents were asked at Question 8.1 who should be responsible for delivering MaaS in London. The majority questionnaire respondents (59.46%) consider TfL as the most appropriate organisation to deliver MaaS in London. Unsurprisingly, MaaS Operators believed private operators, either solely or with a public-private partnership, should deliver MaaS (**Figure 5.6**).

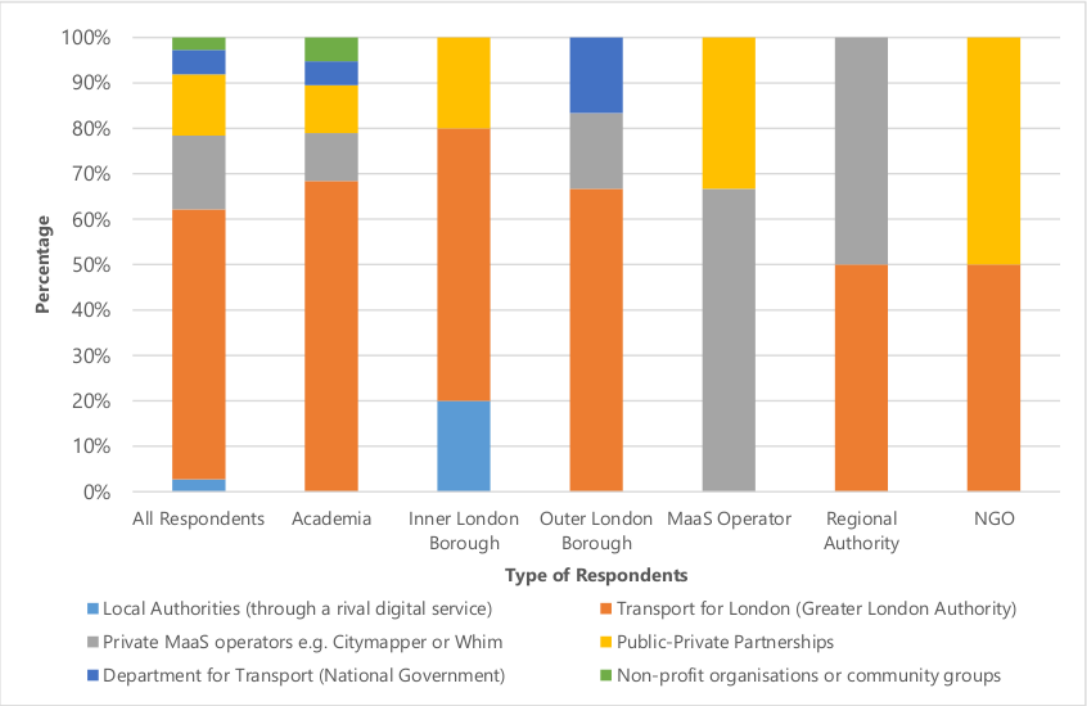

Figure 5.6: Who should deliver MaaS in London?

Contrary to the questionnaire results (Figure 5.6), interview respondents overwhelmingly considered a balance between both private and public ownership could be struck:

> *"There is a chance* [MaaS] *will help people make different decisions but I don't think on its own it makes a more equitable transport system" (*Outer London Borough)

> *"...the private sector has an important role in stimulating innovation but ultimately it is reliant on public services"* (Central Government)

This is in line with Wong *et al's* (2018) recommendation for an 'arm's length' government entity to allow debate and government engagement and confirms Marique and Marique's (2018) belief that a balance between public and private regulation may be required if emerging mobility services are to provide a positive contribution. The fact many respondents considered that regional government (TfL) must play a direct role could also be influenced by respondents wishing to avoid the type of disruption caused during the emergence of Uber. As one Academic responded: *"I can see [TfL] leaving it to private providers and then intervening when it is too late"*. This envisages a scenario when the service has reached a critical mass and effective regulation is frustrated by public demand (Dudley *et al,* 2017).

The involvement of public services to facilitate MaaS is a crucial element of the ownership debate, with an academic querying why mobility should be considered a service (as something that should make a profit) when roads are state-funded. In opposition an NGO disputed MaaS should be state-run, and instead argued the state should be viewed as infrastructure providers:

"If [the Government] *see themselves as a transport provider then they should see themselves as an infrastructure provider, and if they see themselves as trying to help society then they should see themselves as selling that infrastructure in such a way that their policy goals are met"*.

The statement concurs with Giddens' (2008) who believes the state remains a key 'enabler' of services like MaaS by facilitating the correct environment for innovations to flourish, in this instance through the provision of suitable infrastructure that allows MaaS to combine journeys which are currently blocked by poor infrastructure provision. This accords with a Central Government official who states *"if there is an area with poor coverage, we must think how we can improve connectivity infrastructure"*. In summary, while Dowling and Kent (2015) were correct in inferring that the state relies on the ability to form effective partnerships with non-state actors to deliver policy-goals, it remains unclear from the research how this relationship between public and private entities will materialise, and who will ultimately be responsible for managing any future public-private MaaS platforms.

6. CONCLUSION

This chapter provides a conclusion of the study and the data gathered. A review of the research aims and objectives is presented alongside policy implications and recommendations for further research.

6.1 Review of the Research Aim and Objectives

The aim of the study was to explore the role of governance in ensuring MaaS contributes to social inclusion in London. This was achieved by satisfying the research objectives detailed in the following paragraphs.

Research Objective 1: *To review existing literature on social inclusion and governance relating to MaaS*.

This objective was achieved through the literature and governmental document review in Chapter 3. The literature review revealed that current studies into MaaS fail to address concerns regarding social inclusion. Whilst recognising MaaS has the potential to exclude certain populations, no regulatory framework has been proposed. The study defined an inclusive MaaS ecosystem as one which ensures that the heralded opportunities of seamless, on-demand mobility is accessible to all, and that travellers are able to make use of the service. The research also revealed that the state's role in regulating MaaS is focused on facilitating non-state actors in the provision of mobility.

The governmental document review explored the stance of central government towards MaaS. This revealed that, before action can be taken, evidence needs to be gathered to ensure interventions would lead to desired outcomes. This ran in opposition to the literature review which suggested immediate action in MaaS is necessary to avoid negative social repercussions. Both the literature and governmental document review identified a knowledge gap in the governance of MaaS which helped to establish the research objectives of this study: whether MaaS can support inclusion, what the challenges are when regulating MaaS, and the intervention required to ensure social inclusion.

Research Objective 2: *To understand stakeholders' perspectives on the capacity for MaaS to promote social inclusion and the challenges faced when regulating the service*.

