International Transport Forum

Integrating Public Transport into Mobility as a Service

Summary and Conclusions

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The International Transport Forum

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Cite this work as: ITF (2021), *Integrating Public Transport into Mobility as a Service: Summary and Conclusions*, ITF Roundtable Reports, No. 184, OECD Publishing, Paris.

Acknowledgements

This report was prepared by Orla McCarthy, with input from Rex Deighton-Smith, Philippe Crist and Stephen Perkins, all of the International Transport Forum (ITF). The report was based on discussions that took place during the Roundtable on Integrating Public Transport into Mobility as a Service, held virtually on 12-14 October 2020.

Additionally, the report draws on four discussion papers that were prepared for the Roundtable. The ITF would like to thank Yves Crozet, Corinne Mulley and John Nelson, Daniel Hörcher and Danial Graham, and Jana Sochor for their valued contributions. The papers are available for download at https://www.itf-oecd.org/integrating-public-transport-mobility-service-maas-roundtable.

The ITF also thanks Martin Lefrancq (Brussels Mobility) for chairing the Roundtable and all participants for contributing to the rich discussions. Particular thanks go to Kate Pangbourne (Institute for Transport Studies, University of Leeds), Tom Geerts (Flemish Department of Mobility and Public Works, Brussels) and Juan Corro (Municipal Transport Company of Madrid) for their input in follow-up discussions.

The ITF is also grateful to the following people for their feedback and input to the draft report: María J. Alonso González (KiM Netherlands Institute for Transport Policy Analysis), Corinne Mulley (Professor Emerita, Institute of Transport and Logistics Studies, University of Sydney), Göran Smith (RISE Research Institutes of Sweden), Adam Cohen (Transportation Sustainability Research Center, University of California, Berkeley), Jenni Eckhardt (VTT Technical Research Centre of Finland), Daniel Hörcher and Daniel Graham (Department of Civil and Environmental Engineering, Imperial College London), and Lucie Kirstein (ITF).

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Executive summary

What we did

This report examines the potential impact of Mobility as a Service (MaaS) on how passenger transport is currently organised. MaaS is a model for supplying a wide range of passenger transport services through a single, digital customer interface. In its most ambitious form, it integrates different transport, information and payment services into a smooth and reliable customer experience. The report assesses the regulatory and governance requirements for integrating MaaS with public transport and ensuring it delivers more sustainable urban mobility, focusing on the role of public transport authorities. The report is based on discussions at an ITF Roundtable in October 2020 and the four input papers prepared for it.

What we found

MaaS combines public transport modes and commercial mobility services such as ridesourcing, bike- and carsharing and taxis into a unified, multimodal mobility offer with integrated ticketing and payment systems across modes and service providers.

Expectations for MaaS are high. Many governments expect MaaS to improve accessibility and deliver more sustainable mobility. For example, France's 2021 Mobility Law prioritises improving daily transport and getting the most out of the digital revolution. The hope is that the measures provided for in the Mobility Law will prompt travellers to make more sustainable transport choices generally, resulting in a decrease in private car use in particular.

If MaaS is to contribute to mobility policy outcomes through integration with existing public transport, public transport tickets need to be made available through MaaS apps. Most visions of MaaS assume that it will increase the demand for public transport, but this impact remains to be demonstrated at scale. More generally, user demand is an uncertain variable, and the business models of many new on-demand services that would be part of a MaaS ecosystem have not proven their viability.

Government intervention in a MaaS market may be required for some purposes. Authorities will want to ensure that the basic data required for integrating different services are freely available in common formats, for instance. They also have an interest in conserving the value of existing concessions for public services. And public authorities may find it appropriate to support MaaS - or the modes that underpin it - to improve access for communities that are poorly served by the current transport offer.

However, where commercial actors are expected, undue interventions could also undermine the economic viability of MaaS. Unwarranted restrictions for market entry could stifle competition. Unnecessarily high levels of data standardisation could hamper innovation. Interventions that affect market access will need to be mindful of maintaining a competitive environment in the MaaS eco-system. Necessary trade-offs should be guided by public policy objectives for accessibility and sustainability and the ability for MaaS to contribute to them. A flexible, outcome-based approach to regulation with built-in

review periods would allow for innovation in MaaS while enabling a managed introduction of the new system.

MaaS pilot studies suggest users chose travel options based on convenience and quality of service. They pay less attention to sustainability. Thus, reaping environmental benefits from MaaS requires that sustainable modes offer the quality, reliability and accessibility that will make them attractive. Sustainable MaaS services are most likely to develop successfully within a comprehensive framework of sustainable urban mobility policies.

Companies contributing to MaaS have adopted various business models and serve a wide range of markets, some business-to-consumer, others business-to-government and still others business-to-business. Some combine mobility with services in tourism, banking or shopping. For some, non-mobility services are the primary profit centres. Government interventions will need to take into account the complexity of the market to avoid constraining the development of a diverse MaaS offer.

MaaS markets are at a stage of rapid development. New on-demand mobility ventures enter and exit the market all the time, others disappear as a result of consolidation. To accommodate the continuing evolution of MaaS, regulatory frameworks need to be flexible and frequently revised.

Reliable and efficient data-sharing is a prerequisite for the development of viable MaaS models. Building trust among the actors in the system is critical to successfully developing sound data-sharing and governance frameworks.

What we recommend

Adopt a light and flexible regulatory approach that allows Mobility as a Service to evolve

For MaaS to flourish, regulation should not be heavy-handed. Defining a set of *ex-ante* regulations means predicting the "right" model of MaaS, and this could easily impede innovation. Regulatory intervention is only necessary where significant market failures occur and where other direct measures will likely not suffice. Building periodic reviews into the regulatory framework is an effective way to manage the development of this new approach to mobility.

Integrate the governance of Mobility as a Service into broader sustainable mobility policies

MaaS alone will not achieve sustainable transport objectives. However, it could make it more convenient to choose sustainable travel options. It could also provide users with better information and improve co-ordination for the transport authority based on the data from MaaS apps. On the other hand, the availability of on-demand modes that are central to MaaS could entice users to switch from walking or from using public transport to cars. MaaS will only contribute effectively to more sustainable mobility if it is developed in a context of broader policies that contain private car use and encourage sustainable choices while managing public space equitably and efficiently.

Allow public transport operators the freedom to negotiate with Mobility as a Service providers

For MaaS to facilitate a shift away from private car use, it must make access to public transport via its platform as easy as possible. MaaS providers need to be able to offer public transport services via flexible, tailored packages as well as simply providing existing ticket options via a new platform. Public transport authorities, in turn, need flexibility to negotiate the sale of public transport services to MaaS providers. It should also be noted that the public transport authority or operator could also *become* a MaaS provider.

Create data-sharing frameworks that are as open as possible, as constrained as necessary

Well-crafted data-sharing agreements can help to build trust between partners, notably if they limit data-sharing to the necessary data and what is proportional to the end-use. Access to data necessary for the MaaS system to function should be encouraged as much as possible but under fair commercial terms. Public transport authorities should not ask an operator or platform for all their data by default and MaaS stakeholders should map what data is required for what purpose.

Define common building blocks for sharing data within a Mobility as a Service eco-system

MaaS requires the systems of the various mobility operators and MaaS providers to communicate with each other. A single, mandated standard for the data architecture may be overly restrictive. However, a lack of common language elements for data management will hinder interoperability. In addition, smaller operators may find the financial burden of meeting multiple standards to integrate with several larger providers too heavy to carry. Convergence on a single standard may be some way off. Several models to aid interoperability have begun to emerge, however, with some specifically aimed at MaaS actors. The widest possible adoption of common semantics and syntax among operators and providers, even on an initially voluntary basis, will be highly useful for integrating services.

What is Mobility as a Service?

Mobility as a Service (MaaS) is based on the concept of a single, digital customer interface to source and manage travel-related services. At its core, the concept of MaaS digitally connects different transport, information and payment services into a seamless customer experience. MaaS enables the integration of public transport modes, commercial transport services such as ridesourcing, bike- and carsharing and taxis into a comprehensive mobility offer.

The different stakeholders and operators have had difficulty agreeing on what form MaaS should take (Polis, 2017; EMTA, 2019), and varying models are ultimately likely to emerge. Many authorities are looking at how MaaS might contribute to their sustainable mobility goals, primarily through improving the attractiveness and ease of alternatives to the private car. However, the hopes of what MaaS may be able to deliver are tempered by concerns that it could undermine public transport systems and public authorities' ability to manage those systems. The user value proposition of MaaS is also not yet fully understood. Even so, given the success among consumers of app-based mobility offers in recent years, the prospect of the seamless transport experience that MaaS aspires to offer is proving sufficient for authorities to seek means of enabling or implementing MaaS to contribute to their policy goals.

The International Transport Forum's Roundtable on Integrating Public Transport into Mobility as a Service aimed to explore what policy makers should consider if they wish to enable existing public transport systems to be integrated into a MaaS ecosystem. This report looks at the different organisational approaches to MaaS in terms of the involvement of the public transport authority and commercial operators. It considers the impact of MaaS on the user and the role of the public transport authority in a MaaS ecosystem. Questions of data governance are also considered.

MaaS does not necessarily increase the transport services available in a region but may create a smoother experience of using them. Commercial mobility service providers can exist in a market subject to local regulations without MaaS or MaaS regulations. MaaS is a new layer of digital integration overlaid on the existing transport system, potentially introducing new forms of co-operation and integration between mobility service providers. All parties hope that their involvement with a MaaS platform will grow the overall pool of users for their services. Many public authorities look to MaaS as a means of supporting public policies for sustainable travel. The extent to which the public authority is involved in the MaaS system may increase the functions it needs to carry out and the required regulations.

Whether MaaS is considered a niche product aimed at a segment of society or tourists, for example, or whether it is envisaged as an offer for everyone travelling within a region will influence the regulatory approach taken. More broadly, MaaS raises questions about integrating the traditional public transport services, infrastructure and governance into an innovative ecosystem that will potentially include commercial platforms and mobility operators.

From a policy perspective, there are three main aspects to the integration. The first relates to physical mobility: how might MaaS impact accessibility and travel choices for users. The second concerns the regulation of MaaS: given that MaaS does not introduce any new modes or infrastructure into a region, to what extent are dedicated MaaS regulations required? Can existing regulations for the various modes in a city be adapted to MaaS? What might be the impact of MaaS on public authorities' existing functions and policy levers? MaaS itself is a digital marketplace rather than a mobility service provider, and there is a question as to what extent MaaS would necessitate a new transport-focused regulation.

The third aspect is data governance. This concerns the sharing of potentially sensitive commercial data among operators and with MaaS providers, privacy considerations and the sharing of customer data, and the reporting of data to public authorities. The term "MaaS provider" refers to any organisation that combines different mobility operators' services into a single mobility service offer through a user's mobile application (MaaS app). It is also possible, but not a necessary condition, for a MaaS provider to be a mobility operator.

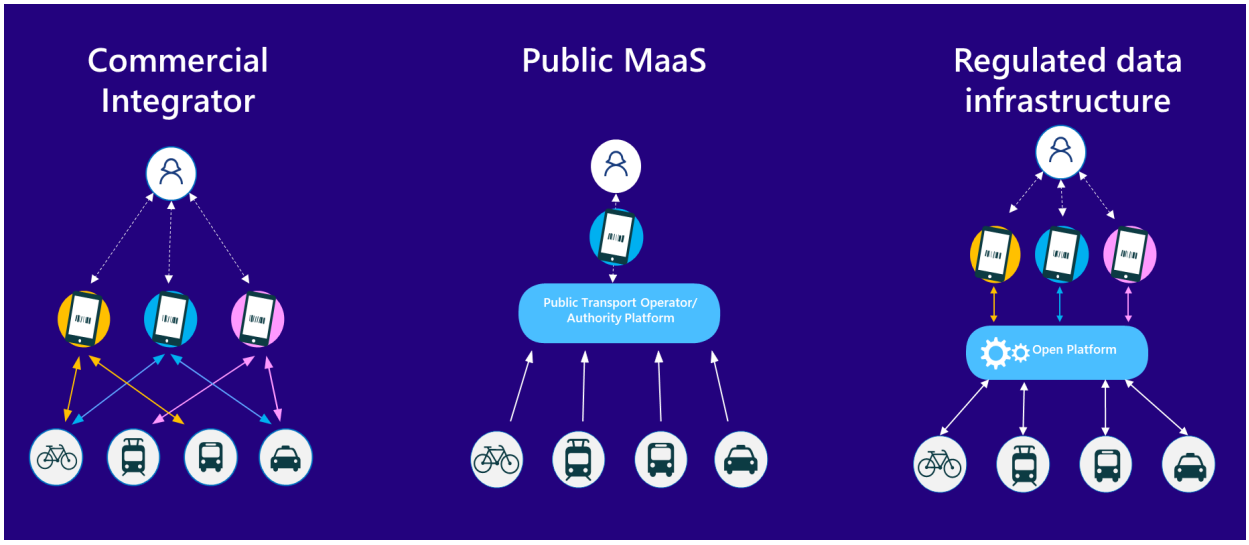
The ultimate answers to integrating public transport into MaaS will depend on the status quo in any given region and the extent to which the public transport authority envisages public authority involvement in the MaaS ecosystem for their region. The MaaS organisational model adopted will determine the regulatory structure. The most common organisational models are discussed below.

