MaaS MOVEMENT?

ISSUES AND OPTIONS ON MOBILITY AS A SERVICE FOR CITY REGION TRANSPORT AUTHORITIES

URBAN TRANSPORT GROUP

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The Urban Transport Group represents the seven strategic transport bodies which between them serve more than twenty million people in Greater Manchester (Transport for Greater Manchester), Liverpool City Region (Merseytravel), London (Transport for London), Sheffield City Region (South Yorkshire Passenger Transport Executive), Tyne and Wear (Nexus), West Midlands (Transport for West Midlands) and West Yorkshire (West Yorkshire Combined Authority). The Urban Transport Group is also a wider professional network with associate members in Strathclyde, Bristol and the West of England, Tees Valley, Nottingham and Northern Ireland.

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1 INTRODUCTION

The concept of Mobility as a Service (MaaS) has been the subject of innumerable conferences, powerpoint presentations and strategy documents as a key component of the future of mobility. By simplifying access to information and payment across a range of transport modes, MaaS offers the prospect of improved consumer choice and reduces the need for car ownership and use.

However, with the practical application of MaaS in its infancy and with so many competing definitions and claims about how best to make it happen, it can be challenging for transport authorities to know how best to engage with the concept.

In this report we seek to provide a framework for transport authorities to think about the role they might play.

We do this by setting out:

- What MaaS is;
- The potential benefits;
- The broader future mobility context from which MaaS has emerged;
- The key issues that transport authorities should consider in relation to MaaS;
- The options for the different roles that transport authorities might play; and,
- Case studies of different approaches that transport authorities have taken so far in the UK and the wider world.

INTRODUCING MOBILITY AS A SERVICE

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The term Mobility as a Service (MaaS) means many things to many people, with multiple definitions in use. Here are some of the commonly cited definitions from key organisations:

Cubic:
Mobility as a Service is a combination of public and private transportation services within a given regional environment that provides holistic, optimal and people-centered travel options, to enable end-to-end journeys paid for by the user as a single charge, and which aims to achieve key public equity objectives[2].

MaaS Global:
MaaS brings all means of travel together. It combines options from different transport providers into a single mobile service, removing the hassle of planning and one-off payments. MaaS is a carefree, environmentally sound alternative to owning a car. It works out the best option for every journey – whether that's a taxi, public transport, a car service or a bike share[5].

Transport Systems Catapult:
Using a digital interface to source and manage the provision of a transport related service(s) which meets the mobility requirements of a customer[1].

Deloitte:
At its core, MaaS relies on a digital platform that integrates end-to-end trip planning, booking, electronic ticketing, and payment services across all modes of transportation, public or private[4].

MaaS Alliance:
The integration of various forms of transport services into a single mobility service accessible on demand. To meet a customer's request, a MaaS operator facilitates a diverse menu of transport options, be they public transport, ride-, car- or bike-sharing, taxi or car rental/lease, or a combination thereof[3].

Polis suggest that some use it [MaaS] more liberally to describe a transport service (such as car-sharing, ride-hailing or cycle hire), an integrated traveller information service (e.g. a trip planner) or an integrated transport payment system (such as a Smartcard)[6].

How we define Mobility as a Service for the purposes of this report

For the purposes of this report we will restrict the concept of MaaS to services which provide access to information on, and payment for, different options for making journeys. This definition of MaaS was initially characterised (for example by MaaS global) as a subscription based service, where users would buy packages of mobility for a period of time. Increasingly, however, the concept has now been widened to incorporate services which provide information across modes but also the ability to pay for single trips on a pay as you go basis.

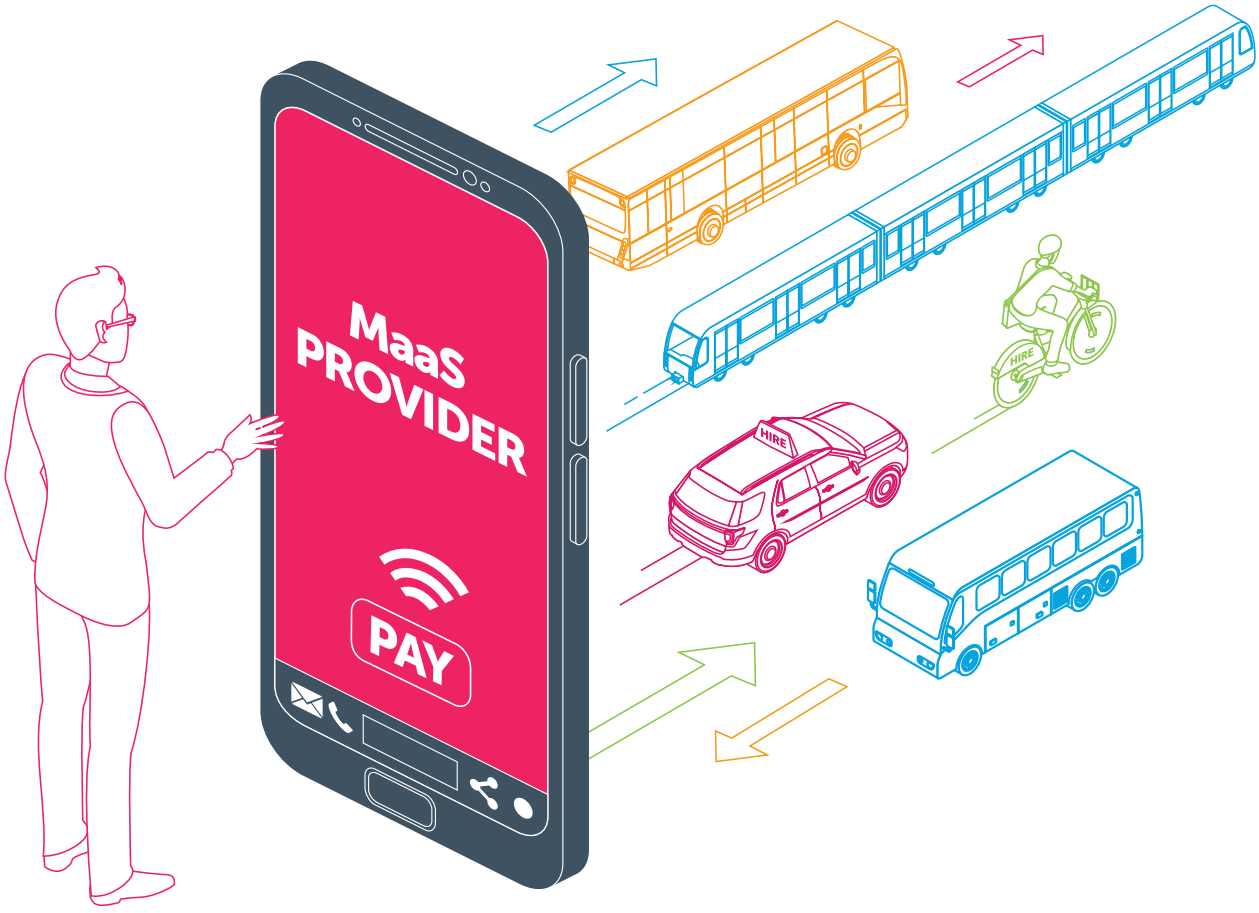

Figure 1 – A visualisation of Mobility as a Service

What are the potential benefits?

If MaaS incorporates multiple modes into a single application, the user benefits could include:

- Personalised services which recognise individual mobility needs;
- Ease of transactions and payments; and
- Dynamic journey management and journey planning[7].

It could also make it easier for travellers to make better decisions on which mode to choose based on their own priorities which could include cost, speed or health benefits.

A fully comprehensive MaaS offer could mean that ownership of private vehicles is no longer necessary for more people and customers' mobility needs are instead provided by a range of services through a single platform: usership replaces ownership.

For transport authorities, there is potential that MaaS could offer increased access to data and insight on mobility behaviour. This could allow for more effective planning of services and infrastructure in order to meet present and future demand, as well as helping to deliver improved policy outcomes.

Where a transport authority is the MaaS provider, it could offer a mechanism for improving customer relationships, providing more accurate and up to date information, including during disruption, and enable a greater diversity of products and services to be offered through a single system.

