



Developing Innovative Mobility Solutions in the Brussels-Capital Region



Case-Specific Policy Analysis

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The International Transport Forum

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Case Specific Policy Analysis Reports

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Foreword

Effective transport policy measures have the power to shape the built environment of a city and the quality of life of residents and visitors. The measures put in place also contribute substantially to the reduction of CO₂ emissions. Transport policy is key to a more resilient city with happier, healthier inhabitants.

Europe's cities and regions are engaged in an ongoing effort to find the most appropriate ways to improve accessibility while also cutting greenhouse gas emissions, through more efficient transport and sustainable mobility plans. The European Union's 2020 Sustainable and Smart Mobility Strategy and its accompanying action plan set out how the EU's transport sector can reduce its emissions by 90% by 2050. A key element of the strategy is developing seamless multimodality to improve sustainable travel. Modelling by the International Transport Forum suggests that digitalised multimodal travel systems, such as Mobility as a Service (MaaS), underpinned by reliable public transport and shared mobility options, can both enhance equitable accessibility and play an important role in reducing the emissions from urban mobility.

The Brussels-Capital Region's sustainable urban mobility plan, Good Move, addresses congestion, pollution, road safety, and transport efficiency to create a more liveable city. Several of the actions in the plan relate to combined and shared mobility, and to Mobility as a Service (MaaS). MaaS and mass transit go well together. Developing shared mobility, integrated with public transport, is a key part of the strategy. Its success will depend on the establishment of an efficient MaaS system under an effective regulatory framework. However, MaaS is a relatively new concept, and a clear business case is yet to emerge. Cities and regions are therefore trying to advance the introduction of MaaS models without being able to refer to any large, well-established examples.

The European Commission, via the Structural Reform Support Programme, has provided support to the Brussels-Capital Region to develop a regulatory framework for MaaS and has funded this study to inform the implementation of a new governance framework for MaaS. The region is looking to foster a hybrid MaaS ecosystem with both public and private actors. The report does not attempt to analyse all possible approaches to MaaS but identifies policies that can support the development of the desired hybrid MaaS ecosystem in Brussels. The report focuses on two key elements: the regulatory framework and the data governance approach.

MaaS introduces a new dynamic into the mobility services sector: that of a digital market. The relationships between the actors and the management of data in the ecosystem will be very important, as MaaS aggregators have access to proprietary operator information and data on users. In the interests of innovation and competition, the regulatory framework for MaaS must also facilitate market entry and enable potential market dominance to be addressed effectively.

As MaaS is still evolving, the regulatory framework should also recognise the need for public authorities to be able to react should any unexpected negative outcomes arise. A pro-competitive regulatory approach should encourage a commercially viable MaaS model to emerge that can support sustainable mobility across the region. MaaS is intended as a tool to foster more sustainable travel choices and should be part of a wider package of mobility policies. It is the combination of measures, the redistribution of space and the integration of technological innovations such as MaaS that will help people make the most sustainable choice, creating a vibrant city on a human scale.



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Glossary

Brussels-Capital Region (BCR)	A region of 19 municipalities in Belgium, including the City of Brussels, the capital of Belgium.
Brussels Mobility	administrative arm of the BCR government, responsible for managing transport in the region.
Data interoperability	a form of data access and sharing referring to the near real-time access and sharing of data that enables different operators to deliver a combined service to the user.
Data portability	allows all mobility operators and MaaS providers involved in delivering a trip to have the necessary access to traveller volunteered and profile (observed) data, subject to user consent.
Data reporting	The reporting of information by MaaS providers and mobility operators to the public authorities.
Data sharing	The sharing of data among and between MaaS providers and mobility operators in a market.
Deep-link access	A link in an interface (of a MaaS app in this instance) that redirects the user to the mobility operators own site to complete a purchase.
General Data Protection Regulation (EU)	The General Data Protection Regulation (GDPR) is an EU law that protects the rights of people (data subjects) and sets out responsibilities and obligations to data controllers and data processors with respect to personal data.
Good Move	The sustainable urban mobility plan for the Brussels-Capital Region.
Inferred data	Data that results from the purposeful processing and transformation of volunteered or observed data that may still relate to a specific person or the device that they are using.
Informational integration	The integration of data regarding the availability of mobility services.
MaaS app	The application that travellers interact with that presents whole-journey transport options and allows for payment (either directly or through deep-linking).
MaaS provider	Entities that aggregate different mobility operators' services into a single offer through an application (MaaS app) for users' mobile digital devices.
Mobility as a Service (MaaS)	A distribution model for mobility services that uses shared data and a digital interface to efficiently source and manage the provision of transport related services into a seamless offer

	which improves the ease of planning, booking and making journeys.
Mobility data aggregator	Entities that collect and process mobility data in order to offer products and services that enable integration and collaboration between cities and connected transportation services.
Mobility operator	Entities that provide a physical mobility service, for instance, public transport or shared bicycles.
Modal shift	Changing the means of transport used to complete a trip – for example shifting from car to bicycle.
Data controller	Data controller in the context of GDPR means the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data; where the purposes and means of such processing are determined by Union or Member State law, the controller or the specific criteria for its nomination may be provided for by Union or Member State law’ (European Parliament and Council, 2016 ^[1]).
Observed data	Behavioural data automatically triggered and logged by a user – or more specifically, by a sensor platform or machine used by a traveller (e.g. a car, a smart phone, a GPS tracker, etc.).
Operational integration	The integration of data regarding the physical joining of different mobility operator services. This may relate to access rights, the seamless integration of access protocols (e.g. gate-based access vs. contactless access).
Personal Data	Personal data is any information relating to an identified or identifiable natural person (‘data subject’). An identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, [e.g. social security number] location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity [e.g. name and first name, date of birth, biometrics data, fingerprints, DNA...] of that natural person” (European Parliament and Council, 2016).
Transactional integration	Integration of booking and payment services and the allocation of revenues that this implies.
Volunteered data	Data, often personal, provided by individuals so that they may use a product or access a service or in the context of consuming a service.

List of abbreviations

API	Application Programming Interface
B2B	Business-to-business
B2C	Business-to-consumer
BCR	Brussels-Capital Region
DR	Data Reporting
DS	Data sharing
GDPR	General Data Protection Regulation
ITS	Intelligent transport systems
MaaS	Mobility as a Service
PAYG	Pay-as-you-go
PSO	Public service obligation
PTA	Public transport authority
SNCB-NMBS	Société nationale des chemins de fer belges – Nationale Maatschappij der Belgische Spoorwegen
STIB-MIVB	Société Des Transports Intercommunaux De Bruxelles – Maatschappij Voor Intercommunaal Vervoer Te Brussel
SUMP	Sustainable Urban Mobility Plan
TEC	<i>Transport En Commun</i> – Walloon Regional Transport Company

Executive summary

Scope

The Brussels-Capital Region (BCR) adopted its latest regional mobility plan, Good Move, in 2020. The objectives of Good Move are to improve the environment and the quality of life of the people of Brussels while supporting the BCR's economic development. The focus is on addressing congestion, pollution, transport efficiency and road safety in Brussels. Good Move incorporates 50 concrete actions. Four of these relate to integrated, shared mobility and Mobility as a Service (MaaS). The BCR government believes that successful development of MaaS will support a shift to more sustainable modes of transport than private cars. In the longer term, the BCR anticipates that a thriving MaaS ecosystem will foster further innovation in sustainable travel.

In view of the above and in the process of reviewing the regulatory environment for MaaS, the BCR requested support from the European Union's Structural Reform Support Programme and developed a project with the International Transport Forum (ITF) to inform the development of a sustainable regulatory framework for MaaS. Project outputs will inform the design of the regulatory and data management frameworks for MaaS in the BCR.

This report summarises the findings of the project. It describes a healthy MaaS ecosystem and how the BCR can facilitate its emergence through a MaaS-specific ordinance as well as by adapting existing regulatory frameworks relating to mobility markets and services. The recommendations proposed in this report seek to support the development of a competitive and innovative MaaS market that includes both private and public sector actors and support the BCR government in achieving the objectives of its regional mobility plan.

The report draws on a broad range of evidence: international experiences in developing regulatory and data governance frameworks, a desk review of the BCR's current mobility landscape, and consultations with stakeholders. The consultations included targeted interviews, workshops and an online survey. The report also builds on ITF's work on micromobility, app-based mobility, data-led transport policy, reducing car dependency and MaaS.

Findings

Mobility operators are entities that provide a physical mobility service, for instance, public transport or shared bicycles. MaaS providers are entities that aggregate different mobility operators' services into a single offer through an application (MaaS app) for users' mobile digital devices. The terms mobility operator and MaaS provider are used in this report to make a clear distinction between the two functions. At the same time, mobility operators may also be MaaS providers.

The BCR government aims to create an innovative MaaS market for the Brussels region that contains both private and public sector mobility operators and MaaS providers. It expects MaaS to make a significant contribution to improving accessibility and to expanding sustainable transport options in the region. It wishes to ensure that MaaS develops in a way that supports the objectives of the Good Move plan while enabling the development of viable business models for mobility operators and MaaS providers. To facilitate this, this report recommends a pro-competitive approach to regulating the market that is in line with EU policies and OECD recommendations.

The BCR government wishes to see a well-developed MaaS ecosystem that is consistent with the “STOP” principle, i.e. the policy of prioritising active and public transport over individual car-based mobility. Recognised by Belgium’s three regions, the “STOP” principle sets the desired hierarchy of transport modes: “Stappers” (pedestrians), “Trappers” (cyclists), “Openbaar vervoer” (public transport and shared-transport users) “Privé vervoer” (private car users).

The BCR is in the process of preparing an ordinance to regulate the MaaS system. It is clear from stakeholder engagement on this and other projects, that the existence of viable business models (i.e. consumer offers and pricing structures that yield positive net revenues) that would support a large-scale MaaS ecosystem have yet to be demonstrated. Overly restrictive or inflexible regulation of such a new and evolving market would risk undermining the ability of market actors to find sustainable business models. At the same time, the BCR needs to be able to respond should the MaaS market develop in ways that detract from the achievement of sustainable mobility.

Many stakeholders see clarity on data governance as an urgent requirement to support the uptake of MaaS. The MaaS ordinance is thus needed to implement a data governance framework in support of MaaS and to license the new MaaS provider business activity. The ordinance will not need to be an all-encompassing regulation for urban mobility services but can complement existing mode-specific and other market regulations. These already cover many aspects of sustainable mobility policy, for instance, vehicle standards. The simplest approach may be to revise existing mobility operator licensing requirements to incorporate MaaS data governance elements and to regulate MaaS providers through the new ordinance. Licensing of operators should be reviewed to ensure there are no provisions that indirectly inhibit MaaS.

The public authorities should support the development of a competitive, open-entry MaaS ecosystem. There is a risk that dominant public or private actors could emerge and exercise substantial market power. Proactive oversight by competition authorities and engagement between the BCR authorities responsible for regulating MaaS and the competition authorities will help to ensure this is avoided.

Public transport should form the backbone of a MaaS ecosystem if its contribution to the sustainable mobility objectives of the Good Move plan is to be maximised. A significant point of contention among stakeholders is the resale of public transport tickets. Concerns exist that a MaaS model with public transport at its core would struggle if MaaS providers cannot earn a margin on the resale of public transport tickets. Others worry that such resale of public transport tickets could reduce net revenues for public transport operators.

Public transport operators should be free to negotiate the terms of their engagement with the MaaS providers looking to resell public transport tickets, while respecting the need to comply with the principle of equal treatment, as set out in their governing legislation. This could potentially include selling access to public transport to MaaS providers on terms differing from existing ticketing structures and providing discounts on bulk sales. Enabling this will require revision of existing instruments, such as the management contract in place between BCR and public transport operator Société Des Transports Intercommunaux De Bruxelles – Maatschappij Voor Intercommunale Vervoer Te Brussel (STIB-MIVB), rather than being addressed directly through the MaaS ordinance.

Some stakeholders have strong concerns that this approach would result in subsidies to public transport, effectively contributing to private profits. However, the resale of public transport services by MaaS providers is best understood as the MaaS provider acting as an agent for the public transport operator, with the potential to increase ridership and thus contribute to the government’s modal shift objectives.

In the medium term, establishing a large-scale MaaS ecosystem could create significant opportunities to reform how mobility subsidies are provided and a move from the current supply-side approach towards a

user-based approach. The latter could be an incentive payment per passenger or a person-centred payment model, for example. Such a change could significantly improve the equity and efficiency of mobility subsidies and help to achieve guaranteed minimum levels of accessibility in a cost-effective way. Creating the conditions for such a shift will take time, but policy makers should weigh this possibility as a significant potential long-term benefit of the successful establishment of MaaS on a large scale.

Brussel's public transport operator STIB-MVIB is currently running a MaaS trial and will likely be the first large-scale MaaS provider in the Brussels market. MaaS may develop more quickly as a result and the dominant role of the STIB-MVIB as a mobility operator may be reinforced. Safeguards should be incorporated into the MaaS ordinance to foster competition and guard against exploitation of market power in the MaaS provider market. These will initially concern STIB-MVIB but will apply equally to private MaaS providers should these acquire market power through growth, mergers or acquisitions.

Recommendations

The following eleven recommendations are grouped into three areas of action necessary to achieve specific outcomes: First, to enable the creation of a MaaS ecosystem with both public and private actors; second, to facilitate an efficient and equitable market for MaaS; and third, to manage the overall mobility outcomes to which MaaS should contribute.

Enable the creation of a MaaS ecosystem

Regulate mobility operators and MaaS providers separately

Operators of mobility services are already regulated and are expected to continue to offer their services directly as well as engaging with MaaS providers. Specific regulations already exist to cover the licensing and operation of mobility services. These include mode-specific elements covering operations and environmental aspects, the use of public space, and the regulation of public transport. Mode-specific regulation will continue to be necessary. However, it will need to be extended to cover data sharing amongst market actors and reporting of data to public authorities. MaaS providers can function without operating transport services themselves and are therefore not necessarily subject to mode-specific regulation. MaaS providers should be regulated separately, rather than trying to combine the licensing of mobility operators and MaaS providers in a single MaaS regulation.

Adopt an explicitly pro-competitive approach to MaaS in policy and legislation

The commercial viability of MaaS in any context remains unclear, as does the nature of the MaaS service users want to see. The potential for a MaaS model to develop that meets user needs and is economically sustainable will be maximised by competition and innovation in the market. The BCR government should ensure regulation and policy are broadly pro-competitive, in keeping with EU competition law and OECD competition policy principles. In particular, it should explicitly state in its MaaS policy and legislation that the provision of MaaS services is an open-entry market.

Clearly establish the status of MaaS providers via a licensing scheme

MaaS providers represent a new entity in the transport market. In their role, they will have access to substantial amounts of consumer data, including payment data. MaaS providers, therefore, must be monitored to ensure they comply with all regulated data security, sharing and reporting requirements. A licensing scheme for MaaS providers that includes a regime for effective and timely sanctions, when needed, is recommended to ensure compliance and facilitate market entry. The BCR government should

adopt a legal definition of a MaaS provider, which includes its status regarding the processing of personal data, and establish a specific MaaS provider licence. At this early stage in the development of the regulatory framework, only minimal conditions – essentially requiring compliance with data regulations – should be incorporated in the licence. Additional licensing requirements might be added in future should any substantial negative outcomes for consumers make it necessary.

Review conditions for mobility operator licences to ensure they do not include barriers to developing MaaS

An attractive MaaS offer depends fundamentally on the existence of a wide range of mobility services. Regulations for mobility operators in all transport modes should be reviewed to ensure that they do not impose undue constraints on the activities of those mobility operators, which could, in turn, inhibit the development of MaaS. In particular, limits on the number of licences issued and rigid caps on fleet numbers for new mobility services should be avoided. Where regulation is required, outcome-based regulations linked to specific performance criteria are preferable.

Add mandatory minimum data-sharing requirements relating to informational and operational data to licences for mobility operators

No MaaS ecosystem can exist without data sharing and data access between mobility operators and MaaS providers. Data-sharing responsibilities for mobility operators and data access rights granted to MaaS providers will allow the latter to create new cross-modal mobility offers tailored to the needs of individuals. These could provide greater efficiency in the use of transport assets and create the space for innovative services and secondary markets based on this data. Responsibilities and rights relating to data should be added as standard conditions to existing mobility operator licences.

Facilitate an efficient and equitable market

Build mandatory consumer data portability, subject to user consent, into the conditions of all mobility operator and MaaS provider licences

Data on individuals' on-trip behaviour should be shared among the operators that provide part of an end-to-end trip to enable the development of personalised travel services. Such enhanced data portability may be seen as a burden by some operators, but a common data resource for all actors in the market enables innovation and value creation. However, data portability must be subject to user consent, in line with the European Union's General Data Protection Regulation (GDPR), which governs the processing and movement of personal data and standard data-management principles.

Adopt competition safeguards as part of the MaaS provider licensing framework

Avoiding distortion of competition in the market is particularly important in light of the uncertain economic viability of MaaS. Licensees should be required to treat their own and external mobility services equally. Cross-subsidising MaaS provider activities via funds from mobility service activities should be prohibited, as this could provide an unfair competitive advantage. The MaaS provider activities of any licensees, whether public or private, which are also mobility operators, should be undertaken separately from transport operations. This is especially important in the cases of MaaS providers that are also mobility operators of sufficient scale to exercise market power. This separation is important to ensure that competitive neutrality principles are respected.

Ensure public transport operators have the freedom to negotiate the terms of public transport ticket resale with MaaS providers who, in turn, should be free to determine the pricing of services to consumers

Public transport operators and MaaS providers should be free to negotiate the terms for the provision of public transport services that will be sold through MaaS platforms, provided they comply with the principle of equal treatment established in their governing statutes. This is consistent with a generally pro-competitive approach to developing MaaS. It may require revision of existing instruments, such as the management contract between BCR and STIB-MIVB, rather than being addressed directly through the MaaS ordinance. MaaS providers should also be given the freedom to develop offers they believe will attract consumers. Where negative effects for sustainable transport outcomes occur, these should be addressed through broader mobility policies rather than MaaS regulation.

Apply OECD and EU best practice principles on regulatory policy and governance to inform approaches to regulating MaaS

The objectives underlying regulation must be clearly specified. A full range of regulatory and non-regulatory options for achieving the objectives should be identified and their impacts assessed and compared systematically via a proportionate process of impact assessment that uses consistent methodologies. Regulatory development should be conducted through open, consultative processes as has been followed by the BCR to date. These processes should be part of a broader consultative effort aimed at generating and implementing a MaaS model that is broadly endorsed by all stakeholders.

Make data reporting requirements to public authorities specific and directly related to regulatory tasks

Data reported by mobility operators and MaaS providers allows public authorities to monitor and enforce compliance with rules aimed to ensure desired public policy outcomes. These can be rules relating to competitive markets, safety, regulated uses of public space, and other public policy objectives. This data is also essential for planning purposes and can help to identify and rectify regulatory weaknesses. This can enable authorities to improve efficiency, equity and sustainability and, ultimately, contribute to improving the welfare of the citizens of the Brussels-Capital Region. However, reporting requirements for this purpose should be specific and limited to the regulatory tasks to avoid overburdening MaaS stakeholders.

Manage mobility outcomes

The Good Move policy package should remain the key vehicle for implementing sustainable urban mobility policies

Policy actions to improve the sustainability performance of the evolving MaaS ecosystem should be pursued through measures included in the broader Good Move package rather than regulations targeting only actors in the MaaS ecosystem. This includes direct measures to control congestion, reducing emissions and improving safety across the transport system. Adopting such a broad policy approach will be more effective for achieving mobility objectives. It will also avoid the risk of MaaS-specific regulation undermining the economic viability of the developing MaaS market.

1 Introduction: Mobility as a Service and the aim of this project

Mobility as a Service (MaaS) is a distribution model for mobility services that uses shared data and a digital interface to efficiently source and manage the provision of transport related services into a seamless offer. It is typically delivered via a MaaS app, which is a single, digital, customer interface that sources and manages travel related services and improves the ease of planning, booking and making journeys in a region. MaaS joins different transport, information and payment services into a smooth and reliable digital customer experience. It enables the integration of public transport (PT) modes, commercial transport services such as ridesourcing, bike and carsharing, and taxis into a comprehensive mobility offer.

Developing MaaS is one of 50 actions to deliver sustainable mobility in the Brussels-Capital Region (BCR) as part of Good Move, the regional sustainable urban mobility plan (SUMP). Authorities want MaaS to support a modal shift in the BCR, to more sustainable modes of transport than the private car. They expect that MaaS will greatly improve the convenience and attractiveness of sustainable modes. In the longer term, the hope is that the MaaS ecosystem will create an environment that fosters further innovations in sustainable travel.

The European Union provided funding to the BCR via the Structural Reform Support Programme for this project with the International Transport Forum to inform the development of the regulatory framework for MaaS. The project's outputs will recommend the most appropriate governance policies for the development of the BCR MaaS system. They will therefore directly inform the accompanying regulatory and data management frameworks for the system.

The concept of MaaS has existed for several years, although city and regional governments are only recently adopting it beyond pilot projects. Authorities now expect a mode-shift away from the private car to contribute to many regions' sustainable mobility policy objectives and see a role for MaaS in that. MaaS represents a new digital market for mobility operators and the wider mobility market to sell their services. These stakeholders hope that the development of MaaS in conjunction with the broader push to more sustainable travel will result in a larger user pool and increased ridership. However, the business case is yet to be proven. For users, it is unclear yet if there is a latent demand for a MaaS product though research underscores the appeal of MaaS for users in improved seamlessness and convenience (ITF, 2021^[2]; Sochor, 2021^[3]).

There are three main functions in the MaaS supply chain; the terminology for which varies across MaaS discourse. The definitions used for the purposes of this report are described in the following paragraph.

Mobility operator refers to any entity providing a physical mode-based mobility service. This includes all modes present in the market (bus, train, taxi/ridesourcing, shared bicycles, shared scooters, etc.). This could also include operators of underlying transport infrastructure services, like parking operators. A **MaaS provider** is any entity that provides the aggregation of mobility services into a single offer delivered via a user-facing interface (typically a MaaS app). A MaaS provider is distinct from a ticket agent, or reseller, as a MaaS provider combines multiple mobility operators into an integrated consumer offering. It is possible for a MaaS provider also to be a mobility operator, but it is not necessary.¹ The MaaS app requires a digital architecture that integrates relevant data from different providers and services necessary for the

operation of MaaS. It is possible for this integration role to be carried out by a separate entity to the MaaS provider, but is common for MaaS providers to manage the integration themselves. Standardised data sharing protocols can facilitate this integration role.

There are many different approaches to MaaS from a governance perspective (see (Mulley and Nelson, 2020^[4]) for a discussion). They can be characterised by the level of involvement of the public transport authority (PTA) and of commercial actors. One scenario is the purely commercial approach to MaaS, in which the public authority facilitates the development of MaaS through necessary amendments to existing regulations, but does not involve itself in the MaaS market. Here, commercial integrators develop the MaaS apps, negotiating bilaterally with mobility operators to integrate those services into a MaaS offer or bundle for the user. At the other extreme is an organisational model wherein the PTA operates the entire MaaS ecosystem as a public utility. Under this model, the PTA either develops or procures the provision of a MaaS app and back-end that integrates the mobility services in the region into the MaaS offer for users. Under this approach, there is no commercial competition between MaaS providers as there is only the one, public-led, app.

Some literature advocates that a single public-sector MaaS provider is better placed to integrate services benefiting from public sector contracts (Kamargianni and Matyas, (2017^[5])). Others favour a private sector MaaS provider to avoid conflicts of interest that arise for a public sector MaaS provider when mobility services are provided by public and private sectors. There is not yet consensus on which approach, if either, is best.

Hybrid models involving the public sector and commercial MaaS providers are also emerging. These solutions vary but usually involve the public sector removing regulatory obstacles to the involvement of commercial MaaS providers (such as those that exist around the resale of public transport tickets). In some cases, the public authority also provides or delegates open back-end infrastructure that commercial MaaS providers can use as well as guidance on data formats. The PTA or incumbent public transport operator may also offer a MaaS app in competition with commercial MaaS providers in these markets.

BCR is looking to develop such a hybrid MaaS market to fulfil the ambition of MaaS set out in the Good Move plan. It would include commercial MaaS providers and a public sector presence in the MaaS ecosystem. BCR hopes this approach would deliver on both the policy goals of the sustainable mobility plan, and capitalise on innovations through competition and the involvement of the private sector. This report takes the BCR's objective as a starting point for exploring appropriate regulatory approaches to support it. There is an ongoing MaaS pilot programme in the BCR, operated by the public transport operator, Société Des Transports Intercommunaux De Bruxelles – Maatschappij Voor Intercommunale Vervoer Te Brussel (STIB-MIVB). Their app, MoveBrussels, is a test for the anticipated development of a fully functioning MaaS app competing in the eventual MaaS market in Brussels.

As of September 2021, there is no specific MaaS regulation in the BCR apart from that related to the pilot operated by STIB-MIVB, and integrated mobility solutions offered to employees within the context of the Belgian mobility budget. STIB-MIVB are expected to continue to develop their MaaS app after the pilot period ends, and as such are anticipated to be the first significant mover in the Brussels market, given their already established brand and position in the BCR mobility ecosystem.

The transport sector has a large physical footprint and is highly capital intensive. The complex, multi-layered and multi-stakeholder nature of the mobility service landscape and transport's dependency on infrastructure presents a challenge to effective governance and integration of the various infrastructure and transport services that comprise a MaaS ecosystem. Although a perfect blueprint for MaaS regulation does not yet exist, the appropriate governance approach will be deeply rooted in the local institutional and organisational frameworks for governing the mobility system. These are highly context specific and differ substantially between any given regions.

A memorandum to the ministers of the BCR (Gouvernement de la Région Bruxelles-Capitale, 2019^[6]) identified some high-level principles for the system. These included that entrants to the market will be subject to conditions on integration with, and contribution to, regional mobility objectives – i.e. MaaS should contribute to the mobility goals of the region as detailed in the Good Move plan. Conditions covered emissions standards, operational areas, information formats, availability and accessibility, use of public space, data sharing and a possible future integration of payment systems. The memorandum notes that public transport should be the backbone of the system and it mentions that some form of targeted subsidy scheme could be put in place. Detailed rules for operating and regulating the market still need to be defined. The BCR intends to use a “test and learn” approach to the implementation of MaaS, by conducting the pilots (Gouvernement de la Région Bruxelles-Capitale, 2019^[6]).

This report provides findings and recommendations to support the BCR in the development of appropriate regulatory and data governance frameworks for MaaS. It draws on wider ITF work on MaaS and related fields, such as on micromobility, app-based mobility, data-led transport policy, reducing car dependency and reforming public transport planning and delivery. Additionally, desk reviews, as well as input from Brussels Mobility and STIB-MIVB informed the work. ITF conducted interviews with 15 stakeholders, with versions of the interview questions being shared with further stakeholders through an online survey. ITF also conducted three workshops with stakeholders focussing on eliciting their responses to different governance approaches to key elements of a MaaS ecosystem. An additional call with stakeholders for accessibility and active travel was also held.

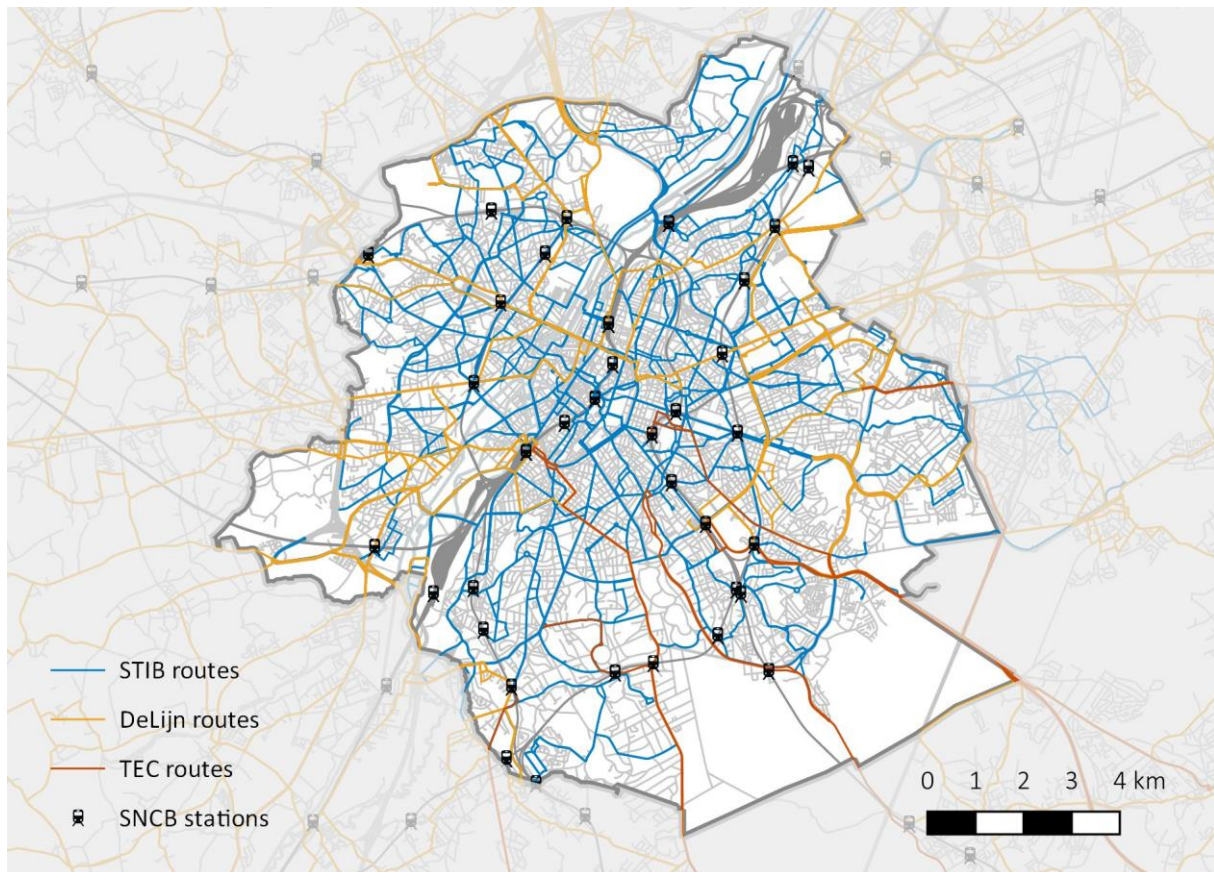
The rest of the report is structured as follows:

- Chapter 2 presents an overview of the Good Move plan and ambitions for MaaS in the Brussels-Capital Region, as well providing context for the subsequent discussion through an outline of the existing mobility landscape in the region.
- Chapter 3 discusses key aspects of the urban mobility market in general and provides an objective discussion of MaaS and the regulatory context for MaaS markets both from a mobility perspective and a digital markets perspective.
- Chapter 4 summarises the key takeaways from the wide-ranging stakeholder engagement conducted for the project
- Chapter 5 discusses the regulatory framework for BCR
- Chapter 6 discusses the data governance approach for BCR
- Chapter 7 outlines some lessons learned from other transport fields on attracting users, which could be of use in a MaaS context for BCR
- Chapter 8 summarises the conclusions and recommendations for the regulatory framework and data governance approach for the BCR, based on the preceding discussion in the report. A section discussing some considerations for those outside BCR that may wish to adapt some of the recommendations is also included.

2 The mobility landscape in the Brussels-Capital Region

Transport in the BCR follows the regional sustainable urban mobility plan (SUMP), which is developed by the government of the BCR and reviewed every ten years. The Region recently established “Good Move”, the SUMP for 2020-30. Its principle objective is to combat rising pollution, congestion and safety issues. Good Move (Brussels Mobility, 2021^[7]) adopts a user-centred approach that aims to improve the liveability of neighbourhoods and address the social, economic and environmental challenges of the region. It builds upon the preceding regional mobility plans Iris I (1998) and Iris II (2010). Figure 1 shows the area of the Brussels-Capital Region and the public transport networks that service it. This chapter outlines the current mobility landscape in the BCR based on desk research, input from Brussels Mobility and STIB-MIVB, and additional information gleaned from the stakeholder engagement

Figure 1 The Brussels-Capital Region and its public transport networks



Source: Base layer © OpenStreetMap contributors (2021); mobility networks data from data.mobility.brussels (2021).

Good move lays out a vision for “peaceful neighbourhoods”, intermodal connections, and efficient public transport and traffic flow. To develop the plan, Brussels Mobility collaborated with around 400 stakeholders from government, the Regional Mobility Commission (CRM), citizens’ representatives and transport user groups, ministers and other public and private entities. The plan is divided into into a **City Vision**, a **Mobility Vision** and an **Operational Action Plan**, which contains 50 actions divided into six focus areas (Brussels Mobility, 2021^[8]).

The City Vision identifies goals to improve a quality of life through mobility, and aligns with the ambitions of the Regional Sustainable Development Plan (PRDD). It outlines specific goals to reduce greenhouse gas emissions, reduce travel expenses for households, introduce peaceful urban areas, and ensure that no one is killed or seriously injured due to travel-related incidents by 2030 (in line with Vision Zero safety principles (BRAL, n.d.^[9]).

The Mobility Vision complements the City Vision with a strong focus on reducing car traffic and favouring active modes and public transport. It envisages an integrated mobility system that allows users to choose the most appropriate mode for their trips and reduces car dependency. It aims to limit personal car trips to 24% of total trips by 2030, compared to the one-third share predicted for 2030 based on current trends. Public governance must be strengthened to achieve this; to do so, the Mobility Vision identifies a need to define clear roles within BCR and private and public mobility operators (Brussels Mobility, 2021^[7]).

The Operational Action Plan is organised around six transversal themes. **Good Network**, has a focus on safety and universal accessibility, and includes ten actions that focus on infrastructure, prioritised cycle routes and optimising the network of all road users, from pedestrians to heavy goods vehicles. **Good Neighbourhood** comprises six actions to promote high quality of life within neighbourhoods by deterring through-traffic, optimising urban logistics, and establishing peaceful residential environments. **Good Service** lists 12 actions to contribute towards an integrated mobility offer (MaaS) for the region, to enable all citizens to access a range of mobility services, which together can replace the need to own or use a car. **Good Choice** comprises nine actions that focus on making users aware of their travel choices and encourage them to consider alternative modes, time of travel, distance travelled etc. **Good Partner** focusses on strengthening partnerships with public and private sector entities, stakeholders from all levels of government and citizens through seven actions. Finally, **Good Knowledge** lists five actions dedicated to the management, evaluation and communication of regional mobility policy (Brussels Mobility, 2021^[8]).

How does Mobility as a Service fit in the regional context?

The BCR identified the aspirational principles for the Mobility as a Service (MaaS) system they want to exist in the region in a memorandum submitted to the members of government in April 2019 (Gouvernement de la Région Bruxelles-Capitale, 2019^[6]). It outlined how MaaS could be attractive and inclusive for users, contribute to sustainable mobility, support optimisation of the transport system, and offer inter-regional solutions, focussing on commuters in particular.