In terms of the involvement of public authorities, the models range from a MaaS system that is treated entirely as a public utility that is managed and operated by the public transport operator or authority to a wholly open-market approach. To the extent that a public MaaS model is envisaged, the governance issue is minimal or internal to the public entity managing the system. Regardless of the organisational model adopted, public transport authorities will likely have to collaborate with other actors in the ecosystem (Smith, Sochor and Karlsson, 2018; UITP, 2019).

Organisational models for Mobility as a Service

There are several different models for organising MaaS. They are based on the varying levels of involvement or control by the public transport authority and commercial operators. Figure 1 provides an overview of the models (see Mulley and Nelson (2020) for a detailed discussion).

Figure 1. Organisational models for Mobility as a Service



Source: adapted from UITP (2019), EMTA (2019), Polis (2017), Smith, Sochor and Karlsson (2018).

Commercial integrator model

A commercial integrator setup is an organisational model where a commercial actor provides the MaaS app that integrates the different mobility services following bilateral negotiations with each mobility

service provider. Whim and UbiGo are examples of commercial integrators in the business-to-customer market (for discussions of different applications of a commercial integrator, see, for example, Audouin and Finger [2019] and Hirschhorn et al. [2019]). Multiple commercial integrators can exist in one market and can target niche audiences.

A subset of the commercial integrator model is the "walled garden" approach. In this model, a primary mobility provider, for example, a ridesourcing company, retains the customer relationship, or interface, and integrates other modes that may also interest the user into their existing offer. This could take the form of horizontal integration (whereby an operator offers its own services, plus those of others through its app) or vertical integration (whereby a single operator provides multiple services, all of which they operate, through a single platform).

The advantages of a commercial integrator approach are that the competition between commercial actors "ensures value creation" (Mulley and Nelson, 2020) and the independence of the platforms from the local public entities can contribute to internationally scalable models (EMTA, 2019). However, this can also lead to redundancy in the system due to the need for each MaaS platform provider to develop its own platforms. High levels of entry into the market may also inhibit the achievement of economic scale and thus, of sustainable businesses. There is still concern that a monopolistic operator could emerge if mobility service providers consistently work with just one, dominant platform (EMTA, 2019).

From a public authority perspective, platform providers will seek the best business outcome, which may not result in the best outcomes for public policy goals (Mulley and Nelson, 2020; EMTA, 2019). Demand for discounted tickets or commissions could also result in higher costs for the public authority (Mulley and Nelson, 2020) if the public transport authority or operator is not in a position to negotiate. Furthermore, the ability of the public authority or operator to use pricing measures to influence traveller behaviour may be limited in this model if platforms are free to dictate the prices charged for mobility (Mulley and Nelson, 2020). Data generated in a commercial integrator environment may also largely remain in the control of the private sector, limiting the potential to realise the aspiration of improved planning (EMTA, 2019). In addition, public transport operators and mobility service providers are concerned about losing their customer relationships. A further complication is the potential for consumer confusion or reticence, as their experience of different platforms will potentially differ widely.

Public MaaS model

Public MaaS sees the integrator role taken by a public transport operator or the public transport authority, which integrates additional modes into the public transport offering and either develops or sub-contracts the only MaaS platform for their region. In such an ecosystem, public authorities may be better placed to use services and data provided by MaaS to reduce losses or costs of existing public transport where MaaS is effectively the authority's mobility ecosystem (EMTA, 2019). The use of the MaaS data to better plan service provision across the breadth of modes in the ecosystem may also be easier in this scenario. In a public MaaS model, no commercial MaaS applications compete with the publicly provided or procured one. However, there are still commercial mobility service providers operating in the market.

An environment lacking competitive pressure between MaaS providers could diminish any drive to innovate or improve efficiency. Given the core role of the public transport authority, competitive neutrality among the non-public transport service providers is likely to be an issue, as other modes will likely be seen as "add-ons" to a public transport core rather than as equal players. These mobility service providers may perceive a loss of their brand (Mulley and Nelson, 2020) and have concerns about losing their customer relationship. It could also prove challenging for the public transport authority to specify the procurement for such a new product (Smith, Sochor and Karlsson, 2017, 2019).

Public transport authorities or operators may lack any comparative advantage in platform development and other technical skills of a digital market, which could be beyond their traditional remit. In addition, the models a local public entity may develop will likely be limited to the local transport setting – limiting their ability to scale internationally or transfer to other cities or regions, or at least requiring dedicated integration (EMTA, 2019).

The regulated data infrastructure model

Underpinning any MaaS app will be the integration of data from multiple mobility operators (public transport, bikesharing, carsharing, etc.) that are necessary for the MaaS system to function. This integration platform can be built by the individual MaaS provider or by a third party. In the regulated data infrastructure model, the public authority provides the shared integration platform that all private MaaS providers may use for their apps (customer interface). The MaaS app and the integration platform can be owned by separate entities, and multiple MaaS apps can operate off the one integration platform.

This scenario is similar to the status quo as a public entity continues to dictate the terms of engagement with the mobility market through the platform (Mulley and Nelson, 2020). However, the public authority takes on the cost of developing the integration platform. The creation of a shared integration platform open to commercial operators also reduces one possible barrier to entry as smaller MaaS providers do not need to incur the development costs for the integration platform. This potentially allows a broad range of participants to enter the market (Smith, Sochor and Karlsson, 2018; EMTA, 2019).

However, if the use of a single public platform is mandated, the resulting lack of competition and investment could hinder innovation. Transport service providers still risk losing their brand (Mulley and Nelson, 2020) and the customer relationship. In addition, the government's reputation is on the line, as it may be held responsible for the success or failure of the MaaS ecosystem.

There is an emerging variation on this approach whereby the public authority seeks to foster common access to data. The idea is that a public body would create and manage a data "lake" for data reporting requirements. It would also mandate that specific application programming interfaces (APIs) for operational data be made available by mobility operators to other actors in the market as a condition of involvement in the MaaS market, in place of a centralised integration platform.

An additional aspirational model, *Mesh-y MaaS,* has also been suggested. It relies on distributed ledger technology and automated contracts. In this model, the role of the aggregator is rendered obsolete through the execution of smart contracts directly between operators. There are not many examples of trials of this approach so far.

The organisational model for MaaS adopted by a city or region will significantly influence the business models (Mulley and Nelson, 2020) that develop within it. However, it is too early to identify the "right" model for MaaS. Given the breadth of contexts in which MaaS is being implemented or considered, there will likely be multiple versions of MaaS organisation and business models over the coming years. The most appropriate model, and the extent to which business models need to change, will only be understood as MaaS systems mature.

Policy makers are not in a position to pick "the best" business model at the outset. The way the public authority organises the MaaS market and the extent to which they plan to be involved will influence the model. Public authorities will likely choose an organisational model for MaaS that they believe best contributes to delivering their policy objectives. These objectives often aim to improve sustainable mobility and minimise the use of private cars. Understanding how users perceive MaaS and the impact it will have on them will help clarify how MaaS may be able to contribute to those policy goals.

The Mobility as a Service market

The answers to several questions about integrating public transport into MaaS are contingent upon the ability of MaaS to improve sustainable travel choices among users (and the aspiration to grow the user pool for public transport). However, MaaS has yet to prove its ability to satisfy these demands. One Roundtable participant reported that even where public transport tickets were available through MaaS in their region, ticket sales have not been high. Understanding the potential appeal of and demand for MaaS to users – i.e., what problems MaaS may solve for them – will be essential to its success. This section considers MaaS from the user market perspective and how the potential for MaaS to appeal to users and contribute to societal goals could be better understood through improvements to pilot planning.

What does Mobility as a Service offer the user?

From a public policy perspective, it is generally expected that MaaS will increase the use of sustainable modes of transport and decrease private car use. It could even reduce private vehicle ownership in general (not only cars but other modes as well, such as bicycles) by providing integrated access to a network of different – and complementary – transport options. A MaaS system would allow users access to a network of modes from various providers to meet their mobility needs.

Individual users will have widely differing mobility needs. The MaaS offer must match their needs. For MaaS to be appealing, users must understand the nature and extent of the service, and the mobility services underpinning the MaaS service must be of sufficient quality (Sochor, 2021).

For users who currently rely on their own car, cost – or perceived cost – will be an important consideration in encouraging MaaS up-take. The private car has a low private marginal cost because fixed costs (for example, purchase and insurance) are high. Thus, the value of the services provided by the car increases with use more rapidly than the cost. This relatively low cost at point of use suggests there is a need to adopt appropriate additional policies to internalise some of the externalities associated with car use – such as road pricing – in order to support the successful development of MaaS. Extrapolation of the UbiGo results from Sweden suggests that MaaS may appeal to families who were otherwise considering purchasing a second car (Karlsson et al., 2017).

Gender is also an important consideration. Women's travel patterns, for example, are often more complex than those of men, with women making more trips, being more likely to combine multiple trips into one (trip-chaining) and having varied trip purposes and times of travel (Duchène, 2011; ITF, 2019b). Women without access to a car may miss out on opportunities (Duchène, 2011) or face increased travel costs due to the need to purchase multiple tickets and longer journey times as they wait on multiple transport modes (ITF, 2019b). Personal security concerns are also important factors in women's mode choice and use of public transport (Dobbs, 2005; ITF, 2018).

Roundtable participants raised concerns about the potential impact of MaaS on independent mobility for women if, for example, it means a two-car family giving up one of their cars. Dobbs (2005) argued that "access to private transport is a key factor in determining women's economic inclusion, and that the development of sustainable transport systems may have serious gender implications". However, advances that form part of the MaaS system could also be beneficial. For example, fare integration can help alleviate the financial impacts on women making more frequent, shorter trips (ITF, 2019b). Studies in Sweden

(Sochor, Sundqvist, and Lindahl, 2018 cited in Sochor, 2021) and Finland have also found that women are among those more likely to try MaaS (Sochor and Sarasini, 2017 cited in Sochor, 2021).

The potential implications of MaaS for accessibility require further investigation and should be considered when determining the design of the MaaS system. Public transport must be of high quality and appealing to users. For MaaS to succeed, a functioning new mobility services market should also be present in the region to support accessibility beyond the core public transport network.

For users who already use public transport, day-to-day trips tend to be routine, and users have established habits, routes and destinations. Many operators also already have their own apps and passes. Even in the presence of a wide range of options, as offered in a MaaS system, a user may simply favour a subset of the modes to continue carrying out their routine trips. A 2015 study of travellers in the European Union found that 78% of respondents reported using only one mode for their most frequent trip (Fiorello and Zani, 2015). However, Zijlstra et al. (2019) found that frequent public transport users were among the more promising prospects for MaaS, a finding also consistent with the SMILE pilot in Vienna (Karlsson et al., 2017). Some participants further argued that international and intercity seamlessness is of little importance among the user base. The international focus may be more relevant to a MaaS product for a niche, high-income audience rather than routine travel and public services.

Ultimately, MaaS must be a better offer than currently available options. Sochor (2021) suggests, "Mobility as a Service could help to shift focus from offering transport (moving something from A to B) to offering mobility (being able to move about freely and easily)". This can incorporate metrics such as convenience, safety, reliability and affordability, among others, but what constitutes "better" will ultimately be user-specific (See Sochor [2021] for a discussion on users' perspectives and service design). A sufficiently dense network of options will be needed to ensure a sense of convenience. A first/last-mile-focused MaaS system designed solely to feed a trunk public transport system will not necessarily do so if the public transport services are not attractive (ITF, 2017). The system will be equally ineffective if making the trip by public transport is less convenient than by car. Previous ITF work has highlighted the importance of valuing convenience[1] in transport planning (Wardman, 2014). Results of the UbiGo pilot also suggest that proximity to good public transport and carsharing impacts the likelihood of individuals taking on MaaS (Karlsson et al., 2017).