The potential to shift travel behaviour through the use of MaaS could help to encourage greater use of public transport, active and sustainable travel choices. Evidence from some of the MaaS pilots in the case studies presented in this report demonstrates that these behaviours increase with the use of MaaS. This could help to improve public health, social inclusion and air quality while reducing carbon emissions and congestion.

The shift away from private car ownership and use towards public transport, active travel and taxi and Private Hire Vehicles (PHVs) could have positive impacts for air quality and carbon emissions. While the impacts would be greatest with high public and active transport mode shares, low emission vehicles are increasingly being used for taxi and PHV services, and additional policy measures are being implemented to accelerate their uptake. For example, in Nottingham, the council is encouraging taxi drivers to switch to ultra low emission models and in Dundee the council has required all new PHVs to be electric vehicles since 2016[8].

There could also be potential benefits to the public sector where MaaS operations result in reduced administration costs, when compared to running more conventional ticketing schemes.

Although the benefits of MaaS could be considerable depending on how it is implemented, the opposite could also be true. For example, increasing taxi and car hire use could contribute to congestion and poor air quality, levels of physical activity could be lower and monopoly pricing and targeting of services might mean that access to MaaS is only available to those with higher disposable incomes.

The potential disadvantages, risks and challenges associated with MaaS are examined in more detail in Section 3.

The wider context

The emergence of MaaS is not occurring in isolation; it is part of a wider transition to a 'smart mobility future'. There are a number of ways to frame this smart mobility future but one useful example refers to the future of mobility as:

Connected
Autonomous
Shared
Electric[9]

MaaS is part of this framing in that it makes use of shared options for mobility and has the potential to engage with and be part of a connected and autonomous future.

There are various estimates of the economic potential of MaaS and other new mobility innovations. Paul Campion, former CEO of the Transport Systems Catapult, suggests that transport data and new mobility services will represent a global market of around £224bn by 2030 and the UK has the potential to hold a significant share of this global market[10]. ABI research from 2016 suggested that global MaaS revenues will exceed $1trillion (US) by 2030, particularly with automation cutting operating costs and increasing utilisation[11]. They also suggest that MaaS will fuel economic growth by lowering the costs of transport for consumers[12].

It is important to recognise the big players who are investing in new mobility initiatives. Large automotive manufacturers are investing huge sums in new mobility services, from Daimler's $50m investment in Via, VW's $300m in Grab to Toyota's investment in MaaS Global[13]. In addition, BMW and Daimler have come together to invest €1bn to develop new mobility services[14]. This cooperation includes five joint ventures:

- **Reach Now** (multimodal services)
- **Charge Now** (vehicle charging)
- **Free Now** (taxi ride-hailing)
- **Park Now** (parking)
- **Share Now** (car-sharing)[15].

MaaS is also part of the wider move towards the sharing economy with the growth of car and ride-sharing. Ride-sharing is a loosely defined term, but can include use of services like Uber, PHVs in the UK, or lift sharing, for example carpooling to travel to work. A Deloitte study found that in the UK, 43% of people currently used ride-sharing, with 22% of these using it at least once a week[16]. 48% of ride-share users now question whether they would need to own a car in the future[17]. Morgan Stanley found that shared cars, taxis and vehicles operated by ride-sharing companies such as Uber and Lyft, accounted for 4% of global miles travelled in 2015, but could rise to 25% by 2030[18]. These trends away from owning vehicles, towards use of vehicles when necessary, fits into wider trends towards MaaS.

MaaS is supported by the wider policy context at both a national and local government level in the UK. Nationally, central Government identified the 'Future of Mobility' as one of its Grand Challenges within the 2017 Industrial Strategy[19]. This aims to position the UK as a world leader in shaping the future of mobility, reducing congestion and carbon emissions[20].

In March 2019, the UK Government released its 'Future of Mobility: Urban Strategy' which sets out the direction of travel for future mobility in the UK's urban areas and the principles which will underpin this[21].

The nine principles for innovation in urban mobility include commitments to safety and security, inclusivity (must be available to all parts of the UK and all segments of society), active travel, the maintenance of mass transit and reducing emissions and congestion[22].

In 2018, the House of Commons Transport Select Committee undertook an enquiry into MaaS, with the final report intended to: increase public awareness of what MaaS is; show policy makers why it could be important and is worth investing time and effort to understand; and clarify the Department for Transport's (DfT) role in shaping its development in the UK[23]. Its final report outlined a number of tasks for the DfT in order to realise the benefits of MaaS and avoid negative consequences. These included: providing leadership; providing practical support for the development of MaaS in the UK; and reviewing guidance and legislation to provide a suitable regulatory framework for MaaS[24]. This should include measures to support and encourage data sharing between transport operators and MaaS providers[25].

At a local level, cities and regions in the UK are making efforts to support mobility innovations. Examples include:

- The West Midlands, which received £20m for the UK Government to become a 'Future Mobility Area'[26] and where the UK's first commercial MaaS trial is running[27];
- Oxford and Oxfordshire, which have a range of smart mobility initiatives[28]; and
- Greater Manchester, where the transport authority Transport for Greater Manchester has been part of a number of EU funded research programmes to explore MaaS and other transport innovations[29].

We are also seeing cities increasingly trying to improve the quality of the urban environment, beyond smart mobility and moving towards 'Healthy Streets', creating cities which are great places to live, work and invest in. The ten indicators of a healthy street are shown in Figure 2[30].

If MaaS can encourage more public transport use and active travel, and reduce vehicle traffic, it could be part of a suite of mechanisms that encourage more healthy streets, making our cities better places to be.

There are more sceptical voices however. In 2018, Gartner assessed MaaS as 'at the peak' on the hype cycle[32]. Mulley argues that we need a shift in culture in order for MaaS to change how we live and move around our cities, and there needs to be *"more than hype"* to do this[33]. Meanwhile, Lyons et al have argued that MaaS is an evolution in how customers access mobility, rather than a revolution[34] and that we have seen similar innovations in the past[35].

For example, advanced traveller information systems, such as Transport Direct, a Government-led national journey planner which ran from 2004 to 2014[36], provided integrated journey information across modes in a similar vein to some contemporary MaaS offers. In the largest world cities (like London) there is also the danger of it receiving disproportionate attention given that mass transit continues to dwarf trips made by modes like PHVs.

However, while there are some MaaS schemes now up and running, it remains to be seen whether MaaS is a niche product for high income, car-free millennials, or a ubiquitous component of the more sustainable and efficient transport policies of the future. The subsequent sections will explore some of the dimensions of these questions.

Figure 2 - Ten indicators of a Healthy Street (Image source: Lucy Saunders[31])

KEY ISSUES FOR TRANSPORT AUTHORITIES ON MOBILITY AS A SERVICE

This section explores some of the key issues which transport authorities need to consider when thinking through their potential role on Mobility as a Service. We focus in particular on: the economics of MaaS; data; social inclusion and the pricing of road use. Section 4 examines the different roles a transport authority could take in relation to MaaS, from operator to regulator, or leaving provision of MaaS to the private sector.

The economics of Mobility as a Service

The potential benefits of MaaS and the widespread interest in it from transport commentators and private sector companies (both up and coming and well established) has led to it becoming a very fashionable concept which is subject to the maxim: 'it should happen, it must happen'. However, if it is to happen at scale, and for any length of time, then it either must be commercially viable, or it will require some form of cross subsidy either from the private or public sector.

Transport authorities therefore need to be alive to the economics of MaaS rather than accept at face value that because the concept has so many attractions in principle that therefore it will happen regardless of the economics. It is also important to understand that the economics of MaaS ultimately could also have much wider ramifications for the future role of transport authorities per se.

A key challenge of MaaS (in the form of advance purchase of packages of mobility) is to be able to offer such a service at a price that users want to pay whilst still making a commercial return to the overarching provider of the MaaS offer, as well as to the operators of the services that make up all the elements of the MaaS offer (the taxi companies, public transport operator, car hire company and so on).

Furthermore, the MaaS package offer has to provide people with the full range of modes when they need them – which can be expensive to ensure where there are multiple players in the car hire and taxi sector. All of this is not easy to do. Especially given the further challenge of the extent to which people actually want to buy such packages in the first place when a) technology makes it relatively easy to access and pay for services on demand and b) there may be a limited pool of people who have journey patterns using a variety of modes in a way which makes a package attractive to them even where the cost of such packages is reasonable.

