

# D2.1 Analysis of best practices and leading initiatives in regulatory policies and governance models

## **WP2 – State-of-the-Art and analysis of new governance and regulations models**

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# 1. Executive Summary

The objective of D2.1 is to provide comprehensive insights on mobility as a service (MaaS) regulatory schemes. To achieve this objective, the research team collected secondary data and conducted semi-structured interviews with public authorities and MaaS operators to investigate factors that influence MaaS regulatory policies and governance models. In addition, Amsterdam, Barcelona, Helsinki and Manchester were selected as 4 case studies in this deliverable to further explore the future regulatory scheme for MaaS deployment. An aggregate data analysis was performed to compare 4 case studies. These findings, together, provide 3 implications for European policy makers to design and implement more suitable regulatory policies and governance models to support the development of MaaS.

First, the findings show that there is a huge potential to leverage existing transport policies at national level and extend them to MaaS. However, from a long-term perspective, the MaaS operators expect that EU will impose concrete standards to MaaS in the future, which might gradually replace the regulations at national level. Therefore, the policy makers might be prepared for an evolving process to extend their existing national regulation to MaaS and then adapt it based on the update of EU regulations. It is critical to take this evolving process into account when designing a transport strategy and plan.

Second, the findings identify 12 factors that might potentially influence MaaS regulatory policies and governance models. These factors are further categorized into 3 groups: economic factors (i.e., market competition and market entry barrier), political factors (i.e., taxation, subsidies, incentive to consumers, data sharing and standardization, data privacy and security, use of public resources, and vulnerability) and social factors (i.e., accessibility and equity, environmental benefits, and health and well-being of citizens). For policy makers, it is important to examine these factors and evaluate how the design and implementation of MaaS regulatory schemes might be positively or negatively influenced by these factors. The design of best MaaS regulatory scheme will also largely depend on the combination of these factors.

Finally, the analysis of 4 case studies indicate that the European regulations might be the most important one for MaaS implementation in the future although there is currently no specific MaaS regulation at this level. With concrete European regulations, policy makers are able to choose the most suitable governance model and maximise the effectiveness of MaaS regulatory schemes.

## 2. Introduction

European policy makers have been working to enhance quality of life in the places we live and work through the development of new mobility services and technologies. MaaS is central to achieve this objective. MaaS is a new concept aiming to provide passengers with flexible, efficient, user-oriented and ecological mobility services covering multiple modes of transport on an one-stop-shop principle (Kamargianni et al., 2018). It offers multimodal route planners and different services under one fare and on the same ticket. MaaS brings together various transportation options including public transport, bike sharing, ride-hailing, on-demand options, etc. and enables citizens to plan their route, choose their preferred mode of travel and book and pay for everything via one app.

This background makes the MaaS ecosystem more complex than other new mobility services and technologies. In particular, data providers in the MaaS ecosystem play an important role to offer a superior multi-modal experience to customers because they process, repackage, and publish data to support information on routes, payment, pricing, and the real-time position of transport services. There are also many technological actors who provide different technical support to make MaaS solutions viable. Given the complexity of MaaS, policy makers and MaaS operators need to understand relevant MaaS policies and regulations in order to design actionable plans for the future.

Therefore, this deliverable reviews regulations and governance models that are relevant to MaaS to better understand the current status of MaaS policies. Then, it investigates how MaaS regulatory policies and governance models are influenced by different economic, political and social factors. Finally, 4 case studies in Amsterdam, Barcelona, Greater Manchester and Helsinki Metropolitan Area are conducted to investigate what kind of MaaS regulatory schemes are expected in the future. The results of this deliverable provide recommendations for policymakers to design MaaS regulatory schemes in order to achieve their ultimate policy goals.

This document is comprised of the following chapters:

- Chapter 1 has a succinct executive summary for D2.1.
- Chapter 2 presents an introduction to discuss the motivation and structure of D2.1.
- Chapter 3 summarises the methodology of this deliverable, including desk research, interviews with experts and case study analyses.
- Chapter 4 reviews governance models and regulations relevant to MaaS.
- Chapter 5 analyses main economic, political and social factors that influence MaaS policies and governance models.
- Chapter 6 discuss 4 case studies.
- Chapter 7 summarise key findings and provides suggestions and guidance for policy makers.

### 3. Methodology

There are 4 phases of data collection and analyses in D2.1. Figure 1 shows the procedure of data collection and analysis.