Good Move aspires to establish an integrated mobility solution that replaces the need for a private car and create options for people to choose appropriate modes based on trip characteristics. This is primarily addressed by the Good Service focus area and the development of MaaS is only one of the 50 actions of Good Move. A successful MaaS rollout also depends on the implementation of other policy actions in the plan. Stakeholders interviewed also generally held the view that MaaS alone will not be sufficient to produce the sustainable mobility transition outlined in Good Move. Synergies between MaaS and the six focus areas of the Good Move plan are described in Table 1.

MaaS plays a direct role in three of the six Mobility Vision goals and has an indirect impact on the remainder. MaaS and the opportunities for multimodal travel that it could provide are part of the path to

reducing reliance on private cars in the region. MaaS is also expected to be a tool to streamline the diverse mobility offers in the region into an accessible and integrated service.

Table 1. Mobility as a Service and the Good Move Action Plan

Good Move Action Plan Focus Areas	Connection/Synergies with MaaS
Good Neighbourhood	If successful in reducing car use and encouraging multimodal, and in particular active travel, MaaS may contribute to more peaceful neighbourhoods with less traffic and less space needed for parking. Users may be able to better navigate areas of 'filtered permeability' with the information MaaS provides and recognise the benefits and accessibility of active modes.
Good Network	Increased multimodal infrastructure as described by <i>Good Network</i> is necessary for MaaS to function, such as improving public transport, walking and cycling networks
Good Service	<i>Good Service</i> describes both physical and service / digital integration of transport modes to establish a MaaS ecosystem. Multimodal hubs will promote and facilitate multimodality in physical space, while MaaS applications offer the digital integration of services that allow citizens to reduce their need to use a car.
Good Choice	MaaS can help make citizens aware of their travel choices and ease decision making by providing integrated, complete, information about different modes, specific to time of day, distances to be travelled, origin and destination of a desired trip.
Good Partner	MaaS requires strong collaboration and trust-building between a wide variety of partners. <i>Good Partner</i> actions will contribute towards establishing these relationships.
Good Knowledge	<i>Good Knowledge</i> focuses on evidence-based policy making, monitoring and analysis of mobility data, and training for mobility stakeholders. Enhanced data collection and sharing agreements may be facilitated by MaaS to help gain better insights for policy makers and operators.

Note: Good Move describes **filtered permeability areas** as neighbourhoods with measures to deter transit traffic, and promote walking, cycling and public transport to increase quality of public space.

MaaS for the city and the users

When considering the possible advantages and consequences of a MaaS system, the typical citizen should experience a net positive impact, or not be affected at all. Stakeholders of Good Move found it very important that the conversation include all citizens of BCR – users and non-users of a MaaS system alike.

If MaaS helps to achieve the goals of Good Move, citizens of BCR would indirectly benefit from reduced numbers of cars on the road. They would gain more urban space, a greater sense of safety, and reduced air and noise pollution. If urban spaces are transformed to be more attractive and multi-functional spaces, neighbourhoods may benefit from this change. As long as the option to use single-mode mobility services does not change significantly in price or ease of access, there should not be a major disadvantage to non-MaaS users.

A number of benefits and potential risks exist for users (and potential users) of MaaS. The points in Table 2 focus on the needs of users and stem from discussions with stakeholders. The realisation of these advantages will depend on the actual service itself and the robustness of the modal integration and information provided. Willingness-to-pay for MaaS services will depend on the value added and the relative cost of other options. There is uncertainty among stakeholders as to how walking and the use of personal micromobility will be incentivised in an app that relies on selling services for revenue. The stakeholder interviews and workshops are summarised in Chapter 4.

Stakeholders also highlighted the importance of rollout and seamless travel options beyond BCR to connect with Wallonia and Flanders. For MaaS to reduce car traffic coming into the BCR, it will need to be useable by neighbouring residents of Wallonia and Flanders given the high share of private car users traveling into the BCR from these areas. This cross-boundary travel should be considered when preparing

the regulatory framework for MaaS. It was also noted that while MaaS may lower the barrier to entry for people trying new transport modes and services, additional communications may be needed especially in relation to use of carsharing services and shared micromobility.

Table 2. Potential advantages and risks of Mobility as a Service for users based on stakeholder interviews

Potential advantages	Potential risks
<p>MaaS to provide easier ways of paying for mobility. Similar to payment for other services/utilities.</p> <p>MaaS to provide more complete information for users to make different/better choices for themselves</p> <ul style="list-style-type: none"> • Gain a better understanding of which destinations are possible by walking, shared micromobility and public transport • Make trip chaining without a car easier/possible • Encourage uptake of new modes by removing barriers to information and understanding (simplifies the process) • Provide information on intermodal considerations such as available bike parking and location • Provide crowding information to allow people to decide on whether to take the next service or wait for a less crowded option. Especially relevant for travellers with luggage, a bike, etc. 	<p>Creating an exclusive mobility service catering to higher income households.</p> <ul style="list-style-type: none"> • The digital divide means that not all communities and social groups are able to access app-based services • Geographic gaps in services, especially from private mobility operators <p>Ignoring the needs of family travel, which significantly influences the choice to own a car. This may limit the impact of MaaS in reducing car ownership.</p> <p>Lack of promotion of personal micromobility and walking due to lack of business case for mobility operators.</p>

How mobility in the Brussels-Capital Region is currently regulated

Multiple actors govern and administer transport in the BCR: the BCR government, including Brussels Mobility and Parking.Brussels, and the 19 municipalities of the BCR. There is no federal mobility plan, but as outlined, a regional sustainable urban mobility plan is adopted and reviewed every ten years by the government of the BCR. Municipal mobility plans translating the regional mobility policy locally are reviewed and renewed every twelve years.

The BCR government organises public transport services via its administrative arm Brussels Mobility, responsible for managing transport in the region. Public sector transport operators include STIB-MIVB, De Lijn, TEC and the national railway company SNCB/NMBS. Brussels Mobility is also the licensing authority for bikesharing operators, taxis, collective taxis, carsharing and car-hire services with a driver.

Parking.Brussels, the regional public sector parking agency, manages parking services and issues the allocation of parking space for licensed carsharing operators. Roads are the responsibility of either the BCR or the municipality in which they are located, according to a hierarchy of purpose.

Data sharing and reporting agreements in the BCR differ across mobility operators, by mode. Each mode-specific regulation has its own data provisions. There is no data-format standards stipulated in the ordonnance for licensing the individual modes.

The following sections describe the current regulatory context of mobility services in BCR based on a number of mode-specific regulations (see Annex A) and consultation with Brussels Mobility and STIB-MIVB.

Mobility operators in the Brussels-Capital Region

Mobility services in the BCR operated by the public sector, or under contract to the public sector, include urban public transport (metro, tram and bus), rail, and a station-based bikesharing system. BCR also has a wide range of mobility services in addition to public transport, including bikesharing (docked and dockless, e-bikes, cargo bikes), e-scooter sharing, carsharing, carpooling, and ridesourcing. There are also taxi services and collective taxis in operation in the BCR. The availability of these mobility options is conducive

to a diverse and attractive MaaS ecosystem from the consumer perspective. In a MaaS ecosystem, there is the option for mobility operators also to become MaaS providers combining their own offers with other services. MaaS providers can also be a separate, stand-alone business. In either case, the current regulatory framework does not identify the MaaS provider function.

Urban public transport (metro, tram, bus, rail)

STIB-MIVB is BCR's designated internal operator for public transport services based on a public service contract. In April 2019, the public service contract between the BCR government and the STIB-MIVB was renewed for the period 2019-2023. The contract establishes the respective duties and commitments of each party every five years. Under the contract, STIB-MIVB cannot outsource the operation of regular services with the exception of tourist buses and TaxiBus services for people with reduced mobility. The latest contract includes responsibilities for STIB-MIVB to encourage intermodality to provide alternatives to private cars through collaboration with other mobility providers. It mentions the integration of pricing, ticketing, and communication between them. There is also a strong emphasis on developing digital technologies to facilitate integration. STIB-MIVB receives a grant from BCR for investment in developing public transport services and for partially covering operating costs. The 2021 contribution was EUR 945 million. In 2019, 54% of STIB's operating revenue was from subsidy and 40% based on ticket sales (STIB, 2019^[10]).

Companies De Lijn and TEC operate transport services linking the BCR to Flanders and Wallonia respectively, and the SNCB/NMBS operates regional and national rail services and international rail services departing from Brussels.

In the BCR, STIB-MIVB, and the regional government have worked together to incorporate flexibility and interoperability into travel tickets while keeping sustainability as their priority. The Mobib smartcard, in use since 2008, has been updated over the years to include a variety of public transport products, access and discounts to carsharing services, public bikesharing, and shared taxi services. The Brupass, which allows travel on STIB-MIVB, SNCB/NMBS, TEC and De Lijn services within the BCR, was introduced in February 2021. The Brupass XL extends coverage to 11.5 km around the BCR, but excludes services to and from the city's airport of Zaventem (STIB/MIVB, 2021^[11]; The Bulletin, 2021^[12]).

Data sharing is stipulated in the regulations and contracts relating to STIB-MIVB. They became the first public transport company in Belgium to start sharing real-time data by launching an open data portal in 2016. STIB-MIVB sought to disseminate information to support innovation in mobility services that integrate a public transport component. Public and private mobility stakeholders sign a standardised data sharing agreement with STIB-MIVB on sharing data and information relative to mobility and network security.

STIB-MIVB reports key aggregated data for regional mobility with Brussels Mobility at intervals ranging from every year to every five years for monitoring purposes. There is no mandated data standard apart from requiring digitally readable formats for numeric data and geographic vector data for spatial datasets. STIB-MIVB also shares specific KPIs with the BCR government to meet performance obligations stipulated in their contract with BCR. These are reported on a monthly or annual basis.

Public bikesharing

The BCR also awards a public utility concession for the operation of a station-based, automated bicycle hire system. JCDecaux is the current provider of the service named Villo, which operates 24/7 in the region and is partially financed through user fees. The concession contract was signed in 2008 for 15 years and has been extended to 2026. The government evaluates the implementation of the contract annually.

JCDecaux, is required to provide information to Brussels Mobility on the number of users and usage of bicycles and stations, time of use and data necessary to verify level of service. This includes availability of bicycles, geographical coverage, number of bicycles per station and the number in use. Data are shared in an online database with a maximum delay of 24 hours. Reporting happens annually, which includes aggregation of this data alongside analysis of the operational characteristics such as origins and destinations of trips and user profiles.

Micromobility

Brussels Mobility grants micromobility licences that are valid for three years. The first licence was granted in April 2019. As of August 2021, there has been a total of sixteen licenses granted (with a further two in the process of being issued), of which seven are currently in effect (with one more expected to begin in late 2021). Any company is able to obtain a licence and there is no limit to the number of licences issued. However, there are a number of conditions that regulate the impact of the service on public space, safety, technical standards, environment and health issues, labour and tax laws, and privacy and data sharing. Applicants must provide an approach plan, which states their intended operation plan, General Data Protection Regulation (GDPR) compliance, pricing, vehicle details and fleet sizes, and recycling/reuse plans for the fleet. The plan is required as part of the application and Brussels Mobility does not impose objectives or monitor performance with respect to each of the topics.

Micromobility operators must provide Brussels Mobility with real-time data on the size of their fleet present in BCR, as well as the number of vehicles available for use. They provide a quarterly report with aggregated and anonymised data, which includes trip itineraries, pick-up and drop-off locations, number of users, and trips and vehicles on an hourly, daily, weekly and monthly basis. No specific format is stipulated. Operators are obliged to contribute to an annual survey. They must also co-operate on an open-data application that allows users to locate vehicles in real time. Brussels Mobility receives a weekly report from a third-party data aggregator on shared micromobility vehicles parked in designated no-parking zones for shared modes.

Carsharing

Carshare operators are authorised by Brussels Mobility to operate in BCR based on an “agrément” or licence. Licences are valid for five years, after which they can be renewed. Licences have been granted each year since 2018 and additional applications are expected in 2021. There are two main types of licence for operators: round trip station-based carsharing, and free floating carsharing. A third type for peer-to-peer carsharing also exists.

Carsharing licence conditions stipulate that costs must be proportionate to trip distance and duration. The maximum rental period is capped at 72 hours for round trips and 24 hours² for free-floating services. Currently there is a maximum rental period of 168 hours during school holidays, but this may be changed in the next review of regulations. Operators must ensure fleets meet certain technical environmental specifications and ensure that there is a 90% availability rate for users booking 24hrs in advance.

Station-based services are incentivised to cover the entire region, especially where public transport coverage is not optimal, through a scoring procedure that is reviewed when the licence is renewed. Round-trip operators have five years after obtaining a licence to develop at least 30 stations and maintain a fleet of 75 vehicles.

Carshare operators are obliged to submit an annual report to Parking.Brussels. It is based on a standard template and summarises the number of vehicles, clients and bookings, demand coverage rate and trip characteristics per station and globally. It also includes analysis of duration and distance of trips, client types (usage frequency, trip characteristics) and vehicle usage (number of bookings, distance and duration

used per day). Operators are also required to contribute once a year to a satisfaction survey among users. Parking.Brussels aggregates this data from operators and publishes an annual report. Most parking data stays within Parking.Brussels. Brussels Mobility currently receives no information from Parking.Brussels about parking violations by licensed operators.

Taxis, collective taxis, and car rental services with a driver

Brussels Mobility licenses taxi services in BCR. Licensing is conditional on operators owning the vehicles, paying taxes related to the operation of the service as well as salaries and social security contributions, and being able to cover maintenance costs for their fleet. All licensed vehicles are required to be available to the public, with a driver, for the time equivalent of a full time job per year. Both operators and drivers are subject to conditions with respect to police records. Drivers must obtain a professional certification and attend training every four years.

Collective taxis are licensed to operate between the hours of 23:00 and 06:00 to substitute for public transport services when these are out of operation at night. Passengers book a ride at least 30 minutes before departure via a switchboard and the vehicle is permitted to carry up to three passengers. Collective taxis must pick up clients in designated areas though they may be dropped off at any address given at the time of booking. BCR sets a fixed price for collective taxi passengers depending on the pick-up and drop-off location. If the amount shown on the taximeter is higher than the total contributions paid by passengers at the end of the ride, the Region pays the difference to the operator.

Collective taxi vehicles must provide real-time data to their switchboard including geographic co-ordinates, vehicle ID, time of embarkation of the first customer and time of disembarkation of the last customer, distance travelled, price on the taximeter, and number of passengers. A monthly statement of each operators' rides is shared with Brussels Mobility to facilitate reimbursement of the difference between the cost of rides and the price paid by passengers.

Integrated journey planning and Mobility as a Service providers on the market

Several private MaaS apps are already available in the city. The providers of these apps combine the services of individual transport operators, both public and private. Some of these apps offer the option of searching for a route as well as booking and paying for the different modes within the app. Other MaaS apps only function as search tools for best routes. Currently, MaaS providers can only re-sell tickets of public transport operators based on bilateral agreements.

In March 2019, the Federal Government of Belgium passed legislation on a 'mobility budget'. The mobility budget was established to act as an incentive for employees entitled to a company car to opt for cash in place of the company car to be used for more sustainable means of transport. Several private MaaS providers have taken advantage of this change in legislation to target the Business-to-Business (B2B) market with adapted mobility bundles that employers can offer employees instead of company cars.

In March 2020, STIB-MIVB launched the pilot phase of MoveBrussels. MoveBrussels is a MaaS app that offers several public (STIB-MIVB, SNCB/NMBS, TEC, De Lijn) and private (shared scooters, taxi, carsharing and bikesharing) transport operators and the option to combine them to plan, book and pay for a single trip. By September 2020, people had started testing the app (The Brussels Times, 2020^[13]). Since the pilot phase was affected by the Covid-19 pandemic, the pilot has been extended to June 2022 for insights to be gathered as travel restrictions and teleworking requirements ease. A dynamic road-user charging scheme, SmartMove, is also under development for the BCR. As part of the work to develop this scheme, a SmartMove MaaS app is also being planned. It is expected to combine multiple modes, and allow journey planning, fare payment and road-user charge payment through the app (SmartMove, 2020^[14]). If this

proceeds, it will mean that Brussels Mobility (through STIB-MIVB) and Brussels Fiscalité – both administrative bodies of the Government of the BCR, would each have their own app.

Mobility-data aggregators

There are also mobility-data aggregators operating in the BCR, which provide a variety of services including monitoring of parking areas, zonal restrictions and vehicle caps for micromobility. They help authorities to better understand mobility patterns by combining demographic, operational and origin-destination data. Brussels Mobility conducted a pilot project with a data aggregator from October 2019 to March 2021. As part of the pilot, the aggregator acted as a middle player between micromobility operators and Brussels Mobility and combined, processed and provided reports to Brussels Mobility based on data reported by licensed operators. Some data aggregators collect data from Brussels without having a contract with the local authorities. Others have made enquiries or expressed an interest in future opportunities. Several stakeholders interviewed and surveyed identified that involvement from a mix of mobility providers, including mobility-data providers/aggregators, would be important to their vision of MaaS.

Public transport in the region in relation to EU directives

EU regulations frame the functioning of Brussels’s public transport market, the types of data it shares, and its integration with services and networks from neighbouring countries. The provision of public transport services in the European Union is governed by regulations to liberalise public transport markets. Key instruments relating to the governance of public transport in the European Union are listed in Table 3.

Table 3 Important governance instruments for public transport in the European Union

Commission Delegated Regulation (EU) No.	Regulation description
Regulation 1370/2007	public passenger transport services by rail and by road
Regulation 2016/2338	amends Regulation 1370/2007 with respect to the opening of the market for domestic passenger transport services by rail.
Directive 2010/40/EU	concerns intelligent transport systems and the deployment of transport technologies in the EU.
Regulation 1315/2013	concerns the development of trans-European transport network and is currently under revision

Liberalisation of the public transport market

Regulation 1370/2007 applies to all national and international operation of road and track-based public transport. It defines the governance framework within which authorities can ensure the provision of quality service with lower fares and better meet public policy outcomes. If an operator is granted exclusive rights to operate services it requires the use of Public Service Contracts (PSCs). These contracts must specify compensation for meeting clearly defined Public Service Obligations. The duration of PSCs is limited to ten years in the case of road transport, fifteen years for rail transport, with the possibility of extension. It specifies that generally, awards should be made by competitive tender, though direct awards are also permitted. In the case of direct awards in the rail sector, the PSC is limited to ten years.

Regulation 2016/2338, which amends Regulation 1370/2007, establishes competitive tendering as a general rule for passenger rail services (excluding metros and tramways) but allows direct awards to continue until December 2023. There are a number of exceptions that still allow for direct award beyond 2023 under certain financial and service thresholds, structural and geographical characteristics,

exceptional circumstances and in emergencies. Direct awards must be justified, transparent, and monitored to ensure performance requirements are met.

Belgium does not currently have a competitive tendering process for public transport services and opts for direct award (DG MOVE, 2019^[15]). Domestic rail services are operated by SNCB/NMBS through direct award contracts. The Belgian government is expected to directly award a new ten-year contract to SNCB/NMBS, which includes new bonus-penalty systems, KPIs to measure comfort, punctuality and late evening and night services in preparation for liberalisation of rail services in Belgium (Rail Journal, 2020^[16]). Urban public transport services in Belgium are operated by publicly owned regional Public Transport operators (Steer, 2016^[17]). In the BCR, STIB-MIVB operates the metro, tram and bus network under directly awarded contracts issued by the regional government. The current PSC covers the period from 2019 to 2023.

Belgium has one of the highest subsidy rates for public transport services when compared to other countries in the EU. Subsidies are targeted at different user groups (e.g. employees, students, retirees, large families). The Belgian railway company, SNCB/NMBS has the lowest revenue and highest subsidy rate per passenger kilometre in relation to comparable international railway companies (OECD, 2020^[18]). In the BCR, total public spending on transport (including road and port of Brussels-related spending in addition to public transport) added up to 25% of total spending in 2019 (IBSA, 2021^[19]). Public subsidies to STIB-MIVB funded all investment and accounted for 54% of STIB-MIVB's operating revenue; 40% of revenue was generated from ticket sales (STIB, 2019^[10]).

The European Sustainable and Smart Mobility Strategy

The European Commission launched its Sustainable and Smart Mobility Strategy and accompanying action plan in December 2020, laying out how transport will contribute to achieving the European Green Deal and the road to digitalisation. It will have implications for the development of MaaS in the BCR and its attendant governance. The action plan contains 82 actions to achieve these goals, grouped into 13 Flagship categories. Flagships 6 (*Making connected and automated multimodal mobility a reality*) and 7 (*Innovation, data and AI for smart mobility*) cover the actions envisaged to enable smart mobility that brings “a seamless multimodal experience throughout [the user’s] journey” (European Commission, 2020^[20]). Several of the actions are of particular relevance to the uptake of MaaS in the BCR. These cover revisions of existing directives and assessment of the need for, and development of, new regulatory frameworks in relation to multimodal digital services and data sharing (European Commission, 2020^[21]). Several of the relevant directives in development or under revision are discussed in this and following chapters. Some indications of timelines relevant to the BCR work are highlighted in Chapter 8 (Conclusions and recommendations).

Deployment of intelligent transport systems

Directive 2010/40/EU identifies intelligent transport systems (ITS) as crucial to cleaner, safer, transport systems in Europe. It was adopted in 2010 to accelerate the deployment of new transport technologies across the European Union. It is currently under revision and the impacts for MaaS in the region will be discussed further in Chapter 6 on data governance. The directive identifies ITS as crucial to cleaner, safer, transport systems in Europe. Member states are required to set up National Access Points to facilitate exchange of data that aids the interoperability of travel services across borders. The scope of National Access Point³ data collection and sharing is defined by four supplemental regulations adopted under Directive 2010/40/EU (EC, 2021^[22]):

Table 4. Regulations that define the scope of National Access Point data collection in the European Union

Commission Delegated Regulation (EU) No.	Regulation description
885/2013	the provision of information services for safe and secure parking places for trucks and commercial vehicles
886/2013	the provision, where possible, of road safety-related minimum universal traffic information free of charge to users
962/2015	the provision of EU-wide real-time traffic information services
2017/1926	the provision of EU-wide Multimodal Travel Information Services

ITS responsibilities in Belgium are shared between the three regions and federal government. The four parties signed a Cooperation Agreement for the Implementation of the ITS Directive 2010/40 EU in 2014 which created the *Belgian ITS Steering Committee* to co-ordinate efforts, exchange information, and align initiatives. The ITS vision in BCR centres around collecting data, analysing and detecting incidents, managing intelligent traffic systems, and better sharing information with users. Since 2014, the focus of most ICT improvements in BCR have been in the area of data collection with the installation of more than 500 cameras, and in centralised traffic control systems ((n.a.), 2017^[23]).

The Trans-European Transport Network Regulation

Regulation 1315/2013 provides guidelines for the development of a trans-European transport network (TEN-T Regulation). Adopted in 2013, it aims to foster economic and social cohesion and reduce regional disparities through integrated transport infrastructure development and policies on interoperability of rail, road safety and information technologies (DG MOVE, 2020^[24]). Belgium has completed the majority of its share of the TEN-T infrastructure network. As of 2016, 100% of high-speed rail connections and 99% of the road network were complete. Inland waterways and conventional rail network were 87% and 71% completed, respectively (DG MOVE, 2019^[15]).

The 2019 European Green Deal, introduced after the TEN-T Regulation, requires changes to TEN-T policies. It will be revised to assist a 90% reduction of CO₂ emissions by 2050. This will include greater emphasis and updates with respect to digitalisation, low or zero-emission vehicles, air pollution, infrastructure quality and automation. It is also expected to include new pricing approaches and collaboration with the energy and technology sectors. These will have implications for Belgium, and the BCR specifically, as it is expected to include greater emphasis on investment in urban transport nodes and multimodal transfer terminals with a focus on active mobility (DG MOVE, 2020^[24]). The revision process, which began in 2020, finished public consultation in May 2021 and has not yet been adopted at the time of writing (EC, 2020^[25]).

The transport user context

The BCR is home to 1.2 million people. As with many parts of Europe, the population is ageing, with the proportion of people aged over 55 years expected to increase further in the coming decades. Of the households in the region, 46% are single adult households, while 36% are families with children. In total 61% of households do not include children (IBSA, 2021^[19]).

Based on 2019 data, 31% of the population is below the at-risk-of-poverty threshold. On average, spending on transport makes up approximately 8% of all households' expenditure. Car ownership in BCR is much lower than the Belgian average: 53% of BCR households do not own a car, compared with the national Belgian average of 27% (IBSA, 2021^[19]).

There were approximately 741 000 jobs in the BCR in 2018. Of these, approximately half (48.4%) are held by commuters entering the BCR from neighbouring parts of Flanders and Wallonia. Conversely,

approximately 16% of employed BCR residents work outside of BCR in the two adjacent regions with two-thirds of these working in the Flanders region (Actiris.Brussels, 2019_[26]). This translates into roughly 375 000 people entering BCR for work, and approximately 82 000 travelling in the other direction (IBSA, 2021_[19]).

Getting around today – understanding current mobility patterns

In total, 46% of trips by BCR residents involve a car. The remaining trips are completed by walking (24%), urban public transport made up of metro, tram or bus (21%), cycling (4%), train (3%) and other modes (2%) (Service public fédéral Mobilité et Transports, 2019_[27]). Of the trips on foot, 68% are less than 2 km, while 46% of bicycle trips are between 2-5 km. One-third of car and public transport trips are also between 2-5 km (Brussels Mobility, 2021_[7]). The region has seen growth in trips on the STIB-MIVB public transport network, and significant increases in cycling between 2009 and 2019 (IBSA, 2021_[19]).

Walking is the most popular option for trips inside the BCR, accounting for 35% of the total internal trips. Urban public transport is the choice for 28% of trips. Cycling makes up 5% (Service public fédéral Mobilité et Transports, 2019_[27]). Approximately 30% are completed by car, with 7-9% as a passenger, and 21-24% as the driver (Brussels Mobility, 2021_[7]; Service public fédéral Mobilité et Transports, 2019_[27]).

Trips between BCR and surrounding regions make up the remaining one-third of trips by residents and rely much more on car and train travel. More than two-thirds of trips between BCR and Wallonia involve a car and 28% are by train. Exchange between BCR and Flanders includes slightly higher train shares of 34%, but car use still makes up 58% of trips (Service public fédéral Mobilité et Transports, 2019_[27]).

The Covid-19 pandemic affected travel quite significantly in European metropolitan regions with the rise in teleworking, apprehension around shared and mass transport, and a rise in active travel. According to an online survey of 2 000 Belgians conducted in November and December 2020, workers and students expect to go to work/school/university less than five days a week after the pandemic; there is expectation that at least a minimum level of teleworking will continue. A similar amount of people expressed the intention to use their car more as those that responded they would use their car less after the pandemic. Significantly, more people intend to walk and cycle more as their principal mode. While most people report that the pandemic will not change their future public transport use, a greater portion expressed a desire to use it “much less” than those who intend to use it “much more” (Service public fédéral Mobilité et Transports, 2021_[28]). As in other metropolitan areas, there is still considerable uncertainty with respect to the lasting impacts of the pandemic.

Several stakeholders interviewed for this report highlighted the importance of tackling mobility poverty in BCR. While public transport was said to have good spatial coverage, other modes such as micromobility (for example, free-floating shared bikes) were not considered to be evenly accessible across the BCR. According to a Belgian study conducted in the summer of 2020 after relaxation of the first Covid-19 lockdown in Belgium, several profiles of mobility poverty were identified, based on age, household location, physical health, income and car and bicycle ownership (Fransen et al., 2021_[29]). Each of these characteristics on their own is not linked to transport poverty, but together, they comprise different mobility poverty profiles. The report concludes that policy measures must be tailored to different profiles, as not all measures will be universally effective. The study highlighted the importance of public transport. One-in-five respondents cannot buy high quality food without using public transport, one-third of respondents are dependent on others if they do not use public transport and 30% rely on public transport more generally (Fransen et al., 2021_[29]).

The digital divide

As digital literacy becomes a necessity for everyday life, access (and lack of access) to the internet and devices can become a source of inequality. As of 2018, 84% of BCR households with at least one member between 16 and 74 years of age had a broadband internet connection. This is 29% higher than in 2010. In 2018, 81% of BCR residents used the internet for social media, 69% banked online and 63% participated in e-commerce (IBSA, 2019^[30]). A number of factors can describe the existing digital gap.

A 2017 study of the 19 municipalities of BCR found that a digital divide still exists, although it had narrowed, particularly in older population cohorts between 2010 and 2016. Those most at risk of exclusion were characterised by lower levels of education, those who are inactive in the economy, and older cohorts (Bonnetier et al., 2017^[31]). In 2019, a survey of digital skills among Belgians corroborated these findings (see Table 5). It found little difference overall between residents of BCR and the Belgian average. Men were only slightly more likely to report “more than basic” skills compared to women, though, when gender categories were disaggregated by age cohort or level of education, differences were slightly more discernible. Income also appeared to correlate to whether people reported “more than basic” skills (Statbel, 2021^[32]).

Table 5. Reported levels of digital skills in Belgium by socio economic characteristics

Characteristic of disaggregation (categories)	Proportion of people reporting “more than basic” overall digital skills
Total (all of Belgium)	34% of all Belgian residents
By region (Brussels, Flanders, Wallonia)	35% in Brussels, 36% in Flanders, 30% in Wallonia
Gender (women, men)	32% of women vs. 37% of men
Age (16-24, 25-34, 35-44, 45-54, 55-64, 65-74 years of age)	51% of 16-24 year olds vs. 9% of 65-74 year olds
Education level (low, average, high)	17% of people with a low level of education vs. 64% of people with a high level of education
Economic status (student, employed, self-employed, unemployed, inactive)	61% of students vs. 11% of inactive members
Income (four quartiles)	12% of people in the lowest income quartile vs. 50% of people in the highest income quartile

Note: Overall skills were determined based on a survey of information, communication, software and troubleshooting skills
Source: (Statbel, 2021^[32])

Young people are the cohort in the BCR to have the highest digital competencies, on average. However not all have access to these technologies. Social and economic status are some of the highest determinants of access. A study of access to digital technologies and the internet among young people in Brussels concluded that the occupational status and level of education of the parents influenced access. In addition, the digital divide was more marked for youth from immigrant families (Mertens and D’Haenens, 2010^[33]).

Given the spatial distribution of people in the region, and the concentration of households with similar socio-economic characteristics in certain neighbourhoods in the BCR, the issue of digital exclusion can also be a geographic one. This is especially relevant when considering the geographic nature of transport services and must be considered when planning, implementing and monitoring the impact of MaaS and the multimodal options offered.

3

Regulatory context for Mobility as a Service

Moves to develop Mobility as a Service (MaaS) are occurring in the context of large-scale changes in the direction of transport policy in general and in urban transport policy in particular. These changes are developing throughout Europe, in a range of other OECD countries, and beyond.

Access to private vehicles broadened substantially in the decades following the Second World War, as rising personal incomes led to rapidly increasing rates of car ownership. Governments responded by greatly increasing expenditure on road infrastructure. The new mobility opportunities offered then by car ownership and the associated infrastructure encouraged low-density settlement patterns, in part due to lower land prices at urban peripheries, resulting in the development of urban sprawl around large cities. This shift toward private vehicles and lower density settlement increasingly undermined the economics of public transport: from being essentially self-funding to increasingly reliant on public subsidies (ITF, 2020^[34]).

The continuation of these trends increased the negative external effects of mass reliance on private vehicles, which became major concerns for policy makers. These included the high costs of road crash-related fatalities and injuries, increasing congestion, which has limited the extent of agglomeration economies, and the health costs associated with air and noise pollution. In some cases, such as the health impacts of air and noise pollution, the size of these negative externalities has only relatively recently become fully understood. In addition, there has been an increasing focus on the need to urgently decarbonise transport. There is a rising consciousness of the need to address climate change and the benefit of reallocating scarce and valuable urban space to uses other than road transport infrastructure if significant modal shifts can be achieved (see (ITF, 2021^[35]) for further discussion on reversing car dependency).

A desire for more equitable accessibility standards are a further driving force for change. While access to private vehicles has become widespread, significant numbers of people continue to lack that access, whether for financial reasons, or by choice, or because age or disability prevents them driving. Continuous transport investment toward roads and car-related infrastructure has yielded increasingly inequitable outcomes, with widespread and substantial disparities in accessibility becoming increasingly apparent. In turn, this has led to an increasing focus on the need to ensure that minimum standards of accessibility are provided for all.

These factors have led most major cities in developed countries to adopt policies that are explicitly focused on encouraging modal shift away from the use of private vehicles and toward public and active transport. In Europe, this policy stance has been formalised in the concept of the Sustainable Urban Mobility Plan (SUMP), which was initially developed in France and subsequently adopted as a significant element of the European Commission's 2013 Urban Mobility Package (European Commission 2013). SUMP's constitute integrated strategies bringing together a range of policy responses in pursuit of the goals of more liveable cities with sustainable, low-carbon transport systems. The Good Move Plan is the Brussels-Capital Region's (BCR) (award-winning) SUMP (Brussels Regional Public Service, 2021^[36]).

The range of objectives which transport policy seeks to achieve has expanded significantly in recent decades, particularly in the urban context. This implies that numerous developments in the transport environment, as well as potential government interventions, are likely to have positive impacts on some transport policy objectives while posing challenges to the achievement of others. For example, there may be significant trade-offs between equity, efficiency and environmental objectives.

An increasingly important element of transport policy-making will therefore be to understand the nature and extent of these trade-offs and to formulate policy that serves the broad range of transport policy objectives as well as possible. This is likely to include accepting that some innovations in the transport ecosystem may have negative impacts on some policy objectives, which cannot effectively or efficiently be mitigated through direct intervention. In such cases the negative impacts will need to be offset in other contexts. While the impact of MaaS on sustainable urban mobility remains uncertain, this may potentially be an example of this dynamic, as discussed below.

New urban mobility and the promise of Mobility as a Service

The complexity of transport policy increased significantly with the introduction of a range of new, digitally enabled mobility options. These are both new vehicle types and new service offers based on existing vehicle types. Their common characteristics are that they depend on a combination of smartphone apps, global positioning technology (GPS) services and electronic payment facilities; they exploit real-time information and they are tailored to user needs (ITF, 2019^[37]).

However, while they share these important characteristics, new mobility services also differ widely in terms of the types of vehicles used and, consequently, have potentially very different implications for the achievement of sustainable urban mobility. Defining trends in the new mobility landscape to date include:

- the rise of ridesourcing, which has greatly expanded the use of taxi-like services across urban areas, as well as increasing the geographical availability of these services in some cities
- the rise of micromobility, including docked and free-floating bicycles, e-bikes and e-scooters
- the emergence of shared, on-demand mobility options, such as ridesharing and vanshare services

The direct and indirect impacts of many of these services on modal shift and sustainability have been the subject of significant research and discussion, yet a high level of uncertainty remains. For example, findings from different research on the growth of ridesourcing have variously found that it significantly increased congestion, had little overall impact, or even reduced congestion. Similarly, while several researchers have found that many micromobility journeys either substitute for walking, or else constitute induced travel demand, others highlight their actual or potential role in addressing first- and last-mile issues (ITF, 2019^[37]). The question of modal shift impact also has a medium-term dimension. As Conway, Salon and King (2018^[38]) note, ridesourcing can both “compete with transit for individual trips, while complementing transit as part of a low-car lifestyle”. That is, if the availability of ridesourcing leads to reduced levels of car ownership, those foregoing private vehicle ownership are likely to increase their use of both ridesourcing and public transport, and reduce total vehicle kilometres travelled.