This in turn can mean that MaaS packages are targeted at areas in cities where it is more economical to provide access to a full range of modes (such as the centre of cities) and at demographics which are tech-savvy, early adopters with relatively high disposable income. This can therefore leave out people with disabilities, those on lower incomes and those who live in less central and dense urban areas.

These linked challenges may help to explain why despite all the hype around the concept of MaaS, it is difficult to find examples of its application at scale as a purely commercial offer. For example, in early 2019 MaaS Global shifted its focus in the West Midlands away from unlimited subscriptions following low uptake and are now looking to trial a different range of products[37].

If a purely commercial MaaS package offer is challenging to achieve at scale, and in a way which serves more people, then there is the option of either the private sector or the public sector cross-subsiding the cost of its provision.

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For the private sector there are a number of reasons why this might be done:

- in order to acquire data which can be sold on, or the ownership of which can increase market valuation
- to sell the operation on to a larger company
- to seek to establish a monopoly position.

In the case of the latter, a reason for 'burning cash' in the short to medium term to achieve this can ultimately bring vast rewards in the longer term, as has been demonstrated by other 'platform' models such as Amazon, Airbnb and Facebook. These platform models are particularly attractive to venture capital as they monopolise the interface between those who provide a service and those who want to purchase it. The cost of providing that interface is relatively modest yet the potential profits that derive from monopolising the interface are vast. Other players may have less venture capital available and the more modest goal of raising their market valuation through being seen as an emerging player and data accumulator. The goal here is to be bought out by a major player.

The challenge around MaaS packages may be a factor in why there has been a shift in focus recently towards MaaS in the form of a single portal for information and pay as you go travel across modes. If a private sector provider can incentivise travellers to use its 'walled garden' for travel information and ticket purchase then it can start to emulate the 'platform' model which has proved so profitable for other sectors.

'Walled Gardens'

Tech start-up Citymapper announced plans in early 2019 to offer a travel pass which will provide access to public transport, cycle hire and taxis[38]. It will offer unlimited London Underground zones one and two, citywide TfL bus for £31 a week, compared to the TfL charge of £35, though users will be required to pay four weeks upfront[39]. They are able to offer these prices as, like Uber, Citymapper has attracted venture capital backers[40]. Citymapper had also begun running its own private hire / ride share services in London in 2018 but has since ceased[41].

We are also seeing companies like Uber (amongst others) positioning itself in the MaaS market, as it has acquired bike share (Jump) and e-scooter hire (Lime) companies, as well as moving to offer public transport ticketing through their platform[42]. It hopes to offer a single price for an entire integrated journey, which might be multi-modal[43].

We discuss the ramifications of monopoly private sector provision in more detail below. However, at the same time, it is also worth noting that it could be argued that the full benefits of a MaaS offer can only be delivered at scale and it is only at scale that the economics improve.

Key implications for transport authorities

The nature of the economics of MaaS means that there could be considerable instability in the market as different players enter and leave or fundamentally change the nature of the offer they are providing (this can be seen in other new formats for transport provision such as dockless bikes). This can be resource intensive for transport authorities to respond to with difficult decisions about how closely to ally the authority to particular players or initiatives. Private sector players might also, at any time, look to the public sector to fund directly, or indirectly, a MaaS offer in order to maintain an existing service or to provide a broad service.

If ultimately the market moves to private sector monopolies and 'walled gardens' then there are challenges around the dangers of providers incentivising travellers to use modes or services which can be most easily monetised or which it is in their financial interest to do so (such as taxis rather than active travel or public transport). Evidence from the USA suggests that the rise of 'Transportation Network Companies (TNCs)' like Uber and Lyft are contributing to congestion. Schaller found that TNCs added 5.7 billion miles of driving in America's nine largest metropolitan areas and 60% of users in dense cities would have used public or active transport if the TNC was not available[44]. This evidence could suggest that more ease of access to TNCs or PHVs could exacerbate congestion in our urban areas.

Zipper highlights how an unlimited MaaS subscription removes the price incentive to take public transport over a taxi, which offers a door-to-door service[45]. This has potential impacts on public transport patronage, increases motorised vehicle miles travelled and congestion.

A private sector monopoly would also have considerable market power in terms of what it charged public and private bodies to use its platform, the use of data it accumulates, ways of influencing travel patterns and the costs to the public sector of providing access to transport and information for marginalised communities and groups.

The Government's Future of Mobility Strategy suggests that the risk of a monopoly operator in this space could limit customer choice and result in a scenario where *'data and algorithms could be used to identify and raise prices for individual consumers who have the fewest alternative mobility options'*[46].

If a transport authority no longer has to provide information or sell access to transport modes, then this could result in cost savings for the authority. However, at the same time, it could remove a major public facing role which in turn could affect its standing and legitimacy with the general public and decision makers.

Hitherto, transport authorities have been the core provider and custodian of information about public transport travel and ticketing, establishing a relationship with their users. Although in Great Britain outside London (and unusually by global norms) this has been to some extent eroded by deregulation and privatisation. However, where private sector MaaS providers take on this role there are issues around:

- How the costs of providing the data on which travel information is based are covered;
- Who benefits from the value of the data generated and how this relates to the protection of personal data; and,
- Where the governance (and related costs) sits of administering fares payments and allocation.

There are also issues around how the impartiality of information about travel options is maintained as well as whether or not the information provided reflects wider public policy goals including promoting active travel (to improve public health), tackling air quality challenges and reducing carbon emissions. For example, if customers are incentivised to use a MaaS app provided by a PHV operator then it is in the commercial interests of that company to steer the user towards using a PHV rather than a public transport option or active travel.

Data

Transformative technological change is unleashing unprecedented volumes of data and the move to greater sharing and opening up of this data offers opportunities[47]. Open data and flows of shared data represent a key factor in the roll out of the MaaS agenda as it enables the range of information required to provide a MaaS platform to be brought together[48]. For a MaaS platform to offer a wide range of travel choices then it needs to be based on data pertaining to the modes it covers.

This can give rise to a range of challenges which MaaS Alliance (a public-private partnership creating foundations for a common approach to MaaS) has identified as:

- Poor quality or incomplete data;
- Lack of data standardisation;
- Lack of interoperability by design;
- Lack of consumer / professional ability to switch between different service providers (data portability); and
- Lack of economic incentives[49].

There are further issues of privacy and trust around data and the respective safeguards placed upon data by the various private and public sector bodies involved, and sharing of data which many private sector companies are unwilling to do because of commercial considerations.

A number of bodies and organisations have made recommendations about how these issues should be best addressed including the National Infrastructure Commission[50]. The Travel Spirit Foundation (a not-for-profit which aims to ensure new mobility services are universally accessible) is also working with developers, transport operators, policy makers and planners to break down barriers and silos within the transport ecosystem that will need to become integrated to deliver a MaaS product[51].

There is the potential that a comprehensive MaaS system could generate huge amounts of data about travellers' behaviour. This could be a valuable resource for transport planners in public authorities, enabling better management of travel demand and planning for future infrastructure developments[52]. However, this requires public bodies to be able to access this data, something that might not be possible if a walled garden system emerges. There are also questions about whether private sector actors have gone far enough to protect their users' personal data, with major high profile data breaches at Uber in 2015 and 2017[53].

Fragmentation of the public transport system through deregulation in the UK makes data sharing between multiple private operators challenging, and has been a significant barrier to multi-operator ticketing. In Quebec, Canada, an interoperable ticketing system was developed for 18 operators (including the metro, six train lines, buses and intercity coaches), which allowed commercially sensitive data to remain closed but facilitated the Opus smartcard to be rolled across multiple operators[54].

Finland Transport Code

The Finnish Government introduced a new law in January 2018, The Transport Code, which aims to create a level playing field for public and private mobility operators[55]. The Code requires public and private mobility providers to have an open application programming interface (API) so that *"all can be integrated into one seamless travel chain that can be paid by one mobile system and all transport modes can be integrated into one holistic system"*[56].

Key implications for transport authorities

Transport authorities will need to consider:

- The strategic, skills and resource implications around maintaining datasets in usable and sharable formats;
- How the sharing of data in relation to MaaS relates to their wider policies on data and to what extent they wish to share it freely and without conditions. Or to what extent they wish to share data on the basis of reciprocal agreements with key private sector players or to recoup some of the costs of the accumulation and maintenance of that data; and,
- The role they want to play as wider guardian and protector of the use of personal data.