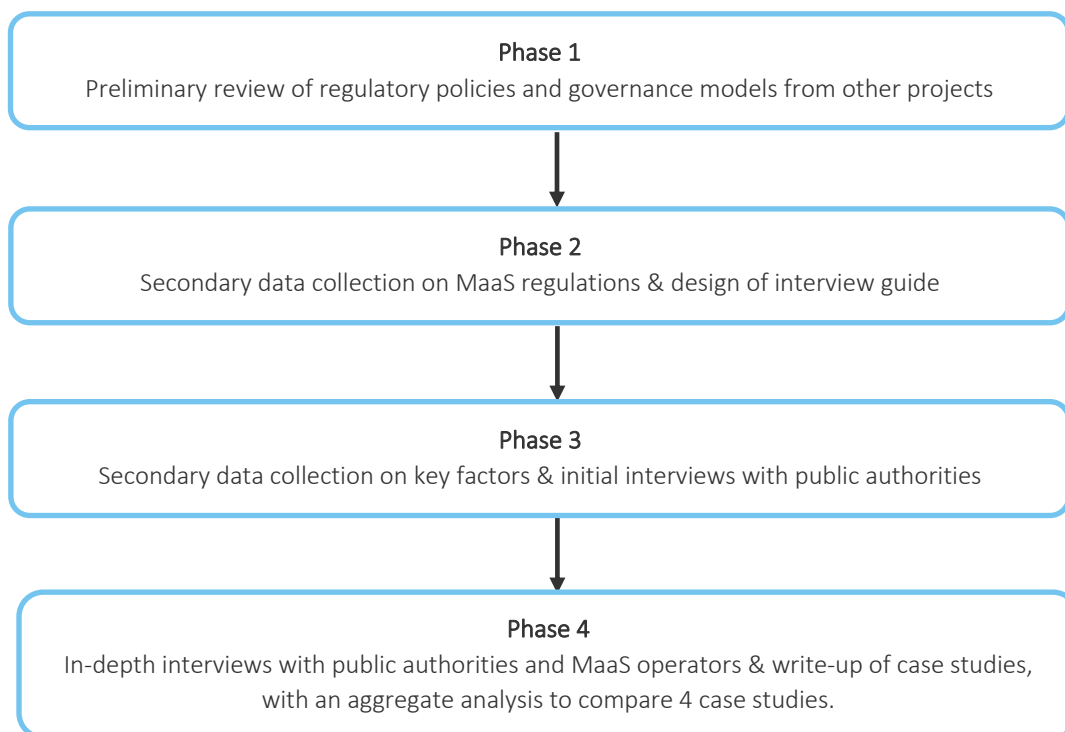


Figure 1 Data Collection and Analysis

In the phase 1, a preliminary review of regulatory policies and governance models was conducted through other projects linked to PROMaaS, such as MaaS4EU, GECKO, and IMOVE. This review serves as the foundation of D2.1 and build up the initial understanding of MaaS regulatory policies and governance models. However, the review also shows that there is a limited understanding of MaaS regulations and regulatory schemes in the existing literature and projects. Based on the result of preliminary review, a further investigation on current regulations and governance model is conducted.

In the phase 2, we collected secondary data from the literature, industry reports, newspapers, government website and other open sources to explore the latest regulations that are relevant to MaaS. Interview guides was also developed at this stage. This interview guide includes semi-structured questions that stimulates discussions between the interviewer and interviewee on the topic of MaaS regulatory schemes.

In the phase 3, factors that influence the MaaS policies and governance models were explored via further secondary data collection and initial interviews. These factors are divided into three

categories: economic factors (i.e., market competition and market entry barrier), political factors (i.e., taxation, subsidies, incentive to consumers, data sharing and standardization, data privacy and security, use of public resources, and vulnerability) and social factors (i.e., accessibility and equity, environmental benefits, and health and well-being of citizens).

In the phase 4, we selected Amsterdam, Barcelona, Helsinki and Manchester as case studies in this deliverable because they have constantly engaged in MaaS projects and have stronger connection with ProMaaS partners. Semi-structured interviews with public authorities and MaaS operators were conducted to explore the MaaS regulations and existing and future MaaS regulatory schemes. Before the interview starts, the interviewer describes the interview objective and introduces the deliverable context to interviewees. During the interviews, different types of questions were asked, such as grand tour questions, verification questions, and other questions. After the interviews, the researchers continued to collect other relevant data to triangulate results and complete the write-up of cases, with the aggregate analysis of 4 cases to find guidance for MaaS policy makers.

# 4. Governance Models and Regulatory Policies and for MaaS

## 4.1 MaaS governance models

Governance models are the fundamental of MaaS regulatory schemes. It is usually implemented with relevant policy instruments in order to achieve the objectives of particular regulatory schemes. In D2.1, MaaS governance models refer to different types of ownership models characterizing the MaaS operator. There are two extreme governance models that a MaaS system can have (Pagoni et al., 2018).