Several broader factors also contribute to the uncertainty regarding new mobility’s overall impact on sustainable mobility. These include:

- whether the rapid demand shifts (e.g. from shared bicycles to e-bikes and scooters) that have characterised the early development of these markets will continue in coming years
- the uncertainty as to the impact of new technologies, notably the adoption of autonomous vehicles (AVs) on travel behaviours and, ultimately, on vehicle-kilometres travelled in inner urban areas

- the implications of the uncertain business models, and reliance of key actors on continued injections of venture capital, on the medium- to long-term viability of many new mobility options. This therefore creates uncertainty around their continued impact on urban travel behaviours
- the nature and extent of the interactions between the various new mobility offers in driving changes in overall travel behaviours, and the potential impact on health and environmental outcomes linked to this.

Consideration of the likely impact of MaaS on travel behaviours generally, and on sustainable urban mobility policies in particular, must take account of these broader trends in the mobility environment.

The principal value proposition of MaaS is based on information provision and on lowering search and transaction costs. The development of MaaS does not add to the range of available urban transport modes. It offers the potential to complete complex journeys in new ways through more efficient combinations of existing modes. However, its long-term viability is dependent on its ability to add sufficient value for travellers to enable one or more viable business models to develop. Whether, when and how this promise will be delivered remains to be seen.

MaaS has the potential to enhance the provision of equitable accessibility. It may improve accessibility for those who do not have access to, or choose not to use, cars by improving the integration and convenience of existing and emerging shared transport modes, and potentially reducing their costs. This potential contribution to important transport policy objectives suggests a potential case for government to actively support the development of MaaS, in the context of the uncertain viability of business models. Unanswered questions over the commercial viability of MaaS also suggest the need for a cautious approach to regulating the sector, since even relatively modest regulatory costs may significantly reduce mobility operators' ability to find and sustain their business model over time.

The policy dilemma raised by Mobility as a Service

Many governments are cautiously optimistic that MaaS can contribute positively to the achievement of SUMP objectives by increasing the attractiveness of a range of shared transport options. At the same time, there is concern that if MaaS develops in certain ways it may have a negative overall impact in this regard. This has created an understandable desire to exercise a strong “steering effect” over the development of MaaS from an early stage. This underlying view appears to be that early intervention, through shaping the regulatory and policy environment, is more likely to be effective in ensuring that MaaS contributes to sustainable mobility goals and that possible negative impacts on the use and/or the revenues of public transport authorities are averted.

However, questions over the potential economic viability of MaaS yield significant risks for such policies. The economics of the majority of the new mobility options appearing in urban contexts in recent years are both uncertain and rapidly evolving, with the long-term viability of most of these modes yet to be proven. If these modes are to constitute a significant part of a broad-based MaaS offer, similar uncertainty exists as to the viability of the MaaS model itself.

Even if a viable MaaS model can be identified, it is likely to require high volumes and exhibit low margins. Regulatory interventions that significantly inhibit market conduct and/or structure may prevent viable models emerging, while regulation that adds operating costs risks undermining otherwise viable models. The MaaS Alliance has recently argued that “As MaaS is still rapidly evolving, regulation and governance should facilitate this evolution and avoid any excessively strict and/or fixed schemes” (MaaS Alliance, 2021^[39]).

More broadly, European law, particularly in the competition area, is predicated on a presumption of open, pro-competitive markets, where new private actors seek to innovate and make new value offers to

consumers. Regulatory interventions should therefore be undertaken only in response to clear and significant market failures, which cannot be addressed by less intrusive means. This argues against the adoption of new regulation that seeks to shape the development of the market, in advance of significant market activity being undertaken and actual market dynamics being studied in detail and well understood.

Government should take a generally cautious approach to regulating MaaS, with initial interventions being focused on establishing pro-competitive rules that aim to facilitate its development. A particularly important issue in this context will be the establishment of clear standards to govern interactions between the key market actors – notably between mobility operators and MaaS providers, as well as among MaaS providers. Provisions relating to data exchange between the actors may be early requirements, as may rules governing contracting between actors.

Key facets of Mobility as a Service governance

Several aspects need to be considered holistically to achieve effective governance of the MaaS and mobility environment. These can be roughly divided into three governance domains that build on each other:

- governance of transport services: planning, facilitation and regulation of transport services (
- managing mobility outcomes: policy, system planning and infrastructure governance (
- specific regulation for MaaS: facilitation and regulation of integrated mobility information and reselling services.

The following introduces some of the main aspects and issues found in these governance domains that are relevant to the governance of MaaS.

Governance of transport services

Many cities and regions consider parts of the mobility system as a utility that should be subsidised as needed to ensure societal objectives in relation to mobility and connectivity are met. Public transport services in Europe operate in this context more often than not. If MaaS is able to deliver on expected accessibility and sustainability outcomes but cannot materialise these benefits because of a lack of commercial viability, a public sector service or subsidisation of privately provided MaaS services may be justified.

Transport service governance needs to consider the regulation of services and market conditions, as well as the ability to integrate transport services into multimodal offerings. It is important to understand and address potential conflicts between mobility service providers' commercial motives and the city's or region's development goals. Issues falling into this category that have been identified in particular in relation to new micromobility services include:

- over-commercialisation of public space with for-profit vehicle fleets, regardless of their effectiveness for the transport system
- differing geographic uptake of services, which are often found in affluent and central city areas, generally well served already, rather than contributing to solving the transport supply issues in underserved communities.

The issues in relation to public transport differ significantly. A city or region might want to ensure that all public transport services in its jurisdiction are eventually integrated into multimodal offerings. The underlying aim would be to achieve the greatest system efficiency and service coverage, as well as the most efficient use of infrastructure and public space. However, a lack of trust in a market that contains

both commercial and public operators is currently preventing many public transport operators from opening their product portfolios to multimodal MaaS providers.

This stems from the often-considerable need for investment by mobility operators in the systems required to participate in the market, and a lack of understanding of the impact of multimodal integration on a mobility operator's business. Mobility operators may fear such market deficiencies as network effects, predatory market share strategies and eventual power asymmetries, as witnessed in sectors like social media or e-commerce. They are thus hesitant in their approach to MaaS integration, or want to become the integrators themselves. This risks creating a landscape of mutually exclusive, vertically integrated multimodal mobility ecosystems that operate as competing walled gardens⁴, each requiring their respective share of public infrastructure.

Managing mobility outcomes – policy, system, and infrastructure planning

There is a risk that MaaS may conflict with some policy objectives. This might be the case if, for example, the adoption of MaaS results in journeys currently undertaken with more sustainable modes (e.g. well-used public transport, active mobility) are substituted with less-sustainable transport solutions (e.g. taxi, ridesourcing, carsharing, powered micromobility), or if additional less-sustainable journeys are induced. If MaaS yields negative sustainability outcomes, appropriate levers must be available to public authorities to address the negative impacts.

The regulation of access to infrastructure and the associated pricing and rules for its usage (for example tolls, parking fees, short-term parking rules and urban vehicle access regulations (UVARs)) allow a certain degree of internalisation of the external cost of the use of private car fleets. Thus, there is an indirect relationship between MaaS effectiveness and infrastructure management, which can contribute to making sustainable modes more appealing than the private car. This would improve the competitiveness of MaaS products based on public transport and shared fleets of vehicles compared to private car ownership. Public authorities also regulate how available street space is distributed amongst various activities and how it may be used by various transport modes. This management by public authorities is especially impactful in urban areas where public space is an acutely scarce resource and thus directly influences visibility, usability and effectiveness of sustainable modes.

Access to street space, or a provision of designated infrastructure, forms the basis for the production of various transport services. These services, in turn, are the modular building blocks of a MaaS offer. This includes provision of infrastructure such as taxi ranks and pick-up/drop-off zones for ridesourcing services, preferred parking for carsharing and designated parking zones for shared bikes and e-scooters. Without such access to public space and infrastructure, transport services cannot operate or be integrated into a MaaS offer, therefore the governance of access to infrastructure forms an integral element for MaaS governance. The governance of access to infrastructure can thus be employed as an effective lever to regulate market access for transport services, ensure services in the market are effective and ensure that services can be integrated into the MaaS ecosystem by making the openness needed for MaaS a prerequisite for the use of the infrastructure.

Specific regulation for Mobility as a Service

The MaaS market for digitally-enabled, integrated-mobility information and reselling services, may show similar natural deficiencies as witnessed in other digital services markets. In markets where network effects apply, market share-driven strategies can obscure the actual business model and commercial viability of actors. It remains questionable whether every MaaS service would produce sustainable mobility outcomes on its own, given that the most sustainable modes – walking, cycling and public transport – are either free or very low-margin, often subsidised, services. The potential misalignment of a region's

sustainable mobility goals and the commercial interests of mobility integrators needs to be identified and addressed by the appropriate policy interventions.

The degree of openness and competition in the market for integrated, multimodal mobility services will influence which actors become involved. A variety of established transport sector stakeholders from the public and private sector are expected to be interested in becoming MaaS providers. Additionally, new entrants and actors from other sectors, especially sectors with strong digital footprints or sectors inducing high volumes of travel demand, may have an interest in establishing themselves as a MaaS provider.

Effective MaaS governance, thus, needs to ensure sustainable and fair market development and data governance while maintaining the openness that allows for innovation. The particular challenge is to achieve these outcomes without yet having a full understanding of the business case behind MaaS and its actual modal shift potential.

Regulating Mobility as a Service

This report focuses on what regulation is required in order to enable MaaS to function effectively and in a manner that is consistent with public policy objectives. Such regulation is likely to be needed to address:

- Data issues, including the establishment of data sharing requirements and limits, data formats and technical standards
- Ensuring competitive neutrality principles are respected in the contracting relationships between mobility operators and MaaS providers, particularly where mobility operators initially take a leading role in becoming MaaS providers, as MaaS evolves;
- Aspects of the relationship between MaaS providers and consumers.

Importantly, this report highlights areas in which regulatory intervention is likely to be counter-productive, or where public policy objectives may be better served through other types of intervention. In particular, the question of how to ensure that sustainable urban mobility objectives can be achieved in the context of large-scale MaaS adoption is considered from this perspective.

The approach adopted to developing a regulatory structure for the evolving MaaS ecosystem should reflect best practice principles for regulatory policy and governance. The OECD has elaborated a set of widely accepted principles in these areas (OECD, 2005^[40]; OECD, 2012^[41]) Key elements include:

- integrating Regulatory Impact Assessment (RIA) into the early stages of the policy process for the formulation of new regulatory proposals
- clearly identifying policy goals, and evaluating if regulation is necessary and, if so, how it can be most effective and efficient in achieving those goals
- considering means other than regulation and identifying the trade-offs between the different approaches to achieve the desired outcomes, which can be analysed to identify the most appropriate
- designing economic regulations to stimulate competition and efficiency, and eliminating them in all cases except those where clear evidence demonstrates that they are the best way to serve broad public interests
- better integrating the consideration of market openness principles within the design and implementation of regulations and the conduct of RIAs.

The broad purpose of these best practice principles is to ensure that regulation is only adopted when it gives rise to a net benefit to society. Also that regulatory options and other potential policy interventions are identified and compared rigorously to ensure the option conferring the greatest net benefit is adopted.

The better regulation agenda of the European Commission also incorporates these broad principles and objectives. They form the basis of the analysis of regulatory issues contained in this report and are referenced as relevant. Consideration of the regulatory issues arising from MaaS should also be informed by the fundamental principles of competition policy and the competition laws of the European Union.

Discussion of the regulation of MaaS should also distinguish clearly between the regulation of mobility operators and of MaaS providers. The operations of mobility service operators are already subject to significant bodies of regulation, addressing safety performance, consumer protection and other key objectives. The regulation of mobility operators is largely mode specific, reflecting the fact that the specific policy issues that arise can differ substantially between modes. The need for such regulation is largely unaffected by the development of a MaaS market, since the adoption of MaaS does not add new mobility services; rather, as noted above, it simply facilitates access to, and combines different mobility services to complete journeys.

Aspects of digital markets to consider in the data governance framework

MaaS is digitally enabled and delivered via digital distribution channels – in particular, via the intermediation of digital actors through their platforms. In the context of digital markets, “platform” refers to the means by which the goods and services of multiple suppliers are brought together into one place, and its accompanying consumer-facing interface. The increasing digitalisation of mobility, as in other domains, has enabled new services, expanded value creation and improved consumer outcomes. It also provides new opportunities for public authorities to engage with market actors in order to deliver on public policy goals.

Digital markets, however, introduce new challenges and require increased scrutiny due to potential harms that may arise in the absence of effective or adapted regulatory frameworks. The very nature of the dematerialised digital economy will give rise to dominant providers and ecosystems that may abuse their position to thwart competition and seek market outcomes in their favour (Cremer, de Montjoye and Schweitzer, 2019^[42]). These risks are especially relevant for fully digital “pure players” such as digital media distribution or social media platforms – but they are also relevant for platforms that have links to physical markets such as e-shopping platforms and platform-mediated mobility services.

There are three overarching characteristics of the digital economy that challenge the application of existing competition policy; extreme returns to scale, network externalities and the central role of data:

Extreme returns to scale. The production cost of digital services is much less than proportional to the number of customers served. While this aspect is not novel as such (bigger factories or retailers are often more efficient than smaller ones), the digital world pushes it to the extreme and this can result in a significant competitive advantage for incumbents and a barrier for new entrants.

Network externalities. The convenience of using a technology or a service increases with the number of users that adopt it. Consequently, it is not enough for a new entrant to offer better quality and/or a lower price than the incumbent does; it also has to convince users of the incumbent to co-ordinate their migration to its own services. Network effects could thus prevent a superior provider from displacing an established incumbent. The size of this “incumbency advantage” depends on a number of factors, including the possibility of multi-homing, data portability, and data interoperability.

The role of data. The evolution of technology has made it possible for companies to collect, store, and use large amounts of data. Data is not only one of the key ingredients of Artificial Intelligence but also a crucial input to many online services, production processes, and logistics. Therefore,

the ability to use data to develop new, innovative services and products is a competitive parameter whose relevance will continue to increase.

Source: (Cremer, de Montjoye and Schweitzer, 2019^[42])

Combining these three aspects lead to the emergence of extreme “economies of scope” which underpin ecosystems that favour early movers and incumbents and prevent other market actors from competing. The emergence of two-sided or multi-sided digital platforms raises the question of how pro-competitive outcomes can be ensured in an environment where strong network externalities and returns to scale may preclude the emergence of rival platforms. This may be the case of an early MaaS provider who, by rapidly deploying at scale, becomes difficult to dislodge. This risk may be exacerbated if the MaaS provider is also a strong mobility operator and can exclude or downgrade other mobility operator offers in the MaaS offer. This specific risk underscores the importance of ensuring, as far as possible, that the feasibility of multi-homing and switching is maintained, particularly by supporting data portability and interoperability to bolster competition “for” the market. These remedies are discussed further in Chapter 6.

Case law or regulation can address these risks and challenges. Both approaches will likely remain relevant in digital markets. Some of the main risks inherent in digital markets relate to competition outcomes and their impacts on consumer welfare. Competition law still serves as the preferred “background” regime framing digital market competition policy in the EU and thus, in Belgium and in the BCR. Continued reliance on competition law as the preferred regime is especially the case for limiting the potential for abuse by dominant market actors as set out in Article 102 of the Treaty on the Functioning of the European Union (TFEU). Digital markets may also give rise to negative competition outcomes as a result of non-dominant market actors – this has been addressed via sector-specific regulation, as in the case of financial services, and is discussed in the context of MaaS in Chapter 6.

The shape of a well-functioning MaaS market

The MaaS Alliance is a public-private partnership working to establish the foundations for building a common approach to MaaS and unlocking the economies of scale needed to support the successful implementation and uptake of MaaS globally. Its recent “MaaS Market Playbook” (MaaS Alliance, 2021^[39]) identifies core characteristics of a well-functioning MaaS market. These are summarised below. Box 1 contains the checklist for evaluating the main characteristics of a well-functioning MaaS Market. The checklist “aim[s] to provide detailed information on how to support the development of an open and competitive MaaS market that delivers clear benefits to users, societies, and the environment” (p.4).

The **governance framework**, which is often designed and applied at a local or regional level, should ensure that MaaS services:

- deliver on the societal goals for MaaS
- provide user-centric value propositions
- enhance the (economic) viability of the ecosystem.

It should support an open ecosystem by establishing parameters for boosting the co-existence of different solutions and business models. It should also be developed in collaboration with the public and private sectors, including market newcomers, and always keep the end-users in mind.

The **societal goals** identified are **connectivity, accessibility, equity, and environmental benefits**. Thus, there is a clear focus on providing an enhanced transport system, which equitably increases accessibility, while also contributing to sustainable mobility policies.

Regulation should establish the preconditions for developing an open ecosystem of data sharing, integrated services, and fair competition. The Playbook notes that regulation is often developed and

implemented nationally or internationally but may also occur at regional or local level. Regulation must establish a clear framework to facilitate the development of the industry and create a predictable environment for public and private sector investments, as well as guaranteeing user rights. Regulation also has the function of addressing negative market externalities such as congestion, noise and pollution.

Box 1. Checklist for evaluating the main characteristics of a well-functioning MaaS market

1. Widespread availability of data

- access to high-quality and accurate data to ensure fair competition
- existence of standardised data sets and protocols
- endorsement of “Open by default” and “Interoperability by design” approaches
- data reciprocity and incentives for data exchange

2. Ease of market entry and exit

- access to market (new mobility services)
- access to integration and resale of services
- non-discriminatory subsidy, incentive, and taxation systems that are aligned with policy objectives
- ability to switch between different service providers (personal + non-personal data portability)
- inclusivity in terms of modes/services

3. Existence of business opportunities

- user buy-in and willingness-to-pay
- incentives for innovation
- commercial viability
- supportive comprehensive policy framework (flanking policies)
- funding available for investments

4. Added-value of partnerships

- trust and equity among market actors
- balance in roles and responsibilities

5. Absence of antitrust issues and abuses of dominance

- competition between MaaS providers
- no gatekeepers in data, service, or integration layers
- roaming between services and local ecosystems

6. Achievement of public interest objectives

- inclusivity
- affordability
- equity
- less emissions
- less pollution
- less congestion
- less accidents

Source: MaaS Alliance (2021^[39]) *MaaS Market Playbook*

Skillset and organisational considerations for managing Mobility as a Service

Digital mobility presents new challenges for transport authorities, who, up to now, have been primarily focused on the regulation and management of physical activities and infrastructure. This broadening of their remit may necessitate updating and diversifying their teams' skillsets to oversee digitally enabled services and business models. Improving digital literacy can also enable the public sector to nurture the immense possibilities of a digitalised mobility system in delivering agreed public policy objectives.

Brussels Mobility appears to have taken a flexible approach to address the skillsets and resource capacity required for their MaaS project so far. For example, they have partnered with Le Centre d'Informatique pour la Région Bruxelloise (CIRB). This regional administration provides support for technology development in the Brussels-Capital Region's public bodies. The partnership focuses on the development of a "data lake"⁵, as there is a resource gap within the authority for this element of the system. Uncertainty of the business models that will prove viable for MaaS now makes it difficult to define what key knowledge profiles will be needed in Brussels Mobility in the longer term. However, the following competencies and skills are likely to be needed by local governments and transport authorities.

Enhanced digital literacy: The authorities themselves may not produce a MaaS platform (although they may equally choose to) but they must have team members who understand the digital elements of MaaS and of integrating multiple services and providing a selection of choices to users. These team members can help authorities recognise the technologies' power and potential and be alert to its risks. The regulation of routing algorithms provides a good example: authorities will not necessarily have to programme routing algorithms in-house, although some authorities may choose to do so. However, authorities will need to understand these algorithms, their principles and biases, and how travel surveys and other sources of data will need to be used to correct for biases.

Capacity to take advantage of new MaaS data: The advent of MaaS will bring new data sources that are reported to the authorities by the various actors in the MaaS market. Authorities will need to be able to process and analyse the data, inferring useful insights for network and service planning, and to inform future policies, to make the most of these new data. They will also need to have the capacity to act quickly on this data to correct any market failures or guide outcomes towards policy objectives. Brussels Mobility has a data analysis team to carry out its existing remit. This team is responsible for analysing data inputs (ridership, for example), development of key performance indicators (KPIs) for monitoring, enforcement, and data-led evaluation of applications for licences. As described in Chapter 2, from October 2019 to March 2021 a trial was also conducted by Brussels Mobility to try working with a third-party data analysis platform for micromobility data.

Commercial mind-set: It would be helpful for authorities to understand the perspectives of the various actors in the market, including those in the private sector and start-ups. This insight would support collaboration with those actors and anticipating how they may act in the market. This understanding is especially important for interactions with technology start-ups, which may not necessarily have a background in urban mobility and are not always aware of transport market dependencies. Staff with appropriate experience can be a valuable link between the traditional planning-based public sector and the trial-based digital business community.

Collaboration: Authorities need to define policy and mobility goals in a way that encourages the wider transport community to contribute their part fully. This engagement will be important for creating a MaaS ecosystem that contributes to the sustainability goals for MaaS in the Brussels-Capital Region. As outlined in Chapter 2, the Good Partnerships component of the Good Move plan recognises the importance of broad stakeholder collaboration.

4 Stakeholder perspectives in the Brussels-Capital Region

The development and implementation of innovative mobility solutions involves a diverse range of stakeholders. These include, among others, public institutions, Mobility as a Service (MaaS) providers, mobility operators and data aggregators. This chapter discusses the perspectives of the stakeholders identified by Brussels Mobility, as shared through targeted interviews, online survey and workshops conducted for the project. The chapter only reports the concerns and aspirations discussed by the stakeholders. Wider discussion of these topics as they pertain to the recommendations in this report is included in subsequent chapters.

In addition to the **public institutions** that are responsible for administering transport in the Brussels-Capital Region (BCR), Brussels has a wide range of **mobility operators** including public transport operators, and private operators of dockless bikesharing, e-scooter sharing, carsharing and ridehailing. The availability of these mobility options is conducive to a more diverse and attractive MaaS ecosystem from the consumer perspective. Brussels also has several **mobility associations** including non-profit advocacy organisations, non-profit community groups and public-private partnership groups that seek to accelerate the transition to sustainable mobility in the BCR.

MaaS providers, including route planners have also emerged in the city under the current regulations. They combine the services of individual transport operators, both public and private. There are also **data aggregators**, which collect and process mobility data in order to offer products and services that enable integration and collaboration between cities and connected transportation services. They also collect, process and offer access to demographic, operational, ridership, origin-destination data, and other custom datasets that allow for geospatial modelling, policy management, tracking, monitoring, etc.

Topics discussed with stakeholders included broader questions on the vision for MaaS, the challenges and opportunities foreseen, specific issues on data governance, ticketing, and how stakeholders envision the market structure for the MaaS ecosystem developing in the BCR. The stakeholders consulted represented all of the categories described above. The stakeholders referred to in this chapter are specifically those that participated in the consultation process. This section summarises the findings and lays out the different perspectives on the issues identified by the International Transport Forum.

Visions for the configuration of Mobility as a Service

Several stakeholders emphasised that the minimum viable configuration for MaaS should include multiple modes and have the option to plan, book and pay within the product developed, as opposed to solely being a route planner. Participants stressed that both public and private transport services must be available, including shared mobility options. The need to safeguard the ecosystem against monopolistic tendencies with respect to services and offers as well as data regulation was highlighted.

Replacing private cars should become attractive and convenient, both in terms of reliability of services as well as cost and should fulfil the majority of the mobility needs that a user might have in a one-stop shop. The MaaS ecosystem should not crowd out small local actors and new entrants. In the longer term, MaaS must contribute to a decline in use, and potentially ownership of cars. This outcome would be supported by incentivising active travel modes and dis-incentivising private cars through measures such as the kilometre charge and higher parking prices, for example. Participants recognised that MaaS should be viewed as one of the measures that can help in the shift towards sustainable mobility; it will need to be supplemented with other measures simultaneously.

Stakeholders had varied views on what the immediate next steps for the authorities should be in progressing MaaS. Many considered that gaining clarity on data standards is crucial. There is also a need to get all relevant actors around the table, to get their buy-in and ensure that the vision of MaaS in the region is shared and understood by those involved.

Perspectives on governance of the MaaS ecosystem

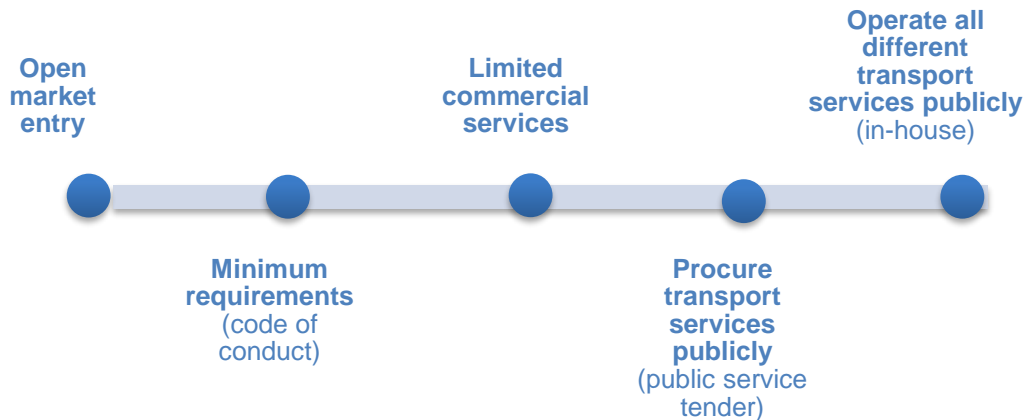
A MaaS ecosystem that is regulated by the public sector garnered support among some stakeholders. Not necessarily by the public transport operator as regulator, but by the Region or other public bodies such as the transport authority. The majority felt that this might be a better approach as it is the public authorities that design, plan and manage transport infrastructure. It was noted that while the MaaS ordinance is being drafted, spontaneous development of the MaaS ecosystem is already underway in the region. The downside of this development was considered to be that there is currently no vision of what this ecosystem should look like and who is responsible for what.

Stakeholders raised the multimodality aims of the European Commission's Smart and Sustainable Mobility Strategy as context for the development of MaaS. The strategy outlines transition targets for the transport sector for 2030, 2035 and 2050 (European Commission, 2020^[43]), of which multimodality and MaaS form an important part. It includes exploring ways of enhancing access to dynamic data and potentially a standardised interface for MaaS. It would act as a technical arm for multimodal digital mobility services (and for long distance train tickets as well). Furthermore, the revised ITS directive of the European Commission will also look at horizontal technology layers of digital services, multimodal services, and data-sharing, specifically with regard to GDPR provisions (Digital Europe, 2021^[44]). It will potentially also tackle the issue of transparency in the ranking of different options in the app and on accessibility of information. Both the Smart and Sustainable Mobility Strategy and the revised ITS Directive can act as guidelines for the development of MaaS. The most appropriate regulatory approach is discussed in Chapter 5 of this report, with the recommendations presented in Chapter 8.

Principles of regulation for market entry of transport services

A discussion was held on how to manage the market entry of the constituent transport services that make up MaaS. The range of options illustrated in Figure 2 were presented to the participants.

Figure 2 The range of possible options for regulating market entry of transport services



An incremental approach to regulation was agreed to be appropriate, as there is not enough known about MaaS at present to define detailed regulations. The approach discussed would see regulation progress from a light touch, based on instruments such as a Code of Practice, toward a more comprehensive set of market rules. If the participants' suggested approach were to be adopted for MaaS providers, there would not initially be a licensing system established for MaaS providers, but one could develop in the medium term. Most participants opted for an approach that was a combination of the minimum requirements and the licensed services approaches. Many participants, however, expressed concern about stability in the market if an open or solely code of conduct based system results in significant turnover. The potential considerations for licensing in MaaS governance is further discussed in Chapter 5.

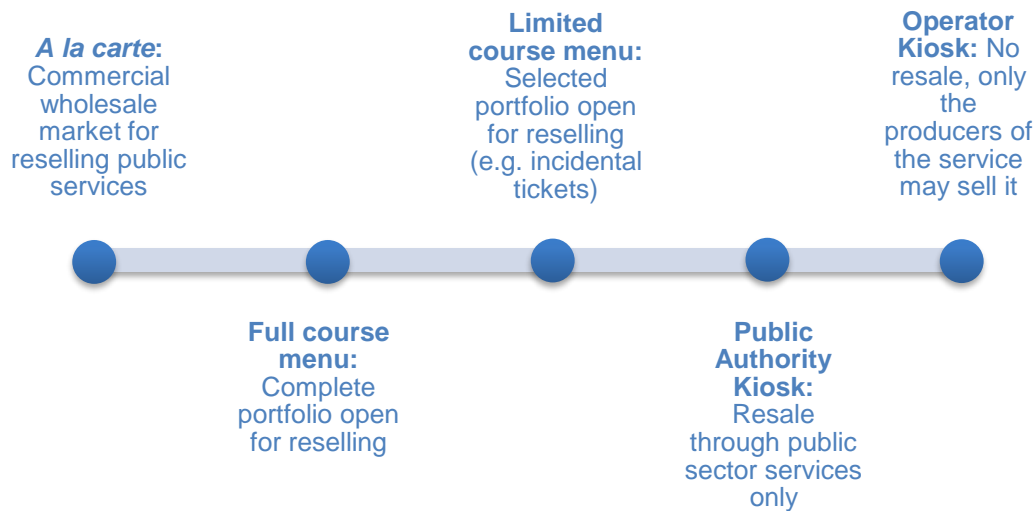
Participants expressed some difference of opinion in how the early phase should be handled in a progressive approach. Some felt that a code of conduct is not suitable as it provides an insufficient basis for the authority to intervene, should it need to. The need to protect and manage public space was a recurring point. Others argued that a licensing system could stifle innovation. Ideally, some form of agreement that is lighter touch than a licence, to allow for innovation, but that establishes more scope than a code of conduct for the authority to intervene is required. This form of agreement would allow for intervention in narrow areas of network management and service operation. The point was also made that MaaS is an area that attracts small local and start-up companies, which could struggle with overly stringent market entry thresholds. The San Francisco Proof of Concept Agreement (POCA) was highlighted as an example of a framework that allowed a period of operation under lighter permitting conditions before there is a need to obtain a licence (San Francisco Municipal Transportation Authority, 2019^[45]).

Stakeholders generally agreed that the conditions for market entry and the regulatory thresholds / frameworks that apply should be clearly articulated at the outset, so actors can easily understand the requirements that apply to them. Many also believed that regulation should be clearly pro-competitive in its approach, to ensure that it facilitates the development of an efficient market in a context of emerging and poorly understood business models.

Resale of public transport services, subsidies and financial viability

A range of approaches to making public transport services available through MaaS were presented to workshop participants. These are shown in Figure 3.

Figure 3 The range of possible approaches for the resale of publicly produced services



Some stakeholders suggested that, given the stated desire to have public transport as the backbone to MaaS, limiting resale to just the service providers or their select agents could be undesirable. There was general agreement that third parties should be able to sell public transport services. Participants noted that a market that is open would provide the best value for users, and thus might be the best market for businesses.

A clear difference was visible in the desired starting points for this evolution. Some stakeholders preferred to start with a limited offering of tariffs, while others leaned more towards the full course menu option from the outset. Generally, however, most participants envisaged a movement towards a greater range of products as the market was established. They expressed the view that to create truly integrated new mobility packages, the *à la carte* option would be needed, although it was considered to be viable only in the longer term. In relation to monthly / yearly passes, some made the point that people travelling on a single mode may be more inclined to stick with their existing pass and may not see a value in a broader MaaS subscription for the same period.

Any move towards the *à la carte* option would need to be incremental. Participants suggested that barriers currently existed to selling (and accounting for) public transport on a volume basis in terms of kilometres, or trips outside of the current ticket and subscription-based offers. The move towards more options could be developed as the MaaS ecosystem matures and as a greater understanding of whether MaaS can grow the pool of public transport users emerges.

The MaaS discussion prompted concerns in some quarters that commercial operators could make a profit off publicly subsidised services, but also that incumbent (and subsidised) PTOs could leverage market position to the detriment of other operators. They are subsidised to provide the services that other operators do not, and removing subsidies entirely would risk undermining public service. This discussion focused on stakeholders' perceptions of a fair way to manage subsidy in a MaaS ecosystem. This is discussed in more detail in Chapter 5 of this report.

The discussion also addressed where value can be found in the market. Participants repeatedly noted that there is, as yet, no clear business model for MaaS. Participants raised that the margins in transport are already tight and public transport is subsidised with public money, hence there is no clear arrangement that could allow MaaS providers to have a viable business at no extra cost to public authorities. Some noted that while there is a clear business case for business-to-business (B2B) as they charge a fee,

business-to-consumer (B2C) providers are still struggling to find a sustainable business model. Integration of the underlying sustainability vision of MaaS with a viable business model is also a challenge.

The availability of discounts or commissions was also raised. Some participants suggested a structured approach. For example, set commissions or discount rates would enable authorities to encourage certain behaviours (for example off-peak travel). It was pointed out, however, that commission on resale can be a constraint as it is often too low to cover the costs. For this reason, some MaaS providers choose not to actively promote MaaS with the B2C end-users because they are a loss-making target group since they do not want to pay extra for the MaaS service.

Fair margins are needed in the short term to enable a MaaS business model that promotes public transport to B2C users. Alternatively, the ability of public transport operators (or authorities) to set the conditions for resale of their tickets through agreements was suggested as a way forward in the future, by some contributors.

A public service obligation (PSO) ensures high quality and reliable service from public transport operators. Public transport functions under PSOs to ensure that equitable and high-quality accessibility is maintained in the region. Due to this, public transport operators are operating under a different and more constraining set of conditions than other market actors.

Some participants thought that including new forms of mobility under such obligations would be worth considering. The licences issued could include obligations on sharing of data, providing services in less economically viable areas like peripheral and rural areas, having round-the-clock service, etc. It is also important to keep in mind that there should be non-digital options still available. While licences currently do include similar conditions, enforcement was not considered strict enough.

The option for having subsidies allocated directly to the user was discussed as way for the existence of MaaS to influence the delivery of subsidies. Participants pointed out that if a user-centric approach is followed, it should mean providing the user with something like a mobility budget rather than a subsidy for a service across the board. In the end, some participants also mentioned that one approach could be to focus on raising the resale margin for MaaS providers to a point where it becomes attractive to launch their service in a B2C context. This could act as a basis for a viable open MaaS market that avoids the government cherry picking some providers over others via subsidies.

Core considerations for the market structure

Discussions on the market structure of the MaaS ecosystem included the type of organisational model that could be adopted for the MaaS market, the regulation for market entry and resale of public service, to name a few. For the organisational model of the MaaS market, options ranged from having a commercial market, a MaaS system operated by a public body as a public utility, or a hybrid of the two. Participants expressed concern that adopting a model based on a single public utility MaaS provider would undermine the potential for private MaaS providers to bring innovation to the market through competition. An appropriately managed hybrid market could satisfy the needs of many discussants. Some participants, however, expressed concern that a potential conflict of interest may emerge if there is not a clear functional separation between the PTA and public transport operators.