Mobility as a Service and social inclusion

Some argue that in the longer term MaaS could reduce the cost of mobility for customers by making services more efficient and, eventually, through the integration of autonomous vehicles (AVs)[57, 58]. Willumsen suggests that the combination of AVs in a MaaS system could halve the costs of mobility[59]. This would improve social inclusion by opening up mobility options to low income groups as well as those with additional mobility needs.

However, given that full AVs are some way off (if they happen at all) as discussed above there are challenges around creating an inclusive MaaS system in the short to medium term, particularly around coverage and pricing of these services, as well as how these services are accessed (given the necessity of being digitally connected). Docherty et al suggest that any smart mobility transition will not be evenly spatially distributed and will require intensive use of vehicles being concentrated in dense areas of bigger cities[60].

Indeed, nearly all the focus of the debate on MaaS so far has been implicitly or explicitly focussed on those who have a car (or could afford a car), are tech savvy and do not have mobility challenges.

Yet there are many opportunities to deploy technology to provide MaaS type services which are rooted in achieving broader social, health and wellbeing, environmental and economic outcomes. These could include providing: more choice and efficiency in provision of transport access to healthcare or social care; highly targeted and accurate information for those with particular mobility needs; and, providing lower cost transport opportunities for people on low incomes.

Current examples of such initiatives include:

- The Rail Delivery Group (RDG) has developed an app which enables customers to book assistance for their travel, allowing passengers to book, change and cancel their requests quickly and also meaning that staff can be updated on any changes or delays[61].
- West Yorkshire Combined Authority (WYCA) is exploring some of the issues around inclusion in its Digital Payment for Travel Strategy[62]. WYCA is seeking to develop a MaaS offer which enables customers to access a range of modes through one payment and offers account based bundles or subscriptions[63]. Through this it also aims to promote inclusive growth by ensuring that a range of ticketing options are available to those without access to a smart phone or contactless card[64].
- Washington DC is piloting a 'Transportation as a Service' to enable low income people to access rides in vehicles which are underused, as the evidence shows that only 40% of taxis and ride-hailing vehicles are occupied at any one time[65]. The pilot will establish a single access point for qualified residents, those on low incomes, disabled or elderly persons, to book and pay for vehicles at an affordable rate[66].

Key implications for transport authorities

Given the tendency of MaaS propositions, and the debate on MaaS so far to focus on a core commercial market located in particular geographies and demographics, there is a danger that more marginalised communities and demographic groups will be forgotten about, be poorly served and the costs of provision for them by the public sector will rise.

It is transport authorities that have a wider public interest remit and therefore it is likely that it is only with public sector involvement that wider social objectives will be reflected in MaaS schemes. At the same time there are opportunities for the public sector to deploy targeted MaaS-style services to meet existing social needs more effectively and efficiently.

Mobility as a Service and the pricing of road use

Exploring options for integrating MaaS and road user charging could help to narrow the gap between motoring and other forms of mobility as well as ensuring that a 'polluter pays' system can be established[67]. Hensher suggests that MaaS offers the opportunity to *'build in an appropriate pricing mechanism for use of the road network'*[68].

The Centre for London suggests that integrating road pricing mechanisms to cover all motor vehicles, including private users, taxis and PHVs, as well as new emerging MaaS operations, would ensure that mobility services are charged at the point of use for the distance travelled or time spent travelling[69].

This has the effect of internalising negative effects such as congestion or pollution[70]. It proposes that, in London, a single system could replace the existing charging schemes (e.g. congestion charge, low and ultra-low emission zones), which would charge drivers by the mile and apply in areas of poor air quality and high demand[71]. Rates could vary depending on vehicle class and emissions as well as the availability of public transport alternatives[72]. This single system would be integrated with other transport options so that the costs of driving could be compared to public transport, car-sharing, taxi, bike hire, cycling and walking[73]. Such an approach could be applicable in other cities but would be more challenging due to the fragmentation of the public transport systems.

Key implications for transport authorities

Where a transport authority might be considering new forms of charging for road use (or modifying an existing scheme) there is the potential to consider how this might form part of a far wider proposition for providing information on travel options and charging for their use.

OPTIONS FOR TRANSPORT AUTHORITIES ON MOBILITY AS A SERVICE

Mobility as a Service has the potential to deliver improved mobility alongside wider public policy benefits. However, there is also the potential for it to encourage more vehicle use (in particular taxis and PHVs), as well as locking out socially excluded groups, whether through pricing, non-availability of the service outside of higher income areas or through lack of access to digital platforms.

In this context we look at the options for the role that transport authorities could play on MaaS. This ranges from the transport authorities being the MaaS provider through to taking a laissez faire approach and leaving it to the market to determine how MaaS develops.

KPMG characterises three regulatory approaches that cities might take to MaaS[74], recognising that these are not discrete silos:

- **Open MaaS Market** – regulation is light touch (if relevant at all) as modal choice is not correlated with risk factors around air quality and congestion
- **Light MaaS Regulation** – modal choice is great and the impacts are higher (e.g. congestion and poor air quality) therefore light regulation of private MaaS operators is in place, such as requiring operators to display all available travel options, not just their own
- **Full MaaS Regulation** – intervention required to ensure policy objectives can be met. Substantial regulation is required with either the MaaS scheme operated by the authority and suppliers operating transport services or MaaS schemes being tightly governed in terms of pricing and services offered[75]

Transport for Greater Manchester offers an alternative characterisation of MaaS models, conceptualising six operational models and the role the public sector could play within them:

Model A (direct): Public Sector is the MaaS operator and uses in-house resources

Model B (external provision of services): Public Sector is the MaaS operator but outsources all of its responsibilities (becomes like a commissioning authority)

Model C (operational commissioning): Public Sector is the MaaS operator but outsources all of its responsibilities except financial transactions

Model D (joint provision e.g. partnership): Public Sector is the MaaS operator but brings in a partner to manage and operate the system

Model E (Spin-out, mutual): Public Sector is the MaaS operator but shares platform/ resources with other providers to make financial savings and bring efficiency

Model F (private sector operation)[76]: Private sector is the MaaS operator and has its full control on its operation

It is worth noting that the ability of transport authorities to take on a more decisive role on MaaS is influenced by the wider regulatory and legislative framework. In particular, the deregulation of the bus sector outside London and privatisation of rail can be a limiting factor as transport authorities do not have full control over the pricing of public transport.

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In London, where there is a regulated bus market and Transport for London also runs the Underground and some local heavy rail services rail, the constraints are fewer, and smart, simple and fully integrated ticketing has been a reality since 2003. There are pros and cons to each of the operational models proposed above.

In models where the public sector is either the MaaS operator or a pro-active participant, transport authorities can ensure that MaaS is delivering across policy goals, from public health and air quality to reducing congestion and reliance on the private car. Without this active engagement, there is a risk that these goals will be undermined by a model which prioritises motorised modes. In addition, further risks exist from a lack of public sector involvement including unfair competition, resilience (if operators fail) and transparency[77].

However, there are risks to the public sector of taking a central role in MaaS including commercial risks and liabilities and the costs of developing, managing and administering a MaaS offer. There are also challenges around the capacity and capability of transport authorities to take on MaaS operations, including in attracting and retaining the necessary skills in a competitive market[78]. All these challenges can be particularly acute given that revenue funding for transport authorities is heavily constrained.

There is also the potential for the public sector to take a stepped approach that starts with existing resources (journey planning, smart ticketing, real-time information, multi-operator ticketing), and then builds a platform that serves these resources in a consistent way. This would then allow for different approaches – either public sector led or providing the basis whereby app developers and private sector third parties could add new modes, and provides an open ecosystem on which new modes (e-bikes, DRT, e-scooters, car clubs, etc) can be added and new ticketing products (new multi-modal products, account based ticket solutions, etc) can be integrated.

Despite the risks of public sector involvement in MaaS, the potential risks of not being involved could be greater. Many of these have been discussed previously, but the risk that a private sector operator will not deliver across public policy goals, and may in fact incentivise more motorised travel through PHV use and car and ride sharing, undermining public transport, is perhaps the greatest. There is also potential for the relationship between transport authorities and the customer to be eroded and that authorities may be denied access to information and data about how people are travelling.

Five tests for 'Good MaaS'

Asking these questions could help to ensure that any MaaS offer helps to deliver on urban public policy goals and help in considering how to be involved in any partnership with MaaS operators.