In a review of previous pilots, Sochor (2021) found that they did not point to one easily identifiable target audience, and the "build it and they will come" approach is unlikely to be successful for a MaaS app. It is important to note that among none of those pilots was the environment the top reason given by survey respondents for trying MaaS. Similarly, a cluster analysis of survey respondents in the Netherlands found that the environmental sustainability of the travel behaviour was only considered by approximately 40% of respondents when making their choices. This was even true among groups of respondents with existing multimodal public transport usage or who were predisposed to adopting MaaS. That proportion dropped below 25% for groups with high car usage (Alonso-González et al., 2020). In terms of messaging around MaaS, there is a possible misalignment between the sustainability goals of transport policy makers and the potential source of added value perceived by the users. The convenience aspect, however, ranked highly, along with the novelty factor of the new system, in the pilot studies reviewed by Sochor (2021).

There is a risk that MaaS could work against sustainability goals if it induces car demand where people who did not previously have a car now have access to one or substitutes existing walking trips for trips by other modes. Research in Oslo, for example, found that e-scooter trips were substituting, rather than complementing, walking and public transport use (Berge, 2019) and the swapping of walking and cycling trips for public transport and taxi was reported from the Helsinki MaaS pilot (EMTA, 2019). Fears have also been expressed that in targeting an affluent niche, MaaS could exacerbate inequity (for example, Smith,

Sochor and Karlsson, 2018). However, reviews of pilots in Gothenburg and Vienna suggest increased public transport use and decreased private car use among participants (Karlsson et al., 2017; EMTA, 2019). Thus, the impacts of MaaS on modal shift and sustainable transport are likely to be multifaceted. Policy interventions may be needed to steer the overall mobility outcomes toward greater sustainability. The role of the public transport authority will be further discussed later in the report.

Market approaches for Mobility as a Service

MaaS is ultimately envisaged as a business-to-customer (B2C) service, although variations are possible. In the B2C market, commercial MaaS providers are not necessarily trying to sell every trip. They adopt a subscription offer instead of a pay-as-you-go method. The known number of subscribers allows them to predict the levels of custom. MaaS providers hope that collaboration between the authorities and the MaaS platform provider will help public transport authorities increase the use of sustainable transport modes.

The user market for a B2C offering for MaaS alone is not yet certain. Some MaaS providers are providing services now on a Business-to-Government-to-Customer (B2G2C) basis. In Berlin, the MaaS platform Trafi (Trafi, n.d.) has partnered with the regional public transport provider to offer a single MaaS platform for Berlin, called Jelbi (BVG, n.d.; Pickford and Chung, 2019). Crozet (2020) argues that this is a natural evolution for MaaS.

Some Roundtable participants suggested the possibility of establishing MaaS in a niche market or as an addition to another service. They suggested that MaaS could initially encourage public transport use – thus supporting policy goals – and then scale up from that established position. The following sections outline the markets that could be viable targets for early iterations of MaaS. For discussion of different pilot types, see Sochor (2021).

Business-to-Business

The Business-to-Business (B2B) market aims at helping employers manage their employees' work travel. It provides added value by easing the burden on the employer through management and administrative services. In Belgium, this B2B model has grown under the country's mobility budget policy. The service is already providing several offerings based on that model. However, in-app payments do not yet appear to be a feature. Instead, a mobility payment card, usually provided through a partnership with a credit card company, is used to pay for transport, in many cases across Europe. Examples of such schemes include Modalizy, Skipr and XXIMO (Modalizy, n.d.; Skipr, n.d.; XXIMO, n.d.).

Tourism

The tourism market could see value in the MaaS app itself. The assumption is that the app eases tourists' interactions with the local transport system, which could otherwise be daunting to navigate. Academic research supports the perception that tourists may find it of value (Alyavina, Nikitas and Tchouamou Njoya, 2020; Ho, Mulley and Hensher, 2020). In Japan's Izu area, a tourist-focused MaaS solution currently offers transport passes, car and bike rental and on-demand shuttle bookings, as well as tourist-relevant information such as recommended itineraries for the region (moovel, 2019). MaaS's contributions to the tourism industry would be relevant to decisions that could impact MaaS's international interoperability.

Services as a Service and super-apps

An alternative to finding a viable business model for MaaS is not to make money from passenger transport alone. Instead, MaaS providers could package mobility services with other services that make money or in such a way as they help each other make money. In Japan, where private companies generally run public transport, several companies already offer a prepaid travel card (pay-as-you-go rather than subscription) that can be used for other services, such as shopping and vending machines in the station (Sakai, 2020). One such company, JR East, which offers the Suica prepaid card, has also partnered with Jcoin Pay and Rakuten to expand the range of outlets where users can pay with Suica (JR-East, 2019). The partnership with Rakuten also allows payments to be made and credit to be added to the Suica card through the app (Rakuten, 2020).

In Belgium, KBC Brussels now offers public transport tickets through its banking app. The app offers clients the option of purchasing tickets for local and regional bus and rail services. While tickets are available on the app for local and regional STIB/MIVB (public transport operator in the Brussels-Capital Region) and SNCB/NMBS (the Belgian national rail operator) services at standard rates, De Lijn's bus tickets cost slightly more if purchased through the KBC Brussels app (KBC Brussels, n.d.). This branching out can be seen within walled garden approaches, too. Uber has branched out from ridesourcing to food delivery, freight shipping and the B2B market (Uber, n.d.).

MaaS may have benefits for rural regions, as well as urban areas. Transport services in rural areas can be expensive, and the low demand and frequency of fixed services can make those services inefficient. A MaaS system could combine different services and groups. It could improve service design to provide connectivity and reduce the risk of spending on unused capacity. It could provide other benefits such as accessibility for non-drivers, deliveries, and cost savings for the public sector. Eckhardt et al. (2018) concluded that rural MaaS services should incorporate individual and group transport with last-mile goods deliveries, based on research in Finland. The paper highlights that the economics of a rural MaaS system will be different, and collaboration will be important for its success.

However, the high cost of implementing MaaS in rural communities combined with the likelihood of little uptake limit MaaS's application in those areas. As such, successful rural MaaS projects are linked to efficiency improvements and innovative funding models. Rural MaaS in Northern Europe relies on on-demand transport services that pool different sources of transport demand and supply, including statutory services. Japanese rural MaaS models have focused on combining transport with non-transport services to improve the financial model. Projects in the United States have developed multimodal trip planners, including options to involve users as prosumers to contribute to the pool of drivers and vehicles (ITF, 2021b).

Lessons learned from effective pilots

MaaS has existed as a concept for several years, and many pilot programmes are in progress. Nevertheless, MaaS remains "a leap of faith" for many stakeholders, including users, operators and public authorities. The design of pilot programmes should recognise that pilot projects are learning opportunities for transport operators as well as users. The pilot projects conducted to date have, for the most part, been too short or too modest in scale to produce results that can be generalised to support the design and implementation of MaaS more widely.

There is concern that the ephemeral nature of pilots could undermine participants' confidence in the system. The long-term reliability of a transport offer is essential to many aspects of users' lives, and experience suggests they are not eager to participate in transport pilots that they expect will end.

When planning a pilot project, planners should consider the stages that the system and the users must go through to provide robust and informative results. Users need time to learn the system, to overcome initial issues they may have with it and to experience usage in different contexts (e.g. seasons). Roundtable participants suggested that a pilot should last a minimum of six months, but preferably one year.

The method of evaluating the pilot project is also important to the usefulness and general applicability of the results. Where a public sector body funds or authorises large-scale pilots, that body should require a robust analysis and evaluation of the project – using appropriate quantitative methods – for the project to proceed (Graham, 2014). Requiring such evaluation will have financial implications, which must be considered by all involved. Sochor (2021) outlines tools and approaches that have been developed in response to the need for a better evaluation of pilots. Depending on the desired model of MaaS, it could also be beneficial to the long-term operation of the system to adopt a pilot model that involves the commercial sector where they are seen as part of the eventual MaaS model. Such involvement allows private operators to share the experience they have from previous pilots in other regions. Such insight could contribute to building frameworks for new projects. International institutions could agree upon or recognise frameworks for evaluating pilots, enabling the wider MaaS discourse to include the lessons learned in commercial pilots.

The role and remit of the public transport authority

Governments will need to consider carefully which regulatory issues are best addressed at which level of government and adopt co-operative approaches. For example, national governments may be the most appropriate body to set data regulations; competition issues will usually be the responsibility of national (federal) regulators: and local authorities will need to ensure that market entry regulation is broadly consistent with national policy. All proposed interventions should be guided by sound regulatory policy principles – such as intervening in free markets only where there is both a clear market failure and a reason to believe regulatory intervention is effective – and the most efficient public policy tool to address them.

Regulating innovative mobility

Basic competition policy principles, as adopted by both the OECD and the European Union, argue that government policy should adopt a fundamentally pro-competitive stance. This means that regulators should impose restrictions on competition only where necessary to secure the achievement of public policy objectives that cannot be achieved effectively in any other, less restrictive way (OECD, 2019) and that the extent of such restrictions should be minimised. In a scenario where private commercial platform providers are expected to enter the market, given the relative lack of knowledge about the business case and business models for MaaS providers, it follows that policy makers should be especially cautious about regulating in ways that restrict competition (i.e. restricts operators from acting freely in the market).

Previous ITF publications analysing innovations in mobility and the regulation of app-based mobility (ITF, 2017, 2019a; OECD / ITF, 2021f) have proposed policy approaches that allow regulated innovation. These reports recommend adopting a permissive regulatory approach, focusing on regulations that achieve the desired outcomes (rather than mandating a specific action), and defining review mechanisms and periods. For MaaS, focusing on the outcomes would mean considering the wider mobility outcomes and how MaaS interacts with them. For example, if an increase in congestion or car mode share is noted after the arrival of MaaS, the regulatory response may be to introduce measures to manage all car travel that is considered problematic at specific times or in particular zones, rather than focusing on car trips organised through a MaaS platform.

Planned reviews of the regulations and their outcomes allow authorities to take action as necessary. In a MaaS ecosystem designed for both public and private actors, there may be multiple outcomes to monitor to understand if the MaaS-specific regulations have the desired effects. Some of those outcomes may relate to how the market is functioning, such as the rate of actors' entry into and exit from the market, and the existence of competition and innovation among the actors. The impact on public transport, active travel mode shares and accessibility could also contribute to understanding the impact on broader mobility outcomes.

New mobility has already prompted co-operative, evolutionary approaches to regulation in some regions. In the Flanders region of Belgium, MaaS policy is being developed through stakeholders' co-creation of a *Flemish MaaS agreement framework* that will provide consistency across the region, but allow for flexibility in how it is implemented (Vlaanderen is mobiliteit & openbare werken, n.d.). Here, the development of MaaS is being conducted under the Basic Accessibility Decree. The decree was passed by the Flemish Government in April 2019 and seeks to move planning for public transport away from more traditional supply-focused planning to demand- (user) focused planning to improve multimodality (ITS.be, n.d.1). The

public transport authority is facilitating the co-creation process. MaaS principles will be developed in a phased approach in Flanders without looking to deliver the complete final MaaS model in one go. A process to develop the agreement framework is currently underway. It will be followed by a review period during which authorities and stakeholders will learn lessons and plan for a second cycle. In this way, a structured, adaptive approach is being adopted. More broadly in Belgium, a public-private, not-for-profit association has taken the lead in organising a collaborative approach to developing MaaS in Belgium through a Belgian MaaS Alliance (ITS.be, n.d.2).

In San Francisco, city authorities created a proof of concept agreement (POCA) to manage the launch of shared mobility services. The authorities recognised the potential benefit of shared mobility to complement the existing transport network, but also the need to have some form of permitting to manage public space (City of San Francisco Municipal Code, n.d.; San Francisco Municipal Transportation Authority, 2019). The goal of the amendment was to "allow new shared mobility entrants a clear path for innovation on city streets, while ensuring the SFMTA has the regulatory tools needed to manage and evaluate their impacts on the City's mobility goals, and alignment with the City's Guiding Principles for Emerging Mobility" (San Francisco Municipal Transportation Authority, 2019). The duration of the POCA is limited to allow for evaluation. The results of the evaluation will determine if there is a need to refine the service or develop either pilot or permit schemes. The POCA can be cancelled at any time by the authority. The authority also has the possibility of levying fines on operators without a permit (ibid.). The POCA is capped at 12 months.