This objective was fulfilled via the questionnaires and interviews, with the questions informed by Research Objective 1. The study identified that respondents did not have differing opinions on the ability of MaaS to include populations, with stakeholders aware that a poorly-run MaaS platform could exclude populations, whilst a well-planned MaaS platform could offer increased capabilities to those in transport poverty. It can be implied that stakeholders agreed that the way MaaS is delivered significantly impacts its final outcome and that the platform should deliver the right mobility rather than more (Gullberg, 2017). The study

discovered that knowledge of MaaS and the availability of funding for subsidies were considered the greatest challenges when delivering inclusion within MaaS. This aligns with the governmental document review and responses from Central Government officials who suggest further research must be undertaken before state intervention.

Research Objective 3: *To set out the state intervention required to ensure MaaS contributes towards an inclusive transport system.*

This objective was achieved by first identifying the key challenges faced when regulating MaaS (Section 5.2.2). The study discovered that roughly 60% of questionnaire respondents believed TfL should have a role in the delivery of MaaS in London. Whilst key stakeholders consider MaaS as a private entity, they viewed an element of state intervention as important, either through regulation, direct ownership or providing incentives / subsidies to MaaS operators. However, the type of state intervention required divided stakeholder opinion. Central government officials considered direct state intervention as frustrating innovation and, instead, called for non-direct action (subsidies) to encourage MaaS operators. Academics generally viewed direct state intervention as a necessity to narrow the gap between those who will have MaaS and those who will not.

The emerging trend was not the ability of the state to effectively influence the direction of MaaS for the benefit of citizens, but the time period in which this should be undertaken. Thus, the study highlights that state intervention in MaaS can be implemented in various guises, albeit, the most effective form remains influenced by partisan allegiances regarding whether the state or the market should steer emerging mobility services towards inclusive outcomes.

6.2 Conclusion

In conclusion, the study has demonstrated that MaaS has the potential to contribute towards a more inclusive transport system by offering greater mobility to those currently excluded from mainstream transport options. It has established the significant role governance can have in facilitating emerging mobility services within London, and thus, stressed the importance in understanding the challenges facing the effective regulation of MaaS. Despite discussions concerning the extent to which regulation can achieve the policy-goals of MaaS, the stakeholders questioned as part of this study reflect on the limited governmental knowledge of how emerging, disruptive mobility services can significantly alter the way travel is derived. It is, therefore, critical that policy-makers understand the short window opportunity faced when seeking to influence MaaS to ensure its benefits are shared by all. The study confirms that a strong

regulatory framework is required to ensure MaaS provides those currently excluded from the transport system greater opportunities to interact within society, but more importantly, to offer a place for open discussion on how we want our cities to develop as new mobility services emerge (Docherty, 2018).

6.3 Implications for Policy

The pace at which mobility services are emerging within cities poses a challenge for how officials regulate to ensure effective outcomes. Time is of the essence if we want to live in cities which provide citizens, regardless of their age, disabilities or socio-economic background, the ability to access the services they require. Governance, and the regulatory frameworks it produces, must remain ahead of the innovation curve and flexible enough to react to disruptive technologies: something which the UK Government has historically struggled with. Governments at all levels could do more to spot emerging mobility services earlier and to recognise the profound impact they can have, both positive and negative, on those currently excluded from mainstream mobility options. A seismic shift in how policy predicts, manages and facilitates emerging mobility services is required if we are to see the most integrated, sustainable and inclusive visions of smart mobility.

6.4 Further Research

As MaaS operators establish themselves within the mobility market, and users increasingly engage with their services, research is recommended into how the platforms may exclude certain populations. This could be undertaken by exploring user's travel patterns based on pre-determined societal groupings to ascertain what MaaS has provided greater mobility towards, and whether this journey is socially valuable. Furthermore, following the FMZ bidding process, a dedicated study is suggested into how subsidies can be structured to actively engage populations, for example the elderly or those in inaccessible locations. It will be crucial to ascertain the thoughts of MaaS operators and the barriers they perceive restrict the implementation of various inclusive measures if we are to see a truly inclusive form of MaaS.

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8. APPENDICES

Appendix A: Example Questionnaire and Interview Questions

Appendix B: Sample Email - Questionnaire

Appendix C: Consent Form and Interview Information Sheet

Appendix D: Statistical Analysis using Kurskal-Wallis test

Appendix E: Supplementary Evidence from Stakeholder Interviews

Appendix F: Risk Assessment Form

APPENDIX A

EXAMPLE QUESTIONNAIRE AND INTERVIEW QUESTIONS

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Mobility-as-a-Service (MaaS) Questionnaire Survey

My name is David Pearce, and I am an MSc student at UCL, undertaking research for my dissertation into the role of governance in steering smart mobility transitions such as Mobility-as-a-Service (MaaS) towards inclusive outcomes for transport users.

The sharing economy is predicted to become a ubiquitous part of everyday life and will lead to a shift from ownership to usership of mobility. Cars will be seen as just commodities, replacing public transport where it fails to deliver mobility. (Government Office for Science, 2017)

"Mobility-as-a-Service is a user-centric, intelligent mobility management system which integrates multiple transport providers, and delivers end-user access through digital interfaces (smartphones), allowing travellers to seamlessly plan and pay for mobility" (Kamargianni et al, 2018).

Examples of MaaS can be found at: www.whimapp.com (Whim) or citymapper.com/pass (Citymapper)

As part of my study, I am seeking to understand the views of public authorities, private operators and researchers from Universities to explore the challenges faced when seeking an inclusive transport system from MaaS in London.

The survey includes 19 questions and is estimated to take 12-13 minutes to complete. Your participation in this study is strictly confidential and anonymous. Thank you for your time and attention; please click below to start the survey.

1. Under MaaS, operators can provide personalised 'bundles' based on the users travel patterns, such as family packages, commuter travel or weekend users.

In your opinion, what social support should bundles include? (please rank the following with 1 being the most important)

- Prioritisation of active travel
- Subsidised fares for those with mobility impairments
- Subsidised fares for those in inaccessible locations
- An equitable distribution of transport options across London
- A minimum level of access to key services
- Increased access to flexible car travel
- Accessibility features for the elderly or those with sensory impairments

2. Are there any further measures that could be implemented within MaaS to improve social inclusion? If so, please comment below.

* 3. Please consider the extent to which you agree with the following quote:

"Under Mobility-as-a-Service, there is a strong potential for increased mobility among those who can pay for it. This runs counter to the need to reduce overall automotive movement... and does not address the needs of those experiencing transport poverty" (Pangbourne et al, 2019)

- Agree
- Somewhat Agree
- Neither agree or disagree
- Somewhat Disagree
- Disagree
- Prefer not to say

Explain the rationale behind your answer

* 4. An individuals capability to interact with their environment influences the level of accessibility they can achieve (Pereira et al, 2017)

To what extent could MaaS positively impact an individual's capability to access activities like work, social events or education services.