1. Does it incentivise public transport use?
2. Does it help reduce congestion and pollution?
3. Is it socially inclusive? (Is it affordable; accessible in a non-digital way; providing good geographical coverage; providing information and options for those with additional mobility needs?)
4. Is there a culture of openness and data sharing?
5. Does it encourage active lifestyles?

CASE STUDIES

MaaS Global

MaaS Global is a Finnish company which currently operates the MaaS platform Whim in Helsinki, Finland, West Midlands in the UK, and Antwerp, Belgium[79]. It has attracted significant venture capital backing, securing €9 million in its most recent funding round[80]. Toyota was a significant investor in previous funding rounds[81] and public transport operator Transdev has also invested[82].

MaaS Global – Helsinki, Finland

Whim in Helsinki offers a number of packages[83]:

- Whim to Go, €0 per month, pay per ride with no commitment
- Whim Urban, €49 per month, unlimited single tickets on public transport, €10 per taxi ride (5km radius), €49 per day car rental
- Whim Unlimited, €499 per month, unlimited access to public transport, taxi or car

As of October 2018, Whim had 60,000 active users per month in Helsinki, with 1.8 million trips booked via the platform[84]. However, this represents just 0.5% of public transport trips in the city[85]. Of Whim's 7,000 subscribers, most use Whim Urban[86].

One of the key challenges facing MaaS Global in Helsinki has been the inability to offer monthly public transport passes, rather customers must obtain a new single ticket for each trip[87].

However, new legislation from the Finnish Government introduced January 2018 aims to create a level playing field for public and private mobility operators[88]. The Transport Code requires public and private mobility providers to have an open API so that *"all can be integrated into one seamless travel chain that can be paid by one mobile system and all transport modes can be integrated into one holistic system"*[89]. This should enable Whim to offer the full range of public transport tickets and passes in Helsinki.

MaaS Global – West Midlands, UK

Whim launched in the West Midlands, UK, in April 2018, with a series of trial packages as follows:

- Pay as you Go, £0 to access pay per ride on public transport, taxi and car hire
- Whim Everyday, £99 per month, which included unlimited use of public transport in the West Midlands and a capped price of £49 for Enterprise car hire
- Whim Unlimited £349 per month, which included unlimited use of public transport, taxi rides within 3 miles of the city centre and unlimited Enterprise car hire[90].

However, in early 2019, MaaS Global withdrew the Everyday and Unlimited packages, due to low uptake, and is now looking to set up a Whim Everyday Bus package[91].

5

Smile – Vienna, Austria

SMILE was a MaaS pilot scheme in Vienna that ran from 2013 to 2015. The prototype integrated mobility app was tested by 1,000 users in 2014 and 2015. The app could be used to book and pay for a range of mobility services including public transport, car share, bike share and taxi[92].

It is interesting to note that almost 80% of participants were male and over 60% of participants were under 45 years old[93]. Participants already had high public transport use and many used car sharing, suggesting these were early adopters in new mobility.

A survey of pilot users found the following changes in behaviour:

- 48% of respondents increased their usage of public transport
- 10% increased use of bike share
- 21% reduced their use of private car
- 22% reduced their use of taxis (though 7% increased taxi use)
- 69% tried new routes, whether this was through a change in mode, a different combination of modes or taking an alternative or cheaper route
- Intermodality increased, with 26% of users increasing their public transport use in combination with private car[94]

The findings and experience with SMILE has led to the development of WienMobil, an app which enables the booking of and payment for a range of mobility services in Vienna[95]. Mobility partners cover car share and rental, taxi and bike share, as well as public transport tickets and passes[96].

Figure 3 – Smile (Left) and WienMobil (Right) (Image Source: Upstream)

UbiGo – Gothenburg, Sweden

UbiGo was a six month trial in Gothenburg, Sweden, where 195 people in 83 households became users of a MaaS platform between November 2013 and April 2014[97]. It offered customers a subscription service including public transport, car and bike sharing, rental cars and taxis, although taxis were booked at a discounted rate and invoiced at the end of the month. Any unspent credit could be rolled over and if there was remaining credits at the end of the trial this was refunded. A bonus was in place for "eco-friendly" travel, whereby participants earned points based on the reduced CO_2 emissions compared to a private car trip. These points could then be exchanged for goods, such as food or audio books, or services, such as access leisure facilities.

Households that were likely to benefit from the offer were targeted during the recruitment process, so those who had low car usage or might be considering whether to buy a car or not. Participants were evenly split by gender, with an average age of 38, the youngest adult participant was 21 and the oldest 73. People were also offered the option to give up their car for the duration of the trial, which 20 households took up.

The results showed that participants reduced their private car use (48% of people reported using their car less) and increased their use of bus/tram and car sharing (50% and 57% respectively used these modes more often). It is interesting to note that 20% of participants reported using taxi more often, as increasing taxi trips is often reported as a concern around MaaS offers, though this could be as a result of lower levels of private car use. Customer satisfaction in using the app was high and 97% of participants wanted to keep using the app at the end of the trial. Attitudes towards different modes of transport shifted as a result of the trial, with 52% of people saying their attitude to bus/tram was 'more positive' and 61% reporting their attitude to car sharing as 'more positive'. Private car was the only mode that saw many participants reporting their attitude as 'more negative', at 23%, with all other modes under 6% for 'more negative'.

Participants were asked what could be done to improve UbiGo, and having a pay as you go option was suggested, as well as improved journey planning facilities including comparison across all modes, not just public transport, with additional details about price and journey time.

Hannover Mobility Shop – Hannover, Germany

The Hannover Mobility Shop, launched in February 2016, is one of the first fully operational examples of MaaS. Run by public transport operator Üstra and the Greater Hannover Transport Association, the Mobility Shop offers a multimodal platform for planning, booking and payment of trips using public transport, taxi and car sharing[98]. A pilot version was trialed in November 2014 to establish how best to provide MaaS .

The aim in creating a 'one-stop shop' for mobility was to provide an offer that supersedes the need for a private car and integrates other transport modes in a way that supplements public transport[100] .

Customers can use the application to look up journeys and receive information about the cost and duration of that trip by a range of modes; they can then either buy a public transport ticket, make a car share reservation or call a taxi [101]. Registered users get discounts on taxi fares and a free Bahn Card 25 (worth €62 a year), giving 25% discount on rail trips[102]. Invoicing is carried out monthly for all services[103].

Martin Röhrleef, manager of the Mobility Shop, suggests that public transport companies need to establish MaaS offers to take advantage of their assets and customer relationships and to ensure that they remain competitive[104]. He has also suggested that MaaS could be made more attractive than owning a car[105].

Jelbi – Berlin, Germany

In Berlin, the public transport company BVG is launching a new app in summer 2019 which will integrate all modes in the city[106]. This will include bike share, scooters, ride share, car sharing, taxis and all public transport modes on a single platform[107]. The app, called Jelbi, is being developed by the tech company Trafi on behalf of BVG[108]. It is seeking to create an offer that competes with automotive companies and ride share operators such as Uber.

The approach taken here, and in Hannover, is that of the public sector being heavily involved in MaaS, either as the operator or commissioner of a MaaS platform. This should enable positive impacts across public policy goals.

MaaS Evolution – Greater Manchester, UK

Transport for Greater Manchester (TfGM), the strategic transport body for the metropolitan area around Manchester, is exploring MaaS as part of its 2040 Transport Strategy and in order to achieve the Mayor's Vision for Transport.
In particular, TfGM is seeking to make travel easier, more flexible and affordable, reduce private car use, increase accessibility and support sustainable economic growth. TfGM has been involved in a number of Horizon 2020 EU funded projects exploring various elements of MaaS solutions.

In October 2017 TfGM, working with Atkins/ SNC-Lavalin, ran a trial, called MaaS Evolution, to understand user behaviour and perceptions of MaaS[109]. 39 participants were selected from 230 volunteer residents. They were provided access to:

- Any bus and tram – a 28 day Any Bus Any Tram, Get Me There Card (value £120)
- On-demand bus – Local Link,TfGM's subsidised on-demand bus service
- Car share – card unlocked Enterprise vehicles
- Car hire – Enterprise also allowed access to car hire trips where appropriate
- Bike share – Mobike provided free credit to users
- Taxi – Gett provided back-up service
- Walking – this mode of travel was encouraged by 'nudging'

A total of 626 journeys were made and of these 73% included two or more different modes of transport. 21% of participants were now more willing to use active travel following the experiment and 26% were more willing to use public transport. Integrated ticketing and real-time updates were popular among participants, with users suggesting that real-time update, re-routing and journey planning helped to reduce travel related stress. Six months after the trial, 82% of participants wanted MaaS to come back and 20% of participants had incorporated active travel into their commute[110].