More broadly, in the United States, the Federal Transit Administration has initiated a number of schemes aimed at encouraging and fostering innovation in mobility in the public sector. These have included Sandbox Demonstration projects, whereby innovative projects can be trialled in partnership with public authorities; a funding scheme for integrated mobility projects that can help improve public transport in a number of ways; and grants to local authorities to support the exploration of new ways of working (Shaheen and Cohen, 2020a). Partnerships between transit authorities and private operators for services such as integrated fare payment, "guaranteed ride home" (a commercial ridehailing service provided and subsidised a public transport service to guarantee rides for commuters), and data sharing have also emerged (Shaheen and Cohen, 2020b; SANDAG, unpublished data, March 2018 cited in Shaheen and Cohen, 2020).

Paris offers an example of a governance approach that evolved in response to unexpected outcomes. Initially, a code of conduct was agreed upon between the city and scooter operators after the first e-scooters appeared on Paris' streets. The code of conduct has since been replaced by operator licensing, with both the number of operators and the size of the scooter fleet now capped. Paris had already brought in other restrictions to manage safety and public space, but the administration opted to manage access to the market through licenses with a two-year duration. From a competition perspective, there are concerns about such a strong regulatory intervention that effectively creates a regulated oligopoly to try to guarantee economic scale for a small, chosen group of businesses. Users are likely to face higher prices as a result.

As a MaaS application in a transport landscape that already contains free-floating modes does not add new vehicles to the city, licensing MaaS platforms may represent an unnecessary and potentially costly intervention through its impact on competition. Nevertheless, the evaluative approach Parisian authorities adopted to manage new modes and their impacts on the city – beginning with light-handed regulation that gradually morphed – is well suited to the development of MaaS.

Authorities may be wise to adopt an approach that allows for evolution when regulating MaaS. If a MaaS environment proves to undermine the public transport system of a city by switching travel from efficient

mass transit to lower-occupancy vehicles, then the authority may need the power to intervene to manage the mobility outcomes.

Competition between MaaS providers is expected to be beneficial for users and innovation. Regulatory policy should avoid creating barriers to entering the market. In addition, the behaviour of incumbent integrators that also operate mobility services will need to be monitored by competition authorities to ensure they do not discriminate between in-house and external suppliers. Local authority regulations can also promote competition beyond the monitoring of competition authorities. In Antwerp, for example, mobility providers are required to integrate with two MaaS platforms.

There is also the question of whether MaaS itself necessitates specific regulation or if it is simply a digital market for the already regulated mobility services sold through it. A procompetitive stance in line with OECD recommendations would argue against regulatory intervention unless there is no alternative. However, there may be merit in requiring MaaS providers to be licensed by the public transport authority, given the extent to which MaaS is still evolving. The goal of this approach would be to provide public authorities with a mechanism by which they could act to ensure open and fair competition or to address any adverse outcomes arising from the introduction of a MaaS market. The license would need to contain minimal conditions for market entry and conduct to avoid becoming a barrier to entry. From a competition perspective, there should be no direct or indirect limits on the number of licenses issued or current at any given time. See ITF (2021a) for further information.

Mobility as a Service and mobility strategies

Mobility policy is important to welfare and quality of life, impacting affordability and access to opportunities, social activities and essential services. The role of mobility policies in addressing or exacerbating inequity is becoming an increasing focus of welfare policy (see OECD/ITF, 2021e). Many cities aim to reduce the dominance of the private car and see MaaS as playing a potential role in achieving this goal. The new mobility law in France (Ministère de la transition écologique, 2021) aims to improve accessibility and affordability of day-to-day transport and to diminish its contribution to climate change. There are three pillars of the law. One relates to enabling new mobility solutions in particular. The other two relate to investment and cleaner mobility.

The development of MaaS will require introducing other policy measures aimed at improving the sustainability of travel. A clear vision, such as specific targets for transport emissions, could open "a window of opportunity" for MaaS to gain a foothold (Audouin and Finger, 2019). Embedding objectives for MaaS in a strategic mobility plan is recommended by Smith and Hensher (2020) when proposing a policy framework for advancing MaaS. In Brussels, MaaS is one of 50 actions identified in the regions' sustainable urban mobility plan (Brussels Mobility, n.d.).

Public authorities will set the mobility strategy and policy outcomes within which MaaS will be delivered. The ability of MaaS to help achieve those public policy objectives should dictate what "success" means for MaaS in any given region, rather than simply considering the *existence* of MaaS a success. This success could be measured by indicators such as increased ridership on public transport, reduced costs while still ensuring service to lower-density neighbourhoods, improved accessibility, reduced private car usage, etc. Were a public authority to set the parameters of the market, actors in the market would clearly understand what the MaaS objectives in that region were and how the system's success would be evaluated.

The anticipated role of MaaS may differ by city. Medium-sized, lower-density cities or cities without a strong public transport network may be better served by newer mobility modes supported by MaaS,

improving general access to transport among the populace. However, in cities with a dense public transport system with high usage in their cores, MaaS may be more useful in the suburbs, where public transport provision may be sparse. Conventional mass transit services are best suited to serving high-volume commuting flows and will remain the backbone of public transport in cities.

If MaaS is to contribute to achieving sustainable mobility goals rather than undermining them, it will likely need to be introduced as part of a package of policy measures to manage wider mobility outcomes. If public transport is to be the backbone of the system, it must be a high-quality, reliable transport system that is frequent and appealing enough to mitigate the need to own a car. Measures in such a policy package include investment in interchange facilities to reduce the stress of multimodal connections. Without effective integrated land use and transport planning and attractive public transport services in place, MaaS in and of itself will be unable to reduce car dependency.

Strategic mobility plans also need to manage the use of public resources efficiently. Roundtable participants did not believe there would be a significant mode shift from cars without increasing the costs of car travel. This could be through direct charges or through the allocation of public space to competing modes, for example. Recent ITF work on reversing car dependency (ITF, 2021c) recommended road pricing, parking policies and road space reallocation. In one practical example, the EC2B project in Gothenburg introduced parking restrictions for private car use in conjunction with a MaaS offer for residents. The study found that, while car ownership did not decrease to the level anticipated, the inconvenience of having to park further away reduced car use (Hensher et al., 2020; Smart City Sweden, 2020).

An effective broad sustainable mobility strategy will also manage the potential undesirable effects of MaaS. There are concerns that MaaS could increase vehicle kilometres by shifting walked trips to paid-for, vehicle-based modes or trips on public transport to carsharing. The tools employed to manage travel demand and mode choice will guide MaaS in the same way as conventional mobility services.

A recent ITF report on regulating app-based mobility also concluded that the risks of ridesourcing contributing to congestion is better managed through instruments that target congestion as a whole rather than specifically trying to regulate ridesourcing (ITF, 2019a).

The role of subsidies in a Mobility as a Service ecosystem

Subsidies for public transport can be motivated by several objectives. At a fundamental level, there is a strong economic case for subsidies due to the existence of scale economies in the provision of public transport (Hörcher and Tirachini, 2021). Subsidisation is also commonly a part of a “second-best” pricing strategy. They seek to compensate for the fact that the negative externalities of private car use are not fully priced by reducing the price of public transport. Subsidies are also commonly deployed to support accessibility objectives. There are two main angles to consider regarding subsidisation in MaaS. The first is the role of subsidisation of services (supply-side subsidies) in a MaaS environment. This angle includes using public funds for the MaaS integration and aggregator functions. The second angle is, in the longer term, how the advent of MaaS might impact existing subsidy practice.

In terms of the MaaS organisational models, both the public MaaS and regulated data infrastructure models discussed previously draw on public funds. In the case of public MaaS, the authority may invest in developing or procuring the necessary MaaS platform and app if it sees value in MaaS in the region but either considers it unlikely to succeed on a commercial basis or believes commercial MaaS incompatible with the region’s mobility policies. With regulated data infrastructure models, the public authority invests in developing a back-end platform that is essentially public infrastructure commonly available to all

participants in the market, which reduces the costs for commercial MaaS providers to participate in the MaaS market. For the delivery of MaaS in rural areas, new forms of co-operation may also be worth exploring (Eckhardt et al., 2018; ITF, 2021b). In a MaaS model that includes commercial actors, public championing of MaaS by the government would be worth more to the development of the market system than direct funding (Wong, 2020, cited in Mulley and Nelson, 2020).

There is also the question of subsidising the mobility services that underpin the MaaS offer. All public transport systems are funded, to greater or lesser degrees, through public subsidies. Similarly, many new mobility offerings such as ridesourcing and e-scooters are yet to demonstrate positive cash flows and are strongly reliant on continued injections of new venture capital (ITF, 2019a). The financial viability of MaaS has also yet to be demonstrated. New mobility services and MaaS, however, offer the possibility of improving accessibility through better co-ordination and integration of services that can reach areas poorly served by public transport. In lower-density or peripheral regions, they could potentially provide connectivity and accessibility at a lower cost than traditional public transport modes. Previous ITF work looking specifically at app-based mobility services found a case for considering subsidising these services where they offer welfare benefits (ITF, 2019a). Public authorities should be willing to consider subsidies or support for MaaS if they see MaaS playing a role in the public service obligations commonly fulfilled by traditional public transport, having the potential to enable the realisation of available scale economies (e.g. in shared car services) (Arnott, 1996), or potentially reducing losses.

A common means of delivering subsidies to those who need them is through concession fares for certain groups in society (for example, older people or school children). Passes for regular users allow them to travel at a reduced cost per trip. MaaS could enable additional ways of delivering subsidised services to targeted groups, allowing a more effective delivery of demand-side subsidies. Maas could improve accessibility for target communities, such as older people or those on low incomes, or incentivise certain behaviours, such as choosing more sustainable alternatives to the private car. It could include subsidies that cover the use of on-demand services to support accessibility in areas where mass transit services are not economically viable. Mulley and Nelson (2020) identify the approach of person-centred payments (PCP) (also known as micro-subsidies or targeted subsidies), planned or already in use in Australia and the United Kingdom, to support mobility in certain communities. In Belgium, employee-focused mobility budgets are already an established alternative to company cars. In this instance, each employee is given a budget based on the expected cost of the foregone benefit of the company car. The budget can then be used to purchase selected sustainable mobility options, including public transport passes, bicycles and cycling equipment (Deloitte, 2019).

Resale of public transport tickets

When commercial MaaS providers sell public transport tickets in a MaaS ecosystem, several issues arise. This is especially true if public transport is to form the backbone of the MaaS system. Commercial MaaS providers argue that earning a margin on the resale of public transport tickets is necessary for their business to be viable. Public authorities have concerns that mandated discounts or commission payments to commercial MaaS providers could undermine the public transport revenue stream. Roundtable participants highlighted that it might go so far as to undermine the management of the network. Furthermore, some actors in the ecosystem are concerned that public funding for public transport could become an indirect subsidy for commercial MaaS providers. This section discusses these concerns and proposes a means for both public and commercial actors to seek value through negotiating their terms.

Fares and ticketing as a policy lever

It is important to consider the potential impact of commercial MaaS offers on the public authorities' ability to price public transport efficiently. In their discussion paper prepared for this Roundtable, Hörcher and Graham (2020) model the impact of subscription-based pricing models on the transport network through a welfare lens. They demonstrate that a subscription model may not result in the best outcomes for the transport network or society if MaaS targets all users rather than a niche. The model results suggest that subscription holders crowd out non-subscription holders, who then rely more on cars.

While multimodal subscriptions can be profitable for MaaS providers, such subscriptions can impose a negative impact on society. The impacts are caused by less predictable travel demand on the network and increased inconvenience for users caused by overcrowding (Hörcher and Graham, 2020). Hörcher and Graham (2020) considered a differentiated pricing approach to balance the demand on the system and the wider welfare effects. Differentiated pricing applies a surcharge on the peak direction to manage demand. Differentiated pricing resulted in a welfare benefit[2] compared to a baseline scenario with flat fares for rail and carsharing[3] while still making a profit for the MaaS provider (Hörcher and Graham, 2020). Proost (2017) also recommended that differentiated peak/off-peak prices and road tolls were beneficial both for the cost recovery of the public transport system and for welfare benefits. There are more complex subscription packages that Hörcher and Graham did not consider in this paper. However, they demonstrated that, ultimately, a tariff structure's efficiency depends on its ability to provide the right incentive for users amid fluctuating demand.

MaaS offers could encourage users to reschedule their trips, thus impeding authorities' demand-management efforts at reducing peak travel demand (Pangbourne et al., 2020). A peak premium charge will need to be maintained for tickets resold through MaaS applications.

Freedom to negotiate the terms of resale for public transport tickets

Public transport operators typically operate as functionally independent entities with substantial levels of financial accountability. This implies the following: 1) that they have financial incentives to negotiate outcomes with MaaS providers that they believe will contribute positively to net revenue; and 2) that public transport operators should have the freedom to negotiate with MaaS providers on the terms of the sale and resale of public transport tickets. In addition, negotiations with public transport operators (or authorities, depending on the local organisation of public transport, see Box 1) could be helpful to MaaS providers' efforts to find a commercially viable business model.