- ◯ A great deal
- ◯ A lot
- ◯ A moderate amount
- ◯ A little
- ◯ Not at all
- ◯ Prefer not to say

Explain the rationale behind your answer

* 5. Which societal group is MaaS expected to benefit to a greater extent than others? (select as many as necessary)

- ☐ Young
- ☐ Sensory impaired
- ☐ Mobility impaired
- ☐ Poor
- ☐ Isolated communities
- ☐ Families
- ☐ Old
- ☐ Professionals
- ☐ Unemployed
- ☐ City centre residents

6. A report by the House of Commons (2018) suggests digitally-connected kiosks at train stations could assist those without smartphones to access MaaS.

To what extent do you agree with this?

- ◯ Agree
- ◯ Somewhat Agree
- ◯ Neither agree nor disagree
- ◯ Please explain your rationale
- ◯ Somewhat disagree
- ◯ Disagree
- ◯ Prefer not to say

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7. To what extent do you believe your organisation has the ability to influence the following outcomes of MaaS?

	A great deal	A lot	A moderate amount	A little	Not at all
Prioritisation of active travel modes	○	○	○	○	○
Subsidised fares for those with mobility impairments	○	○	○	○	○
Subsidised fares for those in inaccessible locations e.g. transport disadvantaged	○	○	○	○	○
An equitable distribution of transport options	○	○	○	○	○
A minimum level of access to key services	○	○	○	○	○
Increased access to flexible car travel	○	○	○	○	○
Accessibility features for the elderly or those with sensory impairments	○	○	○	○	○

8. In your opinion, to what extent could the following barriers impact social inclusion within MaaS?

	A great deal	A lot	A moderate amount	A little	Not at all
Knowledge of smart mobility technology	◯	◯	◯	◯	◯
Funding for implementation	◯	◯	◯	◯	◯
Funding for subsidies	◯	◯	◯	◯	◯
Lack of concern	◯	◯	◯	◯	◯
Planning requirements	◯	◯	◯	◯	◯
Policy requirements	◯	◯	◯	◯	◯
Lack of real-world examples	◯	◯	◯	◯	◯
The ability to negotiate subsidies / discounts	◯	◯	◯	◯	◯
Usability of the technology	◯	◯	◯	◯	◯
Private sector competition	◯	◯	◯	◯	◯

* 9. Currently, MaaS is delivered by private organisations such as Citymapper or Whim.

Who do you believe should be responsible for delivering MaaS in London? (Choose One)

- ◯ Private MaaS operators e.g. Citymapper or Whim
- ◯ Public-Private Partnerships
- ◯ Local Authorities (through a rival digital service)
- ◯ Transport for London (Greater London Authority)
- ◯ Department for Transport (National Government)
- ◯ Non-profit organisations or community groups
- ◯ Prefer not to say
- ◯ Explain the rationale behind your answer

* 10. In the case of London, to what extent does MaaS challenge the position of public authorities as transport provider?

- ◯ A great deal
- ◯ A lot
- ◯ A moderate amount
- ◯ A little
- ◯ Not at all
- ◯ Prefer not to say

* 11. Do you consider current policy to be adequate to maximise social inclusion through MaaS?

- ◯ Yes
- ◯ Maybe
- ◯ No
- ◯ I don't know

Explain the rationale behind your answer

12. When developing regulation or policy for MaaS implementation, how important is it for the following stakeholders to have a say?

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not Important at all
National Government	◯	◯	◯	◯	◯
Regional Government	◯	◯	◯	◯	◯
Local Government	◯	◯	◯	◯	◯
Residents / Communities	◯	◯	◯	◯	◯
Automotive Industry	◯	◯	◯	◯	◯
Technology Industry	◯	◯	◯	◯	◯
Developers	◯	◯	◯	◯	◯
Law Practitioners	◯	◯	◯	◯	◯
Private consultancies	◯	◯	◯	◯	◯
Academics	◯	◯	◯	◯	◯

Other (please specify)

* 13. In your opinion, how important is it to undertake public consultation on MaaS guidance?

- ◯ Extremely important
- ◯ Very important
- ◯ Moderately important
- ◯ Slightly important
- ◯ Not important at all
- ◯ Prefer not to say

* 14. When do you think we should start to develop guidance / regulation for MaaS implementation in planning?

- ◯ Now
- ◯ Once the technology has developed further
- ◯ Once real case studies / other UK cities have implemented the concept
- ◯ Never
- ◯ We should have already started / it may be too late
- ◯ It is impossible to provide guidance for Mobility-as-a-Service

* 15. In what form should guidance / regulation be given?

- ◯ Prescriptive (guidance that must be complied with)
- ◯ Informative (principles which guide designers but allow freedom)
- ◯ Combination of the two
- ◯ Explain the rationale behind your answer

Mobility-as-a-Service (MaaS) Questionnaire Survey

* 16. What type of organisation do you work for?

- ◯ Academia
- ◯ Central Government
- ◯ Regional Government
- ◯ Local Authority (Inner London)
- ◯ Local Authority (Outer London)
- ◯ Other (please specify)
- ◯ MaaS Operator
- ◯ Transport Provider
- ◯ Private Consultancy
- ◯ Non-profit Organisation

* 17. How would you describe your awareness / knowledge of MaaS?

- ◯ Extremely knowledgeable
- ◯ Very knowledgeable
- ◯ Moderately knowledgeable
- ◯ Slightly knowledgeable
- ◯ Not knowledgeable at all

* 18. How would you describe your interest in MaaS?

- ◯ Extremely interested
- ◯ Very interested
- ◯ Moderately interested
- ◯ Slightly interested
- ◯ Not interested at all

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Mobility-as-a-Service (MaaS) Questionnaire Survey

19. Thank you for completing this questionnaire - it is greatly appreciated.

As part of my dissertation i will be undertaking further research via interviews. If you would like to be contacted to discuss in more detail some of the points raised within this questionnaire, or would be interested in receiving an electronic copy of the dissertation once it is completed, please provide an email address below or otherwise respond directly to:

David.pearce.17@ucl.ac.uk

Thank you and have a great day!

David

Name	
Email Address	

EXAMPLE SEMI-STRUCTURED INTERVIEW QUESTIONS

Social Equity in MaaS

1. In your opinion, what is the main benefit of Mobility-as-a-Service?

2. In reference to social inclusion and providing travellers greater opportunities to access services within cities, how do you believe Mobility-as-a-Service could contribute to equity in the transport system?

3. Do you consider the current Mobility-as-a-Service model as inclusive?

4. Do you consider smart technology as excluding certain groups?

5. In what way do you consider smart technology to be the answer to issues pertaining social exclusion and transport poverty?

6. Being a new technology means the final design remains fluid. Is there any features you believe should be included to promote inclusion or offer the transport disadvantaged a greater opportunity for travel?

7. Do you think the state should be involved in certain aspects of Mobility-as-a-Service, for example coverage, pricing, design?

Ownership of MaaS

8. Who do you believe should deliver Mobility-as-a-Service?
    a. Is there room for a State Mobility-as-a-Service operator?

9. Mobility-as-a-Service combines both public and private transport offerings, do you believe this requires specific management?

