

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

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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 the current regulation of emerging mobility services. This article focuses on the role of governance in ensuring MaaS is inclusive for its users within the context of London and 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.

Keywords: Governance; Maas; Mobility; Social Equity Transport; Travel; Urban Congestion

Introduction and Context

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 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).

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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 article, is considered to be 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 emerging 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).

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 article 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 were derived to assist the composition of the article:

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.

Literature Review

Literature collated for this study provides a critique to provide background and identify gaps for further research. Being concerned with the governance of new mobility services, also

included are documents to ground the research question in current governmental practice.

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 centred on 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 automobility 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* (2018: 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, citizens 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.

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 Voegelé, 2017; Rantasila, 2015). The term refers to the combination of real-time data, wayfinding algorithms and a booking system under a single digital platform to integrate mobility services and provide a seamless user-centered travel experience; one which can occur across different 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.

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).

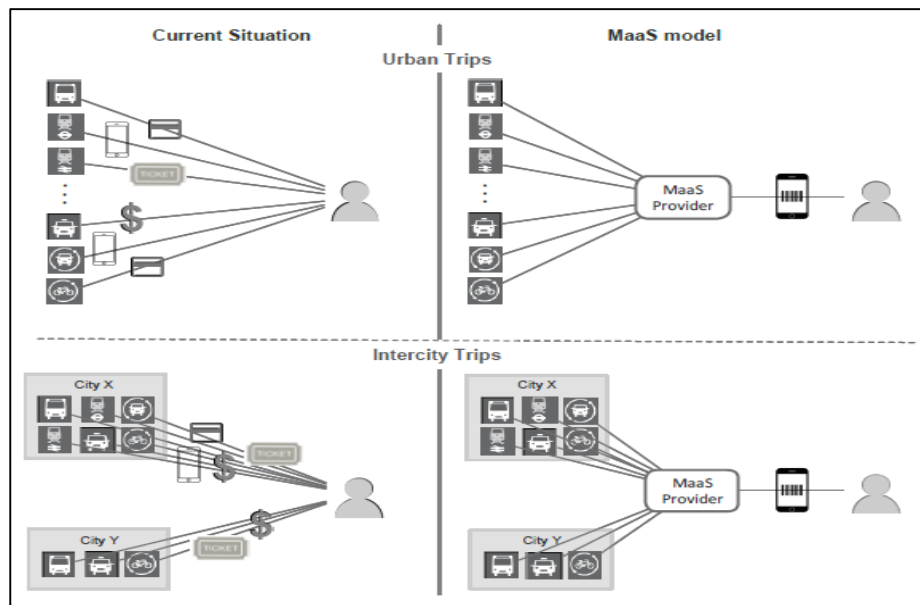


Figure 1: With and without MaaS - A Traveller's Perspective (Kamargianni *et al*, 2018)

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 potential 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).

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 transport

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 that elderly and disabled transport passengers struggle using