The participation of the public authority directly or indirectly (through a delegated entity) in the MaaS provider market should not be prevented by market regulation. However, it should be possible that such participation may not be enacted or may be phased out based on the outcomes delivered by other market actors.

In terms of the approach to regulation adopted by the public authority, most responses ranged between a light steer and anticipatory regulation. Several discussants saw the potential for a progressive transition as the MaaS system matures and as business models become more stable and better understood. Adapting regulation incrementally would allow for potential market failures requiring intervention to be identified, assessed and addressed. Engagement among actors in the market to understand what does and does not work is important. Monitoring would be needed to understand the market better and know whether certain public goals are being met.

Participants noted that some differentiation may be appropriate depending on the size and nature of different actors, although differentiation is always complex. Some level of regulation to ensure that smaller actors have access to facilities and hubs will be required. Some suggested that new rules should only be introduced beyond existing regulations where they were needed to enable MaaS.

Other concerns raised by participants related to business viability of mobility operators:

- too many operators in an open market would make it unviable for operators, especially if some actors are more highly financed than others
- a hybrid market could result in commercial MaaS providers selling discounted public transport tickets or alternative modes to users that would otherwise be able to pay a full fare, while the public MaaS provider is left to service the journeys or areas that commercial operators perceive to be unprofitable

Concerns and hurdles identified by stakeholders

A MaaS ecosystem is not possible without the participation of mobility operators. In the stakeholder discussions, a well-integrated offer that combines planning, booking and payment was seen as fundamental to making the MaaS offer attractive to users. To achieve deep integration, the need for trust, clarity and opportunities for all participants emerged as paramount in the discussions. Addressing these concerns will be important to attract mobility operators to participate in the MaaS market. The recommendations in the following chapter address these issues.

There is currently a lack of trust between parties. Part of this is due to ambiguity when it comes to regulatory, fare and ticketing, and data sharing frameworks. Many MaaS pilots have also identified the need for trust as one of the key success factors (Hensher et al., 2021^[46]; Huynh, 2020^[47]). Stakeholders favour an independent regulatory body, rather than a public mobility operator, to manage MaaS. Such a body can prevent monopolies and ensure large incumbents do not block smaller actors from entering the market. This is especially relevant when it comes to developing a data governance framework. Smaller actors may need additional support to comply with all the data regulations if they are to participate in the market.

The lack of trust regarding ticketing and fares is partly due to the current lack of clarity as to how these might be structured and how relevant operators would be compensated. For payments, Berlin's MaaS app, Jelbi, relies on a third party Payment Service provider that charges users directly and then transfers the amount due to the mobility operators (Trafı, 2020^[48]). Neither the MaaS provider nor the public transport authority are involved in the payment process, which helps maintain objectivity.

When Jelbi was being developed, mobility operators were invited to express interest in participating, and there were around 25 formal requests. While some operators may be reluctant at first to allow users to access their services through a third party app, the Jelbi case highlights that many operators value deep integration and the ability it gives them to reach a wider customer base without extra advertising costs (Trafı, 2019^[49]). With the integration of multiple services working towards a similar goal, participants in the

workshops for this project also identified how communication and marketing could be streamlined since communication helps all participants.

Operators will be more likely to participate in the MaaS system if the policy and regulatory environment supports innovation, provides clear frameworks for data and fares, and creates conditions in which trust can develop between all actors. However, ultimately there must be a viable business case for MaaS. Pilot schemes are often too short and limited in scale to test business cases. Most studies conclude that profitability is based on scalability of the MaaS ecosystem (Lyons, Hammond and Mackay, 2019^[50]; Hensher et al., 2021^[46]; Sochor, 2021^[3]).

Participants considered that technological challenges were also significant. The fast pace of technological change challenges the ability for institutions to manage and regulate innovation. For public authorities, keeping up with the changes in technology and with the typically more agile private sector could be difficult to manage. Other potential challenges that came up in the initial discussions included:

- low level of mobility operator integration and hence, lower attractiveness of MaaS
- lack of physical infrastructure to ensure inter-operability of modes
- hesitance from public transport operators to be a part of MaaS
- Belgium's company car policy; the mobility budget is seen as a step in the right direction to tackle this.

The relative size of potential actors in the market was also discussed by participants. There are misalignments amongst the actors in terms of size as well as nature of their organisation. Large established players naturally dominate the market. Asymmetry also plays into issues related to data sharing and data standards. Some emphasised the need to provide smaller actors with tools that enable them to collectively negotiate with established, bigger actors.

Flanders' approach of making the stakeholders accountable for co-creating the framework for the MaaS ecosystem was seen as a good example. This helped them in engaging all stakeholders and in building more trust among the actors. It led to actors exchanging with each other and working on achieving mutually benefitting outcomes together. In some cases, an option might be to call in the Belgian Competition Authority to reconcile differences (e.g., when some operators are selectively opening up access to data or tickets/fares).

Box 2. Flemish MaaS framework

In the Flanders region of Belgium, MaaS policy is being co-developed by stakeholders of a Flemish MaaS agreement framework that will provide consistency across the region, but allow for flexibility in how it is implemented. The development of MaaS is being conducted under the Basic Accessibility Decree. This co-creation process started in collaboration with five MaaS stakeholder groups (users, MaaS providers, transport providers, local authorities and data brokers) that together form the core business of the MaaS ecosystem. The MaaS solution that develops in the BCR would need to interface with the system in Flanders. If the principles recommended in this report are adopted, then the BCR will have more direct and concrete requirements for the actors in the MaaS ecosystem. Co-operation agreements between BCR and Flanders would be needed to recognise the MaaS providers.

The stakeholders mapped out basic agreements in the first phase to create a Flemish MaaS agreement framework. These agreements are a starting point and form minimum quality requirements that the actors involved deem necessary to achieve more intensive co-operation. Importantly, these basic agreements always apply within all applicable current and future legislation(s). Recommendations are also made on financial aspects, supervision and further development of MaaS, bearing in mind the agreements on commitments from different actors and the findings from the stakeholder engagement process.

Basic agreements on commitments

- commitments of MaaS providers
- commitments of transport providers
- commitments of local authorities
- commitments of all actors

Recommendations

- financial aspects
- recognition and supervision
- further development Support MaaS

Source: (Departement Mobiliteit en Openbare Werken Vlaanderen, 2021^[51])

Principles of data governance for the MaaS ecosystem

When discussing principles of data access, portability and sharing in the MaaS ecosystem, concerns were raised about fragmentation in approaches across regions due to the lack of overarching regulation on data governance. Discussion occurred on which level of government should be primarily responsible for data governance. Naturally, if the BCR is enacting something that could fall under national / EU regulation then it will be subject to prevailing regulations at higher levels. There is tension between levels of government engaged in the regulation of MaaS. BCR has a detailed understanding of their market and implementation challenges, whereas EU level regulations would allow a degree of clarity and consistency for operators across different contexts within and outside of Belgium.

In the short term, the BCR would need to build an adaptive MaaS framework, to allow for updating as higher-level rules are developed or changed. The region should be prepared to adopt specific EU-wide

regulations when these come into play. Data governance is further discussed in Chapter 6 of this report, and the related recommendations are presented in Chapter 8.

MaaS interface and data access

Stakeholders discussed the features of front-end interfaces (customer-facing) and back-end (data access) of the MaaS ecosystem for the BCR. There was a general feeling that access-rights would be an important consideration for the back-office, regardless of private or public hosting of the data. Questions regarding data storage frameworks or open Application Programming Interfaces (APIs) were regarded as technical rather than policy issues, while issues of trust and oversight were seen as crucial elements. Most agreed that data sharing should always be under public oversight and rule-setting and that consensus should be sought regarding which data elements are made available to other vetted actors. For information needed in real-time for MaaS to operate, standardised, operator-housed application programming interfaces (APIs) could be the most functional way to proceed. There was consensus on having multiple apps, with several groups also agreeing with a potential “reference” app developed by the public sector that could be drawn on by other MaaS providers in the market. Such a “reference app” would ensure that elements that public authorities would want to see in the market are indeed offered (in this case in the public app). This might include a listing preference for more sustainable options in the user interface or potential in-app nudges to adopt more sustainable behaviours.

Data portability

Participants agreed that customer data portability should build on data portability requirements defined in the GDPR and that, importantly, users (data subjects) must have control of their data. Data portability should be built into the market (subject to GDPR), but the level of portability should be easily modifiable by the consumers themselves. Whatever framework is chosen, extended portability should be possible, within the remit of GDPR and user preference. Some business models include the added value of porting user identification and payment information across multiple services after a single registration. Some noted that data portability would enable users to change operators more easily. The discussion highlighted transparency as an essential factor. The customers must know who collects the data, for what purposes, who has access to it and received all the information listed in Article 13 or 14 of the GDPR. Data subjects should have the option not to share this data if they so desire.

The example given in the workshop was the cookies consent pop-up presented to users on websites in the EU (based on Directive 2009/136/EC). In the case of MaaS users would be provided with simple and straightforward choices regarding their preferences to share their data which would then be communicated across different operators. Even within extended data sharing, the data shared should be minimised to what is necessary to carry out specific MaaS-related tasks. For example, a driver’s licence does not need to be shared to purchase a train ticket and should not be required as proof of identity for using a vehicle that does not require a licence.

Data sharing, reporting and standardisation

Several approaches were presented to the stakeholders with respect to data sharing and data standards. The workshop discussions stressed the difference between data sharing between mobility operators and MaaS providers and their data reporting requirements to public authorities. Usually, public transport operators have more detailed and strict data reporting obligations than private operators. Discussions highlighted operators and public authorities’ need to prioritise agreement on data sharing and data reporting rules.

Participants highlighted that there is a general lack of standardisation in the data that is shared or reported. One approach to achieving standardisation could be choosing a standard and asking all actors to stick to it. However, there is the risk that dominant or well-funded actors might impose their own standard on the market. The discussion highlighted that while selecting one standard is good for levelling the field, it may also shut down innovation for alternative standards. Participants also noted that large, established actors and small local actors do not have the same capacity to adopt new standards. While large established actors have the resources to develop or adopt new standards, this is less the case for smaller and/or local actors. Providing assistance or resources to help smaller actors to adopt selected standards could be helpful.

Regarding standardisation for **data reporting to a public authority**, most participants settled on having a limited set of acceptable syntaxes or a reference syntax. Participants noted that this approach might be necessary since mobility operators may already employ bespoke, mode-specific standards and may face different reporting requirements. Such limited flexibility would make it easier for operators to make cost-effective investments in integration with different systems and reduce the resource load on public authorities processing the reported data. The ease of auditing data would improve if all data were of the same type and quality. Having an EU standard, or a set of functionally interoperable standards appropriate to each mode would allow working across different cities.

Participants also suggested that data syntax specifications should be time-bound – for example, relative to standard licence periods – to account for new developments and to avoid the risk of locking in an outdated standard. The language used in any framework agreement should reflect these shorter periods to avoid stifling development. Broader standardisation could also make it easier to update systems if they are starting from the same point.

Data sharing among market actors is important to stakeholders. For public transport operators especially, there is value in having client-data sharing agreements as more data sharing would help them understand the door-to-door journey of their clients. An area in which there were clear differences in opinion was voluntary data sharing between operators. Some stakeholders were certain that voluntary sharing would result in no data being shared. Others supported the idea of starting with voluntary sharing and then progressing towards mandatory sharing as necessary. Some supported extended sharing – as much as possible, to help come up with better solutions. The critical question here is what will be the impact of the different approaches on viable business models? Some expressed concern about the impact of too much mandated sharing on smaller operators or start-ups.

The discussions on data sharing and reciprocity were wide-ranging though reached no real consensus. Participants agreed that any mandated reciprocal sharing should be limited and developed over time. Some also suggested that different standards apply to different entities (based on whether they were public or private sector). Limiting the level of mandated reciprocity was argued for because stakeholders should be allowed to retain some bargaining tools and more complete reciprocity agreements could be negotiated bilaterally using the data they hold.

5 Regulatory framework

A sustainable, large-scale Mobility as a Service (MaaS) ecosystem is yet to evolve. Therefore, a key priority for potential market participants – whether mobility operators or MaaS providers – is to identify the strategic issues in the development of MaaS for their own business and frame their business models accordingly. A business model has value creation at its core. The choice of business model rests on how value can be created by networked firms/businesses so that value is created by a collection of firms and partners, along with wider stakeholders in the MaaS ecosystem, producing mobility for multiple users. Seelos and Mair (2007^[52]) define a business model in a way that is fitting for a MaaS ecosystem: “a set of capabilities that is configured to enable value creation consistent with either economic or social strategic objectives” (p.53).

Therefore, the business model encompasses the activities of firms/businesses, their network of partners and the value created collectively. This chapter focuses on identifying key elements of a pro-competitive regulatory framework that can enable and facilitate the development of a MaaS ecosystem. It also identifies critical issues that might lead governments to attempt to push or pull these actors in a particular direction to address conflicts between the emergent MaaS ecosystem and broader public policy objectives.

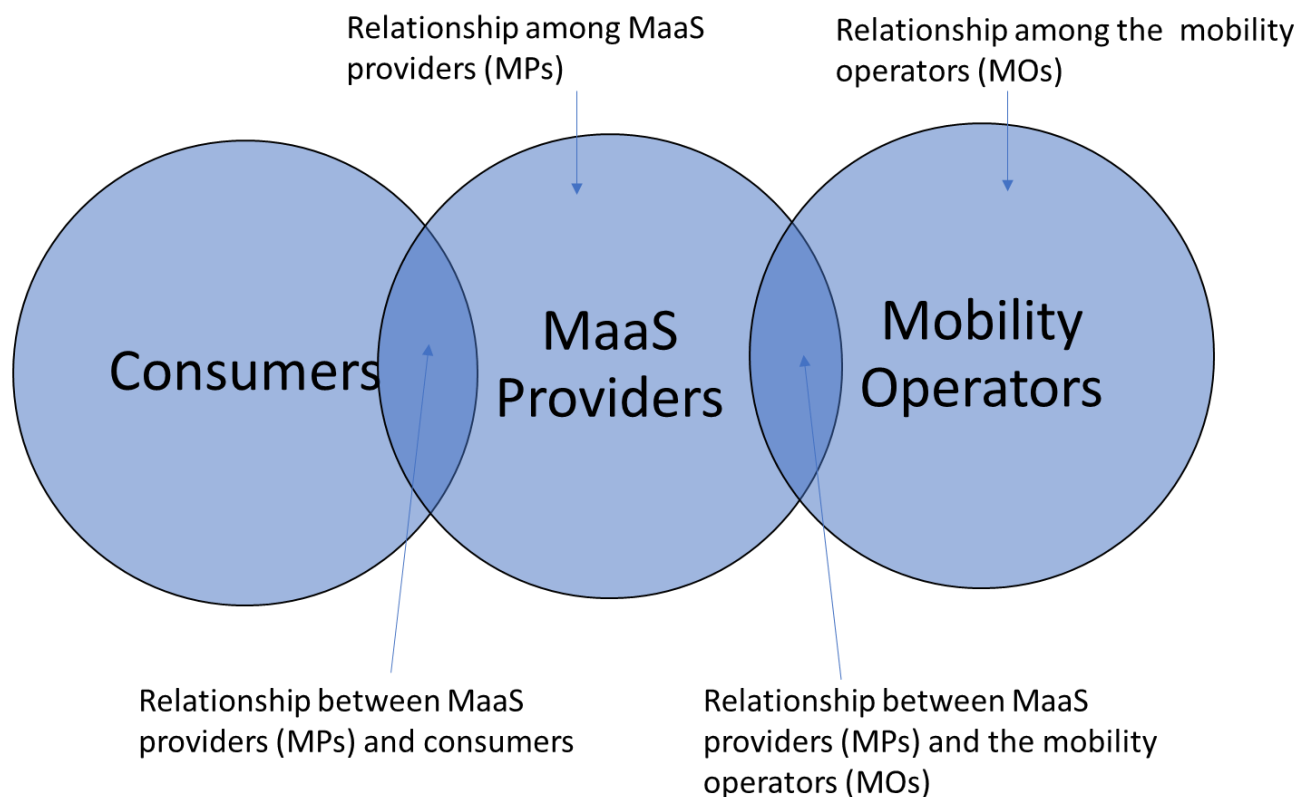
Regulation may be required for a number of reasons. A key rationale arises where the organisation of the MaaS ecosystem creates a potential for an actor or actors to enjoy a competitive advantage. This edge can be due either to the position a firm has in the market, including in markets for digital services (Cremer, de Montjoye and Schweitzer, 2019^[42]) or because, it has spatial dominance in a transport context (Casadesus-Masanell and Ricart, 2010^[53]). An example would be where the public transport operator (and infrastructure manager) also acts as a MaaS provider. Another critical rationale arises when an actor is in a position to create barriers for market entry.

Regulation can address the negative impacts of MaaS on sustainability in the BCR. However, the mitigation of adverse sustainability outcomes is likely to be more effectively addressed via direct measures such as congestion charges or emissions regulations. These measures do not discriminate between MaaS and other forms of service provision. They may also support market development that makes sustainable outcomes more likely, and reduce the chances of unwanted negative impacts on the viability of MaaS providers’ business models.

Regulating interactions between actors

The overall ecosystem of MaaS consists of three main actor domains: the consumer, MaaS providers and the mobility operators. These domains overlap and interact with one another (Figure 4). Consumers interact with MaaS providers, mobility operators potentially interact with each other, mobility operators and MaaS providers interact and MaaS providers interact with one another. However, not all interactions in a MaaS ecosystem call for regulation. The market for each transport mode taken in isolation is not part of the discussion or consideration for MaaS regulation, but rather the interaction between the mobility operators and MaaS providers and any interaction amongst the MaaS providers that would clearly justify regulation. The relationship between mobility operators and consumers is omitted from Figure 4, as that relationship already exists independently of any MaaS governance, which is the focus of this chapter.

Figure 4 The relationship between the actors in a MaaS ecosystem



The following sections examine the interplay between actors and the organisational framework for each interaction identified in Figure 4. The construction of regulatory frameworks will have direct implications for the business model of MaaS providers and mobility operators and also affect how value creation occurs. In particular, how the division of public and private responsibilities are governed during the development and diffusion phases of MaaS will have a critical impact on business models (Smith, 2020^[54]).

Interaction between MaaS providers and consumers

The successful development of a MaaS ecosystem crucially relies on MaaS providers making offers that are both appealing to the consumer and financially viable for the MaaS provider. Thus, the regulatory framework must avoid unnecessarily impeding MaaS providers' ability to find viable business models. Early conceptions of MaaS assumed that MaaS providers would typically be mobility operators offering a combination of their own mobility services and those of other mobility operators to the consumer to create a multimodal offering, thereby leveraging an existing business model by broadening their mobility offer.

A more competitive and innovative MaaS ecosystem, however, is one that allows for MaaS providers that are combined MaaS provider and mobility operator, or just a pure MaaS provider. This environment would also generate greater efficiency in the use of resources and would be expected to provide better customer offers due to stronger competition within the market. Such MaaS providers might be dedicated MaaS start-ups but might also include utility operators, banks, retailers experienced as intermediaries in other sectors and other actors who see an opportunity to create value in this market.

Understanding the customer perspective fundamentally determines the shape of any actor's business model: without the customer, there is no *raison d'être* for MaaS. What the customer wants and what the customer is willing to pay for is central to designing a business model that has potential to be successful. In turn, business model has implications for what forms of regulatory and other policy interventions may be required.

Payment for MaaS services could be as simple as signing up to an app and using services on a pay-as-you-go (PAYG) basis. Alternatively, there may be a commitment to a periodic (monthly or weekly) payment for the provision of a package of mobility services – similar in concept to a mobile phone package that combines phone, text and data entitlements. There might also be a hybrid model, whereby a consumer meets most of their mobility needs with a subscription payment for access to a package of mobility services and purchases additional services not included in their package on a PAYG basis. In practice, there is more likely to be a one-to-one relationship between customers and mobility operators if the package model predominates, whereas if the market is largely PAYG, it is more likely that customers will sign up to multiple MaaS providers. Other alternatives might include the purchase of a mobility service that is integrated into a non-mobility service. For example a mobility service integrated into a sports event ticket purchase as was considered for the Sydney 2000 Olympics (Mulley and Moutou, 2015^[55]).

The current evidence on consumer preferences, coming from pilot studies and academic studies draws mixed conclusions (see Hensher et al. (2020^[56]) for a synthesis of recent experience). Stated preference studies have focused on mobility packages, asking about a hypothetical future to understand which modes customers would like to see in their packages (Caiati et al., (2020^[57]), Fioreze et al. (2019^[58]), Guidon et al., (2020^[59]), Ho et al., (2020^[60]), Matyas and Kamargianni, (2018^[61])). However, research has not truly examined whether customers would prefer PAYG to a prepaid option or whether subscription to a MaaS app requires some form of discount to entice customers to subscribe.

There is some early evidence that customers are willing to pay for the convenience of multi-application smartcards (Edwards and Mulley, 2004^[62]). This finding could translate to customers being willing to subscribe to a service because of its convenience even without a discount. More recent stated preference studies suggest customers want the convenience of what is offered by a hypothetical MaaS offering. But the study by Ho et al. (2018^[63]) suggests travellers are not willing to pay an amount significantly different from zero for it. If their conception of a MaaS service is similar to a journey planner (which is normally free at the point of use) then this is not surprising. On the other hand, the study by Guidon et al. (2020^[59]) found a willingness-to-pay for a MaaS service above CHF 100 (more than EUR 85⁶) which was acknowledged as high, even for Swiss budgets. However, competition between MaaS providers within the market would be expected to keep charges from getting too high because users would be unlikely to pay for an integration service if provided freely or more cheaply by a competitor.

Much evidence suggests the mobility services that customers demand are highly context-specific. Guidon et al. (2020^[59]) found that a bundle of some mobility services (public transport, carshare, and park-and-ride) were valued more highly than the same services provided separately but that including other services in the bundle (bikeshare, taxi services) made the bundle less valuable to potential customers. This finding suggests that consumer demand could lead to a mixed subscription and PAYG offering. In contrast, Caiati et al. (2020^[57]) found customers were interested to have the option of bike hire.

Controlling for context is not always successful, as demonstrated by two Australian studies that yielded very different outcomes. Ho et al. (2020^[60]) found a preference for subscriptions to mobility bundles whereas Vij et al. (2020^[64]) found PAYG to be preferred. Perhaps the most convincing evidence for the context specificity of customer requirements is that the same MaaS provider offers different payment options in other contexts. Whim in Helsinki, Finland provides subscription and PAYG options for travellers

whereas Whim in Birmingham, United Kingdom was unable to make a commercial success with subscription offers and now provides only the PAYG option (Mulley and Nelson, 2020^[4]).

In terms of service design, the digital era has led to an upsurge of new mobility services (e.g., ridesourcing (such as Uber), carsharing, bikesharing, scootersharing) along with more conventional modes (public transport, car rental). This means that the mobility market is expanding quickly and MaaS providers will have an increasingly wide variety of modes to combine in their offer to consumers. The combinations of modes customers want vary by spatial setting, with modes other than public transport having varying appeal.

The most concerning aspect of service design is where including modes such as bikeshare and taxi can reduce the average willingness-to-pay for the bundle (Guidon et al, (2020^[59]). This finding emphasises how important it is to get the mix of mobility services right, particularly in delivering subscription packages, as stressed by Hensher et al (2021^[65]). From a MaaS provider perspective, a benefit of the subscription model over PAYG is pricing flexibility, which enables them to offer packages that are more attractive to customers and more profitable for the MaaS providers. A package also potentially includes options that customers are willing to pay for even if they do not use.

Mobility researchers have drawn parallels between the mobility market and the market for mobile telephony, marked by how both offer services that are “non-storable”. The latter market is competitive and telephony operators seek to expand their market shares by presenting an attractive discount offer on a block quantity of services, a significant portion of which the customer will not use, with two-part pricing to encourage them to over-commit on their subscription payment. Of course, the mobile telephony market is now relatively mature and customers have learnt to become better judges of what sort of package might best meet their needs, providing lesser degrees of freedom for suppliers to benefit from consumers not fully utilising their packages.

The mobile telephony market does not have subsidised elements, as will be the case almost invariably if public transport services are included in MaaS offers. Nevertheless, there appears to be no strong policy imperative to use regulation to constrain the pricing models that can be implemented. That said, policy makers should watch for the emergence of two-part pricing in MaaS markets because this might be a way for MaaS providers to extract consumer surplus from customers and make higher than normal profits.

Interaction among the MaaS providers

It is clear that the MaaS market is a potentially competitive one. In general, competitive markets for the provision of goods and services deliver the most efficient outcomes where competition is feasible. Provided there are no externalities⁷ a competitive market leads to efficient use of resources, a level of output and pricing consistent with maximising social welfare, and an environment where customers can signal what types of services they want and what they are willing to pay. A competitive framework also maximises innovation, enabling the market to develop quickly over time and respond better to changing consumer demand. This factor is particularly important in new and rapidly developing markets, such as MaaS.

By contrast, lower rates of innovation, reduced supply of services and higher prices would be expected where there is a single player (monopoly) or few actors (oligopoly), due to entry restrictions or natural barriers. This dynamic is particularly acute where there is collusion between operators in an oligopolistic market. The smaller number of incumbents are able to exercise sufficient market power to restrict entry (or to influence regulators to do so on their behalf). Hörcher and Graham (2020^[66]) note that private MaaS providers are unlikely to pursue a purely social welfare maximising objective and, as a result, will apply a monopoly mark-up in their pricing strategies if they can exercise market power. However, governments can reduce the extent of these economic efficiency costs by encouraging competition between individual

service providers. Therefore, a regulatory framework that supports competitive outcomes would need to make it difficult for any MaaS provider to dominate the market by restricting access to important mobility resources such as stations or stops. Restricted access to mobility resources for competitors could be a risk where the MaaS provider is also a mobility operator. It would also need to prevent the potential for two or more MaaS providers to collude better to exploit the customer market at the expense of other MaaS providers.

While there are concerns regarding externalities associated with MaaS, particularly about potential negative impacts on sustainable mobility, their existence in practice has yet to be demonstrated. Indeed, the effects of MaaS on sustainable mobility may prove to be positive. Moreover, restricting competition in the MaaS market is unlikely to be the most effective policy response to any negative externalities.

As discussed earlier in this chapter, non-mobility operators will likely move into the MaaS provider market over time. This is not without precedent: for example, in Gothenburg, the EC2B service offers tenants of a residential apartment block a subscription plan including public transport, carsharing, bikesharing and moped sharing instead of car parking facilities. A hybrid MaaS scheme could move beyond mobility to include the provision of utilities in the same ecosystem (utilities being particularly pertinent since they share the non-storable characteristics of mobility), with the utility provider being the MaaS provider. Therefore, the approach taken to regulation of MaaS should recognise that MaaS providers will not necessarily be mobility operators.

In summary, there are no clear reasons to depart from the basic assumption of economics (and European competition law) in favour of enabling and facilitating an open, competitive market for MaaS. This suggests the BCR should encourage multiple MaaS providers to enter the market and avoid an organisational framework based on a single MaaS provider: the latter would likely stifle innovation, even if controlled by competition policy, regardless of whether it was government-owned as in the 'Public MaaS' described above, or private sector based.

Interaction between the MaaS providers and mobility operators

Adopting a governance framework that allows MaaS providers to develop remunerative business models is a fundamental requirement for a viable MaaS ecosystem. There is currently no evidence that a viable business model exists for MaaS providers for the long-term development of MaaS on a large scale. To maximise the probability that a viable long-term business model or models can emerge the policy and regulatory structure must provide scope for innovative and mutually profitable business relationships to develop among stakeholders within the MaaS ecosystem. The emergence of such models requires that MaaS providers can make a commercial rate of return. Also that mobility operators can increase their net revenues by reselling their services through MaaS providers, thus giving them incentives to engage with MaaS providers.

A pro-competitive regulatory environment for mobility operators and MaaS providers requires the maximum degree of freedom to negotiate with each other as they search for viable and attractive market offers and business models. Given that public transport must be at the core of any large-scale MaaS ecosystem that contributes to sustainable mobility goals, this freedom to negotiate must extend to public transport operators. Therefore, public transport operators should be able to enter into arrangements that make their services available via MaaS providers on innovative terms. This could include, for example, the MaaS provider agreeing to assume significant commercial risk by pre-purchasing large numbers of journeys at a discounted price and on-selling them to its customers as part of innovative packages combining public transport and trips by other modes. In exercising this freedom to negotiate, public transport operators will, however, necessarily have to respect the principle of equality of treatment, as established in their governing legislation.

Public transport authorities typically operate as financially independent and accountable entities, even if they are generally funded in significant part by government subsidies. Their corporate financial incentives and governance arrangements are specified explicitly so these public transport operators will only enter into contracts with MaaS providers on terms that they believe will serve their interests on a medium- or long-term basis. That is, that they will agree only to terms that they believe will yield a net financial benefit to them or that contribute significantly to the delivery of regulatory performance standards imposed on them.

Box 3. Gross- versus net-cost contracts for public transport operators

The nature of the contracts between public transport authorities and the public transport operators affects the nature of the incentives the latter face. This, in turn, has implications for the issue of ticket resales via MaaS providers. A key distinction is between net and gross cost contracts. Under net cost contracts, the public transport operator retains fare revenues and the subsidies determined under the contract are intended to meet the shortfall between operating costs (including commercial profits, if applicable) and fare revenues. With gross cost contracts, fare revenues are passed to the public transport authority and the payments made under the contract are expected to cover the entire cost of the public transport operations.

Where a public transport operator is a financially independent and accountable entity, and is operating under a net cost contract it will have appropriate incentives to negotiate the resale of its transport services with a MaaS provider. That is, it will only do so where the expected result is a net financial benefit to the operator or a positive contribution to the delivery of the performance standards for which it is accountable. In this situation, the maximum possible freedom to negotiate terms leads to outcomes consistent with the government's policy objectives for public transport.

However, where gross cost contracts are adopted, the incentive position potentially differs, depending on which entity negotiates the resale of public transport tickets (or access). As the public transport operator, by definition, does not receive fare revenue in this circumstance, it does not face the same financial accountability incentives concerning ticket (or access) resale. This being the case, responsibility for negotiating resale with MaaS providers should not lie with the public transport operator. Rather, this responsibility should lie with the public transport authority.

In the current Brussels-Capital Region (BCR) context, the public transport operator, Société Des Transports Intercommunaux De Bruxelles – Maatschappij Voor Het Intercommunale Vervoer Te Brussel (STIB-MIVB), operates under what are, in effect, net cost contracts. Hence, appropriate incentives will exist if it is given freedom to negotiate with MaaS providers. However, a consequence of the Covid-19 pandemic, with the associated substantial declines in public transport use and fare revenue, is a move from net cost contracts to gross cost contracts in many jurisdictions. Should the BCR government decide to take this approach, it should ensure that the entity with authority to negotiate the resale of public transport services has appropriate incentives to do so.

Where MaaS providers are also mobility operators, they may have an incentive to offer less favourable terms of access to their mobility services to new MaaS providers intending to enter the market to reduce the extent of future competitive pressure. Should such behaviours emerge, the general competition law's abuse of market power provisions are likely to provide an appropriate means of addressing them in the first instance. Therefore, the transport authorities should monitor the development of the MaaS ecosystem (particularly the entry of new mobility operators and MaaS providers) to identify any significant anti-competitive behaviours and actively bring such issues to the attention of the competition authority.

This is a key element of the implementation of a pro-competitive regulatory stance. Especially in the early stages of the development of the MaaS ecosystem, when it will be particularly important to ensure that emerging MaaS providers seeking to enter the market are not disadvantaged in their attempts to reach arrangements with mobility operators. However, competition law should be supplemented by specific provisions in the MaaS Ordinance requiring mobility operators to apply the principle of competitive neutrality, or equal treatment, in their dealings with MaaS providers (including intending market entrants). This can ensure that discriminatory behaviour is effectively prevented in practice.

This requirement should be reinforced by provisions that implement the *principle of separation of functions*. This principle, widely adopted in competition law and policy, requires that a business that holds market power should, if operating in two related markets, undertake such operations independently, to avoid the risk of abuse of market power through cross-subsidisation between the markets. In the MaaS context, if a business operates as both a mobility operator and a MaaS provider, conducting these operations separately will help to avoid cross-subsidisation of the MaaS service by the business's mobility operations. This prevention of cross-subsidisation is essential to achieving competitive neutrality between businesses that are combined large-scale mobility operators and MaaS providers, and those that only operate as MaaS providers. The uncertain viability of MaaS implies that competitive neutrality will be particularly important to developing a competitive market.

Competition policy distinguishes different means by which the required separation of activities can be achieved.⁸ Considered in terms of the degree of regulatory intervention entailed, they are:

- **accounting separation** involves recording and reporting the financial results (i.e. costs and revenues) of different activities separately, even though the same business units and resources may be used to deliver the different functions, at least in some areas
- **functional separation** entails establishing separate business units, deploying separate, dedicated resources, to conduct each activity
- **structural separation** in which separate legal entities are created to conduct each activity
- **ownership separation** where the ownership of one of the structurally separated entities is required to be divested to another unrelated party.

Broadly speaking, the potential costs to affected business tend to increase with the degree of regulatory intervention – i.e. as one moves from accounting, to functional, to structural separation. However, the degree of assurance that the different business activities will be conducted independently also increases as one moves toward the more interventionist approaches. There should be sufficiently robust safeguards against anti-competitive behaviour by entities wielding significant market power to ensure that the development of a workably competitive market is not materially impeded. At the same time, unnecessary or disproportionate regulatory costs should be avoided.

This implies that the choice of model to adopt should be based on a careful assessment of the market involved, including the:

- degree of market power possessed by the entities to be regulated
- incentives they face concerning potential anti-competitive conduct
- nature and extent of barriers to entry and
- position of actual and potential competitors.

These factors may change over time, suggesting the need to move from one model to another. Another common dynamic is adopting a relatively light-handed approach initially and moving toward more interventionist options if market surveillance shows that the initial approach has not been sufficiently effective in preventing anti-competitive conduct.

The emerging nature of the MaaS market in the BCR and the desire of the government to ensure that a MaaS ecosystem is successfully established may suggest the initial adoption of a light-handed approach, such as accounting separation. This should be required as a minimum for all hybrid mobility operator/MaaS provider actors. Further stringency in the separation of the two functions could be triggered by increased market concentration and power concerns or if necessitated by data governance concerns.

Adequate market surveillance and enforcement constitute key elements of a pro-competitive regulatory environment in these areas. The extent of surveillance of the market behaviour of MaaS businesses should be proportionate to the extent of their market power and the incentives they face for anti-competitive behaviours. However, the regulatory framework should explicitly allocate responsibility for these functions. The general competition authority is likely to be well placed to review and analyse the relevant market conduct and address the need for enforcement activity. However, the broader surveillance function is likely to be best located within the transport ministry.