### Broker model

The first includes a situation where the MaaS operator is a single entity and acts as a broker, meaning that it buys and resells capacity in MaaS packages (i.e., broker model). In this case, the MaaS operator takes on full risk and responsibility of the activities. As a principal-agent relationship, bilateral agreements are essential to ensure data exchange, interface compatibility, provision of availability of services and the related fare pricing.

### Partnership model

The second situation is when the MaaS operator is a partnership of several organisations participating in the MaaS scheme. In this case, there is a MaaS operator who coordinates the activities of the partnership and can be referred to as the “MaaS coordinator” (i.e., partnership model). The MaaS operator coordinates the activities of partners and form an alliance in the MaaS ecosystem. Such alliance requires multilateral agreements and encounters the challenge of revenue allocation. The operating costs of the MaaS scheme are assigned to the whole “MaaS partnership” while revenues are allocated to the participating partners. The MaaS coordinator and the participating partners share the same risks.

### Other models

There are other governance models that have different characteristics and are more appropriate in certain situations. First, a mixed model that combines different characteristics of broker and partnership models. Second, a model that the MaaS operator uses in-house resources to provide MaaS solutions. Third, a model that the MaaS operator outsources all of its responsibilities except certain key function (e.g., financial transactions).

There is no absolutely best governance model in terms of MaaS. Different cities/regions usually need to customize their governance model based on the availability and reliability of existing transport



system, the local transport policies, and the market status. Moreover, they need to see whether the existing transport regulations are compatible with specific MaaS governance models.

## 4.2 Existing regulations that are relevant to MaaS

This section reviews regulations that are relevant to MaaS from other projects (e.g., MaaS4EU and GECKO) and secondary resources. Overall, 25 relevant regulations are identified and included in this deliverable. These regulations come from the areas of data, MaaS, micromobility, shared mobility and other categories. This review shows that there are very limited regulations for MaaS. To accelerate the development and implementation of MaaS, it is important to refer to regulations in other categories which might be applied to MaaS. Table 1 summarizes these regulations in terms of their categories, types of regulations, implementation status, country and city.

Table 1 Summary of Regulations Relevant to MaaS

Regulation Category	Regulation Name	Type of Regulation	Implementation Status	Country level	City	Description
Data	Directive EU 2019/1024	EU Directive / Regulation	Implemented	EU level	N.A.	Open data and re-use of public sector information  The Commission considered that action at Union level was necessary in order to address the remaining and emerging barriers to a wide re-use of public sector and publicly funded information across the Union, in order to bring the legislative framework up to date with the advances in digital technologies and to further stimulate digital innovation, especially with regard to artificial intelligence.
Data	Regulation 886/2013	EU Directive / Regulation	Implemented	EU level	N.A.	Commission Delegated Regulation (EU) No 886/2013 of 15 May 2013 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to data and procedures for the provision, where possible, of road safety-related minimum universal traffic information free of charge to users.
Data	Regulation 2015/962	EU Directive / Regulation	Implemented	EU level	N.A.	Commission Delegated Regulation (EU) 2015/962 of 18 December 2014 supplementing Directive 2010/40/EU of the European Parliament and of the

						Council with regard to the provision of EU-wide real-time traffic information services
Data	Regulation 2017/1926	EU Directive / Regulation	Implemented	EU level	N.A.	Commission Delegated Regulation (EU) 2017/1926 of 31 May 2017 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide multimodal travel information services.
Data	Directive EU 2019/1024	EU Directive / Regulation	Implemented	EU level	N.A.	The Directive on open data and the re-use of public sector information provides a common legal framework for a European market for government-held data.
Data	Regulation (EU) 2019/1150	EU Directive / Regulation	Implemented	EU level	N.A.	Regulation (EU) 2019/1150 of the European Parliament and of the Council of 20 June 2019 on promoting fairness and transparency for business users of online intermediation services. Online intermediation services can be crucial for the commercial success of undertakings who use such services to reach consumers. To fully exploit the benefits of the online platform economy, it is therefore important that undertakings can trust online intermediation services with which they enter into commercial relationships.
Data	The Re-use of Public Sector Information Regulations 2015	National / Regional / Local law	Implemented	United Kingdom	N.A.	This regulation allows the re-use of information from public sector entities
Data	Federal Open Data Act of 18 May 2017	National / Regional / Local law	Implemented	Germany	N.A.	This regulation establishes a central support agency for open data. German Government has their open data publicly available.
Data	Personal Data Protection Act 2012	National / Regional / Local law	Implemented	Singapore	N.A.	This regulation governs the collection, use and disclosure of personal data by organisations.