Public transport is central to the MaaS offering. As a result, aggregators must be able to offer public transport services in an attractive format if they are to succeed. In doing so, MaaS would be expected to drive patronage increases and, at least potentially, increase net revenue. In off-peak contexts at least, marginal costs in public transport are very low. This implies that there will be significant scope for public transport operators to offer discounted access to MaaS providers while increasing net revenue. Conversely, where capacity constraints arise, such discounted offers would be unlikely. Thus, the negotiating stance of public transport operators would be expected to reflect their broader ticket pricing policies, albeit that the specific terms negotiated might appear quite different.

Roundtable participants suggested customer relationships and marketing as a potential area where a digital platform could offer value for public transport by reducing costs. Examples already exist where digital platforms have created a business out of adding value in a pre-existing market. The online travel agency Expedia, for example, receives commissions from partner hotels for reservations made through their online platform. Expedia proposes that the value proposition for these hotels derives from Expedia's

investments in international marketing campaigns to attract customers, as well as the customer insights provided to them (Expedia Group, n.d.). Trainline, the train ticket booking platform, generates revenue by charging train companies commission on the tickets it sells and through additional charges, services and advertising partnerships. It also provides white label[4] products to rail companies (Trainline, n.d.1). Trainline sells tickets in the United Kingdom and internationally and also operates a B2B business (Trainline, n.d.2). Examples like these may provide potential insights into the possible value propositions of MaaS.

Box 1. Freedom to negotiate and the outsourcing of public transport operations

The outsourcing of significant public transport operations in many jurisdictions adds a degree of complexity to negotiations between public transport operators and MaaS providers. In these circumstances, the nature of the contracts between the public transport authorities and the private operators to whom they have outsourced service provision will have a major impact on ticket resales via MaaS providers.

For example, in London and Singapore, the respective public transport authorities (Transport for London (TfL) and Land Transport Authority (LTA)) outsource the provision of bus services to a range of private bus companies. Both jurisdictions have recently moved to adopt "performance contracting", which provides incentives for service quality improvements. However, these contracts are, in both cases, based on "gross cost contracting", that is, the contract payments made are intended to cover the full cost of service provision (including operator profits), while the public transport authority receives all fare revenue. In such contexts, the public transport authority can negotiate directly with MaaS providers with no financial impact on the outsourced operators, whose revenue is not affected by any discounted sale of tickets (or access on other terms). This dynamic potentially exists in other contexts (e.g. successful promotional campaigns, change in consumer preferences due to improved service quality) and should be able to be addressed through normal contract negotiation processes, though any significant increase in ridership would lead to some increase in operators' operating costs and subsequent pressure for contract variation.

The position differs where net cost contracts are concerned since outsourced public transport operators retain the fare revenue they collect. In such contexts, the initial presumption is that MaaS providers would need to negotiate with the outsourced operators. However, this would pose substantial challenges in major cities in which numerous outsourced operators exist. Reaching agreements with all or a sufficient number of operators to build a comprehensive MaaS package would entail significant transactions costs and risks. While the public transport authority may, in such contexts, seek to act on behalf of outsourced operators, this would similarly entail a need for the authority to negotiate successfully with operators regarding acceptable terms of access.

In sum, the outsourcing of public transport operations to multiple operators is likely to pose modest but surmountable problems in achieving negotiated access to public transport services by MaaS providers if the outsourcing contracts are established on a gross cost basis. Conversely, if net cost contracts are used, such access on negotiated terms will be significantly more challenging to achieve and may not prove feasible in practice. This conclusion appears to provide an additional rationale for public operators to use gross cost contracts with performance incentives, as has occurred increasingly in leading jurisdictions such as London and Singapore.

If public authorities decide to allow public transport operators to negotiate with MaaS providers, then the question arises of whether to regulate that reselling, given that public transport fares are set as part of broad accessibility and mobility policies. Public transport tickets would continue to be available directly from the public transport operator at their standard fare. As such, the potential for MaaS providers to sell the same tickets at higher prices would be minimal, suggesting that price regulation would likely be unnecessary. Moreover, controls on the terms of resale may significantly constrain MaaS providers' ability to provide attractive market offers and secure their financial viability.

How the MaaS market will develop is still uncertain. As such, both parties would benefit initially from relatively short-term agreements. Public transport authorities and operators will be able to review the evolution of resale offers over time and respond to any concerns during renegotiations with MaaS providers. In the interest of maintaining the social equity and accessibility control on the cost of public transport, the standard public transport fares structure should still be set by a public body where that is already the case. These publicly set ticket prices would be the basis of negotiations for beneficial rates.

Integration of commercially viable and subsidised services

Public transport will be a substantial part of the MaaS offer in any urban context. As such, a full range of public transport services must be available for purchase via the MaaS platform. However, as previously mentioned, public transport services are, in most countries, subsidised by the public sector. Since MaaS operators are expected to be profit-making commercial entities, at least in most MaaS models, some stakeholders have raised concerns that public subsidies might be captured as private profits. This might argue for constraints on the terms on which public transport operators can engage with MaaS operators.

A considerable incentive for public transport operators to engage with MaaS is the expected increase in patronage: that is that overall demand will increase by making services available through a new marketing outlet. There will presumably be some combination of diversion of demand from direct ticket sales to MaaS-operator ticket sales, plus some additional sales. The relevant question is whether the marginal revenue obtained by the public transport operator (i.e. revenue for public transport services received from the MaaS provider minus reductions in direct ticket sales revenue) exceeds the marginal costs of the extra passenger journeys.

This is the perspective that one might expect a corporatised public sector public transport operator to take when negotiating with a MaaS provider. The public transport operator has an annual budget that is based on the receipt of a certain level of subsidies (typically based on expected patronage and service levels) plus expected revenue from ticket sales. The operator has an incentive to contract services via a MaaS operator if it expects the services will have a positive net impact on the budget.

It could also happen that the resale of public transport tickets through a MaaS app might increase the cost of operating services more than the additional revenue generated. It could, for example, sharply increase user demand at peak periods. Were this to happen, introducing peak pricing would be a much more efficient response than restricting resale through a MaaS app. As long as pricing is efficient, increasing ridership will yield net social benefits by reducing the negative externalities of at least the proportion of those trips that are diverted from private vehicles.

Public transport subsidies are provided to achieve public policy ends. Even without efficient peak pricing, increased ridership can be expected to increase public benefits, albeit a modal shift toward public transport is likely to require additional subsidies[5]. From this perspective, the key metric is the average subsidy per passenger (noting that the implicit subsidy can vary widely across the public transport network). The appropriate public policy objective, in terms of the public transport operators' dealings with

MaaS providers, should be to ensure that the average subsidy per journey does not increase as a result of the sale of public transport tickets (or access) to MaaS providers.

In practice, public transport operators will face uncertainty as to whether MaaS might generate sufficient demand to justify increased public transport subsidies. Corporatised public transport operators with the freedom to contract will have an incentive to provide MaaS providers access to their services on any terms they believe will result in a net increase in their revenue over time. Governments will need to consider how to respond should MaaS develop as a mass-market phenomenon with significant public transport involvement and create pressure for increased subsidy. Efficient ticket pricing, with peak premiums, is the recommended response. The presence of a MaaS provider does not alter this principle.

MaaS providers that profit from the resale of public transport services supported by public subsidies might be regarded as parasitic. However, the interaction is better perceived as a standard principal/agent relationship: a producer of a good or service engages an agent to provide marketing and payment services for their product in exchange for a commission.

As noted, a public transport operator is likely to engage voluntarily with a MaaS provider only if it believes that the MaaS provider represents a new marketing channel that will increase total ridership. This, plus the likely role of payment processing (i.e. the public transport operator sells services in bulk in exchange for a single period payment from the MaaS provider), constitutes a commercial service for which the public transport operator should be willing to pay a commission.

The fact that the public transport operator receives a public subsidy in connection with the provision of its output does not change this conclusion. Indeed, governments subsidise the production of many goods and services without seeking to control the sale or resale of the resulting products. That the relative size of the subsidies paid for public transport is large does not suggest that the government should seek to control the sale or resale of the product. This is particularly so if the government has created substantial financial accountability and governance provisions to guide the operations of a public sector public transport operator's management and board.

As previously stated, MaaS is at an early stage of development, and substantial uncertainty exists as to how it will develop over time. The actual impact of the resale of public transport services through MaaS platforms is necessarily one element of this uncertainty. However, the above discussion suggests that public authorities can have reasonable confidence *ex-ante* that allowing public transport operators the freedom to negotiate with MaaS providers will not result in any undue appropriation of public subsidies by profit-making entities. In light of such uncertainty, public transport operators would be likely to adopt a cautious approach, engaging in short-term contracts and perhaps initially involving the sale of limited quantities of services. They would likely require a review and analysis of the actual outcomes, in terms of accessibility, ridership and financial impacts, before renewing or renegotiating further contracts. With that in mind, public authorities should provide public transport operators with the freedom to negotiate.

Data governance for a fair and effective system

Data governance is at the heart of planning for MaaS. Discussion at the Roundtable meeting suggested that there is still considerable learning and development needed on this front. Data flows underpin the main advantages of MaaS: seamless intermodal ticketing; real-time passenger information and a better understanding of users; better trip data for transport planners; and access to data on routing, scheduling and dispatching for seamless service delivery across operators. Operators require access to data that other operators produce and process. Data aggregators also need data to bundle services for travellers. The main groups with an interest in the data flows are outlined below.

Users submit their data in exchange for different travel itineraries that meet their needs and the possibility of purchasing the relevant tickets through a single transaction and interface. Their data may pass to multiple parties in this single (from the user's perspective) transaction. Users need to trust that their data will be used solely for the purposes they agree to and only be accessible by the entities needed to achieve the service. Users' level of trust may differ between a public body and a commercial operator, even if the data shared is the same.

Operators need the data to develop their service planning and potentially develop a customer relationship with the user to build brand loyalty. Operators naturally fear losing market position through the exposure of proprietary information about how they run their service or the loss of customer relationships.

Data aggregators can be MaaS providers or other third-party data aggregators. MaaS providers use the data to develop attractive bundles or packages for the user. Other data aggregators could use the mobility data to generate insights relevant to other types of services.

Public authorities can use the data to better understand travel in their region and to plan their transport network and monitor or audit the MaaS system. The data could also provide insights into other policy areas, such as the environmental impacts of transport.

Data sharing between Mobility as a Service actors

Trust, or the lack of it, can be a considerable barrier in the development of MaaS. There has been a general move by public authorities to open their data to stimulate new services and insights. This is not the case with most private operators, however, who want to protect their customer data and proprietary information. These different approaches raise questions of effective monitoring and regulation. For instance, mobility operators benefit from access to public roads and curbs but, without data, public authorities are limited in their ability to manage these spaces for the public good. The European Union requires each country to have a National Access Point for mobility data, which can take various forms. This aims to give non-discriminatory access to data and contribute to the development of "a digital layer interlinking all of the elements of transport" in the European Union (EC, n.d.).

The Roundtable participants discussed how to develop a data governance approach with as much open access as possible among market actors, but with fair commercial terms. This will rely largely on all actors in the ecosystem trusting the environment in which the data processing takes place. Stakeholders need to have confidence that their market position or business will not suffer from engaging with the MaaS system. Simply put, the benefits they gain by sharing their data must outweigh the risks and cost of data sharing.

Competition is a key concern. While both operators and aggregators can benefit from other MaaS actors' data to correspondingly improve their customer offer (for example, their service planning), there is an understandable reticence among operators to open their data to potential competitors. Actors in the market must feel confident that their position or viability is not undermined by sharing of data with other MaaS actors.

Table 1. Required data reporting elements for operators providing passenger transport services in Finland

The identity of the service provider, commercial registration number and contact information that a service user can use.
Data regarding the spatial coverage of the service.
Information on payment options.
Information related to the accessibility of the service to those with mobility or other impairments.
Machine-readable information regarding scheduled service operation and spatially-referenced route information.
The location of scheduled traffic stops, stations or terminals with related timetable information.
The period(s) for which the service or timetable information is valid.
For non-scheduled services and for any potential service provider, geospatial information on predetermined stops, stations, terminals, etc.
For non-scheduled or on-demand services, information on the times the services are available.
Information on how to book or hail the services(s) with a link to the booking engine if applicable.
Information on the price of the service including the breakdown into both static and dynamic (e.g. time- or distance-based) fare components, including discounts. This information should allow for cross-service comparison (e.g. for peak-hour use).
Dynamic price information and information on available capacity, or a link to the service from which this information is available.
Information regarding restrictions, conditions, extra fees or policies or available options (e.g. regarding baggage transport, policies regarding animals, carriage of children, work stoppages, etc.).
Real-time trip planning and en-route data or a link to a service making this information available.
For non-scheduled services, map-based display of the location of available and/or booked vehicles or a link to the service from which the information is available.
Estimates of significant delays or cancellations in services as soon as they are available to service providers.
A link to the website or other electronic service of the service provider.