These considerations are relevant to the potential for MaaS to develop in Brussels via STIB-MIVB being the first large-scale MaaS provider in the Brussels market but competing with any private providers that subsequently choose to enter the market. This scenario implies a decision of the BCR government to both enable the STIB-MIVB to act as a MaaS provider and to leave the MaaS provider market open to entry by private providers. Such an approach to the development of MaaS would have the benefit of enabling the rapid early development of the market while also maximising competitive pressure and innovation in the medium term, albeit the financial risk of having STIB-MIVB operate as a MaaS provider would fall to the public sector.

This approach to the initial development of the MaaS market is allowed under EU Directives, i.e., the fact that a public transport operator benefits from state aid does not prohibit it from engaging in other types of service (VVA, 2019_[67]). However, it would need to be accompanied by safeguards and a robust audit and redress mechanism governing all market actors. In particular, there would need to be a functional separation between STIB-MIVB's activities as a MaaS provider and their activities as a mobility operator of public transport. Regulations would also be needed to prevent discrimination between the mobility operators included in the STIB-MIVB's offer as a MaaS provider. This separation would prevent STIB-MIVB from using the subsidy it receives to offer services within its MaaS offer below cost to eliminate or reduce competition. This form of cross-subsidy would be contrary to Article 102 Treaty on the Functioning of the European Union (TFEU) (Case T-175/99, UPS Europe v. Commission, ECLI:EU:T:2002:78, para.61) (VVA, 2019_[67]). The regulatory structure would need to ensure openness to the new entry of both mobility operators and MaaS providers and ensure the authority's competitive neutrality vis-à-vis STIB-MIVB. While there appears to be no legal barrier to STIB-MIVB becoming a MaaS provider, this might be regarded as requiring approval from the Commission under Article 107 TFEU (VVA, 2019_[67]).

Governance of market entry and exit

The importance of a pro-competitive stance to facilitate a commercially viable, and thus sustainable, MaaS ecosystem is particularly marked in the context of emerging markets. Uncertain business models and lack of experience in the market imply that the evolution of the market will be characterised by high rates of business failure, hence entry and exit. This pro-competitive approach must be adopted for both mobility operators and MaaS providers if the probability of a commercially sustainable MaaS model developing over time is to be maximised. This is because:

- the availability of a wide range of attractive mobility offers underpins a commercially successful MaaS offer; and

- the development of commercially successful MaaS models is most likely to be achieved in the context of a strongly competitive, innovative marketplace.

While the same competitive principles should apply to both of these markets, some distinct policy considerations should be taken into account. Hence, they are discussed separately here.

Mobility operators

The BCR government should ensure that neither existing nor new regulation of current or emerging new mobility services has the effect of creating significant barriers to entry, or to competent operators' ability to sustain a presence in the market. This relates to both substantive restrictions on the ability of these services to operate and offer new service models in the market and to the imposition of direct regulatory costs. Direct regulatory costs may arise from data sharing and reporting obligations as well (discussed in Chapter 6). These represent the "cost of doing business" in a MaaS ecosystem. Still, they should not be designed to disproportionately affect certain actors or otherwise impose unfair burdens on some classes of operators over others.

Avoiding imposing disproportionate or poorly justified regulation – and associated costs – is particularly important in the current context. As previously noted (ITF, 2019^[37]; ITF, 2021, forthcoming^[68]), few new mobility services have proven profitable to date, either in the micro-mobility space or in the broader app-based mobility market (incorporating ridesourcing, rideshare, etc). Businesses have typically been heavily dependent on continued venture capital injections for their medium-term survival and several have exited the market when these have not been forthcoming.

Despite this, many cities have imposed significant restrictions on the operations of these businesses and levied substantial regulatory fees. In the case of ridesourcing, restrictions have included "return to base" requirements, which reduce responsiveness and raise costs by increasing the amount of "dead running", rigid restrictions on the types of vehicles able to operate in the market and (in the case of New York City) restrictions on driver numbers.

In the e-scooter and shared (free-floating) bicycle markets, cities have sometimes auctioned concessions to operate, with potential operators bidding surprisingly large amounts for market access in an attempt to dominate the market (e.g. Mexico City). In other cases, annual per-unit charges have been levied, often at high levels, while in some cases, both of these approaches have been imposed simultaneously. These fees and charges have been justified on grounds including:

- the need to recoup regulatory costs associated with monitoring the use of vehicles, arranging for the removal of those causing obstructions, or which are derelict and;
- the need to capture a return for the value of public open space used by these vehicles, both for parking and in terms of road space.

However, as the ITF has noted, few cities have designed regulations for new mobility services to make progress toward broader environmental and socio-economic goals specifically. Conversely, in many cities, overly-restrictive regulations are only loosely aligned or even at odds with sustainability objectives. In such cities, the management of shared mobility has not considered how the system can be made most effective, convenient and reliable for users and may thereby have prevented these services achieving mass scale, thus reducing the value of shared mobility to the community (ITF, 2021, forthcoming^[68]).

A number of operators have exited individual markets (i.e. cities) following the imposition of substantial and costly mode-specific regulation. The range and extent of regulatory restrictions on the ability to operate has been particularly acute in relation to micromobility services, and the negative impacts of poorly considered regulation have been apparent. Regulatory restrictions on the sector typically have

three elements. The first is whether, and to what extent, the number of operators allowed to participate in the market is restricted. The second relates to specific regulatory limitations on the kinds of market offers they can provide and particular obligations imposed on them. The third relates to the direct regulatory costs levied on operators.

Direct entry restrictions on operator numbers are a sub-optimal means of addressing identified externality issues and should be avoided. Where direct entry restrictions on the number of mobility operators able to enter the market have been adopted, they have generally been viewed as an indirect means of limiting the number of vehicles (and thus associated negative externalities) and as a means of imposing certain behavioural requirements. With regard to behavioural requirements, this approach is an alternative to explicit regulatory provisions; instead, eligibility to tender for one of a limited number of concessions is conditional on contractual agreement to meet certain standards and requirements in the course of market operations. Entry restrictions have historically been most acute in the taxi industry but have been removed or substantially loosened in many cities after the entry of ridesourcing demonstrated the substantial net benefits of increased supply (ITF, 2019^[37]). However, they remain extremely common in the regulation of micromobility and are contemplated in the current BCR legislation, albeit not currently adopted.

The extent of these restrictions has varied quite widely from city to city. For example, Paris had twelve operators in the e-scooter market in 2019, but subsequently, let concessions to only three operators. Conversely, Copenhagen, a much smaller city, authorised ten providers to operate in the market. Madrid authorised 22 operators, but allocated them to different areas across the city (ITF, 2021, forthcoming^[68]). A key issue with using this regulatory approach is that setting a low limit on the number of market participants risks reducing competitive pressures. In markets with only three actors, concerns over potential oligopolistic behaviour are acute (Deighton-Smith, 2021^[69]). There is also a significant risk that if one of the operators exits, the city will be under-supplied with vehicles, at least until new concessions can be let – a process which may take some time. However, the larger problem with limiting the number of participants in the market is that this approach will almost certainly reduce innovation by, limiting potential entry and reducing the intensity of the market pressures that drive innovation.

Regarding **restrictions on service offers**, many cities have adopted substantial regulatory restrictions on the ways in which micromobility can be used. These have generally been justified as attempts to ensure user safety or address negative externalities associated with the use of micromobility. However, the regulations adopted have often had a poor evidence base and may have limited effectiveness in achieving their objectives, while significantly reducing the attractiveness of micromobility to users. For example, cities have adopted a wide range of restrictions on parking free-floating bikes and scooters, despite evidence suggesting that these vehicles are incorrectly parked far less frequently than cars (Brown et al., 2020^[70]).

In relation to direct **regulatory costs**, drivers of private vehicles do not face the full costs of the negative externalities imposed by the use of their vehicles. For public transport, subsidies are systematically provided for services, in large part on the grounds of a “second-best pricing” approach, which seeks to compensate for the under-pricing of private vehicle use by providing access to public transport services at lower prices. A similar argument underpins the conclusion that there is a case for the effective subsidisation of micromobility services. A minimalist version of this *implicit* subsidisation approach would involve reducing/minimising the specific regulatory requirements imposed on the operation of these modes and having the public budget cover most or all of the costs associated with implementing these regulatory standards, rather than charging substantial regulatory fees on cost-recovery grounds.

MaaS providers

The regulatory system should recognise that a MaaS provider is distinct from a ticket reseller. It combines services from multiple mobility operators¹ into an integrated consumer offering, which may also include

non-mobility services. MaaS providers should also be distinguished from mobility operators in that mobility operators provide transport services, while MaaS provision entails acting as a conduit through which access to existing mobility services can be contracted. Therefore, mobility operators are typically subject to a mode-specific body of regulation, including licensing, which aims to achieve consumer protection and other public policy objectives. These regulations are not necessarily appropriate for application to MaaS providers per se. Mode-specific regulation will continue to be applied to mobility operators in the context of the development of a MaaS ecosystem, while any who also operate as MaaS providers should be subjected separately to regulation appropriate to this function.

The evolving nature of MaaS produces uncertainty as to the nature and extent of the policy challenges its development may pose. This is concerning for authorities who will need to respond promptly should significant policy problems arise as the market evolves. However, striking a balance between ensuring that timely regulatory or other policy interventions can be undertaken and the need for a pro-competitive regulatory approach is both essential and potentially challenging.

Requiring service providers to obtain a licence to enter the market is a common regulatory response where substantial harms may arise from operations in particular markets. However, licensing provisions might also restrict competition. Hence, if licensing requirements are adopted, the nature and extent of the licensing conditions established should be considered carefully through a pro-competitive lens. Each requirement should be linked to a clear policy objective and evidence of the need for intervention. Fundamentally, there should be no direct or indirect limits on the number of MaaS providers that can be licensed at any given time.

Some cities have considered the merits of limiting entry into the MaaS provider market to avoid fragmentation and the attendant risks of both consumer confusion and reduced engagement. This limiting may also be seen by authorities and market actors as increasing the likelihood that MaaS providers will reach an economic scale. However, as with new mobility services, this perspective fails to consider that the prospect of developing business models that can underpin a sustainable market is greater if there are strong competitive pressures and rapid innovation. .

Stringent regulatory interventions should only be adopted where impact assessment shows that there is a high likelihood they will yield a net benefit to society (i.e. benefits greater than the costs they impose) (OECD, 2019^[71]). The form of intervention chosen should also be the least restrictive of competition. Dynamic harms likely to arise from restricting competition are significant in the context of rapidly developing markets of uncertain long-term form and viability. The OECD Competition Assessment Toolkit (OECD, 2019^[71]) provides substantial guidance to policy makers on analysing underlying policy objectives, reviewing potential interventions in pursuit of them and choosing those with the least restrictive impacts on competition.

More generally, the MaaS provider licensing requirements should not provide significant disincentives or barriers to market entrants or impose unnecessary or disproportionate costs. Licensing should be consistent with the generally pro-competitive approach recommended in this report and, particularly the presumption of freedom to negotiate between the parties. An appropriately designed licensing regime is likely to have qualifying conditions typical for any business holding or commercial enterprise. This is because there are no clear, significant consumer protection issues specific to MaaS provision which would, a priori, appear to justify more stringent licensing provisions. An exception is the fact that MaaS providers will be dealing with substantial user data, including payment data. Thus, the licensing requirements should cover compliance with the data sharing and data reporting elements of the regulation pertaining to MaaS providers.

A well-designed licensing structure could achieve several benefits in the MaaS context. First, embodying a licensing requirement in legislation could assist in the process of establishing a clear legal status for MaaS

providers. This legitimacy may facilitate the development of the market by helping to clarify aspects of the relationships between different parties within the MaaS ecosystem. Second, a licensing requirement would also improve authorities' ability to monitor MaaS providers in the market, thereby helping them to oversee the market's functioning and assess the effectiveness of the regulation. Third, licensing will support the monitoring and auditing of MaaS providers to ensure that data governance rules are respected. This adherence is important, as MaaS providers will have access to the data of multiple mobility operators. Some of whom may also be direct competitors if the MaaS provider is also a mobility operator.

The digital and network-based nature of the MaaS market creates some specific issues in terms of the need for governments to support and facilitate market entry, as noted in Chapter 3. New entry will be greatly facilitated if regulation ensures that the feasibility of multi-homing and switching is maintained, particularly by supporting data portability and interoperability (Cremer, de Montjoye and Schweitzer, 2019^[42]).

The BCR will need to ensure that large-scale mobility operators who enter the MaaS provider market cannot use their market position and resources to behave in anti-competitive ways. This will avoid incumbents creating barriers for later entrants to the MaaS provider market, particularly entrants that are not also mobility operators.

Market position in this context should be measured against standard anti-competitive criteria, typically using market share as a proxy for market power in testing for monopoly or dominant position. In a transport context, it is important to recognise that market position and dominance carries an additional spatial component so that market dominance can be achieved with a smaller market share if accompanied by a spatial concentration of activity.

The likelihood that the STIB-MIVB will be authorised to establish a MaaS offer and act as the first large-scale MaaS provider in the Brussels market means that the issue of dominant market position will likely arise in the short term. However, for the successful development of a competitive marketplace in the medium and long term it is important to have generally applicable competitive neutrality provisions in place that would also apply to any future concentration of market power by other MaaS providers. Key aspects of a suite of competitive neutrality protections include:

- active market surveillance by the competition authority and the transport authority to ensure that key provisions of the general competition law aimed at preventing discriminatory behaviour are respected by all mobility operators and participants in the MaaS market
- separation of functions between the mobility operator activities and the MaaS provider activities of any entities that operate in both markets, to prevent the cross-subsidisation of the MaaS activities by the mobility operations, or vice-versa
- transparent and efficient dispute resolution mechanisms which ensure that private MaaS providers are able to challenge any market behaviours by the public transport authorities that they believe are inconsistent with the competitive neutrality requirements imposed on them.

More broadly, the BCR government should have regard to the 2021 Recommendation of the OECD Council on Competitive Neutrality (OECD, 2021^[72]) and the 2015 Recommendation of the OECD Council on Guidelines on Corporate Governance of State-Owned Enterprises (OECD, 2015^[73]).

Subsidy, financial viability and resale of public transport tickets

There are two subsidy issues concerning the introduction of MaaS in the BCR. The first is the implications of the relationship between subsidised mobility operators and the MaaS providers, who may be publicly

or privately owned. The second relates to the most effective mechanisms for delivering mobility subsidies in a MaaS ecosystem, particularly in the longer term.

Relationship between MaaS providers and publicly subsidised mobility operators

The relationship between a mobility operator and a MaaS provider can be seen as a standard principal/agent one. In such a 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. This characterisation is relevant regardless of whether the mobility operator receives public subsidies (for example, public transport) or whether the MaaS provider is privately or publicly owned. Public transport operators that are publicly subsidised are typically structured either as corporatised public enterprises, with clear financial accountabilities, or as private sector concession-holders. Either way, they will only choose to enter into such a principal/agent relationship with a MaaS provider if they believe that they stand to gain from doing so. That is, that it will contribute to their net revenue or another operating objective, if different.

This principal/agent perspective is important to counteract the narrative that the relationship is automatically one-sided. Such a narrative suggests that if public transport services are resold as part of the MaaS offer, the MaaS provider inevitably profits from appropriating the public subsidies provided to the public transport operator.

A mobility operator will only enter into contracts with a MaaS provider if they believe this serves their own interests. The mobility operator is likely to engage if contracting their services to the MaaS provider will increase total ridership, or provide tangible benefits, such as gaining a new marketing channel through the MaaS provider. Therefore, any bulk discount offered by the mobility operator can be seen as a commission payment in respect of the additional sales generated. Combined with the opportunity for a MaaS provider to take on payment processing (for example, the mobility operator sells its services in bulk in exchange for a single period payment from the MaaS provider) this constitutes commercial services, for which the mobility operator should be willing to pay a commission.

The fact that some mobility operators receive a public subsidy in connection with the provision of their 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. The fact that the relative size of the subsidies paid for public transport services is large does not necessarily make the case to control the sale or resale of the product. If the corporate and financial incentives and governance arrangements applied to the public transport authorities are well specified, they will ensure appropriate accountability and guide the decisions of subsidised mobility operators. In this case, they will accept only propositions that provide a benefit to the mobility operator (whether an addition to net revenue or an increase in another objective of the mobility operator) and, by implication, support the achievement of the underlying public policy ends for which the subsidy has been provided.

Public transport journeys are subsidised in most cities. This implies that, even where tickets are sold at full face value to the MaaS provider, with the MaaS provider adding a premium to the price on resale to provide itself with a net revenue, it can be argued that the MaaS provider's profit is derived, in part, from the sale of publicly subsidised services. Despite this, most public officials are comfortable with resales by MaaS providers of at least some subset of public transport tickets at full retail price. This suggests that querying whether a MaaS provider benefits from public subsidy is unhelpful in shedding light on the appropriateness of allowing subsidised mobility operators to sell tickets at a discount to MaaS providers.

The resale of public transport tickets by MaaS providers is better addressed by considering the impact of the discounted sale on the public transport operator. The main incentive for a public transport operator to engage with MaaS derives from an expected increase in patronage. That is, by making services available through the MaaS provider, overall demand is expected to increase. The sales made by the MaaS provider

will effectively constitute some combination of existing and new trips. That is, some MaaS sales will represent diversion of demand from direct ticket sales by the public transport operator, but others will represent additional journeys that would not have been taken on public transport without the bundling of these services into the MaaS offer sold by the MaaS providers. If the additional revenue received from the MaaS provider exceeds the additional costs of the extra passenger journeys that take place then the MaaS provider will positively impact the public transport operator's net revenue.

This is the decision-making approach that would be expected of a corporatised public transport operator undertaking negotiations with a MaaS provider. This is because the public transport operator has an annual budget based on receiving a fixed amount of subsidies (generally based on expected patronage and service levels), plus an expected total revenue. Such an operator has an incentive to engage with a MaaS provider to sell its services if it expects these will have a positive net impact on this budget. From the public policy perspective, this should be an acceptable outcome if achieved in practice. Additional public transport ridership will have been achieved at no cost to the public budget (i.e. either directly or via loss of revenue to the PTA). It will therefore yield net social benefits rather than representing a private capture of public subsidy.

The incentive structure for the public transport mobility operator determines whether this net social benefit is as large as it could be. Public transport subsidies are provided to achieve public policy ends. Each journey taken by public transport is assumed to contribute to the achievement of these ends. However, some journeys are regarded as contributing more, and hence worthy of greater subsidies (e.g. journeys by student, low-income and disabled passengers). This suggests the key metric is the subsidy per passenger journey (or passenger kilometre). The appropriate public policy objective, in terms of a subsidised public transport mobility operator negotiating with a MaaS provider, is to ensure that the average subsidy per journey does not increase due to the sale of public transport tickets (or access) to MaaS providers. This objective suggests that if ridership increases due to the public transport mobility operator contracting with a MaaS provider, then it has improved its performance in respect of the policy ends to which the subsidies relate. This implies that public transport should receive additional subsidies from the public budget since these represent the purchase by the public sector of additional public benefits via these additional public transport journeys.

A fully corporatised public transport operator will have an incentive to provide access to their services on any terms they believe will result in a net increase in their revenue. In practice, public transport mobility operators will face considerable uncertainty as to whether the government will reward increases in journeys by providing a proportionate (or indeed any) increase in subsidy unless such an incentive-based contract is in place. As such, the public transport operator could under-engage with the MaaS provider with reference to the socially optimum decision rule, whereby additional subsidy is provided when ridership increases. This argument is based on the presumption that public transport subsidies are set in a broadly efficient manner – i.e. that they reflect estimates of the size of the social benefits obtained by increasing the use of public transport, at least by certain groups.

In summary, whether conceived in terms of a principle / agent relationship, or interpreted as contracting to increase net revenue to the public transport mobility operator, or considered in terms of net social benefits, the above discussion suggests that the provision of discounted (or alternatively priced) access to public transport services to MaaS providers will lead to net social benefits. Moreover, if public transport operators were suitably rewarded by the authorities for increasing ridership, these social benefits could be further increased. This raises an important question regarding the dynamics of subsidy provision to public transport operators in a functioning MaaS ecosystem.

Box 4. Ticket pricing and public policy

Public transport services are subsidised in most OECD countries in pursuit of key public policy objectives. These objectives notably include the provision of minimum levels of accessibility to all and reducing the negative externalities of private vehicle use, particularly in relation to pollution, health and safety and the liveability of urban environments.

The effective level of subsidy provided varies across different groups in society. Low-income groups, children and students, the aged and others typically benefit from lower public transport ticket prices and thus, implicitly, receiving higher public subsidies. Peak and off-peak fares are also sometimes differentiated, with the objective of spreading demand, reducing overcrowding and congestion and reducing the cost of providing peak period capacity.

Some concerns have been expressed that providing public transport authorities with the freedom to negotiate with MaaS providers, will undermine the government's ability to use public transport fare pricing as a policy tool. This freedom would include the public transport operators being able to sell access to public transport at prices that differ from their public fare offers. However, this is unlikely to be a significant issue, if the governance and financial accountability provisions applied to the public transport services are sufficiently robust and provide appropriate incentives.

One fundamental safeguard lies in the fact that public transport operators will continue to sell tickets to the public directly, even in a scenario where the MaaS market has developed to become relatively mainstream. Therefore MaaS providers will have limited scope to change the price relativities from those established via government fare-setting policy. More heavily subsidised consumers will continue to have the option to purchase concession-priced tickets directly from the public transport operator. A second safeguard arises from the accountability imposed on most public transport operators because they are corporatised entities with detailed financial and performance reporting obligations. In the case of entities that, like the STIB, retain their fare revenues and receive a net cost subsidy from the government, there will be strong incentives to ensure that net revenues are not compromised via sale of services to or through MaaS providers.

Governments can also mandate reporting on specific performance dimensions, including matters such as the access of priority groups through MaaS services. This may require review and updating of existing accountability requirements. However, well-specified accountability mechanisms should exercise significant influence on the terms on which public transport authorities contract with MaaS providers. Governments have delegated significant responsibility for achieving their policy priorities to public transport operators (and other independent public sector entities) in the context of these accountability frameworks. There is no a priori reason to believe that public transport operators will be unable to deliver on these priorities in the context of public transport pricing policy.

In addition, MaaS provides new opportunities for social welfare gains by effectively enabling more efficient forms of public transport pricing. As Hörcher and Graham (2020_[66]) note, "...the single, digital customer interface of MaaS offers a unique opportunity to implement marginal cost pricing in public transport as well, thus improving the efficiency of this mode in line with economic theory".

Potential future delivery mechanisms for mobility subsidies

Subsidies are currently delivered through a supply-side mechanism: the public transport authority provides them to the public transport operator. However, the delivery options of mobility subsidies are wider than this, and the successful development of a mass-scale MaaS market could provide opportunities to develop

other forms of subsidy in the future that could potentially be more appropriate and efficient. While this is at least a medium-term prospect, given that a viable, large-scale MaaS ecosystem has yet to emerge in any market, the following discussion is included in order to indicate some potential sources of additional efficiency and accessibility gains that may be achievable as a consequence of the effective implementation of MaaS.

For example, an incentive payment per passenger (IPP) could be granted to the MaaS provider to build into their business plan. The customer need not notice any difference if the IPP reflects the average current trip subsidy. A schema can be devised so that the subsidy is triggered by the characteristics of the passenger trip, such as whether it is peak or off-peak, uses a particular mode or travelling to or from an under-served area. An incentive scheme could also be devised using IPPs so that customers would become better off if more public transport trips are made. Thus providing an incentive to travel by public transport or other sustainable modes such as bikes and scooters.

Alternatively, there could be a person-centred payment (PCP) made to citizens through a mechanism such as the tax return or the benefit process to provide the subsidy equivalent to that currently provided to public transport operators through contracts. In both these cases, the public transport operators would operate without subsidy and MaaS providers would contract for their services at full cost. On the supply side, this would put all operators on a level playing field. This is discussed in more detail in Mulley and Nelson (2020^[4]).

Removing subsidy from public transport operators could make the transport system more efficient, but this relies on mobility operators understanding their costs well. Particularly in environments where there are many public transport operators, there is a risk that many do not understand their costs properly. A decision-based costing approach using avoidable cost would be the preferred approach to cost estimation. Taking a fixed and variable cost approach to costing ignores the non-constant average cost of provision.

If subsidy delivery opportunities depend on the scale of MaaS in the market, how might this be defined? It is likely that local contexts will define when MaaS is considered mainstream. Mainstreaming MaaS has at least three domains: a spatial dimension, a quantity dimension and a mobility provider dimension. From a spatial perspective, MaaS could be considered as mainstream if it covers at least the geographical area of the labour market. However, this would extend beyond the BCR. For the quantitative dimension, a threshold number of users (or proportion of trips) would need to be exceeded. The threshold is difficult to estimate in the absence of widespread MaaS but a working definition might be to have more than 50% of all trips in the spatial area purchased via MaaS providers. In relation to mobility providers, MaaS should be considered mainstream when all mobility operators are providing services to users through at least one MaaS provider.

Stakeholder opinions and relationships will be critical in the development of MaaS in all of these dimensions. A mainstream MaaS will only be achieved when it has grown from its emergent or niche state in all three dimensions.

Monitoring and transparency regarding regulatory adaptation

The regulation of new and emerging industries poses fundamental challenges for policy makers. The accurate identification of potential market failures that may require intervention and the development of an understanding of the dynamics underlying them is crucial. Arguments in favour of adopting proactive regulatory stances are often advanced, on the basis that it will likely prove more effective to apply a regulatory “steer” to the market to encourage it to develop with the desired characteristics. However, a strong countervailing concern is that regulation undertaken before a functioning market has developed and its dynamics have been studied in practice by policy makers is hazardous. It risks being based on too

limited an understanding of basic market dynamics and emerging business models. As a result, it may overestimate the significance of certain negative externalities or other market failures and adopt unnecessary and/or counter-productive provisions in response. This can yield significant risks of stifling or substantially distorting the development of the market in ways that yield substantial costs to society (ITF, 2019^[37]).

Policy makers should carefully monitor the elements of the developing MaaS ecosystem and continue positive engagement with key stakeholders. They should avoid adopting substantial regulatory interventions that would intervene substantially in the dynamics of a competitive, open-entry market until they have accumulated a good understanding of the dynamics of the developing market and the nature and extent of the market failures that are arising. Once having moved to adopt substantive regulation, it is equally important to adopt a responsive regulatory approach. This implies carefully monitoring the practical impacts of the regulatory provisions adopted in the marketplace and analysing their outcomes. Continuing engagement with key market actors will enable early identification of significant unintended consequences and any ways in which regulation is impeding market development. This can form the basis for timely review and revision of the regulatory architecture.

The OECD's work on regulatory policy and governance stresses the importance of seeing regulation in terms of a "policy cycle", which is completed by undertaking regular review and reform activity in respect of existing bodies of regulation (OECD, 2012^[41]). This is particularly important in the context of emerging markets, both because:

- Initial regulatory choices are more prone to error due to limited ability to predict the direction in which newly emerging markets will develop.
- The need to accommodate what will, in many cases, be a rapidly changing set of market dynamics and business models.

Uncertainties related to MaaS include the unproven nature of the MaaS concept and the expected rapid continuation in the range of mobility options that can potentially form part of the MaaS ecosystem and the business modes through which they may be offered.

While MaaS stakeholders will expect regulatory provisions to change over time, ensuring that such changes are as predictable as possible will help maintain confidence in the economic and government environment. Predictability can be enhanced, in particular by regular engagement with MaaS stakeholders and by ensuring that the broad principles underlying the government's regulatory approach are clearly enunciated and that regulatory change remains consistent with those broad principles.

An important caveat is that, while engagement with stakeholders is fundamental, it is essential that it be conducted on an open and transparent basis. This helps to ensure that all actors can participate, are dealt with fairly and, to maintain confidence across the MaaS ecosystem and beyond, that the regulatory system is open and non-discriminatory. By contrast, closed, corporatist models of stakeholder engagement are often associated with regulatory capture and a diminution of public trust. As discussed in Chapter 4, building trust is important to attracting commercial operators to the MaaS environment.

Managing sustainable mobility outcomes

A crucial issue arising in discussions with BCR government officials and other stakeholders is the appropriate role, and form, of regulation to ensure that MaaS contributes to the achievement of the sustainable mobility objectives that are central to the Good Move programme. As noted in Chapter 3, this reflects concern that, while MaaS has the potential to improve sustainability outcomes, it may also have a negative impact on sustainability if it develops in certain ways. In particular, most sustainable modes (walking, cycling, public transport) are either free or provided on a low-margin and generally subsidised basis. This could mean that commercial MaaS providers will de-emphasise or fail to promote these modal

options actively. Imposing specific obligations on MaaS providers as part of the body of MaaS-specific regulation could potentially “steer” the development of MaaS offers in more sustainable directions.

Conversely, the commercial viability of MaaS has yet to be demonstrated. The ability of MaaS providers to adapt and innovate, develop and tailor market offers in response to improved understanding of consumer demands, will be essential to their commercial success and, hence, the sustainability of the MaaS market. Regulations that constrain market conduct necessarily risk undermining the ability of market players to adapt to consumer preferences and thus may threaten the viability of the developing MaaS ecosystem. A successful MaaS model could contribute to the achievement of other important policy goals as well as sustainability. In particular, it could significantly enhance equitable accessibility outcomes. Thus, seeking to “steer” the development of MaaS through direct regulatory intervention necessarily entails important risks.

The expected benefits and costs of regulatory interventions should be weighed carefully and that regulation should proceed only when there is a clear net benefit. Alternative means of achieving identified regulatory objectives should also be identified and their expected impacts assessed and compared so that the most effective and efficient option is systematically chosen (OECD, 2005_[40]; OECD, 2012_[41]).

In the BCR context, the adoption of the broader Good Move programme, with its strong focus on promoting sustainable mobility, is a key consideration. The suite of measures in Good Move that aim to promote sustainable mobility must be assessed carefully to determine whether the adoption of additional, MaaS specific, regulation is either necessary or desirable. The following identifies and discusses key actions identified in Good Move that are particularly relevant to MaaS, to ensure that its net effect on sustainable mobility outcomes is a broadly positive one.

1. *Develop road charges* based on vehicle use differentiated by distance travelled, time of travel and type of road (Good Move, 2021; Action D.4)

A significant literature demonstrates that private car users do not pay the full costs of their use of road space. Road pricing will change the relative prices of private vehicle use and more sustainable transport options, yielding price signals that support moves toward more sustainable choices. To do so, it must be set at a rate that equalises the marginal private cost of car use with its marginal social cost.

BCR has already begun to develop a dynamic road user charge, known as “SmartMove”, which is intended to be implemented from 2022. The scheme aims to contribute to a reduction of 18% in vehicle kilometres and reduce individual car trips by a quarter by 2030 (SmartMove, 2020_[74]). The calculation of the charge will incorporate elements based on the time of day the trip takes place, the distance travelled and the engine size. Implementation of SmartMove will necessarily have a significant impact on the development of MaaS offers. It will make trips that include the use of private vehicles (e.g. ridesourcing, car hire) relatively more expensive than would otherwise be the case. Thus, this policy will favour the sustainability performance of the MaaS ecosystem.

2. *Phase out internal combustion engines* and prepare for vehicles with alternative propulsion systems (Good Move, 2021; Action D.5)

Policies that favour the shift from internal combustion engines (ICEs) to electric vehicles (EVs) for the vehicle fleet will lead to sustainability gains by reducing air and noise pollution in the urban area. Key measures proposed under this action, such as expanding the charging network for EVs, will encourage greater use of EVs in the MaaS context, as in the vehicle fleet more generally. In practice, the relatively large distances covered by vehicles offered via MaaS (e.g. ridesourcing) suggests that such incentives for EV use will have a proportionately larger impact in the MaaS context than across the vehicle fleet generally.

3. *“Strengthen parking management tools as a lever to achieve mobility goals”* (Good Move, 2021; Action D.2)

Car parks and on-street parking constitute a major use of public urban space. Thus, where parking prices are set at levels that do not reflect the scarcity value of this space, incentives for inefficient misallocation of public space are created. Reforming parking pricing can complement road user charging in helping to internalise the social costs of private vehicle use and have major incentive effects. Policies that move towards more efficient use of space for parking are included in ‘Good Move’, but additional measures could be incorporated into the policy over time to strengthen the impact of this policy tool.

In particular, this should involve removing on-street parking, increasing parking prices and implementing dynamic parking pricing. In addition, amending planning controls to require fewer parking spaces per unit of habitable space can lower citizen expectations about car use (ITF, 2021^[35]). A trial in Gothenburg, Sweden (EC2B) tried introducing parking restrictions in conjunction with a MaaS offer and observed a reduction in car use due to the inconvenience of parking further away (Hensher, D. A. et al., 2020^[75]; Smart City Sweden, 2020^[76]).

4. *“Establish ‘mobility budgets’ in businesses”* to replace tax benefits on company cars and car parking (Good Move, 2021; Action D.3)

The practice of employers offering a company car to employees is particularly widespread in Belgium. A number of employers have adopted the concept of a mobility budget, where employers can offer employees a budget that can be spent on alternative mobility options as part of their compensation package, instead of a company car (Deloitte, 2019^[77]). B2B integrated mobility payment solutions have already developed in Belgium in response to the mobility budget. This is important for MaaS providers since the mobility budget creates a new market for B2B MaaS where a MaaS provider manages employees’ mobility budgets on behalf of the employer. This has been the approach of the Sydney MaaS trial that ran for two years from 2019 (Hensher et al., 2021^[46]). Thus, this element of Good Move should have the effect of increasing MaaS demand, helping to underpin its economic sustainability.

5. *Encourage active transport* (Good Move 2021, actions C3, C11).

Not all externalities are negative. The health benefits of active travel (particularly walking and cycling) are well documented (Mulley et al., 2013^[78]; OECD/ITF, 2013^[79]). Therefore there is an efficiency argument in favour of subsidising the provision of facilities for active travel, as well as recognising that use of public transport usually involves active travel at interchange and in first- and last-mile access. The inclusion of the health benefits of active travel in the assessment of new infrastructure options will help to ensure more rational priority setting. The promotion of active mobility is a key component of Good Move. The Brussels Region has invested in infrastructure and policies, such as a citywide 30 km speed limit that support this goal by helping to provide a safe and inviting environment for active travel. MaaS will have a role in promoting some active travel, notably by shared bikes and e-bikes. However, much active travel is free at the point of use (e.g. walking, owned cycles and push-scooters) and thus falls beyond the scope of MaaS providers’ market offers. That said, an environment that promotes active mobility can create a culture that will indirectly guide the services demanded by the customer in a MaaS offer.

The above discussion highlights the fact that several of the initiatives contained within the Good Move package can be expected to encourage the development of MaaS in a sustainable direction. Moreover, until MaaS develops on a mass scale, its impact on the overall sustainability performance of the BCR region will be limited. These factors, taken together, strongly suggest that explicit measures to steer the development of MaaS in more sustainable directions should not be incorporated within the proposed MaaS ordinance. Avoiding imposing undue constraints on the ability of early movers in the MaaS ecosystem to innovate and compete will increase the likelihood that one or more economically viable MaaS business models will emerge.