Data	Digital Government Agenda	Agenda	Implemented	Netherlands	N.A.	This agenda is part of the Dutch Digitalisation strategy and contains rules on how governments deals digitally with citizens, the application of which may be desirable for the MaaS programme.
MaaS	Shared Mobility, MaaS and the Regulatory Challenges	Recommendation	Implemented	EU level	N.A.	MaaS has the potential to provide a platform that will allow users to combine traditional and new mobility services. In doing so, it can reduce the disutility users would face from simply switching from the private car to public and/or active transport (i.e. walking and cycling). A number of issues emerge in this respect. Those are linked to the role of data, platforms and apps, as well as to the regulation of traditional and new modes of transport. This report attempts to frame those questions and proposes a number of answers and policy recommendations.
MaaS	Mobility as a Service and Sustainable Urban Mobility Planning	Recommendation	Implemented	EU level	N.A.	MaaS might be a valuable ally for decision-makers and planners in cities to reach their mobility goals. Multimodal and user-centric by nature, MaaS may have the potential to provide an attractive and efficient alternative or addition to private car use and to promote a shift towards sustainable transport modes and a more efficient use of transport networks.
MaaS	MaaS Services and Business Opportunities	Recommendation	Implemented	Finland	N.A.	This recommendation evaluates the emerging traffic service markets and analyses the impacts and business opportunities of MaaS for Finland. A key element in the development of MaaS are the organizing and platform services, as these facilitate innovations and services for efficient and sustainable mobility.
MaaS	Framework Agreement for the Implementation	Agreement	Implemented	Netherlands	N.A.	Framework agreement for the implementation of 7 regional, nationally scalable MaaS pilots, issued by the Ministry of Infrastructure and

	n of 7 regional, Nationally Scalable MaaS Pilots					Water Management, Directorate General Mobility. The aim of the Framework Agreement is for the public authorities to create scope for experimentation and remove obstacles, and for the Service Providers and Transport Providers to cooperate and share data with each other and with the Public Authorities.
MaaS	Programme of Requirements as part of the Framework Agreement for the Implementation of 7 Regional, Nationally Scalable MaaS Pilots	Programme of Requirements	Implemented	Netherlands	N.A.	<p>This Programme of Requirements is part of the tender dossier and the MaaS Framework Agreement (Framework Agreement) for the implementation of 7 regional, nationally scalable MaaS Pilots. It consists of the following parts:</p> <p>Chapter 1: Introduction. In addition to the reason for the pilots, the objectives of the Framework Agreement are described here, as well as the relevant data flows for this and the context for the functional requirements included in chapter 2.</p> <p>Chapter 2: Functional requirements and requirements regarding data input for the MaaS learning environment. This chapter describes the requirements imposed on the MaaS services and the MaaS service providers.</p>
Micromobility	Road Traffic Act 1988	National / Regional / Local law	Implemented	United Kingdom	N.A.	The inability to use e-scooters in the UK. This is typical of the need to have more pro-active and flexible means of addressing the rapidly evolving challenge of new mobility in cities around the world.
Micromobility	Car-sharing Policy	National / Regional / Local law	Implemented	Australia	Sydney	The objectives of this car sharing policy are to increase use of car sharing, and to ensure that the city's car sharing program is well-governed and transparent.

Shared Mobility	Deregulation Act 2015	National / Regional / Local law	Implemented	United Kingdom	N.A.	Private hire vehicle regulation: subcontracting by operators and criminal liability in the case of subcontracting.
Shared Mobility	Greater London Dockless Vehicle Hire Byelaws	National / Regional / Local law	Will be implemented	United Kingdom	London	<p>1. This is a proposed legal text – a guidance document.</p> <p>2. These areas will include (but may not be limited to):</p> <p>a. Proposed approaches to enforcement;</p> <p>b. Principles for identifying appropriate places to park;</p> <p>c. Processes for demarcating them;</p> <p>d. Standards for communicating their whereabouts; and</p> <p>e. Charges associated with parking in them.</p>
Shared Mobility	Ordinance on the Operation of Motor Vehicles in Passenger Transport	National / Regional / Local law	Implemented	Germany	N.A.	Regulation is common for taxis and private hire vehicle. The only difference lies in the obligation of private hire vehicle drivers to return to their company's headquarters after each trip.
Shared Mobility	Act on the Priority of Carsharing	National / Regional / Local law	Implemented	Germany	N.A.	This Act enables measures to give priority to car-sharing in order to promote the use of car-sharing vehicles within the framework of station-independent or station-based service models in order to reduce the effects of motorised private transport on the climate and the environment.
Shared Mobility	Subsidy Scheme for One-way Electric Shared Vehicles	Subsidies and incentives	Implemented	Netherlands	N.A.	Subsidy for parking permits for 100% electric shared cars that can be used throughout the city. Valid from 1 October 2017 to 1 June 2021.