Source: ITF (2021d), based on Finnish Ministry of Transport (2019).

There is also a fear among market actors and public authorities that the MaaS provider becomes the "gatekeeper" (UITP, 2019) for the customer relationship and the data that the mobility operators and authorities need to effectively conduct their business and manage their responsibilities. The app interface has the power to control what options are presented to the user through the trip planner function, which poses the risk of anticompetitive behaviour, particularly when the MaaS provider also operates its own mobility services (Bar-Ilan et al., 2009; Fletcher, 2020). The actors need to trust the data-sharing architecture and that their interests will not be negatively affected by sharing their data in the system.

Public authorities can facilitate building trust between partners in the system through a solid regulatory framework. The different data types shared between operators and providers can be a matter of individual agreements negotiated on a bilateral basis. The requirements can also be stipulated as a condition of

joining the system. Either the full extent of data sharing requirements can be mandated, or a minimum set of requirements can be defined. Both will have to take into account the level of integration that is planned for the system.

Designing a data-sharing governance framework based on a single idea of MaaS is not likely to be the best way forward, given that the final viable MaaS models have yet to emerge. It may be more effective to develop the key components of data sharing that allow interoperability and understanding across shared functions and trust between actors. These regulations should protect against requirements to share too much, and they should be revisited often as MaaS develops and as data protection rules evolve (ITF, 2015).

Both Finland and France have recently enacted ambitious data sharing requirements in their national transport legislation. They meet both national and EU-level requirements set out in Directive 2010/40/EU[6] and EU Delegated Act 2017/1926[7] covering the provision of EU-wide multimodal travel information services. The French and Finnish laws also address forward-looking issues that are currently under consultation as part of a review of the directive (ITF, 2021d).

Table 2. Required data reporting elements for operators providing scheduled or free-floating passenger transport services in France

Static data relative to trips and transport service traffic allowing destination search, route discovery, calculation of itineraries, fare requests and trip planning information.
Dynamic data relative to services and traffic conditions for transport services allowing discovery of schedules, calculation of estimated time of departure and arrival, and accounting for service disruptions.
Historic and statistical data regarding the provision of transport services and traffic.
Static, dynamic and historical/statistical data regarding vehicle sharing services (carsharing and fixed or free-floating light individual mobility devices such as bicycles and push-scooters)
Data relative to public electric vehicle recharging infrastructure including wattage, price, payment options, physical accessibility, availability and vehicle size access restrictions.
Data enabling the access and use of peer-to-peer carpooling services including availability, pick-up and drop-off points, provisional schedule and cost.
Some data relating to the localisation of railroad level crossings
Data relating to the physical accessibility for paratransit services offering public transport for people with mobility challenges.

Source: ITF (2021d), based on Légifrance (n.d.).

The recent reform of the Finnish National Transport Code (NTC), lays the groundwork for data sharing in support of a national MaaS ecosystem (Table 1). It focuses on data availability and usability, calling on transport service providers and regulated entities to establish an open, easily accessible and useable digital channel delivering a common set of data items. These provisions are meant to create an open and level playing field where both small and large operators can more seamlessly co-ordinate or link their services and create new innovative options or applications. (Finnish Ministry of Transport, 2019)

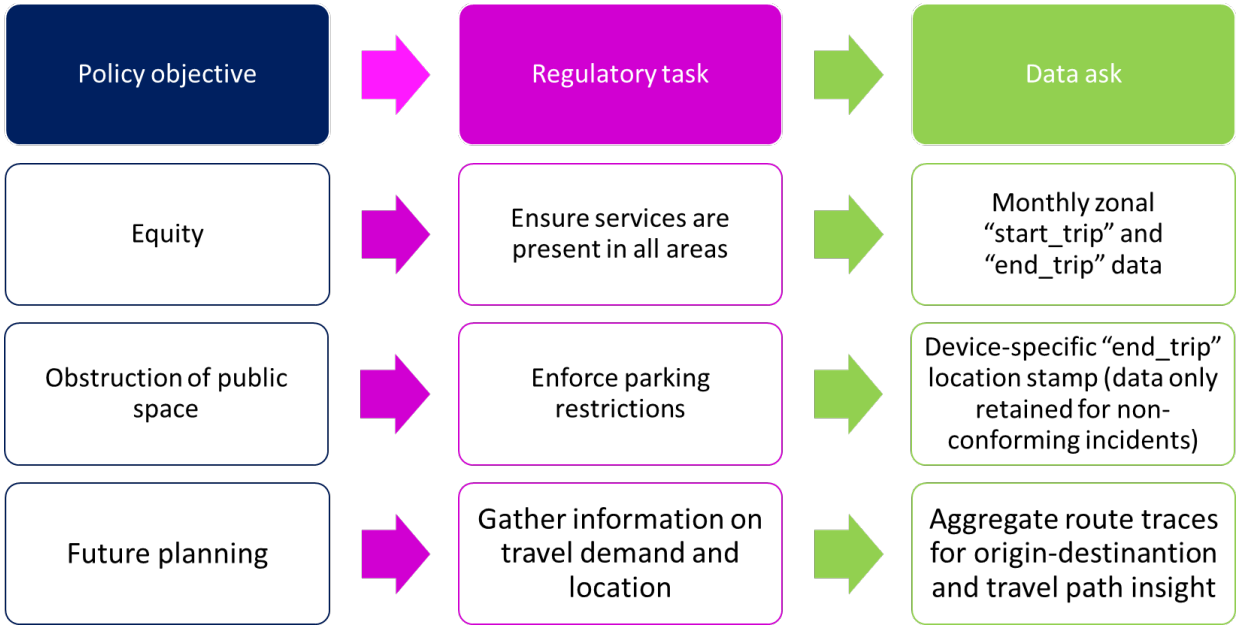
France's national mobility law (Légifrance, n.d.), and its application decree of 28 December 2020, require that certain data elements must be openly shared in a machine-readable format and be accessible to the public, to public authorities and private sector firms. These data elements are listed in Table 2. These requirements apply to public transport operators and all operators of shared vehicle services (including micromobility). They do not apply to ridesourcing or taxis. This creates an imbalance in the data-sharing obligations and access to data among actors in the market. See (ITF, 2021d) for a detailed discussion of local and regional laws.

Data-reporting to public authorities

Public authorities will need data from the operators and MaaS platform providers to monitor the MaaS system and its performance against public policy objectives. In terms of how data is shared for reporting purposes, there are three main approaches based on trust in the system and the actors.

- "Don't trust public authorities": the operators' process their raw data and then share aggregated data with the public authority, who must be in a position to audit what the operator is sharing
- "Don't trust operators/platforms": the operators are required to share their raw data with the public authority who will then process it
- "Don't trust anyone": the operators share their raw data with a third-party data processor trusted by both the authority and the operator, and this data processor then shares the aggregated data with the authority, which must be in a position to audit.

Figure 2. Example of data mapping



Operators are understandably concerned about being asked to share too much regarding the risk to data privacy and commercial information exposure. For data reporting requirements, governments are typically already equipped to process sensitive data in the course of their other remits and have relevant policies in place. There are other concerns, however. For instance, the public transport authorities may lack the technical skills to process the data they receive through MaaS, thus hindering their ability to regulate the system. Additionally, the availability of such quantities of data from MaaS may obscure modes that are not digitally enabled, such as walking.

The disparity in power and obligations creates a trust barrier that needs to be overcome. On the one hand, many public bodies are subject to requirements to open their transport data, while the private mobility suppliers are not. On the other hand, public transport authorities have the power to compel any actor in their transport space to share data as a condition of market entry. As such, limits need to be built into the system to maintain data sharing at a sufficient level without being excessive for the needs of public

transport authorities. Data governance principles should be accepted by all parties as fair and sufficient for the system to operate. These principles must be based on a shared understanding of who uses what data, for what purpose and how often, as well as how long it is retained.

For there to be trust in the system, data reporting requirements must be transparent in terms of what the data is used for. In addition, operators need to be confident that the public authority only requests data it requires to carry out its obligations. A first step may be for the public authority to prepare a process map that links the policy outcome it is trying to achieve to a specific regulatory task. The public authority would then identify what data will be necessary for them to carry out that task. Figure 2 shows an illustrative example of how the public authority's policy objectives could be linked to the request for specific data. This could also help actors provide the public authority with quality data that the authority can easily process. Regardless of the model employed, new or improved skillsets, including data literacy, will most likely need to be introduced or expanded in many public authorities.

Data semantics and syntaxes

For the various systems in the MaaS environment to speak to each other, it will be important to create standardised definitions for the parameters that the different operators' systems and platforms will need to share. For example, system language for "journey start time" or "vehicle available" will likely already exist within each operators' system. However, they may not be consistent across all operators or with the public authority. A lack of standardised definitions could keep smaller operators who may seek to integrate with multiple platforms from participating in the MaaS network; the cost of integrating with multiple systems could be prohibitive. In rural areas, for instance, local buses can be provided by the community on a voluntary basis. This practice is common in Germany, Ireland and the United Kingdom. Such transport operators may require additional support to meet the requirements for communicating with multiple systems and platforms (ITF, 2021b).

Deciding on a standardised form for data would likely reduce the costs required to integrate with multiple platforms. However, at present, it looks unlikely that one international standard will emerge. Mode-specific semantical models exist for public transport but are less well developed for new mobility. Even across public administrations, it may be necessary to review and standardise terminology and definitions. Introducing a common semantical model can aid interoperability and transparency between MaaS actors, but the model needs to be widely used to be effective.

Imposing costly requirements for new operators to enter the market that are relatively less costly to incumbents due to legacy investments could also create issues of dual access to the market, which should be avoided. Swedish stakeholders looked at centralising the technical integration of data as a potential means of lowering the entry threshold in terms of investment for individual actors (Smith, Sochor and Karlsson, 2020). However, concerns were expressed about the potential impact on service quality (ibid.).

To enable MaaS operators to work across boundaries, it may be more effective at this stage to focus on the shared definitions and functional building blocks for data syntax that would allow cross-communication on specific functions where it is needed. These functional building blocks would mean that different operators' systems could at least speak to each other on the functions that are essential for providing a MaaS service, such as asset identification, authenticating users' identities and routing information, for example. See ITF (2021d) for further discussion of functional building blocks.

In order to achieve broad uptake of the data syntax, it seems appropriate that the model be developed at the highest level. This argues for voluntary development among actors across regions and incentivised

deployment via traditional standard-setting processes by authorities. Doing so, however, will take time, and there is no well-defined, broad initiative as of yet. In the meantime, market actors and authorities can begin the discussion, agreeing on a set of emerging semantical models that help build a standardised glossary of terms.

Three examples of these are the OSLO-Mobility semantical model, SAE's Mobility Data Collaborative Data Sharing Glossary and Metrics for Shared Micromobility, and the Mobility Data Specifications (MDS) proposed Metrics application programming interface (API)[8]. Box 2 gives a brief description of each.

Box 2. Examples of semantical models

The Open Standards for Local Administrations (OSLO) semantical model was developed in the Flanders region of Belgium. It addresses the need for common definitions and terms supporting the digital exchange of data in the domains of contact information management, localisation and public services (Van Roy, 2020). It seeks to facilitate semantic and technical interoperability through an open process amongst market actors and authorities, maintain these vocabularies and ensure that rules and governance principles are respected. The mobility component of the OSLO semantical model – OSLO-Mobility, released in its initial version in April 2020 – defines a common vocabulary to be used to exchange data about trips performed by people and the mobility services they have at their disposal. Specifically, OSLO-Mobility establishes a lexicon referring to traveller information, trip information, booking actions, network description, service supply on the part of operators and information relating to licenses to operate.

SAE International (a United States industry-based standard-setting body, formerly the Society of Automotive Engineers) convened a broad range of actors and authorities developing or seeking to regulate micromobility services to develop a common understanding around terms used in the nascent industry. The Data Sharing Glossary and Metrics for Shared Micromobility (MDC, 2021) comprises a standardised set of definitions and methodologies covering commonly used terms and indicators. These terms include "non-operational vehicle" or "maximum average number of vehicles available in a given territory". Disambiguation of these and other terms helps deliver more consistent reporting and monitoring of these services and improves interoperability among operators.