As MaaS develops toward a mass scale, a review of its impact on sustainability will be appropriate. Detailed analysis of MaaS experience by then will provide the best basis for determining whether there is a need for revision to the body of sustainable mobility policies contained in Good Move. And if so, does this need to address MaaS-related issues or will there be a need for MaaS-specific sustainability policies to be incorporated in the MaaS ordinance.

6 Data governance

There is no Mobility as a Service (MaaS) without data or, more precisely, without data sharing among all MaaS stakeholders. The data governance framework is therefore the “architecture” on which MaaS must be built. Data and the knowledge derived from its collection, processing and analysis, has of course been a necessary component of the delivery of any mobility service. Data regarding the location of static and moving assets, the scheduled or real-time operation of services, prices and payment clearing, access rights, and customer profiles. MaaS creates the need to share this data among other actors in the broader mobility ecosystem in order to provide joined-up services for travellers.

MaaS promises ease for travellers via a convenient customer-facing user interface that builds on a complex back-office exchange of sometimes-sensitive information amongst different actors. Delivering MaaS in the BCR requires an appropriate data governance framework that guides the management of these exchanges in a way that provides a compelling experience for travellers, enables remunerative business models to develop, and maximises social welfare outcomes.

Overview of the data architecture, flows and governance principles enabling Mobility as a Service

The data architecture for MaaS enables its ecosystem to function. This section outlines the architecture’s two pillars, the principles that govern it and the data flows between market actors and from market actors to public authorities.

The core data governance framework for the BCR should be articulated around two key pillars. The first comprises **data sharing and portability** requirements among market actors that enable the market to function. The second is the **data reporting** requirements to public authorities that allow monitoring and planning (and control, if necessary). Both pillars must ensure personal data protection is fully in-line with the EU General Data Protection Regulation provisions.

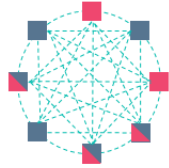
The data architecture for MaaS in BCR should build on three key principles:

1. MaaS is a secondary market, which requires access to data to function.
2. Mobility operators, must abide by the data sharing and data reporting provisions of the regulation as a condition of their licence. MaaS providers, as a condition of their licence, must also abide by the data portability conditions of the regulation and some data reporting requirements.
3. Data sharing and reporting requirements are purpose-specific, minimised and enacted via permissioned access to standard or functionally equivalent application programming interfaces (APIs) except for transactional data sharing.

Figure 5 Outline of proposed data architecture for Mobility as a Service in the Brussels-Capital Region

Pillar 1: Data sharing (DS)

between market actors
to **enable** market function



As a condition of their license, all **Mobility Operators** must share the minimum data elements and access pathways below to all licensed **MaaS Providers** (including those that are also Mobility Operators) to enable the MaaS market to function.

DS1

Informational

Data allowing MaaS Providers to create a combined travel offer (schedule, availability, latency, price, etc...)

DS2

Operational

Data allowing the fulfillment of a combined travel offer (vehicle/gate access, coordination of multi-leg trips, reservation, trip end and final clearing.

DS3

Transactional

A pathway that allows MaaS Providers to act as agents for individual travelers in gaining access and paying for transport services

Data sharing mechanisms

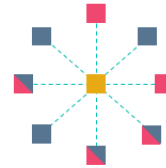
Minimal defined data elements must be shared via **standard or functionally equivalent application programming interfaces (APIs)** to allow all licensed MaaS Providers to create combined travel offers

Minimal defined data elements must be shared that allow the fulfillment of combined travel offers via **standard or functionally equivalent APIs**. This data includes requirements for **real-time data portability** (with data subject consent) relating to volunteered data and observed data but never inferred data (which is the intellectual property of the data processor)

Deep-link pathways must be provided for MaaS Providers to act as agents for individual travelers in accessing and paying for mobility services. Deep-linking allows the producer of the mobility service to retain control of the transaction and visibility on the consumer.

Pillar 2: Data reporting (DR)

from market actors to public authorities
to **monitor** market function



As a condition of their license, all **Mobility Operators and MaaS Providers** must report minimum and purpose-specific data elements to public authorities so that authorities can carry out their public mandates

DR1

Planning

Anonymised and aggregate (spatially and temporally) data that allows public authorities to understand mobility demand and market operation and plan or invest accordingly. Reporting is periodic and does not comprise personal data

DR2

Operations

Anonymised and aggregate (temporally) data that allows public authorities to intervene in real-time (e.g. via traffic light control or road closure/opening) or otherwise carry out their mandate to manage public space. Reporting is more frequent (nearing real-time for some specific data) but data is still de-identified. Data is fully aggregated after use and original data is destroyed.

DR3

Enforcement

Personal or vehicle-specific data is reported for identified (according to a probability threshold) traffic/parking code infractions. This data is treated under a separate secure reporting pathway with restricted and vetted access only. All data is destroyed after the completion of the enforcement action in line with data retention policies for enforcement actions. Only aggregate meta-data is retained.

Data sharing mechanisms

Standard or functionally equivalent APIs

Standard or functionally equivalent APIs.

Standard, restricted access and highly secure enforcement API

Pillar 1: Data sharing to enable Mobility as a Service

Data sharing amongst market actors enables the secondary market for MaaS to exist. Thus, as a condition of their licence to operate, all mobility operators and MaaS providers must share certain data (or provide access to specific transaction functionality) to enable three data sharing (DS) integration pathways.

DS1 Information: Involves mobility operators sharing minimum, necessary, *informational* data elements that allow MaaS providers to plan, create and communicate combined-mobility offers. This data relates to, for example, service schedule, latency, availability, location, cost, etc. This data should be shared via standard or functionally equivalent APIs hosted by all mobility operators and available to all licensed MaaS providers.

DS2 Operations: Involves minimum, necessary, *operational* data related to the provision and fulfilment of a combined mobility offer. This data relates to, e.g. identity of the traveller, their profile, access to vehicles and services, start of trip, on-trip co-ordination and end-of-trip clearing, etc. This data pathway is enabled by enhanced *data portability* requirements subject to data-subject consent (i.e. consent from the user). This data portability requirement allows all mobility operators and MaaS providers involved in delivering the trip to have the necessary access to traveller volunteered and profile (observed) data but not data inferred from the operational data, which remains the intellectual property of the data processor. Data should be shared via standard or functionally equivalent APIs hosted by all mobility operators and MaaS providers and available to all licensed MaaS providers and licensed mobility operators in the context of delivering a specific combined trip.

DS3 Transactions: Involves a pathway to mobility operator *transaction* booking and payment functions. This functionality is enabled by providing *deep-link access* to booking and payment, which enables MaaS Providers to act as agents for travellers when combining and paying for trip segments. Deep-linking also allows mobility operators to own and control the customer relationship while enabling MaaS providers to offer combined mobility offers. If mobility operators provide more extensive full protocol interoperability (discussed further on) for booking and payment pathways, deep-link access requirements may be dropped.

Data-sharing requirements involve sharing sensitive data among market actors. An audit mechanism should monitor strict adherence to purpose specification in processing and retaining data. An effective enforcement and redress mechanism should also be in place to dissuade misuse of data.

Public authorities and agents to whom they delegate public services face different data-sharing obligations than private actors (e.g. STIB-MIVB or SNCB/NMBS). Where these obligations would risk the release of data beyond that needed for MaaS to function, specific provisions will have to be enacted to prevent data “leakage”. This may take the form of a specific derogation to prevailing data-sharing or open-data rules or a ring-fenced data handling protocol that separates and protects these data streams.

DS1, DS2 and DS3 enable common data access pathways for licensed MaaS providers (including those that are also Mobility Operators) to create MaaS offers. As such, the data architecture *does not comprise a central data platform* controlled by a specific entity. Instead, it outlines *standard data exposure pathways* that are accessed by vetted market actors. Public authorities (or delegated third parties monitor and enforce compliance with data-sharing obligations. This provides a shared and open (to licensed market actors) primary data resource on which MaaS Providers may build their own services and platforms (e.g. the secondary market constituted by MaaS). DS1, DS2 and DS3, together, enable the creation of MaaS products which may include full MaaS platforms and apps or MaaS modules that could be integrated into other digital market platforms.

Pillar 2: Data reporting to monitor and control market function

To carry out their mandates, public authorities require access to data from actors in the MaaS ecosystem. Three data reporting pathways make up the data reporting pillar.

DR1 Planning and monitoring: Involves data that can be used to monitor how the MaaS market is functioning and to engage in *planning* activities on the basis of that data. This pathway captures aggregate snapshots of travel demand and developments to guide other policy decisions such as infrastructure provision, targeted subsidies to enhance accessibility or to monitor equity outcomes. This data is only needed on a periodic basis and should be anonymised and aggregated both spatially and temporally. It involves no personally identifiable data.

DR2 Operations: Involves data that allows public authorities to carry out *operations and management* functions, e.g. operating traffic light systems, managing public space, enabling road opening or closure, etc. These data should be anonymised and aggregated temporally (spatial disaggregation may be necessary for location-specific management actions). This data will require reporting with greater frequency and may involve near real-time updating. After operations or management actions have terminated, data is aggregated further and original data is destroyed. One of these management actions is to assess if mobility operators or MaaS providers comply with their terms of licensure, e.g. relating to data sharing, portability and reporting.

DR3 Enforcement: *Enforcement* actions require data directly linked to people and/or vehicles. This data is therefore the most privacy-sensitive and should be treated by a separate, secure and permissioned access-only pathway. This data should be aggregated after the enforcement action is completed in line with rules relating to such data and original data should be destroyed when legal to do so.

DR1, DR2 and DR3 must conform to *purpose specification* – the use that each dataset is being collected for should be clearly established and communicated to market actors. All three reporting pathways should also conform to data minimisation imperatives. Only the data necessary to carry out the purpose for which it is being collected should be requested by public authorities.

The technical mechanisms enabling data reporting should be aligned with those for data sharing – standardised or functionally equivalent APIs hosted by all mobility operators and mobility providers. DR3 APIs require specific security and data access protocols given the sensitivity of the information collected.

Data heterogeneity and data governance: Essential points from a Mobility as a Service perspective

The data governance framework must account for multiple aspects of data that will impact its use in the MaaS ecosystem. These aspects relate to what type of data is collected, how the data is collected and what type of integration is necessary to deliver MaaS. What follows is a discussion of some essential aspects of data that will influence and must be accounted for in the data architecture on which MaaS will be built.

Personal versus non-personal data

Data is heterogeneous. This fact is important in designing the MaaS data governance framework, as it directly impacts potential privacy risks to travellers. Principal distinctions to bear in mind are whether data is personal or not and, if personal, if it is being used anonymously or not.

The processing of personal data creates specific risks and must be handled under a dedicated regulatory regime – the EU General Data Protection Regulation (GDPR Regulation (EU) 2016/679). This regime

recognises a fundamental right to protect natural persons in relation to the processing of their personal data as outlined in Article 8(1) of the Charter of Fundamental Rights of the European Union (CFR) and Article 16(1) of the Treaty on the Functioning of the European Union (TFEU). In the case of the non-personal data or aggregate data, different rules may apply. For example, under the Digital Content Directive (Directive (EU) 2019/770) that applies to B2C applications, or the Free Flow of Data Regulation (Regulation (EU) 2018/1807) – that applies to B2B relationships, in addition to general competition law stemming from the application and interpretation of the Treaty on the Functioning of the European Union – TFEU) (Kramer, Senellart and de Streeel, 2020^[80]). Non-personal data may be contextual data (e.g. mapping data, data relating to parking rules, etc.) – insofar as this data is produced by public authorities, its conditions of access and dissemination are outlined under the EU ‘Open Data Directive’ (Directive (EU) 2019/1024).

Personal data is defined in Article 4.1 of the GDPR as “... any information relating to an identified or identifiable natural person (‘data subject’); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, [e.g. social security number] location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity [e.g. name and first name, date of birth, biometrics data, fingerprints, DNA...] of that natural person” (European Parliament and Council, 2016^[1]; CNIL, 2021^[81]).

The definition of personal data is fluid in that many data that have no direct personal identifiers may nonetheless be used to re-identify an individual. Whether data is considered personal depends on the potential for a data controller or data processor to determine the identity of an individual (the data subject) using reasonable means. The technical ease with which this may be accomplished increases as more and more data relating to individuals’ activities can be cross-referenced with other data. This is especially the case of location data (where an individual is) or location-activity data (from where to where an individual travelled). Because of the relative ease with which location-based data may be used to re-identify individuals, location-based data is considered personal data in the context of GDPR (Cremer, de Montjoye and Schweitzer, 2019^[42]; CNIL, 2021^[81]; ITF, 2016^[82]) and, as with other forms of personal data, has great commercial worth. It is also an essential type of data produced and processed by mobility operators and MaaS providers in delivering services to individual travellers.

Personal data can be used “as is” or may be anonymised – that is, it is treated so that it no longer has direct identifiers. GDPR governs the use of the “as is” data and may govern the use of the anonymised, depending on the strength of the de-identification processing. A set of GPS co-ordinates tracking the movement of a person using a shared e-push scooter may be anonymised by removing any direct identifier (name, credit card, birth date, etc...). For these reasons just outlined, such anonymisation does not constitute robust de-identification processing as cross-referencing that data with other available data sources could re-identify the person. The risks of re-identification should still trigger GDPR protection of the GPS track as personal data. If, on the other hand, the track was truncated at the starting point and at the ending point, aggregated with other truncated tracks by departure and arrival zone and grouped into chronological bins (e.g. per hour), then the effort required to re-identify individual tracks (and therefore, the person travelling) would be orders of magnitude higher. Such data would constitute personal data used anonymously and would not trigger GDPR protection.

Data collection methods

Data may be volunteered by a data subject, *observed* based on the data subject’s actions and behaviours or *inferred* from the data subject’s actions or behaviours (World Economic Forum, 2011^[83]). These distinctions matter for data portability and data sharing requirements for MaaS.

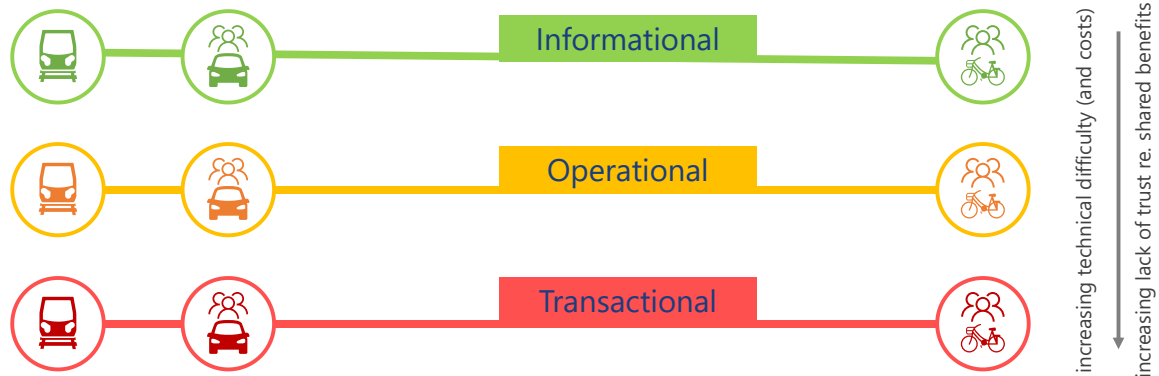
- **Volunteered data** is typically personal data and includes data provided by individuals so that they may use a product or access a service or in the context of consuming a service. These might include name, birthdate, payment information, access credentials (e.g. driver’s licence or public transport subscription), etc. It may also include reviews and ratings offered by individuals in the context of a service they have used.
- **Observed data** relate to behavioural data automatically triggered and logged by a user – or more specifically, by a sensor platform or machine used by a user (e.g. a car, a smart phone, a GPS tracker, etc.). This data may include GPS tracks, logs of vehicle usage characteristics (acceleration, deceleration, speed, web page clicks and navigation data). Observed data may be purposefully initiated by a user action (e.g. a search request) or passively recorded in the background (WiFi networks queried for status updates or to which users may have connected). These data constitute observations of individuals’ behaviours but do not include inferences based on these observations. Insofar as observed data is personal data or can be reasonably judged to be so. It falls under the framework of the GDPR.
- **Inferred data** relates to data that results from the purposeful processing and transformation of volunteered or observed data that may still relate to a specific person or the device that they are using. This data may include profiles derived from grouping and processing volunteered data or observed data. This processing may use proprietary algorithms or group different data together to create new data insights. Inferred data is derived from personal data that has been processed by a data processor, which may also be a data controller. Its creation is subject to both disclosure by the data controller of the purpose to which it will be put and to the consent given by the data subject for this processing and use.

These terms and distinctions do not constitute legal definitions – there is some grey area – especially concerning what constitutes observed data (Cremer, de Montjoye and Schweitzer, 2019_[42]). They are nonetheless important concepts to bear in mind when considering data sharing and data portability requirements in support of MaaS. These categories are useful to assess whether data access via the data controller is necessary to compete in the MaaS ecosystem or if other pathways for collecting or substituting volunteered or observed data exist (Cremer, de Montjoye and Schweitzer, 2019_[42]). Inferred data is at the core of competition in data and digital markets – it is in “mining” these insights that market actors create intellectual property and leverage it to gain an advantage *in the market*. Depending on market characteristics and dynamics, providing shared access to certain forms of volunteered or observed data may, on the other hand, be essential to *create the conditions for a competitive market* (Cremer, de Montjoye and Schweitzer, 2019_[42]).

Data integration domains

MaaS requires the integration of different mobility operator data (Figure 6). This integration takes place across three domains – *informational integration*, *operational integration* and *transactional integration* (Lyons, Hammond and Mackay, 2019_[50]).

Figure 6 Types of data integration necessary for Mobility as a Service



Source: Adapted from Lyons, Hammond and Mackay (2019^[50])

Informational integration relates to the integration of data regarding the availability of mobility services. It covers information on asset/vehicle identity, location, service type, schedule information or latency in the case of non-scheduled services, etc. It may also include routing and navigation information for a specific, customer-initiated trip request. This data represents what information is necessary to select a trip option and is generally not technically challenging to provide (though it is not costless). Insofar as it represents the integration of largely publicly available data, informational integration is generally not seen as much of a commercial challenge. However, there are concerns that mobility operators may lose direct contact with their clients if the request for information integration is initiated by a MaaS provider.

Operational integration relates to the integration of data regarding the physical joining of different mobility operator services. This may relate to access rights, the seamless integration of access protocols (e.g. gate-based access vs. contactless access – an issue in the BCR with STIB-MIVB and SNCB/NMBS operating on the basis of different access protocols). Poor operational integration leads to greater interchange penalties as travellers must overcome unjoined or poorly linked legs of multimodal journeys. Operational integration is more complicated to carry out than informational integration largely because of sunk investments in data systems and associated hardware that must be retrofitted to ensure more seamless interoperability. For this reason, mobility operators are often unwilling to pursue operational integration unless they feel they would derive clear benefits from doing so and that these benefits are greater than the investments required. Therefore, public authorities have often required and/or facilitated operational integration of public transport services with the expectation that these benefits would generate overall improvements in consumer and societal welfare.

Transactional integration is the most difficult type of integration to achieve, as it requires that mobility operators and MaaS providers agree to integrate booking and payment services. It also requires agreement on revenue allocation principles and protocols. The spectrum of transactional integration ranges from none, to reciprocal (or not) deep-linking to other mobility operator booking and payment protocols and finally to fully integrated, in-App booking and payment for all mobility operator services in MaaS provider interfaces.

Public authorities and transport services have recognised the value of data integration across all three of these domains. They are making an effort to ensure that public transport mobility operators display high levels of informational, operational and transactional integration. This is the case for public transport services within the BCR.

Types of data interoperability

Data integration across all three domains outlined above requires interoperability. Enhanced interoperability of the sort required by MaaS can take one of three forms – *protocol interoperability*, *data interoperability* and *full protocol interoperability* (Cremer, de Montjoye and Schweitzer, 2019^[42]). These constitute the technical models that serve to integrate services in the MaaS ecosystem.

Protocol interoperability refers to the technical ability for distinct services or products to connect to each other. It comprises the technical standards, data schemas, syntaxes and common semantical models that allow systems to “speak” to each other. The strongest level of protocol interoperability stems from the use of accepted (or imposed standards) and data syntaxes. These may be set by standard-setting bodies or may be *de facto* standards set by a firm or by consortia of dominant market actors. In the context of MaaS, public authorities may also set standards for protocol interoperability concerning data reporting, for instance. Even when they are evolutionary, setting standards may close out innovation and impose costs related to complying with the standard. This is especially true for small and medium-sized operators who have already built their data architecture around one standard or data schema.

A lighter approach to ensure protocol interoperability could be to ensure broad functional alignment between standards used by actors in the market. This functional interoperability may be delivered by market actors agreeing to (or being required to) conform to a common data schema rather than a specific standard. The difference between a data standard/syntax and a data schema may be illustrated by analogy to the design of a house. A standard/syntax defines the function, size and disposition of every room in the house as well as their fittings. A schema defines only the functional attributes of the house (e.g. a house should have a bathroom, a kitchen, a living space, etc.). In the context of a MaaS data schema, these functional attributes (or “bins”) relate to, for example, identification, trip planning, operational trip joining, access rights, bookings, payments, transaction settlement, on-trip assistance, etc. These can be seen as the basic building blocks or functional elements that any mobility operator or MaaS provider should enact in their preferred data syntax to ease protocol interoperability.

Data interoperability is a form of data access and sharing referring to the near real-time access and sharing of data that enables different operators to deliver a combined service to the user. Current approaches to data interoperability rely on permissioned use of automated programming interfaces (APIs) that enable users to grant access to their data held by one operator to another operator (using a unique access token⁹). Data interoperability requires protocol interoperability extended to the specification of common APIs. There is a direct cost to market actors of ensuring data interoperability. This cost comprises *fixed* costs relating to re-engineering internal data architectures and creating and maintaining necessary APIs and the *variable* costs of servicing API calls, handling the resulting data transfers (network costs) and ensuring security. In most cases, the variable costs are low but complex, frequent or voluminous API calls may drive network costs up.

Full protocol interoperability refers to the ability for two completely separate systems to display full and deep interoperability – for instance a public transport operator being able to offer a shared scooter service natively within the public transport operator’s App, or vice-versa. Email and other messaging systems display full protocol interoperability as do the interconnection of telecoms networks. Full protocol interoperability requires protocol interoperability built on broadly accepted (or often required) common standards. Regulatory interventions have imposed full protocol interoperability (as in telecoms markets) where the benefits of this requirement outweigh the costs firms must face in its implementation. Figure 7 summarises the principal elements of data heterogeneity relevant to the data governance framework for MaaS in the BCR.

Figure 7 Overview of data heterogeneity elements to consider in the data governance framework

Data may be personal or non personal in nature

Personal data (including location-based data pertaining to individuals) triggers application of GDPR.

Non-personal data may still fall under other rules but these are generally less constraining or specific.

Data collection may be volunteered, observed or inferred

Volunteered data is data provided by individuals to use a product or access a service or in the context of consuming a service.

Observed data relates to behavioural data automatically triggered and logged by a user or a machine they use.

Inferred data results from purposeful processing and transformation of volunteered or observed data to derive insights not contained in the data itself.

Data integration may relate to information, operations or transactions

Informational integration relates to the integration of data regarding the availability of mobility services.

Operational integration relates to the integration of data regarding the physical joining of different mobility operator services.

Transactional integration relates to mobility operators and MaaS Providers integrating booking, payment and transaction clearing functionalities.

Data interoperability may relate to protocols and data access or full interoperability of both

Protocol interoperability refers to the technical ability for distinct services or products to connect to each other.

Data interoperability is a form of data access and sharing that refers to the near real-time access and sharing of data that enables different operators to deliver a combined service to the user.

Full protocol interoperability refers to the ability for two completely separate systems to display full and deep interoperability of protocols and data.

Source: Adapted from Cremer, de Montjoye and Schweitzer (2019^[42]) and Lyons, Hammond and Mackay (2019^[50]).

Portability of consumer data

Consumer lock-in is an inherent risk in digital markets and leads to sub-optimal competition outcomes by preventing the free movement of consumers from one service to another or by preventing consumers from using the services of their choice (multi-homing) (Kramer, Senellart and de Streel, 2020^[80]; Cremer, de Montjoye and Schweitzer, 2019^[42]). Data portability of a data subject’s personal data is a right inscribed in article 20 of the GDPR (see Box 5). The European Data Protection Board (EDPD) has provided guidance that the term “provided by the data subject” should be interpreted broadly, and should cover both volunteered data and observed but exclude inferred data and derived data (Kramer, Senellart and de Streel, 2020^[80]; European Commission, 2017^[84]). The *Guidelines of Article 29 Data Protection Working Party on the right to data portability* (European Commission, 2017^[84]) also note the limits of data portability under GDPR – “portability aims to produce interoperability systems, not compatible systems”.

Data portability – operated automatically or via a third party – also enables the creation of secondary markets (Cremer, de Montjoye and Schweitzer, 2019^[42]) and has been upheld as principle for enabling more competitive EU markets. In the context of MaaS, data portability reduces frictions, enabling more seamless travel resulting from the combination of multiple mobility operator services. It also enables the secondary market for the delivery of MaaS Provision. Enhanced data portability may be seen as a burden by some operators but requiring it for all actors on the market enables innovation and the creation of new value based on a common data resource.

Building mandatory data portability into the MaaS framework would require a robust interpretation of data portability rights that extends those outlined in Article 20 of the GDPR. This portability right should be exercised not on an occasional basis but in near real-time as needed to service each data subject’s MaaS

transactions. Such an interpretation of data portability constitutes a case of *Data interoperability* outlined above. Both the extension of the limited data portability right to more types of *observed data* and the extension of that right to cover *data interoperability* may or may not be confirmed by European judges in response to legal challenges that would question this broad interpretation. Nonetheless, there is an argument that such a broad interpretation would benefit consumers (by further avoiding lock-in) and by opening up secondary markets (e.g. of providing MaaS offers) (Cremer, de Montjoye and Schweitzer, 2019^[42]).

According to article 20.3 and recital 68 of the GDPR, data portability does not apply when the data processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the data controller or when a data controller is exercising its public duties. This provision is a limitation to a broad interpretation of the data portability right. This limitation is important when the STIB and other mobility actors are public authorities or perform a public service. Therefore, it will be necessary to ensure that regulations distinguish between the data processing carried out by these organisations in the context of enabling MaaS and the data processing they carry out in the context of their public service mission.

More robust data portability (and data access/data sharing requirements) have been imposed through sector-specific regulation or under article 102 of the Treaty on the Functioning of the European Union (TFEU) in the case of dominant firms.

The banking sector has settled on broad interpretations of the implementation of data portability rights – e.g. extending the types of rights outlined in GDPR to allow near real-time portability of a data subject’s personal data. The Payment Services Directive 2 (PSD2) – Directive 2015/2366/EU – builds on and broadens the B2B portability rights outlined under Article 20.2 of the GDPR. It allows data subjects to authorise direct transmission of their data to third-party service providers and requires banks to carry out this transmission of data. It compels banks to ensure the technical feasibility of these transfers and specifies that this portability should be continuous (e.g. enacted every time the data subject triggers a data portability request by authorising a third-party service provider to deliver a service or carry out a transaction on the data subject’s behalf (Kramer, Senellart and de Streel, 2020^[80]; Cremer, de Montjoye and Schweitzer, 2019^[42]). This is the model of data portability that this report recommends the BCR (and indeed, the EU) aim for.

The first data portability right (see Box 5) is the strongest and should be exercised fully and without obstruction by the data controller. The second portability right is weaker in that it must be exercised where “technically feasible”. The right to data portability may include data generated by a data subject in the context of asking for or using a service. The portability of such real-time data is an instance of data interoperability described above and requires protocol interoperability to function. In its interpretation and implementation of the GDPR data portability rights, the BCR’s data governance framework should address the technical feasibility of data interoperability by providing guidance or specifying requirements on the technical means to enact enhanced data portability in support of MaaS. It should carefully consult and interpret the GDPR portability rights to do this. Especially when considering the specification of common data portability API functionality or standard APIs for all market actors to use (see Box 6).

Other aspects of GDPR govern data portability, namely data-subject consent (i.e. consent from the user), stated purpose of data collection/processing and the possibility for a data subject to authorise the direct transmission of their personal data from one data controller to another either automatically or via a designated third party. In the case of MaaS, the designated third party could be a MaaS provider or a combined mobility operator/MaaS provider.

Several risks must be managed in the implementation of data portability rights, especially those that would extend the basic interpretation of these rights as outlined in Article 20 of the GDPR. These are outlined in Chapter 8 following the recommendation on data portability.

Box 5. Article 20 of the General Data Protection Regulation – Regulation (EU) 2016/679) – Right to data portability

1. The data subject shall have the right to receive the personal data concerning him or her, which he or she has provided to a controller, in a structured, commonly used and machine-readable format and have the right to transmit those data to another controller without hindrance from the controller to which the personal data have been provided, where: (a) the processing is based on consent pursuant to point (a) of Article 6(1) or point (a) of Article 9(2) or on a contract pursuant to point (b) of Article 6(1); and (b) the processing is carried out by automated means.
2. In exercising his or her right to data portability pursuant to paragraph 1, the data subject shall have the right to have the personal data transmitted directly from one controller to another, where technically feasible.
3. The exercise of the right referred to in paragraph 1 of this Article shall be without prejudice to Article 17. That right shall not apply to processing necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller.
4. The right referred to in paragraph 1 shall not adversely affect the rights and freedoms of others.

Data sharing between market actors

The sharing of data between market actors is what defines MaaS and is thus essential for the existence of its ecosystem. Data sharing by mobility operators is complementary to data portability rights and requirements for traveller personal data – they both enable the basic function of the MaaS ecosystem. Shared data should be available to all accredited MaaS providers and allow each to create products and services using the same common data resource. Minimum data sharing requirements would enable actors in the market to compete based on their added value, not because of exclusionary data access policies.

The MaaS ecosystem cannot exist without data sharing and data access between mobility operators and MaaS providers. Data sharing responsibilities for mobility operators and data access rights granted to MaaS providers allow the providers to create new cross-modal mobility offers tailored to the needs of individuals. It allows greater efficiency in the use of transport assets and creates the potential for innovative new services and secondary markets to be developed based on this data.

Enhanced data sharing and data access requirements raise several vital questions. The first is what data can and should be shared or possible to access between market actors?

Each data controller receiving personal data may only retain and process the data relevant to the purpose of the “new processing” they are performing. The receiving operator becomes a new data controller regarding the personal data and must respect all the principles stated in GDPR.

Minimum data sharing requirements for mobility operators should include data necessary for informational integration and operational integration. This would be imposed in licensing agreements by

Brussels Mobility or other relevant public authorities and would assist search and pre-booking functionality and ensure that MaaS offers can be executed. At present, both the EU ITS Directive – 2010/40/EU (in *principle*) and the EU Delegated Regulation on Multimodal Travel Information Services 2017/1926 (in *practice*) address data sharing and data access among potential MaaS market actors. Both directly reference *informational integration* and indirectly imply some level of *operational integration* – insofar as certain types of shared information on services enable their operational delivery. Both are also under revision with, among other things, the stated objective of including some form of *transactional integration* within their scope (e.g. booking and ticketing).

Implementing minimum data sharing requirements implies a high degree of *data interoperability*. This data must be made available at a latency that allows MaaS providers to create and execute travel contracts with their clients – this supposes a latency of a few seconds. Meeting such latency requirements suggests the use of dedicated, standardised MaaS integration APIs by mobility operators with standardised but limited access rights granted to accredited MaaS providers. This explains the need for a specific legal status for MaaS providers, even when these are also mobility operators (See Box 6). The identification of which data elements should be included in data access/data portability requirements can build on work already underway. This can create a data-sharing licence in the context of the implementation of the Delegated Regulation on Multimodal Travel Information Services (the draft “Convention d’octroi d’une licence communale aux fournisseurs de transport à la demande – section données”).

In the context of this recommendation, Brussels Mobility may wish to explore including a limited form of *transactional integration* to these requirements as well. At present, there is no obligation that all MaaS providers should offer transactional integration, though public transport operators voluntarily do so amongst themselves in the BCR. This may change due to the revision of EU Delegated Regulation on Multimodal Travel Information Services 2017/1926. The revision will condition the final configuration for data sharing among MaaS stakeholders in the BCR. In the meantime, lighter forms of *transactional integration* may be worth exploring.

The data governance framework could include an obligation for mobility operators to provide *deep-link* access for all accredited MaaS providers to mobility operators’ respective booking and payment functions. This would build on the concept of MaaS providers acting as agents representing travellers (as enacted by data portability requirements). This would simply replicate the access an individual traveller already has to book and purchase travel products via the mobility operator’s interface or App. This would facilitate the execution of combined trip offers while retaining the possibility for mobility operators to control the access to their existing product booking and sales channels. Such *deep-link* functionality is not an example of *full protocol interoperability* described above. However, insofar as MaaS providers and MaaS providers have negotiated mutually acceptable rates as described in Chapter 5, it provides a technical means for MaaS provider clients to access those rates.

A second question is who should share or give access to their data?

Data sharing could be enacted on bilateral or multi-lateral terms between market actors. Indeed, this is the dominant model for data sharing in support of MaaS absent an over-arching data governance framework. This approach is more straightforward to implement and govern but it faces risks. One such risk is the creation of vertically segregated “walled gardens” where data sharing agreements, especially if a dominant player is involved, exclude other actors from accessing the market or discriminate against their participation in the market on fair and reasonable terms (Cremer, de Montjoye and Schweitzer, 2019^[42]). Another risk is that data sharing by only a few actors in the market reduces the overall benefits that data sharing would enable in a more comprehensive and complete MaaS ecosystem. Incumbents may not wish to share data to preserve their market position and market entrants may not wish to grant dominant firms access to their data without reciprocal access. This would inhibit the possibility for a secondary market of MaaS provision to develop thus dampening the overall function of the MaaS ecosystem.

The focus of competition policy in the EU with respect to data sharing in digital markets has been on dominant firms that act as platform gatekeepers or otherwise exert disproportionate market power to protect their position and thwart data-driven competition (Cremer, de Montjoye and Schweitzer, 2019^[42]). This focus is included in the proposed EU Digital Markets Act and the proposed EU Digital Services Act. The Digital Markets Act imposes market dominance tests and specifies data access and sharing requirements for dominant firms or platforms.