There are a number of challenges facing the development of MaaS in Greater Manchester, including customer, commercial and reputational risks[111], though these are not unique to the city region. However, the opportunity is there to create a flexible new mobility offer and support economic growth[112]. The trials being undertaken offer the chance to experiment with different ways of developing a MaaS offer and to generate detailed insight and understanding of public attitudes to MaaS and the potential behaviour change that can be delivered.

Vervoerregio – Amsterdam, The Netherlands

Vervoerregio Amsterdam, the regional transport body for the Amsterdam metropolitan area, is exploring options for deploying MaaS in order to deliver improved accessibility, sustainable transport and a liveable city and region[113]. It is adopting an approach of learning through experimentation, exploring options that are scalable and interoperable for large scale roll out and delivering a professional service for users[114]. Amsterdam is a growing city with few options for expanding infrastructure capacity to meet demand, therefore MaaS could offer options for influencing how people travel in order to improve system efficiency.

Its initial pilot study is focusing on Zuidas, a business district with 40,000 employees and a growing residential population[115]. Key aims of the MaaS pilot here will be to reduce car use and increase customer satisfaction, as well as provide data and insight for the transport authority. Depending on the pilot outcomes, further experimentation will be undertaken to identify a solution that could work for the region and across the Netherlands.

CONCLUSION 6

The challenges and opportunities around Mobility as a Service are fast moving and rapidly evolving as organisations and operators explore different options and large sums of venture capital are invested.

In principle, the concept of MaaS could have many benefits for customers and for cities.

However, as we have shown, the extent to which these are realised is dependent on how schemes are delivered in practice.

The key issues which will shape the future of MaaS that we have identified in this report are:

- the **economic models** which underpin MaaS schemes will determine how impartial, stable, extensive, competitively priced and popular MaaS schemes are
- the extent to which issues around the ownership, sharing, resourcing of **data** are resolved will determine how comprehensive MaaS schemes are
- the extent to which **wider environmental, social and public health goals** are built into MaaS schemes will determine whether they will contribute to making cities the less congested, more inclusive, greener and healthier places they want to be.

We have also shown that transport authorities have choices to make about how much of a role they wish to play in determining the evolution of MaaS and in shaping the way in which the key issues identified above play out. At the same time, the report recognises that in the Great Britain context there are significant constraints around funding and the wider regulatory and legislative framework (particularly outside London) in which transport authorities work which can make playing a more central role in MaaS more challenging.

The report highlights a number of implications transport authorities need to consider when thinking through their potential role on MaaS. These are:

- How the economic models of MaaS schemes stack up, and the implications this will have on traveller behaviour.
- How data is managed including in relation to ownership, sharing and resourcing
- How MaaS schemes can truly serve all strata of society, and not ignore marginalised communities or demographic groups

There are also issues to consider around how MaaS schemes could potentially be integrated with road user charging to help narrow the gap between motoring and other forms of mobility

The future of MaaS is yet to be decided. It could be a private or public sector monopoly or a competitive market. It could be a system that steers people towards use of cars or away from them. It could make travelling easier for all, no matter their income, disability or location or it could make mobility easier for tech-savvy, city centre dwellers and harder for those who are already excluded and marginalised. It could be a great concept that takes off at scale or one that people don't need or want in practice.

In this report we have sought to provide a framework for thinking through what role transport authorities might want to play in influencing this future for the better.

REFERENCES

1 Transport Systems Catapult (2016) Exploring the Opportunity for Mobility as a Service in the UK, [online] *https://ts.catapult.org.uk/intelligent-mobility/im-resources/maasreport/*

2 Cubic (2018) Mobility as a Service – Putting Transit Front and Centre of the Conversation [online] *https://www.cubic.com/sites/default/files/Maas_Final_Whitepaper.pdf*

3 MaaS Alliance (2018) What is MaaS? [online] *https://maas-alliance.eu/homepage/what-is-maas/*

4 Deloitte (2017) The rise of mobility as a service [online] *https://www2.deloitte.com/insights/us/en/deloitte-review/issue-20/smart-transportation-technology-mobility-as-a-service.html*

5 MaaS Global (2018) MaaS as a concept [online] *https://maas.global/maas-as-a-concept/*

6 Polis (2017) Mobility as a Service: Implications for urban and regional transport [online] *https://www.polisnetwork.eu/uploads/Modules/PublicDocuments/polis-maas-discussion-paper-2017---final_.pdf*

7 Transport Systems Catapult (2016) Exploring the Opportunity for Mobility as a Service in the UK, [online] *https://ts.catapult.org.uk/intelligent-mobility/im-resources/maasreport/*

8 Low Carbon Vehicle Partnership (2018) Low Emission Taxi Guide [online] *http://www.lowcvp.org.uk/assets/reports/LowCVP_Low_Emission_Taxi_Guide.pdf*

9 Beard J (2018) Designing in diversity for our transport infrastructure and services, presentation to Smarter Travel Live! Conference, Liverpool, October 2018

10 Paul Campion (2018) Innovation in Mobility – Presentation to Smarter Travel Live Conference, Liverpool, 16th and 17th October 2018

11 ABI Research (2016) ABI Research Forecasts Global Mobility as a Service Revenues to Exceed $1 Trillion by 2030 [online] *https://www.abiresearch.com/press/abi-research-forecasts-global-mobility-service-rev/*

12 Ibid.

13 Kubitz (2018) Take your partners – MaaS marketplace opens up new world for mobility players in Local Transport Today

14 Intelligent Transport (2019) BMW and Daimler invest over €1bn in joint mobility services [online] *https://www.intelligenttransport.com/transport-news/76168/daimler-bmw-cities-mobility-solutions/*

15 Ibid.

16 Deloitte (2017) Global Automotive Consumer Study [online] *https://www2.deloitte.com/content/dam/Deloitte/de/Documents/consumer-industrial-products/Deloitte-Global-Automotive-Consumer-Study-2017-German-Market-Perspective.pdf*

17 Ibid.

18 Morgan Stanley (2016) Shared Mobility on the Road of the Future [online] *https://www.morganstanley.com/ideas/car-of-future-is-autonomous-electric-shared-mobility*

19 Department of Business, Energy and Industrial Strategy (2017) Industrial Strategy: building a Britain fit for the future [online] *https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future*

20 Department of Business, Energy and Industrial Strategy (2018) The Grand Challenges – Policy Paper [online] *https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/industrial-strategy-the-grand-challenges#future-of-mobility*

21 Department for Transport (2019) Future of Mobility: Urban Strategy [online] *https://www.gov.uk/government/publications/future-of-mobility-urban-strategy*

22 Ibid.

23 Transport Select Committee (2018) Mobility as a Service – Eighth Report of Session 2017-2019 [online] *https://publications.parliament.uk/pa/cm201719/cmselect/cmtrans/590/590.pdf*

24 Ibid.

25 Ibid.

26 Digital Birmingham (2018) West Midlands will be the first 'Future Mobility Area' in UK [online] *http://digitalbirmingham.co.uk/blog/2018/10/01/west-midlands-will-be-the-first-future-mobility-area-in-the-uk/*

27 Transport Knowledge Hub (2017) Mobility as a Service in the West Midlands and elsewhere [online] *https://transportknowledgehub.org.uk/case-studies/mobility-service-west-midlands-elsewhere/*

28 Oxford Smart City (2018) *https://www.oxfordsmartcity.uk/oxblog/home/*

29 Transport for Greater Manchester (2018) Written evidence to the Transport Select Committee Mobility as a Service inquiry [online] *http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/transport-committee/mobility-as-a-service/written/76041.pdf*

7

30 Transport for London (2017) Healthy Streets for London [online] *http://content.tfl.gov.uk/healthy-streets-for-london.pdf*

31 Transport for London (2017) Healthy Streets for London [online] *http://content.tfl.gov.uk/healthy-streets-for-london.pdf*