Another similar approach is currently being incorporated into the forthcoming version of the MDS (MDS 1.1.0); it relates to standardised semantical models for reporting on MDS data via a proposed MDS Metrics API (Open Mobility Foundation, 2021). This API sets out standard definitions and parameters for calculating commonly used metrics based on MDS data. It builds on a common set of semantical terms by defining a common set of measurement outputs that enable consistent interpretation of data.

Source: ITF (2021d), pp. 103.

Once common definitions are established, a data syntax must follow. The data syntax structures the language, communicates meaning and triggers action. Specifying a data syntax that enables communication or finding an efficient way to translate meaning from one syntax to another is a core concern in the deployment of digital services.

At present, this common syntax is not in place for MaaS, although several industry-specific solutions exist. For public transport, these include NeTex (scheduling information), SIRI (service performance), Transmodel (a reference model for the sharing of passenger service information) and General Transit Feed

Specification (GTFS – a syntax to allow data sharing about services). There is also the General Bike Feed Specification (GBFS) for micromobility operators.

API-based solutions aimed at supporting MaaS have also started to emerge. For example, the Dutch government convened a working group in the Netherlands to support data sharing among actors in a MaaS ecosystem (TOMP-API, 2021, n.d.). To that end, the working group is developing the Transport Operator to Mobility Provider API (TOMP-API) (ibid.).The TOMP-API standardises MaaS platform access across the full range of functionalities: general operator identification, registration and onboarding, trip planning, booking, trip execution, payment, support, asset information and other optional functionalities. The Dutch government requires that the common standard be used in the seven MaaS trials taking place in the Netherlands. In Sweden, a special investigator established by the Government recommended an open API based on the *National Ticket and Payment Standards* for Public Transport (BoB) be created. It would be compulsory for national public transport operators and optional for commercial public transport operators. The standard is recommended to facilitate innovation and the incorporation of public transport tickets into new services, and reduce the cost of integration for the public transport operators (SOU, 2020). The BoB standard is a series of APIs for operational data necessary to plan and book travel. They are not entirely open, as actors must be registered in a national database to use the APIs in BoB (Samtrafiken, n.d.). See also ITF (2021d) for further discussion on data governance.

Public policy and governance for Mobility as a Service

The business case for MaaS is not yet proven. Given that MaaS will rely on publicly funded and managed networks and infrastructure, it is understandable that this should be a particular point of concern for many incumbent public transport operators and authorities. Nevertheless, many transport authorities have high hopes for the contribution MaaS could make to their policy goals. There are several ways of configuring the organisation of MaaS, with varying levels of involvement of the public transport authority and commercial MaaS providers. Each organisational approach has its risks and benefits, and implications for governance. However, if governments want the private sector to take the lead, the governments will need to avoid imposing undue regulatory costs or restrictions. A better understanding of the impact on and perceptions of users could also help with planning for possible outcomes due to MaaS.

In line with ITF's recommended approach to wider innovative mobility solutions, a permissive and outcome-based regulatory approach would also be appropriate in the context of MaaS (ITF, 2017, 2019a, 2021f). Such an approach would allow MaaS actors to develop their business models without potentially insurmountable regulatory barriers being introduced *ex-ante* based on fears for negative outcomes due to MaaS or a desire to control how the system develops. Adopting an outcome-based approach that identifies the role of MaaS within a wider mobility strategy would allow authorities to monitor how MaaS impacts the mobility outcomes and act if any unexpected outcomes develop. Agreed review periods would then allow public authorities to address any potential shortcomings in the regulatory approach.

For urban MaaS, public transport is generally considered the backbone of the system, and in most cities, these services are supported by public subsidies. Where the public authorities see a strategic role for MaaS in delivering against their policy objectives, it would seem sensible to integrate public transport tickets with the MaaS platform. In a MaaS system with commercial MaaS providers, the providers will charge a commission on ticket resale. This is a normal principal/agent relationship and should not be regarded as a capture of public subsidy. Under this approach, the public transport operator would be free to contract and negotiate with the MaaS providers. They could award a discount or commission based on the value they perceive the MaaS provider bringing as a seller of public transport services to a potentially new or wider audience. MaaS providers would also need to identify and demonstrate the value they bring in order to progress from initially short-term contracts to longer-term agreements. They would need to show that their involvement helped realise policy outcomes, such as improved accessibility and increased public transport ridership.

Alternatively, if governments wish to establish functional MaaS systems in contexts with little private interest, they may need to adopt the "Public MaaS" model and bear the attendant financial and reputational risks. They could also potentially subsidise private aggregators in the interests of reaping the social benefits of a modal shift towards sustainable mobility or improving accessibility in poorly served regions.

Data sharing is also central to the success of MaaS. There are two types of data sharing to be considered:

- data reported to the authority from the mobility operators and MaaS providers
- data shared between mobility operators and MaaS providers.

Policy makers looking to facilitate MaaS must enable a data-sharing system that actors in the market trust. There are concerns from mobility operators about the risks to their business inherent in sharing their data. There are concerns from public transport authorities that a private MaaS provider could become a gatekeeper for the data they need to plan their network. Some minimum level of mandatory data sharing may be necessary if voluntary data sharing does not work.

The costs involved in data sharing will affect the viability of MaaS businesses. Some form of standardisation or reference syntaxes for data reporting would enable cost-effective investment when integrating smaller actors in the market. For authorities, too, this would make auditing of the system easier and more economical. Rules that focus on "functional building blocks" for data syntax – not specific architecture – could enable interoperability without standardisation. Such rules would dictate what should be present in data syntaxes to participate in the MaaS ecosystem. Rather than specifying a certain syntax for all users, functional equivalence between systems should be required across the MaaS ecosystem. So, instead of regulating and specifying the language to be used in a system, each language should be able to map itself directly to another.

Notes

1 The report by Wardman (2014) took convenience to be a function of time factors (except in-vehicle time) and crowding, but excluding considerations on "…safety, security, comfort, scheduled journey time and speed".

2 "…defined as the sum of consumer surplus and the financial result of PT and carsharing operations…" (Hörcher and Graham, 2020).

3 The baseline scenario assumes rail fares and carsharing passes that maximise welfare (Hörcher and Graham, 2020).

4 White label products are, in this case, where a company develops a generic app without branding it. Other organisations who wish to have such an app available without developing it themselves can pay to brand a version of the "white label" app with their own branding. The user sees that organisation's branding on the user interface, but the back-end is the generic app.

5 Not all additional journeys will yield public benefits, as some may represent modal shift from active transport, or induced demand. However, on average, modal shift toward public transport is expected to enhance social welfare by reducing the negative externalities associated with private vehicle use.

6 Directive 2010/40/EU *on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport*. Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32010L0040.

7 EU Delegated Act 2017/1926, *with regard to the provision of EU-wide multimodal travel information services*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R1926.

8 APIs are standardised code-based "gateways" that enable otherwise incompatible data architectures to interact and share information.

References

Alonso-González, M. J. et al. (2020), "Drivers and barriers in adopting Mobility as a Service (MaaS) – A latent class cluster analysis of attitudes", *Transportation Research Part A: Policy and Practice*, Vol. 132, pp. 378–401, https://doi.org/10.1016/j.tra.2019.11.022.

Alyavina, E., A. Nikitas and E. Tchouamou Njoya (2020), "Mobility as a service and sustainable travel behaviour: A thematic analysis study", *Transportation Research Part F: Traffic Psychology and Behaviour*, Vol. 73, pp. 362-381, https://doi.org/10.1016/j.trf.2020.07.004.

Arnott, R. (1996), "Taxi travel should be subsidized', *Journal of Urban Economics*, Vol 40/3, p. 316-333, https://doi.org/10.1006/juec.1996.0035.

Audouin, M. and M. Finger (2019), "Empower or Thwart? Insights from Vienna and Helsinki regarding the role of public authorities in the development of MaaS schemes", *Transportation Research Procedia*, Vol. 41, pp. 6-16, https://doi.org/10.1016/j.trpro.2019.09.003.

Bar-Ilan, J. et al. (2009), "Presentation bias is significant in determining user preference for search results: A user study", *Journal of the American Society for Information Science and Technology*, John Wiley and Sons, Ltd, Vol. 60/1, pp. 135-149, https://doi.org/10.1002/asi.20941.

Berge, S. (2019), *Kickstart for mikromobilitet En pilotstudie om elsparkesykler (Kickstarting Micromobility – A Pilot Study on e-Scooters)*, Institute of Transport Economics, Oslo, https://www.toi.no/getfile.php?mmfileid=50932.

Brussels Mobility (n.d.), *Good Move: The Regional Mobility Plan 2020-2030*, webpage: https://mobilite-mobiliteit.brussels/en/good-move (accessed 24 March 2021).

BVG (n.d.) *Jelbi – Berlin's entire public transport and sharing services in just one app*, https://www.jelbi.de/en/home/ (accessed 02 April 2021).

Christiaanse, R. (2019), "Mobility as a Service", WWW '19: Companion Proceedings of The 2019 World Wide Web Conference, pp. 83-92, https://doi.org/10.1145/3308560.3317050.

City of San Francisco Municipal Code (n.d.), *San Francisco Transportation Code*, Sec. 1206-1, Proof of Concept Authorization, https://codelibrary.amlegal.com/codes/san_francisco/latest/sf_transportation/0-0-0-50136 (accessed 30 March 2021).

Crozet, Y. (2020), "Mobility as a Service: A New Ambition for Public Transport Authorities", International Transport Forum Discussion Papers, No. 2020/16, OECD Publishing, Paris, https://doi.org/10.1787/3de9adb3-en.

Deloitte (2019), *The Mobility Budget: A second alternative for the company car*, webpage, www2.deloitte.com/be/en/pages/tax/articles/The-Mobility-Budget.html (accessed 16 August 2021).

Dobbs, L. (2005), "Wedded to the car: Women, employment and the importance of private transport", *Transport Policy*, Vol. 12/3, pp. 266-278, https://doi.org/10.1016/j.tranpol.2005.02.004.

Duchène, C. (2011), "Gender and Transport", *International Trasnport Forum Discussion Papers*, No. 2011/11, OECD Publishing, Paris, https://doi.org/10.1787/5kg9mq47w59w-en.

EC (n.d.), "Intelligent Transport Systems: National Access Points", *Mobility and Transport*, webpage, European Commission, https://ec.europa.eu/transport/themes/its/road/action_plan/nap_en (accessed 22 July 2021).

Eckhardt, J. et al. (2018), "MaaS in rural areas - case Finland", *Research in Transportation Business and Management*, Vol. 27, pp. 75-83, https://doi.org/10.1016/j.rtbm.2018.09.005.

EMTA (2019), "Mobility as a Service: A perspective on MaaS from Europe's Transport Authorities", European Metropolitan Transport Authorities, https://www.emta.com/IMG/pdf/emta_pointofview_mobilityasaservice_june2019-2_1_.pdf.

Expedia Group (n.d.), *All FAQs to list your property on Expedia Group Partner Central*, webpage, https://welcome.expediagroup.com/en/help-and-faqs/faqs (accessed 31 March 2021).

Finnish Ministry of Transport (2019), "Act amending and temporarily amending the Transport Services Act and related laws", *National Transport Code*, https://valtioneuvosto.fi/hanke?tunnus=LVM030:00/2020 (accessed on 04 October 2021).

Fiorello, D. and Zani, L. (2015), "EU Survey on issues related to transport and mobility", *JRC Science and Policy* Report, European Union, doi: 10.2791/48322.

Fletcher, A. (2020), "Digital competition policy: Are ecosystems different?", paper presented as part of the background material in support of a presentation at the 134th meeting of the Competition Committee on 1-3 December 2020 at the OECD, https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DAF/COMP/WD(2020)96&docLanguage=En (accessed 16 August 2021).

Graham, D. (2017), "Causal inference for ex-post evaluation of transport interventions", in Ex-Post Assessment of Transport Investments and Policy Interventions, OECD Publishing, Paris, https://doi.org/10.1787/9789282108154-6-en.

Hensher, D. A. et al. (2020), "MaaS trials—What have we learnt?", in *Understanding Mobility as a Service (MaaS): Past, Present and Future*, pp. 59-75, Elsevier, doi: 10.1016/b978-0-12-820044-5.00004-x.

Hirschhorn, F. et al. (2019), "Public transport regimes and mobility as a service: Governance approaches in Amsterdam, Birmingham, and Helsinki", *Transportation Research Part A: Policy and Practice*, Vol. 130, pp. 178-191, doi: 10.1016/J.TRA.2019.09.016.