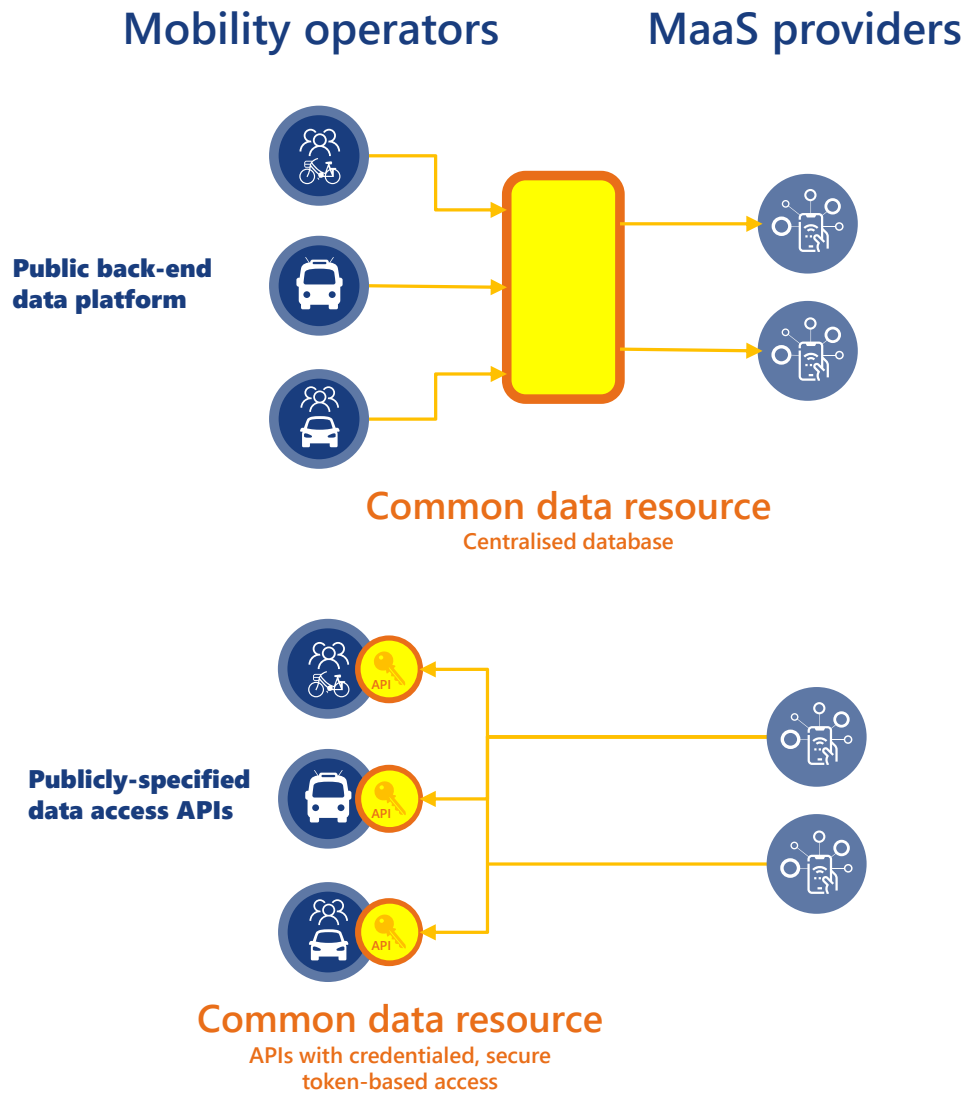
These tests and guidance provide insight on who should share data in a local/regional MaaS market. However, the nature of what constitutes “market dominance” for MaaS will likely be linked to a different reference scale. The scale of MaaS is essentially local or regional and is thus very different than the scale of other intermediary services that integrate multiple suppliers and may reach millions of consumers across multiple regions and countries. Given the importance of public transport in the regional MaaS ecosystem and the dominant role it plays in many cities, public transport operators may be seen as dominant market actors on the mobility operator side. At the same time, the ease with which digital actors, especially digital platform operators that can muster considerable economies of scale (e.g. search engine and navigation platforms) could conceivably quickly gain dominance in data-enabled MaaS markets on the MaaS provider side. This suggests that incumbency advantages and market dominance may switch within the MaaS market and this requires ongoing monitoring.

A third question is whether (minimal) data access should be required of all MaaS actors?

The answer to this question is not settled but there is precedent in Europe, again, in the financial services sector. The Payment Services Directive 2 (PSD2) – Directive 2015/2366/EU – described earlier not only specifies a broad and enhanced data portability right. It also mandates data sharing of customers account information by banks to support the execution of the data portability right. The justification for this is that this data access requirement is essential to create the secondary markets for payment and processing services targeted by the directive (Cremer, de Montjoye and Schweitzer, 2019^[42]). Absent settled case law or an existing defined regulatory framework on data sharing in the context of MaaS, this report recommends adopting data access/data sharing requirements of PSD2 as a model for the BCR MaaS ecosystem.

Apparent consensus already exists on the desirability for an open framework built on a common back-office platform and API architecture to underpin the regional MaaS ecosystem. STIB-MIVB has taken the lead in developing both the platform and a front-end MaaS application. Other transport service operators or MaaS providers would be able to build their own consumer or business facing MaaS applications through the open back-end platform. Enacting this recommendation would involve changing the focus from a dedicated and open back-end platform to a set of commonly implemented standardised data access APIs (see Figure 8). This change implies a different data-sharing governance framework moving from oversight and control of a data platform to monitoring and auditing open API connections and use. Such an approach has the advantage of reducing some of the potential risks of concentrating all of the data necessary to operate an integrated MaaS offer (see Box 6).

Figure 8 MaaS data sharing architectures: Open back-end platform vs. distributed API portals



Box 6. Technical implementation of data sharing in support of MaaS

Much of the focus on data sharing arrangements in support of MaaS has centred on centralised data collection and management by a back-end data platform operating entity. This approach assumes that market actors provide data to the platform and that the platform operator manages access to the data by different market actors as necessary and as required to carry out integrated trip offers. This model raises questions regarding trust that the back-end data platform operator would act in a neutral capacity regarding both its gate-keeping and governance functions. There is also the risk that centralised data collection may lead to data leakages or other unwanted outcomes.

One way to address these risks is to create a more agile data-sharing mechanism building on permissioned and conditional data exposure via specific Application Programming Interfaces (APIs) – see Figure 8. In practical terms, when a MaaS provider wishes to create or initiate a trip integration request, an authenticated token is issued that authenticates the MaaS provider's identity as well as the validity of the trip request and establishes a trip identifier. This token is used to access relevant mobility operators' data sharing APIs and triggers the exposure of agreed data elements necessary to plan and fulfil that trip request. For instance, informational and operational data elements and, if contractually agreed by the transacting parties, booking and payment elements – otherwise, providing a deep-link pathway to the mobility operator's own booking and payment service.

The trip-based token is also used to deliver on the data portability requirement allowing the MaaS provider to join different services and for mobility service operators to co-ordinate the delivery of these. Tokens can also be used to deliver time-bound authorisation for certain actions and transactions. The validated authentication and conditional authorisation functions provided by the token-API architecture limit over-broad data exposure risks and allow auditability and traceability in order to address risks of anti-competitive behaviour. They also have the advantage of building on well-known protocols, including those conforming to representational state transfer architecture (RESTful architecture).

Data reporting to public authorities

This functionality is central to the ability for public authorities to carry out their mandates concerning the MaaS ecosystem and its actors. It is, therefore, an integral element of the MaaS governance framework. Because of governments' unique ability to compel action, data reporting mandates should require the minimum amount of data necessary by default. Mandated data reporting from mobility operators and MaaS providers to authorities should be purposeful and adapted to the regulatory tools and methods authorities deploy to meet their mandates such as market oversight and enforcement, pricing, parking policy, urban access restrictions, speed management. Reporting requirements need to include rules relating to an appropriate level of aggregation, data handling, data retention periods and auditability, as well as data destruction protocols. Consistent with the separate regulatory treatment of mobility operators and MaaS providers, reporting frameworks should be distinct and specific to each functionality (providing mobility services versus providing MaaS).

From a public policy perspective, data reported by mobility operators and MaaS providers to public authorities allows the authorities to enforce and monitor compliance with rules related to public policy

outcomes. For example, rules relating to competitive markets, safety, regulated uses of public space, and other public policy objectives. This data is also essential for planning purposes, enabling regulatory weaknesses to be identified and rectified through further regulatory change, thus helping authorities to improve efficiency, equity and sustainability, contributing to improving the welfare of people.

Meeting regulatory reporting requirements calls for deploying common data elements and syntaxes. Regulatory compliance burdens can be reduced by specifying and enabling the use of common data access methods, semantics and syntaxes. Common formats have been the rule for analogue data reporting in the past and the call for convergence around common reporting formats for mobility data is still very much relevant today. However, the rapid expansion of digitally enabled mobility services has led to a double burden. Reporting requirements that specify standards and syntaxes place burdens on mobility operators and MaaS providers who cannot easily export their data into those formats. A second burden is placed on public authorities who, in the pursuit of their regulatory tasks, face costs stemming from having to process data from various operators in incompatible formats or data syntaxes. Furthermore, the multiplicity of bespoke data architectures and syntaxes are often not directly compatible with the data public authorities may wish to access.

At present, there is no broadly accepted data syntax to convey information from mobility operators and MaaS providers to authorities. This lack of coherence hampers the governance of MaaS. Several standards exist – public transport operators in Belgium rely on NeTeX and DATEX II to co-ordinate interoperable services. These syntaxes are also used to report data to public authorities. Other syntaxes have been deployed or are under development, notably to help manage data reporting from new mobility services. These include the Mobility Data Specification (MDS) and the City Data Standard – Mobility Mobility standard (CDS-M). These may form the basis of a broader multimodal and multi-service data reporting framework, but it is still too early to tell how and when this might happen.

At present, it seems prudent to provide MaaS stakeholders with clarity on what data should be reported to public authorities for which purposes while adopting a flexible approach regarding the specification of data reporting mechanisms for MaaS stakeholders.

Brussels Mobility and other public authority bodies should develop a data inventory that MaaS providers and mobility operators must report to public authorities. This data inventory should seek to minimise data reporting requirements to only those data that enable authorities to carry out specific and identified regulatory functions or mandates. This requirement meets the twin goals of purpose specification and data minimisation. It should enhance trust on the part of MaaS stakeholders that data reporting requirements are proportionate and necessary to carry out effective governance of the MaaS ecosystem.

Data-reporting mechanisms should reduce burdens on reporters and receivers of data. In this respect, Brussels Mobility may designate a reference digital data syntax and a functional schema relating to that syntax (see discussion of data schemas under protocol interoperability, above). Use of the digital data syntax should be voluntary at first and could be incentivised. Use of the functional schema should be required. Such a “bring your own syntax” framework ensures that stakeholders understand the preference of public authorities with regards to data reporting methods but allows them the freedom to use another syntax if it is functionally compatible with the reference syntax or if stakeholders can provide their own interoperability interface “plug-in” that is compatible with the functional architecture of the reference syntax. Such an approach should avoid lock-in to one syntax, allow greater potential for future adjustment and reduce data reporting compliance costs for MaaS providers and mobility operators and also data processing burdens on the part of Brussels Mobility or its designated data processor.

Public authorities in the BCR have already engaged themselves in two new data reporting initiatives that have an incidence in the MaaS data governance framework:

1. The first is the creation of the Brussels Data Hub. This Hub responds to an identified need to centralise access to mobility relevant data collected and held by public authorities in the BCR. This data hub would allow common but credentialed and differentiated access to publicly held data across regional agencies and government departments. The data-hub solution would allow the processing of disparate data in multiple formats and syntaxes, enabling the extraction of monitoring or regulatory insights. In the context of this recommendation, the Brussels Data Hub should be seen as a facilitative mechanism to achieve less burdensome data collection on the part of public authorities. Data collected through the interaction with mobility operators and MaaS providers in the MaaS ecosystem could be stored and made available for authorised and accredited use in the Brussels Data Hub.
2. The second is a data reporting framework for shared micromobility that conditions market access, enables effective enforcement and serves as the basis for forward planning. Putting in place the shared micromobility data reporting framework has revealed the need to create new regulatory definitions – in particular that of *data processor* to designate the legal entity that undertakes data intake and processing on behalf of Brussels Mobility. Insofar as this is a continuation of prior, siloed approaches to data reporting, this initiative should eventually be subsumed into a broader data reporting framework.

7 Marketing Mobility as a Service

Though communications are not a matter for governance policy, the uptake of Mobility as a Service (MaaS) by travellers in the BCR region is important if MaaS is to contribute to mobility outcomes for the region. To assist in this, this chapter looks at several considerations for communicating to users about MaaS, drawn from desk research. Given the emerging nature of MaaS markets, much of the discussion draws on the wider transport literature. The user context, discussed in Chapter 2, considering the different socio-demographics and digital access in the BCR should be taken on-board in communications strategies.

Mobility as a Service and behaviour change

MaaS must be widely adopted if it is to achieve the public policy outcomes the BCR government hopes it will deliver, and sustain a viable business case. Providers must convince potential users of the benefits of changing their mobility behaviour if MaaS is to contribute to sustainable mobility objectives. Yet, discussions of MaaS still centre largely around the supply-side of innovation, integration and technological solutions. Efforts have been made to understand relevant behavioural dynamics through pilot schemes. However, many, including the Brussels' MoveBrussels pilot have been interrupted or affected by the Covid-19 pandemic to varying degrees. Greater market research is needed to shape MaaS successfully. Who will be the users of this service and how can MaaS provide an attractive offer? Who is sceptical and who will need greater incentives to change their behaviour? Answers require an understanding of the range of individual attitudes, motivations and deterrents towards using MaaS.

Travel decisions can be difficult to predict and influence. Most human decision making cannot be explained by purely rational logic. Humans are not simply utility maximising individuals with full knowledge of their options. Constraints on time, information and cognitive effort cause people to rely on heuristics, or mental short cuts. People also rely on habits and the behaviour of others, preferring to stick to the status quo even if potential changes may prove beneficial, and emotions affect choices too (Tversky and Kahneman, 1974^[85]; Todd, 2007^[86]; Durand et al., 2018^[87]; Lyons, Hammond and Mackay, 2019^[50]). Authorities cannot rely only on financial benefits or the added convenience that MaaS could offer to encourage residents to use MaaS, but rather must integrate strategies incorporating broader behavioural approaches.

Attracting users – figuring out who to target

The first step is to understand the whole population, not just the most likely MaaS consumer. Pilot schemes have demonstrated varying degrees of success in achieving behaviour change but there is a risk that the participants in these trials are not representative of the general population (Hensher et al., 2021^[46]; Reck et al., 2021^[88]; Sochor, Strömberg and Karlsson, 2014^[89]; Ramboll, 2019^[90]). A better understanding of different user types means that offers and communication can be more effectively targeted to help people change their behaviour. The ability to cater to unique identities and mobility needs without relying on a one-size-fits-all solution is one of the advantages of MaaS (ERTICO – ITS Europe, 2019^[91]; Strömberg, Karlsson and Sochor, 2018^[92]). It is important to understand user groups based on sociodemographic characteristics, personal needs and preferences, attitudes towards their current travel patterns, attitudes

towards MaaS, their desire to change, deterrents to using MaaS and so on. By segmenting the population by user profile, authorities can better understand whom to target, when and how.

Who are the potential users?

Evidence from MaaS trials suggest that MaaS users are more likely to be young, live in dense urban areas, and have a high level of digital competence. They tend to travel multimodally already and have relatively high levels of public transport use. Some trials suggest that users typically have some experience with carsharing, and lower levels of private car use and ownership, while others identified the majority of participants as frequent users of public transport and private cars (Hensher et al., 2021^[46]). Older people were less likely to be MaaS users in the EC2B and UbiGo trials in Gothenburg, likely due to existing free off-peak travel arrangements on public transport and greater reluctance to ride bikes. UbiGo also tended to have more employed and educated users. Income levels vary among the early adopters identified by trials (Sochor, 2021^[3]). Shared mobility users have also been found to be disproportionately younger, highly educated adults with moderate incomes (Durand et al., 2018^[87]).

Many trial participants could be considered to be early adopters, attracted to the pilots by curiosity and the prospect of convenience and flexibility (Strömberg, Karlsson and Sochor, 2018^[92]; Sochor, Strömberg and Karlsson, 2014^[89]; Lyons, Hammond and Mackay, 2019^[50]). Environmental considerations were more of an added bonus rather than a significant driver of decisions (Sochor, 2021^[3]). Catering to these motivations, while important for attracting a subset of customers to MaaS, may not apply to the wider population (Durand et al., 2018^[87]). Surveys and analysis from the MoveBrussels trial could partially reveal the BCR context, but greater attitudinal research is needed of the BCR population to understand why users may consider or, just as importantly, not consider using MaaS.

What deters people from Mobility as a Service?

A major deterrent to participation in the UbiGo MaaS trial was found to be higher costs, compared to current transport choices. If the individual travelled little or relied primarily on walking and cycling, the MaaS offer was not attractive. There were also concerns with respect to lack of access to child seats in shared cars, especially if traveling with more than one child (Sochor, Strömberg and Karlsson, 2014^[89]). Concerns as to how MaaS would address family travel were also echoed in the stakeholder workshops held as part of this study and will need to be addressed to reach families within BCR.

The quality and coverage of the underlying mobility offers are significant determinants of whether MaaS is seen favourably by citizens. Unsurprisingly, where people felt carsharing systems were not widespread enough, there was hesitation (Sochor, Strömberg and Karlsson, 2014^[89]). Where there is a range of high-quality alternatives and their use is already significant, people will be more willing to adopt a MaaS offer (ERTICO – ITS Europe, 2019^[91]).

There was also concern that the pricing of car use was unattractive for trips of several hours or days (Sochor, Strömberg and Karlsson, 2014^[89]). In general, any perception that MaaS would make travel more difficult, expensive, or time consuming, was a deterrent, highlighting the need for flexibility for different use cases.

Understanding the potential market

Behaviour change campaigns must be tailored to specific groups. The success of any behaviour change campaign starts with understanding the target group (Davies, 2012^[93]). Classifying users according to key characteristics such as travel practices (mode, destinations, frequency etc.), sociodemographic factors, household location, and attitudes, priorities and aspirations helps to better gauge behaviour and readiness

to change. Neighbourhoods often have a certain degree of sociodemographic homogeneity, which means they can be used to help classify population segments geographically. For example, Transport for London's Transport Classification of Londoners classifies small geographic zones into nine segments and thirty-two sub-segments (TfL, 2017^[94]; TfL, n.d.^[95]). However, sociodemographic characteristics alone are not sufficient. User attitudes have also been found to cut across several sociodemographic groups and lead to different travel behaviours. Conversely, the same travel behaviour can also stem from different attitudes (Anable, 2005^[96]).

By understanding users, transport services can be better designed to serve the needs of certain groups, and policies can be differentiated for each segment (Walk21, 2019^[97]; Strömberg, Karlsson and Sochor, 2018^[92]). Certain products and incentives are more appropriate for some groups than others. The key barriers to the uptake of MaaS may differ between groups. The same sort of segmentation can also be applied to visitors to the region to better target transport offerings for tourists and for businesses to better understand and help influence travel behaviours of employees (TfL, 2013^[98]; TfL, 2009^[99]).

By understanding the types of individuals most ready to change travel behaviour, authorities can improve the cost-effectiveness of marketing campaigns. Especially in the early stages of MaaS development, resources can be allocated to target likely early adopters. Communication can happen in a segmented/tiered approach, targeting those for whom MaaS offers the clearest immediate benefit without the need for significant effort or who show the greatest likelihood for uptake.

There is currently no publicly available market segmentation of the BCR population concerning transport behaviour and likelihood to use MaaS, although the ongoing MaaS trial will presumably help to inform understanding of target markets. More broadly, the MaaS literature suggests some potential motivations for MaaS use that could be considered when planning communications: early adopters and people looking to reduce their car use or ownership. These represent very high-level motivations for consideration in communications. However, bespoke market segmentation analysis for the BCR context will be necessary to ensure the specific motivations of BCR residents are clearly understood. See (ITF, 2021^[2]) for a more detailed discussion of users' perspectives.

Early adopters are likely to include citizens who participated in the MoveBrussels trial and had a positive experience, or, those similar to them in terms of demographics, attitudes and current mobility practices. If these people typically travel multimodally already, MaaS does not change their travel behaviour significantly but may improve the multimodal experience. Tourists may also fall into this category if they arrive in Brussels by means other than a private car.

There may be unintended behavioural changes, however. While MaaS may make it easier to continue to live without owning a car, it also allows non-car users to gain access to a car. Some UbiGo trial participants joined particularly in order to gain car access (Sochor, 2021^[3]). Increasing access to cars in populations who did not previously have access to cars may not in itself be a bad thing if it is linked to improved accessibility without needing to own a car. However, significant increases in overall car use in Brussels may challenge some of the stated objectives of the Good Move plan.

People open to reducing household car ownership or reducing car use without replacing car ownership entirely may be potential MaaS users. They may be multimodal travellers who rely on a mix of private car and mobility services to get around, like the majority of trial participants in the Sydney MaaS trial (Hensher et al., 2021^[46]). Their motivation for using MaaS may be to substitute for a second car (see Karlsson et al (2017^[100])). Transport for London's 2004 "My other car is a bus" advertising campaign was aimed at such individuals (Lyons, Hammond and Mackay, 2019^[50]). Enabling people to reduce car ownership is an important stepping-stone to moving from an *ownership* to *access* mentality, and helping diminish the emotional value given to cars under the ownership model (Lyons, Hammond and Mackay, 2019^[50]).

Identifying attitudes and readiness for change is important to help recognise which groups may be most willing to reduce car use (Walk21, 2019_[97]).

Attracting users – identifying the best approach

This section describes some strategies, or nudges, that could be considered based on evidence from the broader fields of behavioural science and sociology, and from transport behaviour-change campaigns. How they are applied may vary (e.g. emails, posters, in person kiosks, partnerships with local businesses, mailed leaflets, online advertisements, social media) according to the targeted groups and what may be most effective in the BCR context. Further research can help identify resonant messaging regardless of the medium.

Remove barriers versus provide incentives

Campaigns are stronger when they identify consumer barriers and remove them rather than simply advertising the benefits or offering incentives. People are more likely to experiment with a new behaviour if a barrier is removed (Alta and Behavioural Insights Team, 2018_[101]; Strömberg, Karlsson and Sochor, 2018_[92]; Strömberg et al., 2016_[102]; Davies, 2012_[93]). Surveys in BCR could identify individuals who would use MaaS offers or adopt a more multimodal lifestyle, if certain barriers were removed. Helping them overcome these barriers (perceived or structural) and their psychological biases will be crucial.

There may be fewer barriers to overcome for those already comfortable with multimodal travel and who wish to be early adopters. The goal should be to prevent the emergence of barriers that may encourage car ownership or use in the future by improving their multimodal experience in the present. The added benefit of seamless information and payment interfaces afforded by MaaS would likely be of interest to this group. Elements of interest could include improving the level of service by adding real-time crowding information, gamification¹⁰ and incentives (e.g. choosing a less-crowded travel time or a more sustainable mode) (Alta and Behavioural Insights Team, 2018_[101]). Rewards could be mobility-based benefits or promotions through other local partnerships, e.g. entries to win tickets to local shows, promotions at local stores (Jan and Ho, 2020_[103]).

Time it right

Much of daily travel behaviour is habitual and people do not typically consider nor assess alternatives available to them. A window of opportunity opens at times of transition or change when people must actively seek to adopt new behaviours. Significant lifestyle change such as moving house, starting a new job, or changes in family circumstances force people to reconsider their travel patterns. Timing interventions to coincide with these moments is especially important for people who are less inclined to change behaviour otherwise (Alta and Behavioural Insights Team, 2018_[101]; Lyons, Hammond and Mackay, 2019_[50]; Roberts, 2018_[104]). Campaigns could partner with educational institutions or with employers to reach new employees, target people when they move to a new neighbourhood or students when they start school or post-secondary studies.

In Portland, Oregon, promotional offers for the local bikeshare system were mailed to two groups to take advantage of a moment of possible transition for customers. One was existing residents who recently gained access to a bikeshare station due to an expansion of the service and the other was new residents who had just moved to an area with bikeshare access. The take-up rate was nearly four-times higher among the new movers than the existing residents, demonstrating the impact of life changes on willingness to try new behaviours (Roberts, 2018_[104]; Kirkman, 2019_[105]).

Timing considerations also apply at a more micro level. The start of the school year, the start of the calendar year and peoples' birthdays can also be inflection points for desired changes. At an even smaller scale, Mondays tend to be more associated with new habits and change than other days of the week (Roberts, 2018_[104]).

Reverse preconceptions

Focussing communication on reversing negative perceptions rather than the benefits of MaaS or the associated behavioural change may be more effective in some circumstances. For example, if some citizens view public transport as unreliable or slow, promoting the opportunity of tracking trips in real-time, and displaying wait times with MaaS may help to counter biases toward overestimation of public transport wait times and unreliability. If public transport is seen as inconvenient and uncomfortable, messaging that highlights opportunities for reading or listening to podcasts or music on their commute rather than facing the stress of driving in traffic may be effective (Alta and Behavioural Insights Team, 2018_[101]). If independence and flexibility are important to certain people, messaging could highlight the flexibility and dependability of walking, cycling, or travelling by push-scooters on quiet streets without facing congestion or crowding in public transport.

Trials to overcome inertia/fear of risk

The human affinity for the status quo is a primary deterrent to changing behaviour. Even a low level of risk is enough for people to continue with familiar behaviours, regardless of whether the alternative could have significant benefit. To overcome this, people may need to perceive trying the service as low-risk. In the UbiGo MaaS trial, car owners were offered compensation for the duration of the trial cover insurance and sunk costs, so that they were more willing to try the service (Strömberg et al., 2016_[102]). Authorities can also design incentives such as vouchers or passes, promotional codes to cover a certain amount of travel, or free fare days to allow people to trial the service (Alta and Behavioural Insights Team, 2018_[101]).

Trials can also enable people to counter previously held biases, highlight the flexibility of the service, and build confidence. For example, in MaaS trials, people typically overestimated their need for a car, and many people perceive public transport travel times to be longer than they are (Sochor, 2021_[3]). Trialling is helpful for users to test the kind of service plan that is best suited for them and for MaaS aggregators to design service bundles that meet the needs of their users (Hensher et al., 2021_[46]).

Trial initiatives should focus on user groups that are already inclined to make the change being trialled. A trial may provide the final push necessary to close the gap between intention and action. Buy-in from an initial group can help create a ripple effect in the rest of the population as they begin to see more significant numbers adopting new travel behaviours (Strömberg et al., 2016_[102]; Batty, Palacin and González--Gil, 2015_[106]).

Invoke social norms

Behavioural science also points to the importance of framing incentives with messaging that invokes social norms. For example, pairing a promotional code with messages that suggest that the participant is the kind of person that contributes to making the city healthier and greener, may make some people more likely to continue new behaviours after the end of a trial to maintain consistency with their beliefs (Alta and Behavioural Insights Team, 2018_[101]). Strategies to invoke social norms can also include messaging which informs people of the true number of people engaging in a specific behaviour. This has proven effective in contexts where there may be a false sense of an action being done by the minority. This strategy is most relevant when there is a large proportion of people already engaging in a behaviour or when there has been a significant change in behaviours within a group (Roberts, 2018_[104]).

Referral programmes can also help attract new customers via other users that they trust within their social circles. People respond more strongly to norms within a group they identify with (Alta and Behavioural Insights Team, 2018_[101]). Many private operators already use this strategy by giving people discounts to send to friends or by providing a referral bonus to both parties in the form of credit or free rides.

Leverage loss aversion

Loss aversion is the tendency of people to value the avoidance of losses more highly than receiving an equivalent gain. By pairing incentives with loss framing, public or private mobility operators could encourage trialling of MaaS by topping-up credit on their users' accounts and specifying an expiry date (Alta and Behavioural Insights Team, 2018_[101]). The prospect of losing a credit already received provides greater incentive than if the credit was offered as a "gain" for the user to claim on their own. For example, an intervention in San Jose (California) used loss framing to inform city employees of their automatic eligibility for a subsidised public transport pass. This resulted in eleven-times higher activations compared to a prior email informing them of this benefit (Roberts, 2018_[104]; The Behavioural Insights Team, 2016_[107]).

Past trials have found that the financial cost of MaaS was a deterrent for some people who found their existing choices to be less costly than MaaS (Sochor, 2021_[3]). While sometimes this was due to higher use of commercially provided shared micromobility, it may be the case that the private car is currently the most economical choice for some people's travel needs. Given the suite of sustainable transport measures envisioned under Good Move – including road pricing and reallocation of street space away from cars – there is an opportunity to craft messaging which informs potential users of the loss (in time, in fees, etc.) that could be avoided by using alternative modes or buying a MaaS subscription.

Monitor success/change

Behaviour-change campaigns need to be tested and monitored to determine whether they are successful or if a change in strategy is needed. The ideal means of testing behavioural-change strategies is to conduct randomised control trials comparing final behavioural outcomes. While advice and examples from literature and other contexts can help inspire campaigns in BCR, it is imperative first to understand the unique mix of population segments in the BCR context. The success of behavioural change campaigns are dependent on the population and unique local needs, which is why testing is imperative (Roberts, 2018_[104]).

Actual rates of behaviour change during a campaign may not fully reflect the attitudinal changes that may occur, especially if a participant is early in their stages of change. Even if there is no strong shift in behaviour during a short trial, the participant may have made a step in the process of change by changing attitudes or intentions (Strömberg et al., 2016_[102]). Long-term monitoring may provide greater insights on the effect of campaigns, than short-term follow-ups alone.

Keeping users

Communication campaigns are important for gaining users but ultimately MaaS offers need to provide good value to keep users. High levels of integration are important for MaaS to offer a distinctive advantage and therefore be attractive to users. (Durand et al., 2018_[87]; Lyons, Hammond and Mackay, 2019_[50]; Li and Voege, 2017_[108]). It also needs to be economically feasible. The financial commitment must be seen as good value for the service compared to alternative travel options.

There are some concerns that MaaS will downplay or exclude “free” modes like walking or cycling in favour of paid options. To gain trust MaaS applications should take care to ensure walking and cycling feature prominently. For example, in Antwerp, the SmartWays MaaS app plans to integrate safe and comfortable unimodal walking and cycling routes (Kishchenko, 2020^[109]).

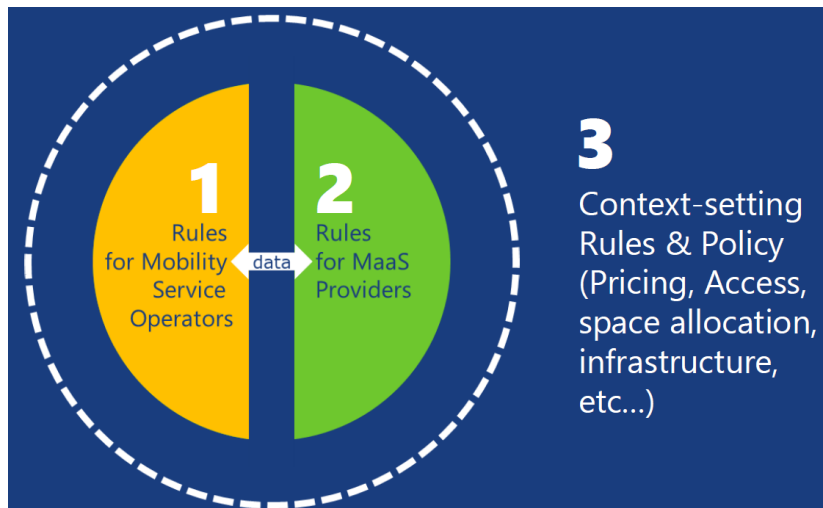
Personalisation has been identified as one of the greatest opportunities for MaaS to add value (Andersson, Winslott Hiselius and Adell, 2018^[110]; Sochor, 2021^[3]; Durand et al., 2018^[87]). Designing MaaS subscriptions in a way that simplifies daily travel by bundling only modes relevant to the user is fundamental (Hensher et al., 2021^[46]). Paired with clear information and simple, appealing and intuitive interfaces, MaaS has the potential to attract and keep users with offers that meet their travel needs sustainably, conveniently and affordably (Durand et al., 2018^[87]; Sochor, 2021^[3]).

8

Conclusions and recommendations

Mobility as a Service (MaaS) has the potential to enhance the transport system by improving accessibility. This is particularly true for those who cannot, or do not wish to, drive and for those without access to private cars. It is therefore a potential source of important welfare gains. MaaS may also contribute to the achievement of sustainable urban mobility policies. However, achieving these outcomes is uncertain and depends on specific market offers, consumer preferences and other factors, including broad policy settings. Uncertainty regarding viable business models for MaaS means that achieving these benefits is contingent on the adoption of MaaS regulation that supports the development of a competitive and innovative market. MaaS also introduces new requirements for data sharing and reporting to enable the market to function. Figure 9 illustrates the three regulatory domains for the governance of MaaS.

Figure 9 Regulatory domains for the governance of Mobility as a Service



The BCR has identified introducing MaaS as one of the 50 actions in their Good Move Sustainable Urban Mobility Plan (SUMP), with the aspiration of fostering a MaaS market that contains both public sector and private MaaS providers, integrating public transport and new mobility services. MaaS is expected to support increased sustainable travel, acting in turn as a catalyst for further innovation in mobility in the region. This chapter summarises recommendations on the principles that the BCR should adopt and actions to take based on the regulatory framework and data governance approaches discussed in Chapters 5 and 6.

Considerations for the regulatory approach

Although the concept of MaaS has existed for several years, how best to manage a successful implementation is still uncertain. This is especially the case for MaaS models that intend to include both

public and private sector actors. Consequent questions to address include whether MaaS can deliver against mobility policy objectives, and if viable business models can be found.

Concern over the potential for MaaS to have negative implications for sustainability outcomes, or for public transport operators, has created pressure to steer the development of MaaS before the market develops. This approach would be likely to significantly compromise the achievement of the potential benefits of MaaS. Effective regulation must be based on a clear understanding of the relevant market dynamics and the identification of significant market failures or equity issues. While governments may wish to regulate *ex ante* to address foreseeable harms, the nature of new services and the emerging market in which they operate needs to be well understood in order to avoid imposing ineffective regulation with unanticipated costs (ITF, 2019^[37]). Moreover, the potential public policy benefits of MaaS will only be realised, and will only be significant, if it achieves sufficient scale and scope. Its ability to develop in this way is highly uncertain: it is not clear that viable business models exist, as no city has seen the development of a full-scale MaaS ecosystem involving commercial MaaS providers on a sustained basis. This characteristic of MaaS implies that governments should take a particularly cautious approach to regulatory and other policy interventions that would constrain the freedom of action of actors in the maturing MaaS ecosystem (ITF, 2021^[2]). The recommendations outlined below adopt this approach in identifying the principles that should inform the regulatory framework.

The existence of viable commercial models for MaaS remains uncertain. This report thus recommends that adopting an enabling regulatory environment that facilitates the development of an innovative and competitive MaaS ecosystem is the best way to maximise the likelihood that such a sustainable commercial business model, or models, will develop. However, should the BCR government become convinced, in the medium term, that a commercially sustainable MaaS is not currently feasible, consideration should be given to the provision of subsidies to enable and sustain the development of MaaS on a mass scale. Such subsidisation would be justified if MaaS is seen as being able to contribute significantly to the accessibility and/or sustainability objectives of the BCR region's transport policy. Should this approach be taken, careful consideration of the most efficient and effective subsidy model would be required.

Considerations for the data governance approach

As described in Chapter 2, data reporting requirements by licensed mobility operators vary by licence type. As a public body, the public transport operator comes under more stringent requirements to open its data. The fairness of any data-sharing requirements is also a contentious issue among actors who wish to participate in MaaS in the future. This is true across the MaaS discourse globally, not only in Belgium. The BCR highlighted data governance particularly as something this report should address.