Shared Mobility	Parking Permit for Car Sharing without a Stand with 100% electric vehicles	Subsidies and Incentives	Implemented	Netherlands	N.A.	Car sharing organizations can apply for a parking permit for the entire city for their free floating sharing service with 100% electric vehicles. A maximum of 750 permits are available for this and a maximum of 350 units are granted per provider. From March 31, 2020. The experiment for the city-wide parking permit for shared cars ends on 31 March 2020. If the organization wants to use the city-wide parking permit for shared cars after 31 March 2020, then it must request the permit (s) again.
Other	170/2017. (VI. 29.): Government Decree on Electric Car Charging Services	National / Regional / Local law	Implemented	Hungary	Budapest	Government Decree on certain public tasks related to the dissemination of electromobility in Hungary (for example electric charging). Also alternative fuel labelling and greenhouse gas emissions regulations. This instrument also amends the 2012 Regulations to allow certain transport fuel suppliers to claim credits relating to the reduction of greenhouse gas emissions resulting from the production of transport fuels, known as upstream emissions, in meeting emissions reduction targets in 2019. These credits incentivise producers of
Other	243/2019. (X. 22.): Government Decree on Electromobility Services: Electric Charging Devices and Stations, Tasks of the Electromobility Provider, Pricing	National / Regional / Local law	Implemented	Hungary	Budapest	Similar to above one.

# 5. Analysis of Main Economic, Political, and Social Factors

As Table 1 indicates, there are very limited regulations directly relevant to MaaS. Therefore, this chapter investigates the economic, political and social factors that influence MaaS regulatory policies and governance models.

## 5.1 Economic factors

### Market competition

Competition between MaaS and other mobility solution and between MaaS platforms

The growth of one mobility service operator could lead this operator to a monopolistic situation that blocks the entry of other operators and take advantage of its position to control the market and up fares. The same could happen if there is only one MaaS operator, which could dictate the terms under which the transport provider sells tickets to the operator. However, a multi-player MaaS environment could become confusing for the user (Hoadley, 2017).

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
MaaS market competition drives public authorities to design innovative policies with the consideration of diversified mobility solutions. However, fierce competition and dynamic market conditions increase the difficulties for public authorities to develop concrete and long-term policies related to MaaS. In particular, public authorities often need to make a balance between new and old policies to find harmony between innovative and traditional mobility services.	Although market competition will enhance service quality, provide diversified offerings, and increase supply, it will hamper the partnership model's adoption in the market. The fierce competition might destroy the trust between mobility service providers and MaaS operators, making cooperation even more complicated than the non-competitive market. Moreover, single MaaS operator could always raise mobility prices to the end-users, with the possibility of the increased income being taken as profit by the MaaS brokers rather than distributed amongst the transport operators.

### Market entry barrier

Factors that prevent or make it difficult for new MaaS firms to enter a market

High market entry barriers can block some operators' market access, which could reduce the offer of services into the MaaS. Data can be one potential entry barrier if MaaS operators use the data generated to block new mobility providers from entering the marketplace through developing some mechanism related to data ownership (Pangbourne et al., 2020). Some infrastructure could be another entry barrier. For instance, in electric vehicle carsharing, the development of the charging infrastructure can be a market barrier. In Paris and Copenhagen, the local authority invested in the event of this infrastructure, facilitating the introduction of carsharing services. In contrast, in Madrid, each service provider must install their charging points (Lagadic et al., 2019). Finally, regulation can block the entry of some mobility services. In some European countries, the launch of ride-hailing has met massive opposition from taxi associations because they consider them unfair competition. In Spain taxi drivers, protested since ride-hailing are not paying enough taxes and have a cheaper cost of VTC licenses compared to that of taxis. In Hungary, regulators expelled Uber from the country. Conversely, Finland opted to deregulated taxis to secure a fair competition between both services.

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
The new mobility services lead to new regulations, both for each business model (e.g., UBER) and the general transport regulation. These regulations must allow the coexistence of current and future business models related to the transport market and their role in the MaaS platform.	In the MaaS broker model, the leading entity can block the entry of some services or impose its criteria to fix the play rules among the service companies.