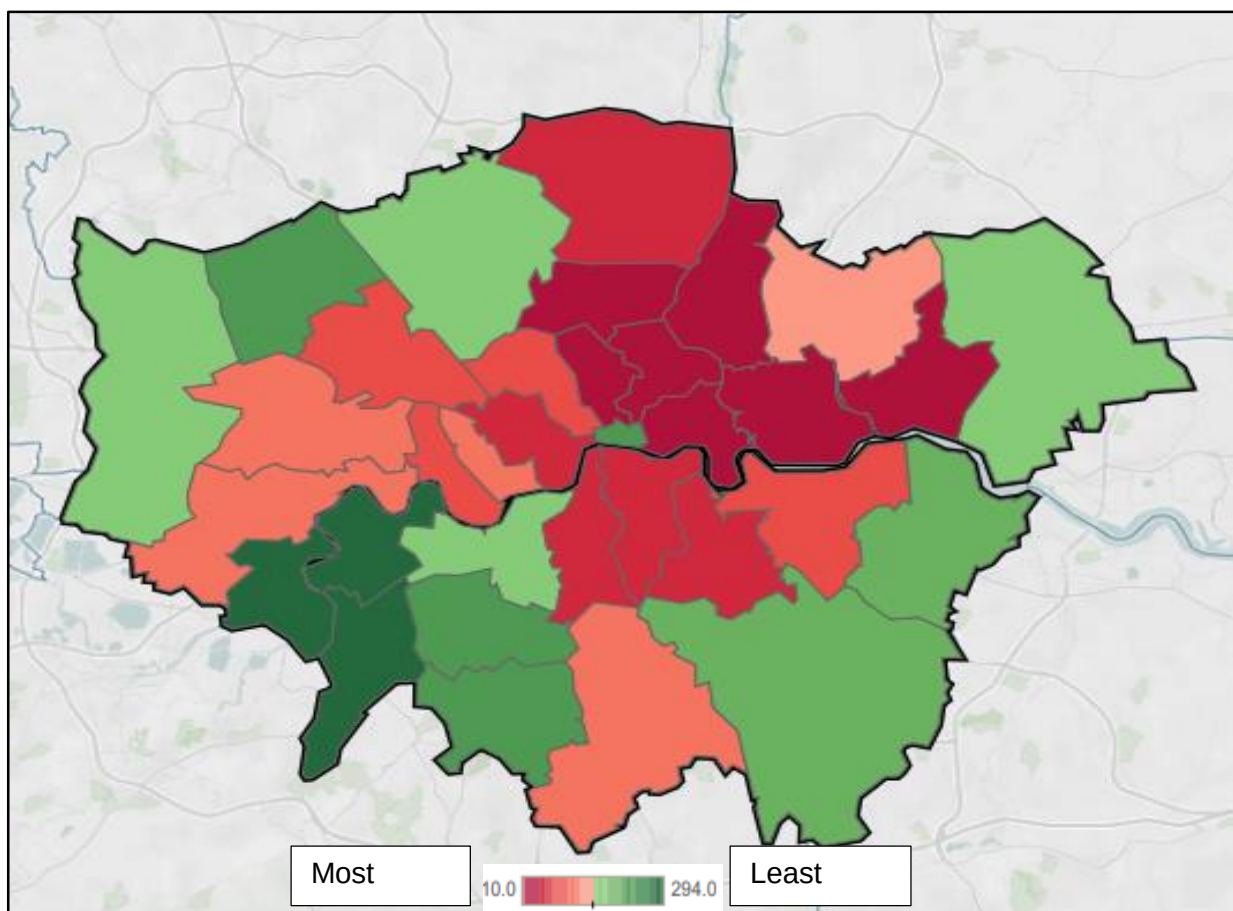


Figure 2: 2018 Indices of Multiple Deprivation in London (LC, 2018)

conventional public transport because it is not tailored to their specific needs, a barrier MaaS could assist. 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 tailored MaaS bundles could have a significant positive impact (GoS, 2019). However, MaaS is currently pursued by private operators looking to operate in profitable locations meaning that travelers with specific mobility issues or in poorer neighbourhoods may be excluded from the service and the opportunities it creates (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 will be sporadic, focusing on densely populated areas that guarantee usership. The distribution of deprivation in London (**Figure 2**), however, reflects the difficulty in identifying where MaaS will have its greatest benefit. The provision of good public transport services meaning 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.

Table 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 include and exclude both. Interestingly, Pereira *et al* (2017) assumes ‘accessibility’ is a combined ‘capability’ that offers

human agency, i.e., the capability to access and use mobility technologies. Gullberg (2017) warns, however, that the uptake of autonomous vehicles will lead to increased mobility and the side-lining of accessibility within emerging mobility services.

Table 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 Voegelé, 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 <i>et al</i> , 2019)	The provision of digitally-connected kiosks in train stations for those without smartphones (HC, 2018a)
Cognitive barriers exclude those who might have never experienced such technology (Lucas <i>et al</i> , 2019)	Tailored options for the elderly, those with autism, dementia, or those with sensory-impairments that assist in avoiding inaccessible routes (Melis <i>et al</i> , 2018; Viaaio, 2017)
Disengagement of those who choose to walk and cycle from the policy debate (Docherty <i>et al</i> , 2018)	Mobility packages include front-end interfaces that prioritise health and well-being (Pangbourne <i>et al</i> , 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 <i>et al</i> , 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.

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:06). 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 historically 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 as 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).

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

No regulatory framework has been defined by the UK Government to manage MaaS at the local, regional or national level, but significant research into the implementation of the service has been undertaken. Various mobility innovations have 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 and accessibility have been considered challenges for future policy-makers.

Instead, equity concerns arose during roundtable discussions held by the Government Office for Science (GoS, 2017: 2) with industry stakeholders which suggested 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 models could increase digital exclusion (CfBT, 2017; TravelSpirit, 2017; Viaaquo, 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 is essential for those currently excluded from digital

software, for example the over-65s or those with dementia (Viaaqio, 2017). A governmental report (Enoch, 2018) suggests policymakers are faced with a major challenge in balancing the promised benefit with issues of equity.

The lack of an 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 one identified during this study that offers local authorities a framework 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 at the local level (TechUK, 2018). A Transport Committee (HC, 2018b) reflects the concern that authorities are 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 cities across the UK. 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. This supports the remark made by Marsden et al., (2018) that more adaptive approaches to planning are needed to shape travel in the future. They argue, however, such debates are often undertaken in 'silos' rather than considering various societal impacts. For example, the Inclusive Transport Strategy (DfT, 2018b) considers that 'mobility trials' are when dialogue between disabled transport users and mobility providers should occur. Unfortunately, the social repercussions of MaaS do not appear central to 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 currently disjointed does not address the fact MaaS platforms are entering the UK market devoid of appropriate regulation. A GoS evidence review 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 (Lucas *et al*, 2019).

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 role of state when governing MaaS to ensure inclusion and highlights the confusing relationship of governance in the UK, tasked with balancing effective state intervention alongside promoting 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 emerging mobility services has outlined the requirement for a regulatory framework to manage the relationship between state and non-state actors. However, the most suitable form of state intervention for MaaS remains unknown.

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