The core data governance framework for the BCR should be articulated around two principal pillars. The first comprises data *sharing* and data *portability* requirements amongst market actors that enable the *market to function*. The second comprises data *reporting* requirements to public authorities that *allow monitoring* (and control, if necessary). Both pillars must enable personal data protection fully in line with the EU General Data Protection Regulation.

Data sharing, data portability and data reporting may be seen as the essential building blocks that will enable the emergence of an innovative, dynamic and competitive MaaS ecosystem in line with BCR's stated aspirations. The recommendations relating to data sharing and data portability describe how data exchange among market stakeholders enables the MaaS market to develop in a fair and pro-competitive way. The recommendation on the data-reporting framework relates to the relationship between the MaaS providers and the public authorities. Ensuring robust personal data privacy protection is essential to build user confidence and therefore to the success of the MaaS ecosystem.

The recommendations made in this chapter do not specify a set configuration for MaaS but enable MaaS stakeholders to build their own offers and to compete on fair terms within the MaaS ecosystem, drawing on existing legal frameworks. The implementation guidance also takes account of likely future developments concerning their respective focus – i.e. data portability, data sharing and data reporting.

Recommendations

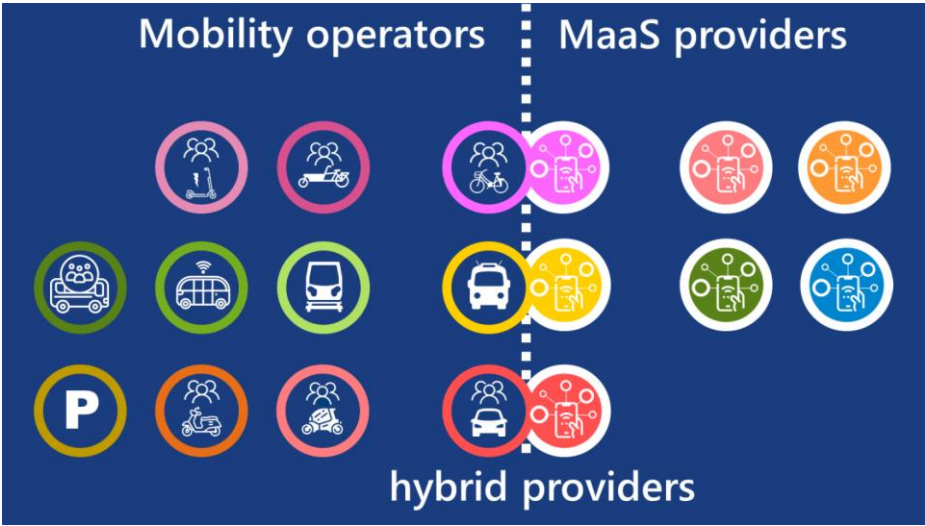
The regulatory framework and data governance recommendations can be grouped according to three high-level objectives: enabling the creation of a MaaS ecosystem that contains both public and private actors; facilitating the development of an efficient and equitable market, and; more broadly managing the mobility outcomes.

Enable the creation of a MaaS ecosystem

Regulate mobility operators and MaaS providers separately

At present, the BCR is developing a MaaS ordinance, the scope of which is still to be defined. The work for this report suggests there should be a clear separation between MaaS-specific regulation and regulation applying to individual transport modes. Even if a mass-market MaaS model develops successfully, it can be anticipated that all (or nearly all) of the mobility operators that contribute to MaaS will also continue to offer their services to consumers directly, in parallel to their MaaS-based offers. This implies the need for continued mode-specific regulation, as does the fact that much of this regulation deals with safety and other issues, which are largely mode-specific.

Figure 10 Regulate Mobility operators and MaaS providers separately



The operation of MaaS should, in most cases, have little impact on the regulation of mobility operators, which have mode-specific regulations, such as regarding parking or vehicles used, which are relevant to the operation of that mode, regardless of whether MaaS exists or not. There are two key exceptions. The first relates to data governance, which is dealt with in specific recommendations below. The second relates to contexts in which a large mobility operator becomes a “first mover” in the large-scale development of MaaS by also starting to act as a MaaS provider. This issue may be particularly significant if this first mover is a public transport operator/authority, as could be anticipated in BCR, where the public transport

operator is already piloting a MaaS app. In such cases, it will be important to monitor the market behaviour of these entities to ensure non-discriminatory behaviour, as this will be essential to ensure that entry by new MaaS providers is not prevented and competitive pressures are not undermined. While, there is not a clear case for *ex ante* regulation in this area, policy makers should stand ready to regulate to require non-discriminatory behaviour.

Adopt an explicitly pro-competitive approach to Mobility as a Service in policy and legislation

In any context, the commercial viability of MaaS remains unclear, as does the nature of the MaaS service that users want to see. This fundamental issue must be given due weight by BCR in designing its MaaS ecosystem. In this context, the potential for a MaaS model that meets user needs and is economically sustainable to develop will be maximised by encouraging competition and innovation in the market. The BCR government should ensure its regulation and policy approaches are broadly pro-competitive, in keeping with EU competition law and OECD competition policy principles. In particular, it should explicitly state in its MaaS policy and/or legislation that provision of MaaS services is an open-entry market.

Regulation should be avoided in critical areas that could constrain the successful development of MaaS, such as, limiting the number of licences issued for the mobility services that underpin the MaaS offer in BCR. MaaS providers should not be unnecessarily constrained in the nature of the market offers they make to potential consumers. Such constraints risk undermining the commercial viability and, hence, the sustainability of MaaS in the marketplace.

The European Commission intends to consider how to ensure that intermediaries support sustainability goals as part of its work on Multimodal Digital Mobility Services. This could include the ranking and promoting of active modes. The results of the work are anticipated in the third-quarter of 2022. Depending on the outcome of this work, the resultant mechanism would have implications for policies concerning the pro-competitive nature of the market, particularly the introduction of constraints on how MaaS providers develop their offers.

Mobility operators who also become MaaS providers could pose a particular risk. They may have an incentive to offer less-favourable terms on their mobility services to competing MaaS providers. Provisions of the general competition law on abuse of market power address these risks, and the transport authorities should report any concerns that arise to the competition authority promptly. MaaS-specific regulation under the ordinance in preparation should refer to the competition law, noting the general requirement that mobility operators and MaaS providers maintain competitive neutrality in conformity with the principle of equal treatment.

This safeguard should be supplemented by provisions in the ordinance that ensure that, where a mobility operator also operates as a MaaS provider, there is an effective separation of these two functions. The extent of the separation required by the ordinance (e.g. accounting, functional or structural separation) should be determined having regard to both judgements about the extent of the market power of the relevant market participants and, particularly in the longer-term, to judgements regarding their prior market behaviour. This implies that, should significant market conduct issues arise as the MaaS ecosystem evolves and reaches commercial scale, the ordinance may need to be amended to include more stringent separation requirements. Such decisions should be taken by the BCR in consultation with the competition authority.

Adequate market surveillance and enforcement are key elements of a pro-competitive regulatory environment in these areas. The extent of this surveillance of the market behaviour of MaaS businesses should be proportionate to the extent of their market power and the incentives they face for anti-competitive behaviours. However, the regulatory framework should explicitly allocate responsibility for these functions.

Figure 12 Review licenses that apply to mobility operators to ensure they do not inhibit the development of MaaS



Add mandatory minimum data sharing requirements relating to informational and operational data to licenses for mobility operators.

Data sharing from mobility operators to MaaS providers (including hybrid mobility operators and MaaS providers) enables integration among market stakeholders. Without this integration, there is no MaaS. In the context of this recommendation, minimum data-sharing requirements imposed on all mobility operators (via their licensing by Brussels Mobility or other relevant public authorities) should include data necessary for **informational integration** (this allows for search and pre-booking functionality) and **operational integration** (this ensures that MaaS offers can be executed). Combined, these categories of data allow a trip to be planned, co-ordinated and delivered to the user, but without the payment taking place. The data governance framework should also target **transactional integration** thus allowing MaaS providers to serve as agents for individual travellers and also require **deep-link** access for all accredited MaaS providers to mobility operators' respective booking and payment functions.

Figure 13 Add data sharing requirements to licenses for mobility operators



In order to implement this recommendation the BCR government should:

- Chart a roadmap for achieving data access and data sharing by mobility operators no sooner than Q3 2022 – or when the revision of EU ITS Directive (2010/40/EU) and the revision of the Delegated Regulation on Multimodal Travel Information Services (2017/1926) are completed.
- Initiate a consultation process to determine who should share or otherwise grant access to their data to support MaaS ecosystem functionality.
- Initiate a consultation process with market actors to design mandatory data access/data sharing API functionalities and architectures that will enact this recommendation in support of the MaaS data governance framework for the BCR. This API structure should account for discussions underway at the EU to develop guidance on MaaS API standards based on Transmodel.
- Determine an appropriate incentive strategy to trigger data access/data sharing in advance of the full implementation of this recommendation (or in the case that this recommendation faces implementation challenges).

There are some risks that must be managed concerning this data sharing recommendation. These include the following:

- European courts or evolving data governance rules may not agree with the applicability of the PSD2 data access/data sharing rules in the case of MaaS. This would be a serious risk to the implementation of this recommendation. One approach to mitigate this risk is to ensure that market actors support the rule because of the value they would derive from it. This suggests their active consultation in its creation and adoption. Another mitigation action would be to incentivise, rather than require, data access and data sharing by mobility operators. This would be enacted by other levers that authorities in the BCR control (e.g. access to public space, parking or road pricing, terms of licensure, etc...)
- Bad market actors could create spurious trip requests with the intention to mine operational data from mobility operators in order to gain an unfair market advantage. To counter spurious data requests, the MaaS data access/data sharing requirements should specify that these requirements are only applicable when a data sharing call is initiated in the context of a specific transaction triggered by a verified client. The client identity should be immutably linked to the data shared in the MaaS ecosystem by, for example, a validated access token (See Box 6). This would reduce the possibility of spurious requests and enable authorities to discover instances of these via an audit mechanism.
- As in the case of data portability, there are a number of EU regulations and initiatives that may further define rights and responsibilities with regards to data access and data sharing by mobility operators and MaaS providers. These include the EU ITS Directive (2010/40/EU) – expected delivery Q3 2021, the revision of the Delegated Regulation on Multimodal Travel Information Services 2017/1926 – expected delivery Q2 2022 and the forthcoming proposal to support Multimodal Digital Mobility Services – expected delivery Q3 2022. As with data portability, this suggests a phased-in approach to the data access/data sharing requirements for MaaS actors in the BCR MaaS.
- Implementing data access/data sharing requirements in support of MaaS, especially regarding technical specifications, may impose unwieldy costs and burdens on the part of market actors, especially small- and medium-sized firms. This risk may be mitigated by ensuring that data access/data sharing API functionalities and architectures are developed in concert with MaaS market actors and not imposed without their input. The design of these standards and functionalities should maximise the benefits that all would derive from enhanced data access while minimising the costs that this might impose.
- The technical specification of data access/data sharing API functionality and architectures would lead to lock-in if these are built on proprietary code which would lead to data capture. To mitigate

this risk, API architectures should avoid the use of proprietary code and should be based on open standards and architectures.

Facilitate an efficient and equitable market

Build mandatory consumer data portability, subject to data-subject consent, into the conditions of all mobility operator and MaaS provider licences

Data relating to individuals' on-trip behaviour should be shared among all stakeholders that provide a component of the trip, in order to enable MaaS providers to offer personalised travel services. This recommendation focuses on data about individuals that enable co-joined services to be operated in real-time and should cover volunteered data and observed data (both with data-subject consent) but never inferred data. This functionality is essential for the effective operation of the MaaS ecosystem.

Figure 14 Build-in mandatory consumer data portability, subject to data-subject consent



In order to implement this recommendation, the BCR government should:

- Define and give legal effect to a minimum data portability requirement for mobility operators and MaaS providers.
- Chart a roadmap for achieving full enhanced data portability requirements for mobility operators and MaaS providers no sooner than Q3 2022 – or when the revision of EU ITS Directive (2010/40/EU) and the revision of the Delegated Regulation on Multimodal Travel Information Services (2017/1926) are completed.
- Initiate a consultation process with market actors to design mandatory data portability API functionalities and architectures that will enact enhanced data portability in support of the MaaS data governance framework for the BCR.

There are some risks that must be managed with regards to this data portability recommendation. These include the following:

- European courts may limit what they might consider an overbroad interpretation of data portability rights. This risk may be mitigated by adopting the rights as defined in settled law – namely the PSD2 directive for the financial services sector.
- Forthcoming EU legislation and guidance may re-interpret or differently interpret the data portability right as it related to mobility operators or MaaS providers. The three legislative initiatives that have (yet undetermined) potential to do so are the revision of the EU ITS Directive (2010/40/EU) – expected delivery Q3 2021, the revision of the Delegated Regulation on Multimodal Travel Information Services 2017/1926 – expected delivery Q2 2022 and the

forthcoming proposal to support Multimodal Digital Mobility Services – expected delivery Q2 2022. This suggests a phased-in approach to the data portability requirements for the BCR MaaS data governance framework would be prudent.

- Market participants acting in bad faith may seek to gather data via the near real-time data portability requirement by initiating spurious trip requests and gaining undue market intelligence and competitive advantages for their own services. In addition to setting out data portability for personal data to spur the exchange and re-use of data, the GDPR also sets out principles regarding purpose limitation and data minimisation that limit some of these risks. The MaaS data portability requirements may specify that data portability requests may only be initiated by consent by verified individuals, to counter spurious data requests. The triggering data portability request and the confirmation of verified identity should be immutably linked to the data ported in the MaaS ecosystem, for example, by a validated access token (see Box 6). This would reduce the possibility of spurious requests and enable authorities to discover instances of these via an audit mechanism.
- Combined multimodal trip chain could make mobility operators feel that they would lose valuable insights on customers who use their services. This risk would be mitigated by enabling all stakeholders providing joined mobility services to have access to information regarding on-trip information regarding travellers when the latter consent to this data sharing.
- Implementing enhanced data portability in support of MaaS – especially regarding technical specifications – may impose unwieldy costs and burdens on the part of market actors, especially small and medium-sized firms. This risk may be mitigated by ensuring that data portability API functionalities and architectures are developed in concert with MaaS market actors and not imposed without their input. The design of these standards and functionalities should maximise the benefits that all would derive from enhanced data portability while minimising the costs that this might impose. Some development costs may be borne by public authorities.
- The technical specification for API functionality and architectures enabling data portability would lead to lock-in if these are built on proprietary code which would re-introduce data capture into the data portability architecture. To mitigate this risk, API architectures should avoid the use of proprietary code and should be based on open standards and architectures.

Adopt competition safeguards as part of the MaaS provider licensing framework

The nature of the required regulation will depend, to some extent, on the approach taken to MaaS development – i.e. the market model that the BCR government enables or allows. The public transport operator, STIB-MIVB, has released a MaaS app on a trial basis and ITF understands that the BCR government is considering authorising the STIB-MIVB to take the role of first large-scale MaaS provider in the Brussels market, in developing a standing MaaS offer for the region. This approach to the development of MaaS has both advantages and disadvantages.

Given the development of MaaS in the Brussels-Capital Region is an action included in the Region’s SUMP, and is specifically intended to support the sustainable mobility outcomes, key advantages of the model where the public transport operator acts as first large-scale mover are that it:

- enables an early start to MaaS activity to be decided by government, rather than being dependent on a commercial operator deciding to provide services
- enables government to subsidise the early development of MaaS, rather than such development being dependent on private venture capital or rapid commercial viability among actors that have yet to identify feasible business models
- ensures that the MaaS model includes the full involvement of public transport services.

Key disadvantages of the model are that:

- The presence of a government player may discourage the entry of private sector competitors, both due to fear of unfair competition and due to concern that the large initial market share of the

government incumbent may raise doubt as to new competitors' ability to achieve commercial scale.

- That the market offer of the government MaaS entity may be distorted by incentives to favour certain types of mobility services (notably public transport) and thus less attractive to consumers.
- That a lack of competition, due to limited entry by private sector actors, will reduce innovation and further hinder development.
- That government will bear significant financial risk.

It is for the BCR government to determine the balance of these risks and benefits, and therefore whether to require or authorise the STIB-MIVB to act as a first large-scale MaaS provider in the Brussels market. However, if it decides that it wishes to go down this path, then, consistent with the recommendations above relating to regulating mobility operators and MaaS providers separately, and adopting a pro-competitive approach, it should take several regulatory and administrative actions to minimise the risks identified above and maximise the potential for effective private sector competition to arise. In particular, it should

- require the MaaS activities of the STIB-MIVB to be separate from its public transport activities
- require STIB-MIVB to act in a competitively neutral way, as between mobility services (i.e. its own vs those of other actors)
- explicitly state that it encourages private sector competitors to participate in the MaaS market.

Public transport operators should have freedom to negotiate the terms of public transport ticket resale with MaaS providers who, in turn, should be free to determine the pricing of services to consumers

Consistent with the recommendations above and the generally pro-competitive approach to the development of MaaS, public transport operators and MaaS providers should have the maximum freedom to negotiate the provision of public transport services through MaaS services. Public transport operators should be given the maximum possible degree of freedom to negotiate with MaaS providers, both public and private, subject only to a requirement to act consistently with their governing legislation and other relevant legislative instruments.

The governance and accountability arrangements applicable to the public transport operators should be reviewed and revised where necessary, to provide clear guidance as to their role and responsibilities, thus ensuring that they face appropriate incentives when contracting with MaaS providers.

MaaS providers should have freedom to develop and sell market offers they believe will be attractive to consumers. Should negative implications arise for sustainable transport outcomes, these should generally be addressed through broader mobility policies, rather than MaaS regulation *per se*.

Approaches to regulating MaaS should be informed by the OECD and EU best practice principles on regulatory policy and governance. This implies, in particular, that the underlying regulatory objectives should be clearly specified, a full range of regulatory and non-regulatory options to address them should be identified and that their impacts should be assessed and compared systematically, via a proportionate process of impact assessment using consistent methodologies. Regulatory development should be conducted through open, consultative processes as part of a broader consultative effort aimed at generating and implementing a MaaS model that is broadly endorsed by all stakeholders.

Figure 15 Approaches to regulating MaaS should be informed by the OECD and EU best practice principles on regulatory policy and governance



In developing MaaS regulation and reviewing the existing regulation of mobility operators, the BCR government should have regard to the OECD regulatory policy principles and the EC better regulation agenda. Regulatory impacts should be monitored carefully after implementation and compared with ex ante expectations. Regulatory change should be undertaken in a timely manner where this monitoring shows that initial regulatory objectives are not being met, or significant unanticipated consequences are identified.

Make data reporting requirements to public authorities specific and directly related to the task

This recommendation focuses on the data reporting from MaaS stakeholders to public authorities that enables them to carry out sufficient monitoring and oversight to ensure the MaaS ecosystem functions in a way that is compatible with public policy objectives. Mandated data reporting from mobility operators and MaaS providers to authorities should be purposeful and adapted to the regulatory tools and methods authorities deploy to meet their mandates. For example, market oversight and enforcement, pricing, parking policy, urban access restrictions, speed management. It should only cover the minimum amount of data necessary to carry out these public policy objectives. Reporting requirements should include rules relating to an appropriate level of aggregation, data handling, data retention periods and auditability, as well as data destruction protocols. Consistent with the separate regulatory treatment of mobility operators and MaaS providers, reporting frameworks should be distinct and specific to each functionality (providing mobility services versus providing MaaS).

Figure 16 Make data reporting requirements specific and directly related to the task.



The following actions are required in order to implement this recommendation:

- Brussels Mobility, in consultation with MaaS stakeholders, should define a data inventory that MaaS stakeholders must report to public authorities. This should clearly link each reporting requirement with identified policy objectives and identify the minimum data necessary to support the achievement of the policy objectives. This data inventory should be organised by public policy outcomes targeted and differentiate between reporting requirements for mobility operators and reporting requirements for MaaS providers. A forthcoming ITF report¹¹ will explore more broadly what data types hold a public value for authorities to be able to carry out their remits.
- Brussels Mobility, in consultation with MaaS stakeholders, should designate one (or several) reference data reporting syntaxes and incentivise their use by MaaS stakeholders in reporting data to public authorities. This (or these) data syntaxes should serve to map out data schemas that all MaaS stakeholders must conform to when reporting required data to public authorities.
- Public authorities in Brussels should finalise the specification of its planned Brussels Mobility Hub such that it is aligned with and conforms to the elements of this recommendation outlined above.

There are some risks that must be managed with regards to this data reporting recommendation. These include the following:

- Public authorities may implement over-broad requests for data from MaaS market actors. This risk is expressly mitigated by the requirement for purposeful and data minimised data requests from public authorities.
- Sensitive personal data collected by public authorities in line with their oversight and enforcement mandate may lead to misuse or harm from data breaches. Data reporting of personal data as defined under GDPR must trigger a different, highly secure and GDPR-compliant workflow. This will entail specifying specific GDPR-compliant data access, handling, processing, retention and destruction protocols.
- Requiring conformity to a data reporting syntax may impose costs and technical burdens on MaaS market actors. This risk is mitigated by enabling reasonable flexibility in selecting a data reporting syntax on the part of MaaS market actors by offering actors the option to adopt the “reference” syntax (or syntaxes) or to bring their own syntax as long as it conforms to the data schema of the reference syntax(es).

Manage mobility outcomes

Sustainable mobility objectives should be pursued primarily via measures in the Good Move policy package that apply to all mobility services rather than regulations specific to MaaS

Sustainable urban mobility objectives will be addressed more effectively if pursued primarily through the other initiatives contained in the Good Move policy package, rather than through MaaS-specific regulations. MaaS is not a panacea for achieving sustainable mobility outcomes. As discussed in Chapter 5, there is a range of direct measures aimed at addressing specific travel behaviours that, if adopted in conjunction with the advent of MaaS could improve outcomes for mobility as a whole. Furthermore, the potential impact of MaaS on accessibility for urban dwellers, particularly those without access to private vehicles, is a key consideration, as discussed in Chapter 2. The development of MaaS should serve to enhance equitable accessibility and transport poverty in the region.

Figure 17 Sustainable mobility objectives should be pursued primarily via measures in the Good Move policy package



An economically viable MaaS ecosystem may have the potential to help advance sustainable mobility objectives, but MaaS-specific regulation should not be the principal means of achieving desired sustainability outcomes. Any policy interventions to steer MaaS in this direction should also be taken as part of broader sustainable mobility policy. The package of measures envisaged to deliver the Good Move plan should be revised as needed in response to the development of large-scale MaaS, should negative trends arise – a prospect that will necessarily be medium to long term in nature.

Mobility as a Service beyond the Brussels-Capital Region

The focus of this report is to provide guidance to the BCR on how to structure and implement a regulatory framework that enables MaaS to deliver better mobility and accessibility outcomes for the inhabitants of that region and help the public authorities there to deliver on their mandates for more liveable and sustainable outcomes. Brussels is not alone in sharing these ambitions and though the recommendations target the BCR, they are equally relevant to many other cities and regional contexts.

The previous sections highlight the key principles and recommendations that should guide the creation of a vibrant, innovative and competitive MaaS ecosystem that would improve opportunities for people,

create remunerative returns for mobility operators and MaaS providers and supports the region's broader sustainability aspirations. These principles and recommendations are universal in nature but their implementation in practice is very much influenced by the BCR context, and in particular, by the broader regulatory context specific to the BCR, Belgium and, more generally, the European Union. This section briefly explores where the BCR context may diverge from other cities and regions and what this may mean for the practical applicability of the report's recommendations elsewhere.

There are four principle areas of divergence with other contexts. These concern the overall guiding vision for mobility, the presence or not of facilitating regulation outside of the context of MaaS, the mix of mobility services available and their organisation and the spatial context.

A vision for mobility

Through its Good Move SUMP, BCR has established a broad vision for mobility that identifies where and how MaaS may contribute to its achievement. This vision covers a wide range of interventions that, when enacted, will set the context for MaaS and will help ensure that the MaaS ecosystem delivers on the region's broader objectives. The creation of the SUMP in Brussels is mandated by a Regional law (2013-07-26/05 – Ordonnance du 26 juillet 2013 instituant un cadre en matière de planification de la mobilité et modifiant diverses dispositions ayant un impact en matière de mobilité).and is facilitated by the EU's work to help design and implement effective SUMPs. In other contexts this mandate and assistance may not be present. This may increase the risk that policy in support of MaaS is not articulated with other public policies or poorly aligned with desired public policy outcomes. Nonetheless, the guidance on creating and implementing SUMPs is an open resource (European Commission, 2013^[111]) and there are many other regionally targeted guidance documents on developing similar plans. Where analogous urban mobility planning processes are not in place, countries and regions may explore establishing them.

Other regulatory frameworks that facilitate Mobility as a Service

The recommendations in this report build on broad regulatory frameworks set at the regional, national and supra-national levels. These help establish what is possible for the regulation of the MaaS ecosystem and touch on domains including competition law and policy, data governance, public space governance, public transport governance and the governance of new mobility services. The presence of these regulatory frameworks facilitates the implementation of the principles outlined in this report. Their absence would pose potentially severe challenges to transposing this report's findings into dissimilar contexts.

Regulatory frameworks similar to those in place in BCR are also found elsewhere, especially pertaining to competition policy, public transport and public space governance. There is value in assessing if these regulations pose unreasonable or unwitting barriers to the deployment of MaaS and the implementation of the recommendations in this report.

The regulatory framework surrounding new and emerging mobility operators and services is more problematic. Regulation of these is still quite new (if present at all) and not fully matured. There may be a temptation to conflate elements of MaaS regulation into the regulation of new mobility services – at a very minimum, this should be avoided. Better still is to adapt the regulation of these (and other more established mobility services like public transport and taxis) so that they are compatible with the regulatory framework for MaaS providers – especially as concerns data sharing and data reporting. As a general principle, it makes sense to explicitly license these services to have visibility on them and, where necessary, leverage certain outcomes like data reporting.

Finally, this report's recommendations pertaining to data governance build on a broad and deep regulatory framework set at the EU level and implemented by national governments within Europe. This framework

includes EU rules on data privacy and the processing of personal data (GDPR), the development of digital market places and the digital economy and the reporting and sharing of mobility data. This facilitates the transposition of this work to other EU contexts. Outside of the EU, the lack of similar rules on data governance poses a barrier to the implementation of these recommendations and will lead to more negotiated, bi-lateral and ad-hoc agreements on data sharing, data portability and data reporting. Even in the absence of national data governance frameworks, conditioning licensure to elements of data governance will help create the right conditions for MaaS, especially if similar approaches are incentivised or mandated more broadly within countries.

Mix of mobility services

A wide range of mobility operators is present in BCR. These include a large and well-established public transport operator, a national rail carrier offering regional services, taxis, ridesourcing, various fixed or floating carshare operators, a docked public bikeshare operator and a multitude of floating micromobility operators. This mix is more or less common in a number of other European cities though the regulations pertaining to each operator may differ. As noted above, it is worth reviewing the regulatory frameworks for each of these services to ensure that they are MaaS-ready or, at a minimum, are not unjustifiably MaaS-unfriendly.

The organisation of public transport differs greatly across international contexts and urban regions of varying size and population density. In some contexts, e.g. North America, public transport provides only minimal basic accessibility outside of many large urban regions. Here it will be difficult to build on public transport as the backbone of MaaS and a greater contribution from other mobility services is likely. In other contexts, public transport is fully privatised and operated as a fully commercial activity, as in the case of Japan and Hong Kong. In such contexts, safeguards against abuses of market power in the provision of MaaS will have to account for the commercial nature of the public transport operator. This may mean adapting the advice this report sets out for markets dominated by fully commercial actors if necessary.

Finally, high levels of informal transport provision characterise many urban regions. These are largely not digital (outside of basic SMS text message functionalities for payment) and poorly regulated. They will therefore prove difficult to integrate into MaaS offers and within the MaaS ecosystem. Immediate pathways to improve their “pre-MaaS” readiness would include mapping these services, integrating some form of information regarding the schedule or availability of these services and exploring ways to integrate SMS-based payment for these services within broader customer-facing MaaS interfaces. This is in addition to the broader transport service reforms that will help to formalise MaaS services.

The spatial context

The BCR is a dense urban region with strong links to adjacent regions, compared to which it is relatively small. The travel patterns and mobility service offers there reflect this reality. In peripheral and rural areas, the mix of services and travel behaviours may differ, and the primacy of public transport in delivering on mobility needs of the population may be greatly reduced. In rural areas especially, a broader range of non-traditional mobility assets such as school buses and postal vehicles may play a role in delivering mobility outcomes alongside a much greater dependence on cars. With the challenge of integrating traditional mobility services in rural areas comes the additional challenge of integrating available capacity, which may be found in these non-traditional vehicles. This implies some form of digitisation of available seat capacity which no single commercial actor may find remunerative and thus underscores a potential role for the public sector in conjunction with local actors. These challenges are similarly found both in and outside of Europe.

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Annex A. Overview of regulations and documents relative to urban mobility in the Brussels-Capital Region

Mode	Regulations and documents considered
All	<i>Ordonnance instituant un cadre en matière de planification de la mobilité et modifiant diverses dispositions ayant un impact en matière de mobilité</i> (26/07/2013). Good Move plan.
Public transport	<i>Ordonnance relative à l'organisation des transports en commun dans la Région de Bruxelles-Capitale</i> (22/11/1990). <i>Cahier des charges de la STIB-MIVB</i> (18/07/1996). <i>Contrat de service public entre la Région de Bruxelles-Capitale et la Société des Transports Intercommunaux de Bruxelles, 2019-2023.</i>
Free-floating bike- and electric push-scootersharing services, and other light mobility devices	<i>Ordonnance relative à l'utilisation de modes de transport partagés en flotte libre alternatifs à l'automobile</i> (29/11/2018). <i>Arrêté du Gouvernement de la Région de Bruxelles-Capitale portant exécution de l'ordonnance du 29 novembre 2018 relative au partage des modes de transport en flotte libre constituant une alternative à la voiture</i> (17/01/2019).
Public automated bikesharing service	<i>Ordonnance réglant l'exploitation d'un service public de location automatisée de vélos</i> (25/11/2010).
Carsharing	<i>Arrêté du Gouvernement de la Région de Bruxelles-Capitale fixant les modalités d'utilisation des places de stationnement par les opérateurs de véhicules à moteur partagés</i> (21/03/2013).
Taxis, car-hire services with a driver and collective taxis	<i>Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif aux services de taxis et aux services de location de voitures avec chauffeur</i> (29/03/2007). <i>Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à la fixation des conditions particulières d'exploitation des taxis collectifs</i> (29/05/2008).

Annex B. Existing rules and guidance that impact data governance for Mobility as a Service

There are multiple digital governance initiatives underway that will have a direct or indirect impact on the data governance framework for MaaS in the BCR. These include the following (this list is not exhaustive):

- EU General Data Protection Regulation – GDPR – Regulation (EU) 2016/679)
Relevance for MaaS data Governance:
 - Protection of personal data
 - Requirement for data controllers to provide purposes for data collection and use
 - Requirement for data controllers to get consent from data subjects to collect data
 - Possibility for data processors to process personal data on behalf of the data controller
 - Right to data portability for data subjects – this can be delegated to a third party enacting portability right on behalf of the data subject – this is the main one for the MaaS Governance framework
- Proposed EU Data Governance Act – COM(2020) 767 final
- Open Data Directive – Directive (EU) 2019/1024
- Proposed EU Digital Markets Act – COM(2020) 842 final
- Proposed EU Digital Services Act – COM(2020) 825 final
- Revision of the EU ITS Directive – 2010/40/EU
- Revision of the Delegated Regulation on Multimodal Travel Information Services 2017/1926
- New Market Proposal to support Multimodal Digital Mobility Services
- Payment Services Directive 2 (PSD2) – Directive 2015/2366/EU (PSD2)

Notes

1 This definition of a MaaS provider raises the question of whether mobility operators that offer a combination of their own services (e.g. ridesourcing, bikeshare, scootershare) via a single app should also be licensed as MaaS providers. This is not recommended at present. The objectives of MaaS provider licensing are to ensure the public authorities are aware of all operators in the market and to provide a means of enforcing compliance with data reporting, sharing and portability requirements. The existing licensing of mobility operators already addresses the awareness and data reporting objectives, while the data sharing and portability objectives are not relevant to vertically integrated providers.

However, the scope of MaaS-provider licensing may need to be revisited in the medium term, should vertically integrated mobility operators acquire significant market power via mergers and acquisitions, or should the purposes of MaaS provider licensing be expanded to address other policy objectives.

2 A temporary change to that maximum rental period was made in 2020. Based on behaviour changes observed after the Covid-19 lockdown. Some users had doubled their mean rent time and so the maximum rental period of free floating carsharing services was extended to the same duration as station based (72 hours) for a year. A decision has yet to be made as to whether that modification will be extended beyond that year.

3 The Belgian National Access Point covering most regulations is available at <https://www.transportdata.be/en/> with the exception of data under Commission Delegated Regulation (EU) No 885/2013 which is available at <http://data.its.be/>.

4 A walled garden refers to a “primary mobility provider, for example a ridesourcing company, which retains the customer relationship / interface and integrates other modes that may also interest the user into their existing offering” (ITF, WBCSD, 2021; ITF, 2021).

5 In this case, the data lake, owned by Brussels Mobility, is the virtual location where data generated by actors using the Brussels-Capital Region’s MaaS platform is intended to be stored (Brussels Mobility memo, 2021).

6 This is an average exchange rate for the month of the survey (May 2018).

7 Externalities are actions by one party or parties affecting other parties that are not reflected in the market price.

8 Requirements for separation of business activities have largely been adopted as part of competition law in the context of vertically integrated entities exercising market power, where some activities have natural monopoly characteristics while others are at least potentially competitive. In the case of public transport, natural monopoly elements are often complemented by legislative monopolies. By contrast, the MaaS provider market is potentially competitive, albeit subject to network effects. For a discussion of differing taxonomies of business separation models, see Cullen International (2019).

9 “An access token is a credential, given by the user to a complementary service. This credential then allows the complementary service to access a third-party API (e.g. of a dominant company) to access the user’s data.” (Cremer, de Montjoye and Schweitzer, 2019).

10 Gamification means incentivising desired real-world behaviour, such as getting people to choose active modes over car-based ones by rewarding these actions with points or awards within the MaaS app, for example.

11 Publishing updates for this report can be found on the ITF Corporate Partnership Board webpage: <https://www/itf-oecd.org/CPB>

Developing Innovative Mobility Solutions in the Brussels-Capital Region

This report provides recommendations for regulatory and data governance frameworks to support the development of Mobility as a Service (MaaS) in the Brussels-Capital Region. These highlight the need to enable the development of a competitive and innovative MaaS ecosystem, with both public and private actors, in order to maximise the likelihood that sustainable MaaS business models will be developed. The work identifies the necessary scope of a new legal framework for MaaS and recommends how the existing regulation of mobility operators should be modified in order to integrate effectively with the MaaS framework. Finally, the work also addresses key data governance requirements, including data protection, transfer and reporting needed to support the development of MaaS.

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