## 5.2 Political and legal factors

### Taxation

#### The existing taxes and tax reliefs

It is important to reflect on how 'smart mobility' will be taxed. On the one hand, the use of electric vehicles will reduce the tax revenues because they are more efficient than the internal combustion vehicles and because the tax on electricity is much lower than the fossil fuel tax (Lindberg and Fridstrøm, 2015). On the other hand, taxation could help the efficient usage of mobility services. According to Docherty et al. (2018, p.120) "Congestion charging or time-varying per mile tariffs remain at the forefront of options which would address usage effectively, but there could be alternative or additional approaches which for example address the liveability impacts of pick up and drop off in environmentally sensitive areas."



Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
Taxing vehicles, fuels, and road use will significantly influence MaaS regulatory policies. The public authorities should avoid conflicts between taxation policies and new MaaS policies. The strategic consistency between them is critical to the long-term planning of MaaS implementation.	In the broker model, the aggregator can use time-varying price structures and provide both the technology platform and the political cover to support a change in how the network is charged (Docherty et al., 2018).

## Subsidies

Sum of money conceded by the state or a public body to provide mobility service with a low price

Operators of shared services are increasingly being used as a substitute for public transport in some areas. This fact can help to provide transport services in areas where public transportation does not exist or is not efficient. For instance, in Pinellas Park, Florida, in August 2016, the agency responsible for the area’s public transportation stopped running two bus lines. It started paying for a portion of Uber rides instead (Brustein, 2016). However, building the business using aggressive subsidies leads to a risk of leaving car-less residents without mobility options (Pangbourne, 2018).

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
Public subsidies could be an option when mobility services permit reaching areas that are poorly served by public transport or the elderly, disabled or weak, or provides a first or last-mile connection with public transport the subsidies (Cerre, 2019). However, there are some examples that the service could not survive without the subsidy (e.g., Kutsuplus, in Finland), which could leave an area without mobility options.	The governance styles and transportation subsidies in different independent municipalities do not allow market players to compete and establish business models that bring demand and supply into a natural balance (Surakka et al., 2018).

## Incentive to consumers

Economic measures used by governments to stimulate the economy

Governments, in an economic crisis environment, have been using different incentives to stimulate the economy. One of the most used is the incentive to buy a new car to help the automotive industry in its countries. This industry represents a significant part of its Gross Domestic Product (GDP), and it

generates a lot of work directly and indirectly. Due to the coronavirus pandemic, some countries have announced a new incentive to stimulate this sector. Germany has raised the incentives to buy electric cars and has cut the sales tax on more fuel-efficient internal combustion engines (Winton, 2020). The Spanish government has announced direct aid to buy a new car. The assistance will depend on the vehicle's emissions: the more polluting ones will receive the lowest subsidies, while zero-emission vehicles will attract the maximum amount. To be eligible for the subsidies, it will also be necessary first to scrap a more than 10 years old car. The amount of the aid will depend on the vehicle's emissions: the more polluting ones will receive the lowest subsidies, while zero-emission cars will attract the maximum amount (Urrea, 2020). Perhaps, new incentives have to be considered, which are more aligned with the sustainable mobility strategies driven by cities.

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
<p>The incentive to buy a new car helps neither the use of alternative mobility services nor the deployment of MaaS. However, in an economic crisis, governments need to launch some measures to stimulate the economy. Therefore, it could be recommended to find new formulae coherent with the mobility strategies followed by the cities. For instance, incentives to use shared mobility services could drive to their deployment, which, at the same time, could lead them to invest in increase their fleet of vehicles and renewing the existing ones.</p>	<p>In a public-private governance model, governments could be less reluctant to give the incentive to increase the use of shared mobility services.</p>

## Data sharing and standardization

**Clarity regarding who will own data as part of a MaaS solution (traffic, payment, personal, etc.) will be shared**

MaaS needs public and private mobility operators to share data to offer its customers the most convenient door-to-door travel. But some mobility operators have some concerns about to whom the customer belongs to because they do not want to lose control over the customers' data to do marketing campaigns or send them personalized offers. On the other hand, it is necessary to establish standards for data exchange between mobility services. The Act on Transport Services, in Finland, obliges passenger transport service providers to ensure that essential up-to-date data on its services are freely available from an information system (open interface) in a standard, easy to edit, and computer-readable format.