10. Do you believe Mobility-as-a-Service challenges the position of Transport for London as a transport provider, and do you believe this will have any repercussions for general equity goals?

11. Do you believe that MaaS can achieve equity goals without regulation? Is there a limit?

Governance of MaaS

12. In your opinion, how do you think governance should influence the direction of Mobility-as-a-Service?

13. Would you agree that if action isn't taken soon, the social benefits that could be realised will be difficult to achieve as private operators become established in the transport network?

14. Do you consider there to be any barriers in implementing policies that promote inclusion in Mobility-as-a-Service?

15. What change to governmental practice or policy do you believe is required to maximise the inclusivity of Mobility-as-a-Service?

APPENDIX B

SAMPLE EMAIL - QUESTIONNAIRE

Dissertation Study Assistance Request – MSc Student University College London

Pearce, David

Sat 31/08/2019 12:47

To: Pearce, David <david.pearce.17@ucl.ac.uk>

Dear fellow transport professional,

My name is David Pearce and I am a Masters student at University College London studying Transport and City Planning. I am currently undertaking a questionnaire survey for a study into the role of governance in steering smart mobility transitions such as Mobility-as-a-Service towards inclusive and equitable outcomes.

In my work life, I am a transport planning consultant at a private consultancy in London and I got hold of your email address through our professional contact list / online and I am especially interested in getting the views of peers / industry colleagues. Please excuse the direct email. I would be extremely grateful if you could spare your time to complete the questionnaire!

I wish to understand the views of public authorities, private operators and academics to explore the opportunities and barriers faced when seeking an inclusive and equitable outcome from Mobility-as-a-Service in London.

The questionnaire has been prepared using SurveyMonkey and takes approximately 12-13 minutes with all survey responses completely anonymous and confidential. The questionnaire is online and can be undertaken on mobile or computer. The deadline is the 19th July (circa 2 weeks). It would also be greatly appreciated if you could pass this onto any colleagues who might be interested.

Please find a link to the survey here:

https://www.surveymonkey.co.uk/r/NYVBFJW

UCL

The Bartlett School of Planning

Mobility-as-a-Service (MaaS) Questionnaire Survey

www.surveymonkey.co.uk

Take this survey powered by surveymonkey.com. Create your own surveys for free.

If you have any queries or would like to discuss the survey at all, i'd be happy to answer by return to this email.

I will be undertaking further research via interviews. If you would like to be contacted further to discuss the topic in more detail please fill out the last question in the survey questionnaire or responddirectly to the email below.

Many thanks in advance,

David

David Pearce
The Bartlett School of Planning
University College London
David.Pearce.17@ucl.ac.uk

APPENDIX C

CONSENT FORM & INTERVIEW INFORMATION SHEET

UNIVERSITY COLLEGE LONDON
BARTLETT SCHOOL OF PLANNING

CONSENT FORM FOR ADULT IN RESEARCH STUDIES

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: State intervention in Mobility-as-a-Service: the role of governance in steering new mobility services towards inclusive outcomes in London
Department: Bartlett School of Planning, UCL
Name and Contact Details of the Researcher: David Pearce 07426662136 **David.Pearce.15@ucl.ac.uk**
Name and Contact Details of the UCL Data Protection Officer: **data-protection@ucl.ac.uk**

Thank you for considering taking part in this research. The person organising the research must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

I confirm that I understand that by ticking/initialling each box below I am consenting to this element of the study. I understand that it will be assumed that unticked/initialled boxes means that I DO NOT consent to that part of the study. I understand that by not giving consent for any one element that I may be deemed ineligible for the study.

		Tick Box
1.	I confirm that I have read and understood the Information Sheet for the above study. I have had an opportunity to consider the information and what will be expected of me. I have also had the opportunity to ask questions which have been answered to my satisfaction and would like to take part in an individual interview.	
2.	I understand that I will be able to withdraw my data up to 4 weeks after the interview	
3.	I consent to participate in the study. I understand that my personal information (organisation) will be used for the purposes explained to me, however, will be under broad terms. I understand that according to data protection legislation, 'public task' will be the lawful basis for processing.	
4.	**The data collected will be used for this research project only and will be destroyed afterwards.** I understand that all personal information will remain confidential and that all efforts will be made to ensure I cannot be identified *(unless you state otherwise, because of the research design or except as required by law).* I understand that my data gathered in this study will be stored anonymously and securely. It will not be possible to identify me in any publications. For example, categories will be created under broader terms like central government, Non-profit organisation or academia.	
5.	I understand that my information may be subject to review by responsible individuals from the University for monitoring and audit purposes.	

6.	I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason, without the care I receive or my legal rights being affected. I understand that if I decide to withdraw, any personal data I have provided up to that point will be deleted unless I agree otherwise.	
7.	I understand the potential risks of participating and the support that will be available to me should I become distressed during the course of the research.	
8.	I understand that no promise or guarantee of benefits have been made to encourage you to participate.	
9.	I understand that the data will not be made available to any commercial organisations but is solely the responsibility of the researcher(s) undertaking this study.	
10.	I understand that I will not benefit financially from this study or from any possible outcome it may result in in the future.	
11.	I agree that my anonymised research data may be used by others for future research. [No one will be able to identify you when this data is shared.]	
12.	I understand that the information I have submitted will be published as a report and I wish to receive a copy of it. Yes/No	
13.	I consent to my interview being audio/video recorded and understand that the recordings will be destroyed within 4 weeks after the data has been collected or destroyed immediately following transcription.	
14.	I hereby confirm that I understand the inclusion criteria as detailed in the Information Sheet and explained to me by the researcher.	
15.	I hereby confirm that: (a) I understand the inclusion criteria as detailed in the Information Sheet and explained to me by the researcher; and (b) I do fall under the inclusion criteria.	
16.	I am aware of who I should contact if I wish to lodge a complaint.	
17.	I voluntarily agree to take part in this study.	
18.	Use of information for this project and beyond will be for research purposes with personal data stored for a 3 month period. I understand that other authenticated researchers will have access to my anonymised data.	

_____ _____ _____

Name of participant Date Signature

Participant Information Sheet for Adult

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Title of Study: State intervention in Mobility-as-a-Service: the role of governance in steering smart mobility transitions towards inclusive outcomes in London

Department: Bartlett School of Planning, UCL

Name and Contact Details of the Researcher: David Pearce, 07426662136, david.pearce.15@ucl.ac.uk

Dear Participant,

You are being invited to take part in an MSc research study. It is important for you to understand why the research is being undertaken and what participation will involve. Please take time to read the following information carefully. The study will explore the opinions of stakeholders pertaining the role of governance in steering Mobility-as-a-Service towards inclusive outcomes in London. Participation is voluntary and can be withdrawn at any time. If there is anything that is not clear or if you would like more information please ask. Take time to decide whether or not you wish to take part.