Ho, C., C. Mulley and D. Hensher (2020), "Public preferences for mobility as a service: Insights from stated preference surveys", *Transportation Research Part A: Policy and Practice*, Vol. 131, doi: 10.1016/j.tra.2019.09.031.

Hörcher, D. and D. Graham (2020), "Pricing and Efficient Public Transport Supply in a Mobility as a Service Context", *International Transport Forum Discussion Papers*, No. 2020/15, OECD Publishing, Paris, https://www.itf-oecd.org/pricing-and-efficient-public-transport-supply-mobility-service-context.

Hörcher, D. and A. Tirachini (2021), "A review of public transport economics", *Economics of Transportation*, Vol 25, doi: 10.1016/J.ECOTRA.2021.100196.

ITF (2021a), "Developing innovative mobility solutions in the Brussels-Capital Region", *International Transport Forum Policy Papers*, No. 96, OECD Publishing, Paris, *forthcoming*.

ITF (2021b), *Innovations for Rural Mobility*, ITF Research Reports, OECD Publishing, Paris, *forthcoming*.

ITF (2021c), *Reversing Car Dependency: Summary and Conclusions*, ITF Roundtable Reports, No. 181, OECD Publishing, Paris, https://doi.org/10.1787/bebe3b6e-en.

ITF (2021d), *The Innovative Mobility Landscape: The Case of Mobility as a Service*, International Transport Forum Policy Papers, No. 92, OECD Publishing, Paris, https://www.itf-oecd.org/innovative-mobility-landscape-maas.

ITF (2021e), *ITF Transport Outlook 2021*, OECD Publishing, Paris, https://doi.org/10.1787/16826a30-en.

ITF (2021f) "Forging Links: Unblocking Transport with Blockchain?", International Transport Forum Policy Papers, No. 90, OECD Publishing, Paris, https://doi.org/10.1787/738454bb-en.

ITF (2019a), *Regulating App-Based Mobility Services: Summary and Conclusions*, ITF Roundtable Reports, No. 175, OECD Publishing, Paris, https://doi.org/10.1787/94d27a3a-en.

ITF (2019b), "Transport Connectivity: A Gender Perspective", OECD Publishing, Paris, https://www.itf-oecd.org/transport-connectivity-gender-perspective.

ITF (2018), "Women's Safety and Security: A Public Transport Priority", OECD Publishing, Paris, https://www.itf-oecd.org/womens-safety-security.

ITF (2017), "Shaping the Relationship Between Public Transport and Innovative Mobility", *International Transport Forum Policy Papers*, No. 34, OECD Publishing, Paris, https://doi.org/10.1787/7a1f7b89-en.

ITF (2015), "Big Data and Transport: Understanding and Assessing Options", *International Transport Forum Policy Papers*, No. 8, OECD Publishing, Paris, https://doi.org/10.1787/5jlwvzdb6r47-en.

ITS.be (n.d.1), *Decree basic accessibility*, webpage, http://its.be/maas/legal-framework/decree-basic-accessibility (accessed 01 October 2021).

ITS.be (n.d.2), *MaaS*, webpage, http://www.its.be/maas (accessed 29 March 2021).

JR-East (2019), "An Interview with the President", East Japan Railway Company, https://www.jreast.co.jp/e/investor/interview/index.html?src=gnavi (accessed 17 March 2021).

Karlsson, M. et al. (2017), *Deliverable 4: Impact Assessment*, Mobility As A Service For Linking Europe (MAASiFiE) project funded by CEDR, https://publications.lib.chalmers.se/records/fulltext/248829/local_248829.pdf.

KBC Brussels (n.d.) *Arrange your public transport in KBC Brussels Mobile*, webpage, www.kbcbrussels.be/retail/en/products/payments/self-banking/on-your-smartphone/mobile/public-transport.html (accessed 17 March 2021).

Légifrance (n.d.), *LOI n° 2019-1428 du 24 décembre 2019 d'orientation des mobilités (1),* https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000039666574/ (accessed 03 April 2021).

Ministère de la transition écologique (2021), *La loi d'orientation des mobilités* (The mobility orientation law), webpage, https://www.ecologie.gouv.fr/loi-dorientation-des-mobilites (accessed 11 June 2021).

Modalizy (n.d.), *Modalizy: Smart Mobility*, website, https://www.modalizy.be/en (accessed 16 March 2021).

moovel (2019), "moovel Group testing its Mobility-as-a-Service platform in Japan: Izuko app launched for the Izu region", *Automotive World*, https://www.automotiveworld.com/news-releases/moovel-group-testing-its-mobility-as-a-service-platform-in-japan-izuko-app-launched-for-the-izu-region/ (accessed 01 October 2021).

Mulley, C. and J. Nelson (2020), "How Mobility as a Service Impacts Public Transport Business Models", *International Transport Forum Discussion Papers*, No. 2020/17, OECD Publishing, Paris, https://doi.org/10.1787/df75f80e-en.

OECD (2019), *Competition Assessment Toolkit: Volume 1 principles*, http://www.oecd.org/competition/assessment-toolkit.htm.

Open Mobility Forum (2021), "About MDS", Open Mobility Foundation, https://www.openmobilityfoundation.org/about-mds/ (accessed 23 June 2021).

Pangbourne, K. et al. (2020), "Questioning mobility as a service: Unanticipated implications for society and governance", *Transportation Research Part A: Policy and Practice*, Vol. 131, pp. 35-49, https://doi.org/10.1016/j.tra.2019.09.033.

Pickford, A. and E. Chung (2019), "The shape of MaaS: The potential for MaaS Lite", *IATSS Research*, Vol. 43/4, pp. 219-225, https://doi.org/10.1016/j.iatssr.2019.11.006.

Polis (2017), "Mobility As a Service: Implications for Urban and Regional Transport", Discussion Paper, Polis, Brussels, https://www.polisnetwork.eu/wp-content/uploads/2019/06/polis-maas-discussion-paper-2017-final_-2.pdf.

Proost, S. (2018), "Reforming Private and Public Urban Transport Pricing", *International Transport Forum Discussion Papers*, No. 2018/15, OECD Publishing, Paris, https://doi.org/10.1787/3567dda4-en.

Rakuten (2020), "Rakuten and JR East Launch Suica Services in Rakuten Pay App that Enable Customers to Issue, Charge and Pay with Suica", *Rakuten*, https://global.rakuten.com/corp/news/update/2020/0525_01.html (accessed 17 March 2021).

Sakai, K. (2020), "Public transport promotion and mobility-as-a-service", *IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences*, Vol. E103A/1, pp. 226-230, https://doi.org/10.1587/transfun.2019TSI0001.

Samtrafiken (n.d.) *BoB - National Ticket & Payment Standards for Public Transport - WIKI*, webpage, https://samtrafiken.atlassian.net/wiki/spaces/BOB/overview (accessed 01 August 2021).

San Francisco Municipal Transportation Authority (2019), *Transport code amendments,* https://www.sfmta.com/sites/default/files/reports-and-documents/2019/10/11-5-19_item_12_permit_harmonization_-_transportation_code_amendments.pdf.

Shaheen, S. and A. Cohen (2020a), "Similarities and differences of Mobility on Demand (MoD) and Mobility as a Service (MaaS)", *ITE Journal*, https://www.nxtbook.com/ygsreprints/ITE/ITE_June2020/index.php?startid=29#/p/30 (accessed 01 August 2021).

Shaheen, S. and A. Cohen (2020b), "Mobility on demand (MOD) and mobility as a service (MaaS): Early understanding of shared mobility impacts and public transit partnerships", *Demand for Emerging Transportation Systems: Modeling Adoption, Satisfaction, and Mobility Patterns*, pp. 37–59, https://doi.org/10.1016/B978-0-12-815018-4.00003-6.

Skipr (n.d.), *Skipr*, website, https://www.skipr.co/ (accessed 16 March 2021).

Smart City Sweden (2020), *Residents using a mobility service app travel more sustainably*, webpage, https://smartcitysweden.com/residents-using-a-mobility-service-app-travel-more-sustainably/ (accessed 29 March 2021).

Smith, G. and D. Hensher (2020), "Towards a framework for Mobility-as-a-Service policies", *Transport Policy*, Vol. 89, pp. 54-65, https://doi.org/10.1016/j.tranpol.2020.02.004.

Smith, G., J. Sochor and M. Karlsson (2020), "Intermediary MaaS Integrators: A case study on hopes and fears", *Transportation Research Part A: Policy and Practice*, Pergamon, Vol. 131, pp. 163-177, doi: 10.1016/J.TRA.2019.09.024.

Smith, G., J. Sochor and M. Karlsson (2019), "Public–private innovation: Barriers in the case of mobility as a service in West Sweden", *Public Management Review*, Vol. 21/1, pp. 116-137, https://doi.org/10.1080/14719037.2018.1462399.

Smith, G., J. Sochor and M. Karlsson (2018), "Mobility as a Service: Development scenarios and implications for public transport", *Research in Transportation Economics*, Vol. 69, pp. 592-599, https://doi.org/10.1016/j.retrec.2018.04.001.

Smith, G., J. Sochor and M. Karlsson (2017), "Procuring Mobility as a Service: Exploring dialogues with potential bidders in West Sweden", Paper ID EU-SP0980, ITS World Congress 2017 Montreal, https://publications.lib.chalmers.se/records/fulltext/249640/local_249640.pdf.

Sochor, J. (2021), "Piecing Together the Puzzle: Mobility as a Service from the User and Service Design Perspectives", *International Transport Forum Discussion Papers*, No. 2021/08, OECD Publishing, Paris, https://doi.org/10.1787/1c7b4c5b-en.

SOU (2020), *Ett nationellt biljettsystem för all kollektivtrafik (A national ticket system for all public transport)*, Statens Offentliga Utredningar, Stockholm, https://www.regeringen.se/499447/contentassets/339c31bcd5a74b12b92e689b898dfb37/ett-nationellt-biljettsystem-for-all-kollektivtrafik-sou-202025.

TOMP-API (2021) *GitHub - TOMP-WG/TOMP-API: Transport Operator to Mobility-as-a-Service Provider (TOMP) API development Github*, webpage, https://github.com/TOMP-WG/TOMP-API (accessed 17 August 2021).

TOMP WG (n.d.), *TOMP Working Group*, webpage, https://tomp-wg.org/ (accessed 17 August 2021).

Trafi (n.d.) *Trafi*, website, https://www.trafi.com/ (accessed 02 April 2021).

Trainline (n.d.1), *Our business model*, webpage, https://investors.thetrainline.com/what-we-do/our-business-model (accessed 31 March 2021).

Trainline (n.d.2) *What we do*, webpage, https://investors.thetrainline.com/what-we-do (accessed 31 March 2021).

Uber (n.d.), *The best of Uber for your business,* website, https://www.uber.com/ie/en/business/ (accessed 17 March 2021).

UITP (2019), "Mobility as a Service", *WWW '19: Companion Proceedings of The 2019 World Wide Web Conference*, pp. 83-92, doi: 10.1145/3308560.3317050.

Vlaanderen is mobiliteit & openbare werken (n.d.), *Visie en traject (Vision and trajectory)*, webpage, https://maasafsprakenkader.vlaanderen.be/traject (accessed 29 March 2021).

Wardman, M. (2014), "Valuing Convenience in Public Transport", *International Transport Forum Discussion Papers*, No. 2014/02, International Transport Forum, Paris, https://www.itf-oecd.org/sites/default/files/docs/dp201402.pdf (accessed 02 April 2021).

XXIMO (n.d.) *The flexible and most complete business mobilitycard*, webpage, https://www.xximo.be/en_be/ (accessed 16 March 2021).

Zijlstra, T. et al. (2019) *Kansrijke groepen voor Mobility-as-a-Service (Proming groups for Mobility as a Service)*, Knowledge Institute for Mobility Policy (KiM), https://www.kimnet.nl/publicaties/rapporten/2019/04/14/kansrijke-groepen-voor-mobility-as-a-service (accessed 17 August 2021).

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International Transport Forum

Integrating Public Transport into Mobility as a Service

This report examines the potential impact of Mobility as a Service (MaaS) on how passenger transport is currently organised. MaaS is a model for supplying a wide range of passenger transport services through a single, digital customer interface. In its most ambitious form, it integrates different transport, information and payment services into a smooth and reliable customer experience. The report assesses the regulatory and governance requirements for integrating MaaS with public transport and ensuring it delivers more sustainable urban mobility, focusing on the role of public transport authorities.

All resources from the Roundtable on Integrating Public Transport into Mobility as a Service are available at: https://www.itf-oecd.org/integrating-public-transport-mobility-service-maas-roundtable

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Published: 10/2020 | Photo credit: GaudiLab/Shutterstock