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
In the provision of MaaS, data needs to flow between the different actors so that the right services can be offered at the right time. The success of MaaS policy implementation will largely depend on data-related policies, such as data standards, data sharing, data integration, and data ownership. The state needs to exert some control over data generated by the mobility services to avoid anti-competitive practices and other negative externalities (Docherty et al., 2018). Finally, MaaS need the interoperability of tickets—one ticket for several services from different providers. Some regulations about the procurement and the criteria to satisfy everyone and simplify the work of customers are needed.	MaaS aggregates different services in just one place. Therefore, it is necessary to define some prevalent criteria related to support services, terms, and conditions of use, software, and licenses. These interfaces need to offer fair, reasonable, and non-discriminatory terms.

## Data privacy and security

### Clarity of what data will be used and the use that will be given

Shared mobility operators maintain sensitive personal data of their users and employees. Some operators have suffered from cyber-attacks, which has obliged them to implement measures to ensure data security (Shaheen et al., 2016). Moreover, data leakage draws more attention from public agencies since Uber exposed the personal information of around 57 million users around the world (Jin, 2018).

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
Data shared between the different actors raises a question of how data can be shared in a way that respects the user's privacy and does not breach their permissions. Some regulations about cybersecurity and privacy should be provided when introducing new MaaS regulatory policies.	MaaS aggregators and their associate mobility services operators have to take measures to protect sensitive data.

## Use of public resources

### Privilege access to public resources

In some cities, the mobility operators have privilege access to public space for free or for a small fare. In the case of car-sharing, the service's deployment depends on the availability of car park spaces. In Copenhagen, the city council gives reserved parking space at the cost of a 30 euro car/year to the round-trip schemes. In Madrid, fully electric vehicles and plug-in hybrids can park everywhere free of charge and without time limit (Lagadic et al. 2019). Besides, in some cities, shared bicycles, scooters, or kick-scooter services have a dedicated space on the road to park the vehicles by paying a reduced tax by car and providing the geolocalization to control where they are stationed. On the other hand, in some cities such as Barcelona, taxi services are allowed to use the fast lines dedicated to buses, which could also be used by ride-hailing operators.

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
The allocation of public space to the different mobility services or the use of fast lines can help deploy the shared vehicle services and provide charge points for electric share services. However, some cities (and citizens) are concerned with the proliferation of shared vehicle services because they fill the city with their vehicles, occupying a space that is also used for parking private cars.	The public space is a scarce resource that has to be shared between the different partners.

### Vulnerability:

#### Vulnerability in relation to MaaS's dependence on ICT

Relying only on MaaS systems to provide mobility services implies a substantial disruption potential due to power failure, ICT failure, or cyberattacks (Pangbourne, 2018).

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
If access to transport is through MaaS platforms, these must be included in critical infrastructure protection strategies (Pangbourne, 2018).	Each mobility operator has to analyse its vulnerability and establish contingency plans.

## 5.3 Social factors

### Accessibility and Equity

MaaS entails various level of accessibility and their use can be challenging for certain groups of people due to physical, economic or technological limitations

The access to the new mobility services and to MaaS in particular, requires the use of mobile application which can exclude part of the population due to difficulties in handling new technologies or having access to banking (Paangbourne et al, 2020). This question is more concerned if these services substitutes public transit which is accessible to all community members (Jin et al., 2018). In Polis (2017) it is suggested to avoid a situation where MaaS offer only addressed the most profitable part of the market with some areas with better transport provision than others.

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
The choice of MaaS solution over another is usually guided by the benefits of that part of the population that travels more often. These people typically have higher incomes, which means that the interests of the lower-income part of the population that cannot bear high travel costs are overlooked. It has been argued that accessibility (both financial and physical) should be an essential factor in designing and implementing new MaaS policies and regulations. Moreover, such equity and accessibility issues will need to be considered for governance models.	The public-private partnership model could better guaranty accessibility and equity since the public transport operator focusses on enriching its services by integrating additional services. However, in the broker models, these characteristics should also be guaranteed.

### Environmental benefits

Maas could lead to a reduction in car use and/or car ownership, which would reduce congestion and improve urban air quality

If there are a convenience offer of mobility options and the car's use is less attractive, customers may be more disposed to use public transport and to walk or use a bicycle than the private car (Hoadley, 2017). Hence, MaaS can remove a significant number of cars from the network, with drivers switching mainly to public transport (Kamargianni et al., 2018). However, the pre-paid models of MaaS could imply a rebound effect because MaaS users could make more trips to take advantage of the unlimited modes in their packages (Pangbourne et al., 2018). Besides, public transport use could be reduced by the shared vehicles available through MaaS, which would not reduce congestion (Pangbourne et al.,

2020). Therefore, governance actors need to decide which modes should be prioritized according to the social and environmental needs of their jurisdiction and specify MaaS packages accordingly (Pangbourne et al., 2018, p.13). Cerre (2019) recommends continuing and enhance policies aimed at increasing the share trips made by public transport, walking, and cycling and implement policies that discourage the use of private cars.