Thank you, David

1. **What is the project's purpose?**
   I am undertaking this study to understand the challenges faced when regulating new mobility services to achieve inclusion within our transport networks. The aim is to explore the extent to which current and forthcoming regulatory frameworks for Mobility-as-a-Service are suitable to promote inclusion within the transport network, while understanding the measures that could be implemented to maximise societal benefits. The project will be completed at the beginning of September 2019.

2. **Why have I been chosen?**
   The inclusion criteria was selected to engage a balance of viewpoints between those involved in the Mobility-as-a-Service ecosystem: central, regional and local authorities, academia, non-profit organisations and MaaS Providers.

3. **Do I have to take part?**
   It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form). You can withdraw at any time without giving a reason. If you decide to withdraw you will be asked what you wish to happen to the data you have provided up that point.

4. **What will happen to me if I take part?**
   Research will be undertaken via a telephone interview and amounts to a single session of 30-45 minutes. Consent will be recorded via digital recorder with all participants asked whether they consent to this. You will not be contacted further regarding research. Data can be removed from the research study up to 4 weeks after reading this information sheet / collecting the data.

5. **Will I be recorded and how will the recorded media be used?**
   The audio recording of the conversation made during this research will be used only for analysis and for illustration in conference presentations and lectures. No other use will be made of them without your written permission, and no one outside the project will be allowed access to the original recordings.

6. **What are the possible disadvantages and risks of taking part?**
   The risk of attributing statements or phrases made during the interview to the participant following publication has been mitigated by the data being anonymised.

7. **What are the possible benefits of taking part?**
   Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will help shape understanding regarding the relationship between smart mobility transitions and social exclusion.

8. **What if something goes wrong?**
   If you wish to raise a complaint regarding the handling of the research, the treatment of the participant by the researcher, or in reference to serious conduct mismanagement, please contact:

   Eric.ward@ucl.ac.uk (MSc Dissertation Supervisor).

   Should the participant feel their complaint has not been handled to their satisfaction (e.g. by the supervisor) then please contact the Chair of the UCL Research Ethics Committee:

   ethics@ucl.ac.uk

9. **Will my taking part in this project be kept confidential?**
   Consent will be obtained from the participant to allow restricted access to information collected about them in the course of the research project. All the information that is collected about you during the course of the research will be kept strictly confidential, being stored digitally and password locked, with access only provided to the researcher. You will not be able to be identified in any ensuing reports or publications. All data will be anonymised and transcribed before being destroyed 3 months after collection.

10. **Limits to confidentiality**
    Please note that confidentiality may not be guaranteed; due to the limited size of the participant sample (focusing on industry experts).

    Confidentiality will be respected subject to legal constraints and professional guidelines.

    Confidentiality will be respected unless there are compelling and legitimate reasons for this to be breached. If this was the case we would inform you of any decisions that might limit your confidentiality.

    Confidentiality may be limited and conditional and the researcher has a duty of care to report to the relevant authorities possible harm/danger to the participant or others.

11. What will happen to the results of the research project?

The data collected will form part of an MSc Dissertation which has the potential to form part of a research publication. All data will be stored for 3 months before being destroyed. The results are likely to be published in September 2019 and can be obtained through the researcher or via the Bartlett School of Planning, UCL. The participant will not be identified in any reports or publications.

12. Local Data Protection Privacy Notice

Notice:

The controller for this project will be University College London (UCL). The UCL Data Protection Officer provides oversight of UCL activities involving the processing of personal data, and can be contacted at data-protection@ucl.ac.uk

This 'local' privacy notice sets out the information that applies to this particular study. Further information on how UCL uses participant information can be found in our 'general' privacy notice:

For participants in research studies, click here

The information that is required to be provided to participants under data protection legislation (GDPR and DPA 2018) is provided across both the 'local' and 'general' privacy notices.

The categories of personal data used will be as follows:

Name:
Address:

The lawful basis that would be used to process your personal data will be performance of a task in the public interest.

The lawful basis used to process special category personal data will be for scientific and historical research or statistical purposes.

Your personal data will be processed so long as it is required for the research project, a 3 month period. If we are able to anonymise or pseudonymise the personal data you provide we will undertake this, and will endeavour to minimise the processing of personal data wherever possible.

If you are concerned about how your personal data is being processed, or if you would like to contact us about your rights, please contact UCL in the first instance at data-protection@ucl.ac.uk.

16. Contact for further information

You should give the participant a contact point for further information. This can be your name, address and telephone number or that of another researcher in the project (if this is a supervised-student project, the address and telephone number of the student's supervisor).

Finally the information sheet should state that the participant will be given a copy of the information sheet and, if appropriate, a signed consent form to keep and remember to thank the participants taking part in the project.

Thank you for reading this information sheet and for considering to take part in this research study.

APPENDIX D

STATISTICAL ANALYSIS – KURSKAL-WALLIS TEST

Question 1.1: Under Mobility-as-a-Service, operators can provide personalised 'bundles' based on the users travel patterns, such as family packages, commuter travel or weekend users. In your opinion, what social support should bundles include? (please rank the following with 1 being the most important) - Mean Score

	Academic	Inner London	Outer London	MaaS Operator	Regional Authority	NGO	Total Respondents
Prioritisation of active modes	4.444	5.6	5.5	3.0	2.5	4.0	4.174
Subsidised fares of mobility impaired	3.789	4.75	4.5	2.75	5.0	5.0	4.298
Subsidised fares for those in accessible locations	3.611	2.5	3.167	4.25	4.0	4.5	3.671
Equitable distribution of transport options	4.368	4.6	4.833	5.25	2.5	5.0	4.425
A minimum level of access to key services	5.0	4.4	2.167	5.0	7.0	4.5	4.678
Increased access to flexible car travel	2.579	1.5	2.5	2.75	1.5	1.5	2.055
Accessibility features for the elderly or sensory impaired	4.444	5.5	5.333	5.0	5.5	3.5	4.880

Question 1.1: Social Support through MaaS – A comparison of Mean Scores – PART 1

	KW p.	Academic		Inner London		Outer London	
		Median	Std. Dev	*Median*	Std. Dev	*Median*	Std. Dev
Prioritisation of active modes	0.328	4	2.093	7	2.191	6.5	2.345
Subsidised fares of mobility impaired	0.369	3	1.893	5.5	1.893	4	1.643
Subsidised fares for those in accessible locations	0.718	4	1.914	3	1.0	3	1.169
Equitable distribution of transport options	0.654	5	2.216	4	0.894	5.5	1.941
A minimum level of access to key services	0.036	5.5	1.645	5	2.302	2	2.167
Increased access to flexible car travel	0.815	2	1.865	1	1.0	1.5	2.074
Accessibility features for the elderly or sensory impaired	0.410	4.5	1.854	5.5	1.291	5	1.033