32 Gartner (2018) Hype Cycle for Connected Vehicles and Smart Mobility 2018 Summary [online] *https://www.gartner.com/doc/3883166/hype-cycle-connected-vehicles-smart*

33 Mulley C (2017) Mobility as a Service (MaaS) – does it have critical mass? In Transport Reviews Volume 31, Issue 3 [online] *https://doi.org/10.1080/01441647.2017.1280932*

34 Lyons, Hammond and Mackay (2019) The importance of user perspective in the evolution of MaaS, in Transportation Research Part A: Policy and Practice [online] *https://www.sciencedirect.com/science/article/pii/S0965856418307134?via%3Dihub*

35 Lyons G (2018) MaaS evolution through the eyes of the prospective user, presentation to the IET Behavioural Science in Transport Conference [online] *https://tv.theiet.org/?videoid=12587*

36 Department for Transport (2014) Transport Direct website closes on 30 September 2014 [online] *https://www.gov.uk/government/news/transport-direct-website-closes-on-30-september-2014*

37 Local Transport Today (2019) Rethink of MaaS products in the West Mids, LTT763 January 2019

38 Citymapper (2019) Citymapper PASS [online] *https://medium.com/citymapper/citymapper-pass-17c56da5dfa0*

39 Hern (2019) Citymapper to undercut TfL with London travel card [online] *https://www.theguardian.com/uk-news/2019/feb/27/citymapper-pass-launch-london-travel-card-with-cheaper-rate-than-tfl*

40 Ram (2018) Citymapper drops bus plans, looks to take on Uber [online] *https://www.ft.com/content/7a798068-1664-11e8-9e9c-25c814761640*

41 Hern (2018) Citymapper launches bus-taxi hybrid Smart Ride in London [online] *https://www.theguardian.com/technology/2018/feb/21/citymapper-launches-bus-taxi-hybrid-smart-ride-london-transit-app*

42 Franklin (2018) Uber is expanding and rebranding – is that a good thing? [online] *https://www.greenbiz.com/article/uber-expanding-and-rebranding-good-thing*

43 Younger (2018) Presentation to CIHT Young Professionals conference, Leeds *https://www.youtube.com/ watch?v=mm0Lw2iHP80&t=389s&list=PLRtUjcubdyjf7QiPUa6ztwUxaWLRB xY3f&index=2*

44 Schaller B (2018) The New Automobility: Lyft, Uber and the Future of American Cities [online] *http://www.schallerconsult.com/rideservices/automobility.pdf*

45 Zipper (2018) Helsinki's MaaS App, Whim: Is It Really Mobility's Great Hope? City Lab [online] *https://www.citylab.com/perspective/2018/10/helsinkis-maas-app-whim-is-it-really-mobilitys-great-hope/573841/*

46 Department for Transport (2019) Future of Mobility: Urban Strategy [online] *https://www.gov.uk/government/publications/future-of-mobility-urban-strategy*

47 Urban Transport Group (2016) Getting Smart on Data [online] *http://www.urbantransportgroup.org/system/files/general-docs/Getting%20Smart%20on%20Data%20-%20Final.pdf*

48 Hietenan, S (2016) The launch of MaaS Global, Presentation to the TravelSpirit Conference, 28/06/2016, Manchester, UK

49 Maas Alliance (2018) Data makes MaaS happen – MaaS Alliance Vision Paper on Data [online] *https://maas-alliance.eu/wp-content/uploads/sites/7/2018/11/Data-MaaS-FINAL-after-plenary-1.pdf*

50 National Infrastructure Commission (2017) Data for the public good [online] *https://www.nic.org.uk/wp-content/uploads/Data-for-the-Public-Good-NIC-Report.pdf*

51 TravelSpirit Foundation (2018) Internet of Mobility [online] *https://travelspirit.foundation/internet-of-mobility/*

52 Transport Select Committee (2018) Mobility as a Service – Eighth Report of Session 2017-2019 [online] *https://publications.parliament.uk/pa/cm201719/cmselect/cmtrans/590/590.pdf*

53 BBC (2017) Uber agrees to 20 years of privacy audits to settle FTC charges [online] *www.bbc.co.uk/news/technology-40946680*

54 Xerox (2014) Quebec, Canada [online] *https://www.xerox.com/downloads/usa/en/bpo/casestudies/bpo_casestudy_quebec.pdf*

55 Søren Sørensen (2018) Making MaaS work: overcoming the issue of governance [online] *https://www.intelligenttransport.com/transport-articles/65230/improving-mobility-service-maas/*

56 Ertico (2017) Finland's transport code focuses on digitalisation of transport [online] *http://erticonetwork.com/finlands-transport-code-focuses-digitalisation-transport/*

57 Gindrat R (2018) How MaaS Public Transit is Changing the World, Forbes [online] *https://www.forbes.com/sites/forbestechcouncil/2018/11/06/how-maas-public-transit-is-changing-the-world/#1afe44707518*

58 ARK INVEST (2018) Big Ideas 2018 [online] *https://research.ark-invest.com/hubfs/1_Download_Files_ARK-Invest/Infographics/Big%20Ideas%202018%20-%20ARK%20Invest.pdf?hsCtaTracking=37c67fc6-1932-4b42-887c-ba1332a0e7a9%7C4a9f618a-acf9-428b-a7ab-11965014a86b*

59 Williumsen L (2018) On CAVs and MaaS: Congestion and silver bullets [online] *https://www.transportxtra.com/publications/local-transport-today/news/56893/on-cavs-and-maas-congestion-and-silver-bullets/*

60 Docherty, Marsden and Anable (2018) The governance of smart mobility in Transportation Research Part A: Policy and Practice [online] *https://doi.org/10.1016/j.tra.2017.09.012*

61 Rail Delivery Group (2018) Easier assistance app will transform journeys for disabled rail passengers [online] *https://www.raildeliverygroup.com/media-centre/press-releases/2018/469774616-2018-09-28.html*

62 WYCA (2019) Digital Payment for Travel Strategy, report to Transport Committee [online] *https://westyorkshire.moderngov.co.uk/documents/s10307/Item%206%20-%20Digital%20Payment%20for%20Travel.pdf*

63 Ibid.

64 Ibid.

65 Nyczepir (2018) D.C. Prepares to Launch Transportation as a Service [online] *https://www.routefifty.com/smart-cities/2018/10/dc-launch-transportation-service/151839/*

66 Ibid.

67 Wong, Hensher and Mulley (2018) Emerging transport technologies and the modal efficiency framework: A case for mobility as a service (MaaS) [online] *https://ses.library.usyd.edu.au/bitstream/2123/17503/1/Thredbo_15_Thredbo_15_Paper_44.pdf*

68 Hensher D (2018) Road pricing reform: a thorny issue, [online] *https://imovecrc.com/news-articles/intelligent-transport-systems/road-pricing-reform/*

69 Centre for London (2017) Street Smarts: Report of the Commission on the Future of London's Roads and Streets [online] *https://www.centreforlondon.org/reader/street_smarts_report_of_commission_on_future_of_londons_roads_and_streets/chapter-3-policy-packages/*

70 Ibid.

71 Centre for London (2019) Green Light: Next generation road user charging for a healthier more liveable London [online] *https://www.centreforlondon.org/publication/road-user-charging/*

72 Ibid.

73 Ibid.

74 KPMG (2017) Reimagine Places: Mobility as a Service [online] *www.kpmg.com/uk/reimagine-maas*

75 Ibid.

76 Transport for Greater Manchester (2018) Written evidence to the Transport Select Committee Mobility as a Service Inquiry [online] *http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/transport-committee/mobility-as-a-service/written/76041.pdf*

77 Transport for Greater Manchester (2018) Written evidence to the Transport Select Committee Mobility as a Service Inquiry [online] *http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/transport-committee/mobility-as-a-service/written/76041.pdf*

78 Urban Transport Group (2016) Getting Smart on Data [online] *http://www.urbantransportgroup.org/system/files/general-docs/Getting%20Smart%20on%20Data%20-%20Final.pdf*

79 MaaS Global (2018) MaaS Global Secures €9 million in Latest Funding Round [online] *https://maas.global/maas-global-secures-e9-million-in-latest-funding-round/*

80 Ibid.

81 MaaS Global (2017) Toyota and its insurance partner make significant capital investment in Finnish company MaaS Global [online] *https://maas.global/toyota-and-its-insurance-partner-make-significant-capital-investment-in-finnish-company-maas-global-2/*