Figure 1.1: Social Support through MaaS – A comparison of Mean Scores – PART 2

	MaaS Operator		Regional Authority		NGO	
	Median	Std. Dev	*Median*	Std. Dev	*Median*	Std. Dev
Prioritisation of active modes	3	1.633	2.5	0.7071	2.5	4.243
Subsidised fares of mobility impaired	2.5	0.957	5.0	1.417	5.0	0.0
Subsidised fares for those in accessible locations	4.5	2.5	4.0	1.414	4.5	2.121
Equitable distribution of transport options	6.0	2.217	2.5	2.121	5.0	1.414
A minimum level of access to key services	5.5	2.16	7.0	0.0	4.5	3.536
Increased access to flexible car travel	2	2.363	1.5	0.707	1.5	0.707
Accessibility features for the elderly or sensory impaired	4.5	1.414	5.5	0.707	3.5	0.707

Question 7.1: In your opinion, to what extent could the following barriers impact the promotion of social inclusion through Mobility-as-a-Service? – Mean Score

	Academic	Inner London	Outer London	MaaS Operator	Regional Authority	NGO	Total Respondents
Knowledge of Smart Technology	4.235	3.4	3.5	4.5	3.5	4.5	3.939
Funding for Implementation	3.824	3.2	4.5	3.25	4.0	5.0	3.962
Funding for Subsidies	3.941	3.8	3.833	4.0	5.0	5.0	4.262
Lack of concern	3.235	2.75	3.5	4.0	3.0	3.5	3.331
Planning requirements	3.294	2.4	2.5	4.25	3.0	4.0	3.241
Policy requirements	3.471	2.75	3.333	4.5	3.5	5.0	3.759
Lack of case-studies	2.706	2.4	3.167	3.0	3.0	3.5	2.962
The ability to negotiate subsidies	3.647	2.75	3.833	4.0	3.0	3.5	3.455
Usability of the technology	3.706	2.8	3.833	4.0	3.0	4.0	3.557
Private sector competition	3.176	4.0	3.333	2.25	3.0	4.0	3.293

Question 7.1: The extent to which challenges impact social inclusion within MaaS – PART 1

	KW p.	Academic		Inner London		Outer London	
		Median	Std. Dev	*Median*	Std. Dev	*Median*	Std. Dev
Knowledge of Smart Technology	0.2477	4	0.903	3	0.548	4	1.225
Funding for Implementation	0.1113	4	1.074	4	1.304	5	0.837
Funding for Subsidies	0.2621	4	1.088	4	0.837	4	1.169
Lack of concern	0.7639	3	1.251	2.5	0.957	3.5	1.049
Planning requirements	0.1255	4	1.047	2	1.14	2	1.378
Policy requirements	0.0841	4	1.179	2.5	0.957	3	0.516
Lack of case-studies	0.5355	3	0.985	2	1.14	3	0.753
The ability to negotiate subsidies	0.4407	4	1.222	2.5	0.957	4	0.753
Usability of the technology	0.5454	4	1.16	2	1.095	4	0.477
Private sector competition	0.327	3	1.074	4	0.817	3.5	1.366

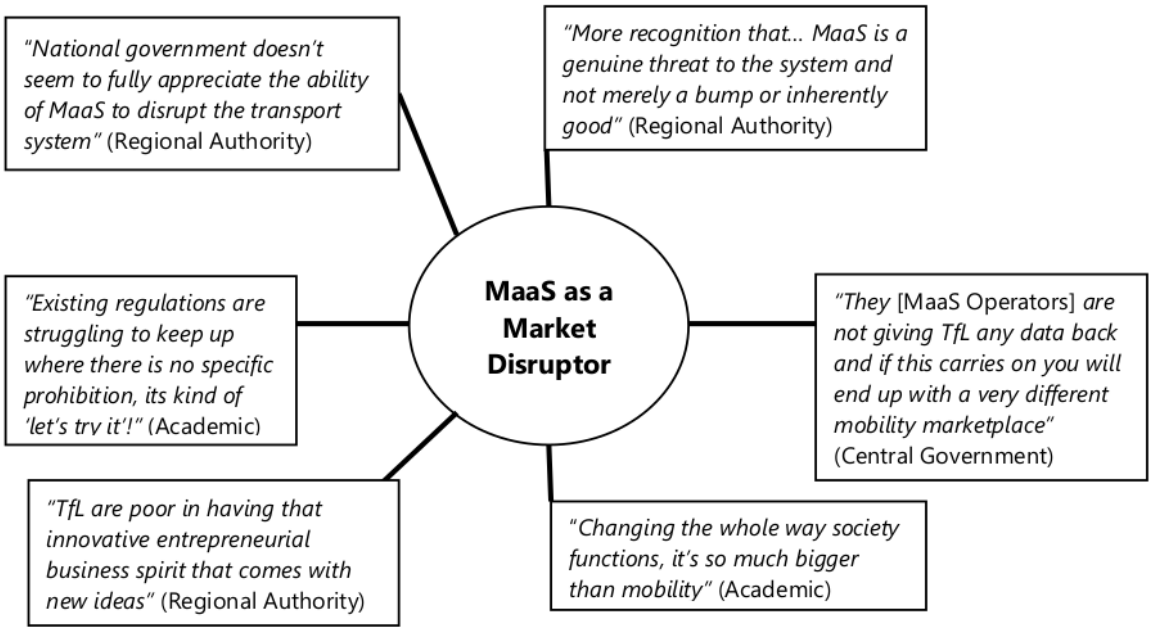
Figure 7.1: The extent to which challenges impact social inclusion within MaaS – PART 2

	MaaS Operator		Regional Authority		NGO	
	Median	Std. Dev	*Median*	Std. Dev	*Median*	Std. Dev
Knowledge of Smart Technology	4.5	0.577	3.5	2.121	3.5	0.707
Funding for Implementation	3.0	1.258	4.0	0.0	5.0	0.0
Funding for Subsidies	4.0	0.817	5.0	0.0	5.0	0.0
Lack of concern	4.0	1.155	3.0	1.414	3.5	2.121
Planning requirements	4.5	0.957	3.0	1.414	4.0	0.0
Policy requirements	5.0	1.0	3.5	0.707	5.0	0.0
Lack of case-studies	3.0	0.817	3.0	0.0	3.5	0.707
The ability to negotiate subsidies	4.0	0.817	3.0	0.0	3.5	0.707
Usability of the technology	4.0	0.817	3.0	1.414	4.0	1.414
Private sector competition	2.0	1.258	3.0	1.414	4.0	0.0

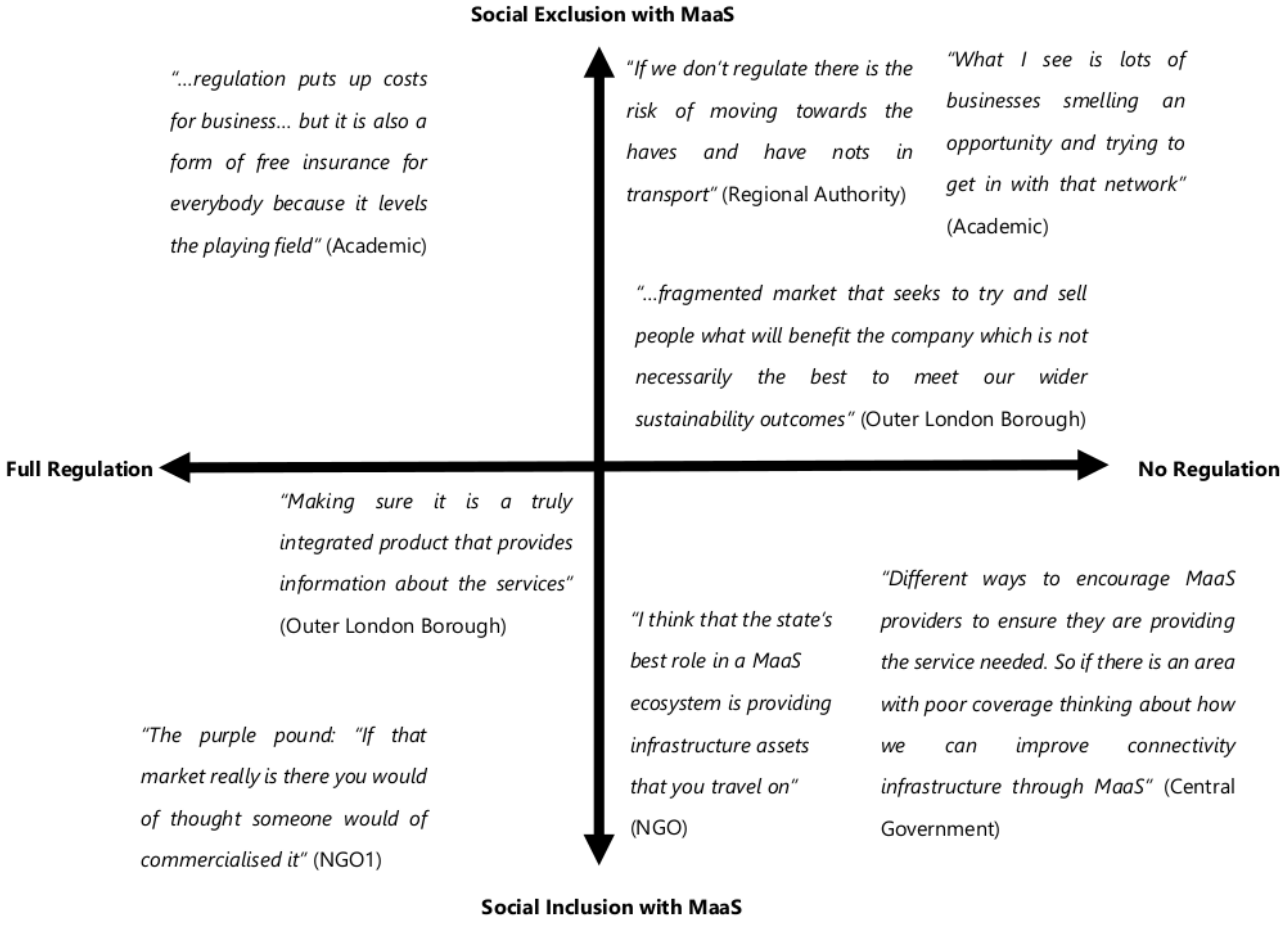
APPENDIX E

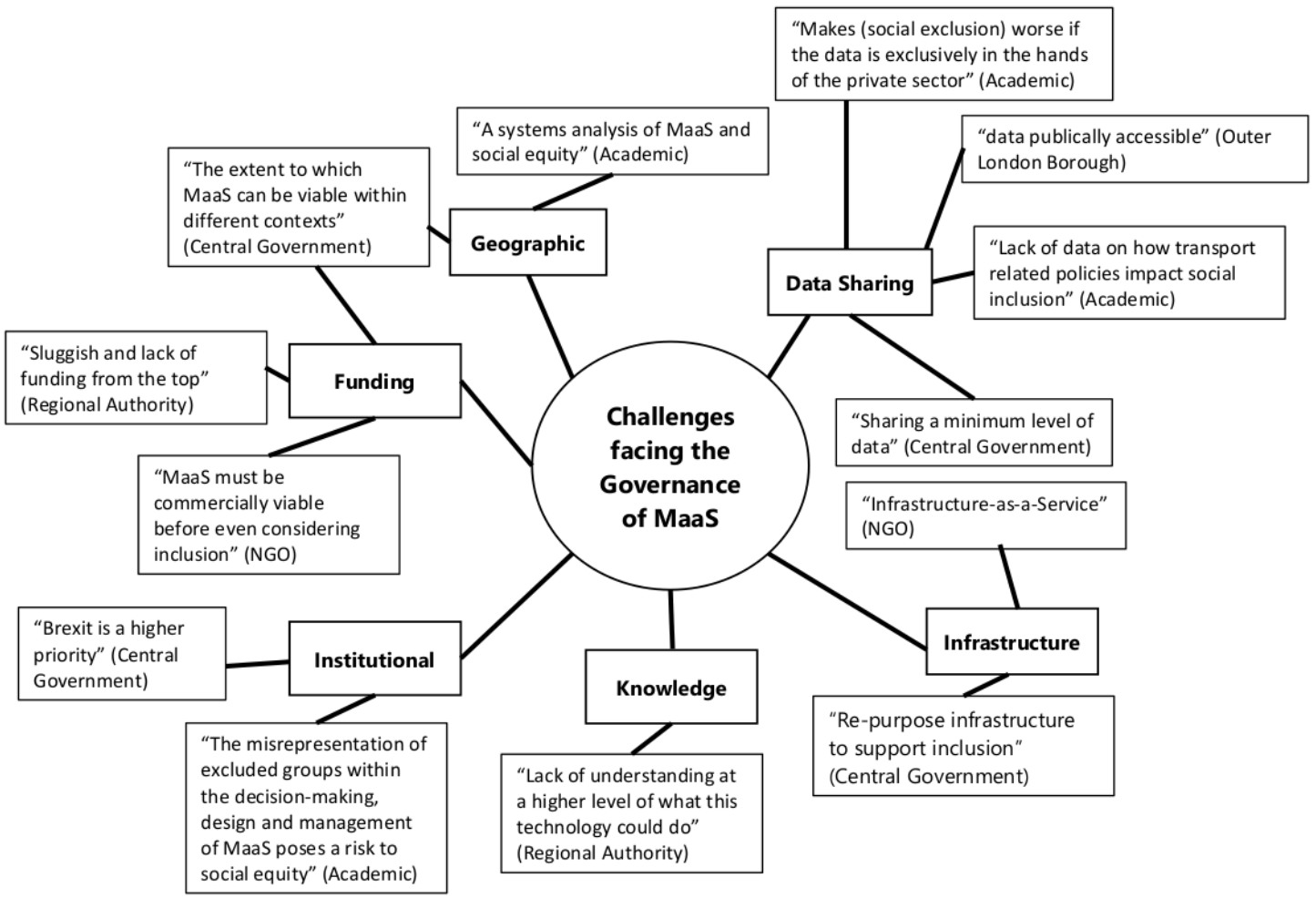
SUPPLEMENTARY EVIDENCE FROM STAKEHOLDER INTERVIEWS

Interviews: Opinions of MaaS as a Market Disruptor



Interviews: Matrix of Social Inclusion and Regulation Opinions




Interviews: Opinions of the Challenges facing the Governance of MaaS
Challenges facing the Governance of MaaS
Geographic
"A systems analysis of MaaS and social equity" (Academic)
"The extent to which MaaS can be viable within different contexts" (Central Government)
Data Sharing
"Makes (social exclusion) worse if the data is exclusively in the hands of the private sector" (Academic)
"data publically accessible" (Outer London Borough)
"Lack of data on how transport related policies impact social inclusion" (Academic)
"Sharing a minimum level of data" (Central Government)
Infrastructure
"Infrastructure-as-a-Service" (NGO)
"Re-purpose infrastructure to support inclusion" (Central Government)
Knowledge
"Lack of understanding at a higher level of what this technology could do" (Regional Authority)
Institutional
"Brexit is a higher priority" (Central Government)
"The misrepresentation of excluded groups within the decision-making, design and management of MaaS poses a risk to social equity" (Academic)
Funding
"Sluggish and lack of funding from the top" (Regional Authority)
"MaaS must be commercially viable before even considering inclusion" (NGO)

APPENDIX F

RISK ASSESSMENT FORM

RISK ASSESSMENT FORM
FIELD / LOCATION WORK

The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form
http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf

DEPARTMENT/SECTION : BARTLETT SCHOOL OF PLANNING
LOCATION(S) : LONDON
PERSONS COVERED BY THE RISK ASSESSMENT : DAVID PEARCE

BRIEF DESCRIPTION OF FIELDWORK : ONLINE QUESTIONAIRE SURVEY AND TELEPHONE INTERVIEWS

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.
If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.
Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low ? No risk

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	work abroad incorporates Foreign Office advice
☐	participants have been trained and given all necessary information
☐	only accredited centres are used for rural field work
☐	participants will wear appropriate clothing and footwear for the specified environment
☐	trained leaders accompany the trip
☐	refuge is available
☐	work in outside organisations is subject to their having satisfactory H&S procedures in place
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EMERGENCIES	**Where emergencies may arise use space below to identify and assess any risks**
e.g. fire, accidents	Examples of risk: loss of property, loss of life

No possible emergencies

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
☐	fire fighting equipment is carried on the trip and participants know how to use it
☐	contact numbers for emergency services are known to all participants
☐	participants have means of contacting emergency services
☐	participants have been trained and given all necessary information
☐	a plan for rescue has been formulated, all parties understand the procedure
☐	the plan for rescue /emergency has a reciprocal element
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EQUIPMENT	Is equipment used?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. clothing, outboard motors.	Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	the departmental written Arrangement for equipment is followed
☐	participants have been provided with any necessary equipment appropriate for the work
☐	all equipment has been inspected, before issue, by a competent person
☐	all users have been advised of correct use
☐	special equipment is only issued to persons trained in its use by a competent person
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	Is lone working a possibility?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. alone or in isolation lone interviews.	Examples of risk: difficult to summon help. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	the departmental written Arrangement for lone/out of hours working for field work is followed
☐	lone or isolated working is not allowed
☐	location, route and expected time of return of lone workers is logged daily before work commences
☐	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
☐	all workers are fully familiar with emergency procedures
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

ILL HEALTH	The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.
e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.	Examples of risk: injury, asthma, allergies. Is the risk high / medium / low? Personal Illness - Low Risk