82 MaaS Global (2019) Investors [online] *https://maas.global/company/*

83 Maas Global (2019) Whim Helsinki, *https://whimapp.com/, prices correct 07/02/2019*

84 Zipper (2018) Helsinki's MaaS App, Whim: Is It Really Mobility's Great Hope? City Lab [online] *https://www.citylab.com/perspective/2018/10/helsinkis-maas-app-whim-is-it-really-mobilitys-great-hope/573841/*

85 Ibid.

86 Ibid.

87 Ibid.

88 Søren Sørensen (2018) Making MaaS work: overcoming the issue of governance [online] *https://www.intelligenttransport.com/transport-articles/65230/improving-mobility-service-maas/*

89 Ertico (2017) Finland's transport code focuses on digitalisation of transport [online] *http://erticonetwork.com/finlands-transport-code-focuses-digitalisation-transport/*

90 Forster (2018) Prices unveiled for West Mids MaaS subscription packages in Local Transport Today, [online] *https://www.transportxtra.com/publications/local-transport-today/news/56412/prices-unveiled-for-west-mids-maas-subscription-packages*

91 MaaS Global (2019) WhimUK [online] *https://whimapp.com/uk/*

92 Smile (2018) Pilot operation and survey [online] *http://smile-einfachmobil.at/pilotbetrieb_en.html*

93 Ibid.

94 Ibid.

95 Wiener Linien (2017) WienMobil App [online] *https://www.wienerlinien.at/eportal3/ep/channelView.do/pageTypeId/66533/channelId/-3600061*

96 Ibid.

97 This case study is based on: Karlsson, Sochor and Stromberg (2016) Developing the 'Service' in Mobility as a Service: experiences from a field trial of an innovative travel brokerage, in Transportation Research Procedia, Vol.14, pp.3265-3273 *https://www.sciencedirect.com/science/article/pii/S2352146516302794; and Sochor, Stromberg and Karlsson (2014) Travellers' motives for adopting a new, innovative travel service: insights from the UbiGo field operational test in Gothenburg, Sweden, 21st World Congress on Intelligent Transportation Systems, Detroit, September 7-11 2014*

98 UITP (2016) World's first example of Mobility as a Service now live in Hannover [online] *www.uitp.org/news/maas-hannover*

99 Ibid.

100 Röhrleef M (n/k) Creating a "One Stop Mobility Shop" for Hannover (Germany) presentation [online] *https://www.connective-cities.net/fileStorage/Veranstaltungen/Projektwerkstatt_Cebu/Dokumente/Presentation_Mr_Roehrleef_Hanover.pdf*

101 Röhrleef M (2017) Hanover's 'one stop mobility shop' in Intelligent Transport [online] *https://www.intelligenttransport.com/transport-articles/69062/hanovers-one-stop-mobility-shop/*

102 Röhrleef M (2016) Creating a "One Stop Mobility Shop" for Hannover [online] *https://www.iru.org/sites/default/files/2016-11/iru-taxi-forum-2016-roehrleeff-en.pdf*

103 Röhrleef M (2017) Hanover's 'one stop mobility shop' in Intelligent Transport [online] *https://www.intelligenttransport.com/transport-articles/69062/hanovers-one-stop-mobility-shop/*

104 Ibid.

105 UITP (2016) World's first example of Mobility as a Service now live in Hannover [online] *www.uitp.org/news/maas-hannover*

106 Peters (2019) In Berlin, there's now one app to access every mode of transportation [online] *https://www.fastcompany.com/90308234/in-berlin-theres-now-one-app-to-access-every-mode-of-transportation?partner=rss&utm_source=rss&utm_medium=feed&utm_campaign=rss+fastcompany&utm_content=rss?cid=search*

107 Ibid.

108 Ibid.

109 Wray S (2019) A MaaS trial in Manchester in the UK generated fascinating insights in Smart Cities World [online] *https://www.smartcitiesworld.net/special-reports/special-reports/manchester-road-tests-maas*

110 Ibid.

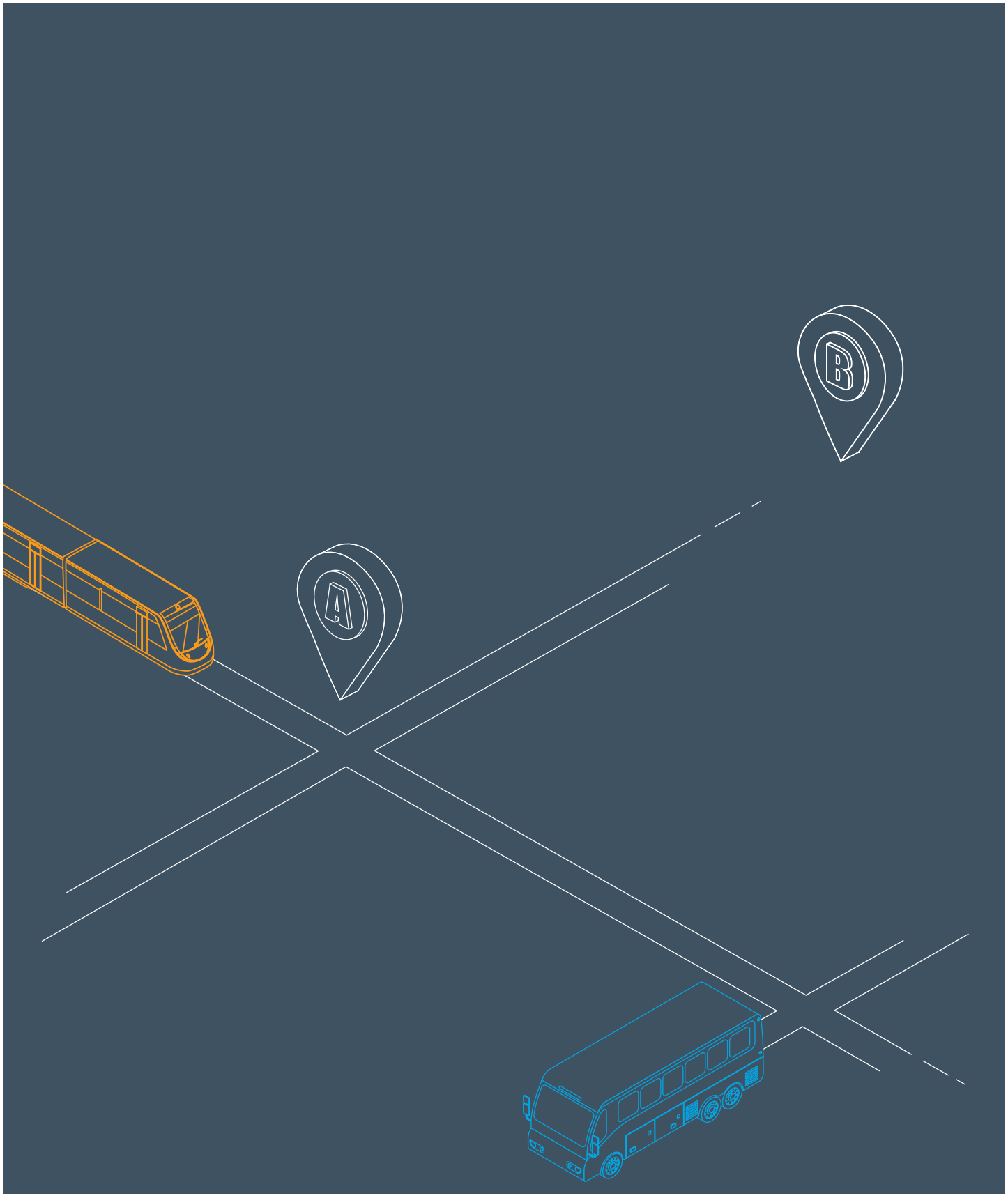
111 Guisti M (2019) MaaS in Greater Manchester [online] *https://blogs.salford.ac.uk/healthyactivecities/wp-content/uploads/sites/48/2019/01/MG-MaaS-16Jan19-v1.0.pdf*

112 Ibid.

113 Vervoerregio Amsterdam (2018) Mobility as a Service for a lever of integrated transport data for planning in Amsterdam, presentation to EMTA meeting November 2018

114 Ibid.

115 Ibid.



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