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	an appropriate number of trained first-aiders and first aid kits are present on the field trip
☐	all participants have had the necessary inoculations/ carry appropriate prophylactics
☐	participants have been advised of the physical demands of the trip and are deemed to be physically suited
☐	participants have been adequate advice on harmful plants, animals and substances they may encounter
☐	participants who require medication have advised the leader of this and carry sufficient medication for their needs
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

TRANSPORT	Will transport be required	NO	☐	Move to next hazard
		YES	☐	Use space below to identify and assess any risks
e.g. hired vehicles	Examples of risk: accidents arising from lack of maintenance, suitability or training Is the risk high / medium / low? X			

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	only public transport will be used
☐	the vehicle will be hired from a reputable supplier
☐	transport must be properly maintained in compliance with relevant national regulations
☐	drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
☐	drivers have been trained and hold the appropriate licence
☐	there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
☐	sufficient spare parts carried to meet foreseeable emergencies
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE PUBLIC	Will people be dealing with public	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. interviews, observing	Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	all participants are trained in interviewing techniques
☐	interviews are contracted out to a third party
☐	advice and support from local groups has been sought
☐	participants do not wear clothes that might cause offence or attract unwanted attention
☐	interviews are conducted at neutral locations or where neither party could be at risk
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

WORKING ON OR NEAR WATER	Will people work on or near water?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. rivers, marshland, sea.	Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	lone working on or near water will not be allowed
☐	coastguard information is understood; all work takes place outside those times when tides could prove a threat
☐	all participants are competent swimmers
☐	participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
☐	boat is operated by a competent person
☐	all boats are equipped with an alternative means of propulsion e.g. oars
☐	participants have received any appropriate inoculations
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	Do MH activities take place?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.	Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	the departmental written Arrangement for MH is followed
☐	the supervisor has attended a MH risk assessment course
☐	all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
☐	all persons performing MH tasks are adequately trained
☐	equipment components will be assembled on site
☐	any MH task outside the competence of staff will be done by contractors
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES	Will participants work with substances	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	the departmental written Arrangements for dealing with hazardous substances and waste are followed
☐	all participants are given information, training and protective equipment for hazardous substances they may encounter
☐	participants who have allergies have advised the leader of this and carry sufficient medication for their needs
☐	waste is disposed of in a responsible manner
☐	suitable containers are provided for hazardous waste
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	Have you identified any other hazards?	No	If 'No' move to next section If 'Yes' use space below to identify and assess any risks
i.e. any other hazards must be noted and assessed here.	Hazard: Risk: is the risk		

CONTROL MEASURES	Give details of control measures in place to control the identified risks

Have you identified any risks that are not adequately controlled?			
	NO	☐	Move to Declaration
	YES	☐	Use space below to identify the risk and what action was taken

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research?	No
If yes, please state your Project ID Number	

For more information, please refer to: http://ethics.grad.ucl.ac.uk/

DECLARATION The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

☒ I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk

☒ I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

NAME OF SUPERVISOR DR. JOHN WARD

SIGNATURE OF SUPERVISOR DATE