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
MaaS has the potential to achieve environmental benefits but also could feed unsustainable individual practices. Hoadley (2017) suggests that if a subscriber does not use all the trips, notably the taxi or car-sharing trips, that are part of a monthly package, these are carried over to the next month. Besides, the author also suggests transport authorities to ensure that public transport fares remain low to keep them affordable and make it an attractive travel option.	In the public-private partnership model, public transport could have a central role in the MaaS offer, helping to reach the environmental benefits. In contrast, in the broker model, the use of more sustainable practices (walking or cycling ) or the role of public transport is in the aggregator’s hands.

## Health and well-being of citizens

The transportation modes included in the MaaS packages will affect users’ physical health and subjective well-being

Key active travel sharing options have to be integrated into MaaS packages. For many people, the efficient way to achieve minimum recommended levels of physical activity is to switch some shorter journeys to active travel (walking or cycling). Having a MaaS package might result in a neglect of these minimum amounts of active travel through its door-to-door promise (Pangbourne et al., 2020, p.43).

Influences on regulatory policies (positive/negative)	Influences on governance models (positive/negative)
Walking or cycling has to be incentivized. By subsidizing actives modes, local authorities can drive citizens to use this option on short trips.	Active travel modes such as walking or cycling have to be included in the point-to-point route in the Broker and Public-private model.

# 6. Regulatory Schemes for Future MaaS Deployment

This chapter presents 4 case studies to investigate what MaaS regulatory scheme is expected in the future. Four cities (i.e., Amsterdam, Barcelona, Helsinki and Manchester) are selected as case studies because they have engaged in MaaS projects. To complete case studies, researchers collected secondary data and conducted semi-structured interviews with public authorities and MaaS operators. Each case study follows the structure of case background, international and European regulations, national regulations and regulatory scheme for MaaS deployment.

## 6.1 Case 1: MaaS Regulation Scheme in Amsterdam

### Case background

Four virtual interviews were conducted to collect data and information of the impacts of current regulations on MaaS implementation and MaaS governance models and regulatory scheme in Amsterdam. Specifically, the interviews involved two representatives from the public sector and two representatives from the private sector, directly involved in MaaS-related initiatives at different levels. The collected information were also integrated with data derived from desk research, to have a more comprehensive overview of the ongoing development in the field.

Amsterdam, the Dutch capital city, is one of the first European cities to have officially adopted a smart city strategy. Initiated in 2009 and organized in the form of a public-private collaboration between municipalities, knowledge institutions, businesses, and citizens, the Amsterdam Smart City Programme aims to implement a multidimensional approach to develop innovative and sustainable solutions to common global challenges and specific urban planning challenges (Amsterdam Smart City, 2020). The results achieved through its strategic approach to smart cities and its holistic vision in city innovation related to key areas of urban life have also been internationally recognized. As an example, in 2016 Amsterdam won the European Capital of Innovation award (iCapital) from the European Commission (European Commission, 2016).

Transport and mobility represents one of the thematic area of the Smart City Programme. A plenty of initiatives and measures have already been implemented and have been planned for the coming years to overcome the complex challenges related to the increase in mobility demand. By 2030, it is estimated that the population density in Amsterdam will increase from 5,100 inhabitants per square kilometre to 5,700 (City of Amsterdam, 2020a) with consequent rising pressure on public spaces and impacts on accessibility and liveability. Public transport currently connecting the various city's areas by metro, tram, bus, train and ferry and relying on the smart ticketing infrastructure valid at national level (i.e. OV-chipkaart), is expected to continue playing an important role to ensure that the densely populated city functions properly. For this purpose, the Amsterdam Metropolitan Area and the Dutch

government have made huge investments to improve regional accessibility, aimed at realizing new metro routes, fast-connecting tram-lines, and at giving priority to bus and trams over cars on the streets in specific parts of the city (Gemeente Amsterdam, 2013). Although the private car use in Amsterdam (31%) is considerably lower compared to other Dutch cities and the “active modes” (walking and cycling) have a high share (46%) (KiM, 2019), the city still strives to reduce traffic congestion, especially in the city centre and surrounding neighbourhoods. Along with the new developments in public transport network, to discourage car traffic and ownership, the city government has taken a variety of measures to: (i) improve its cycling network; (ii) improve bicycle parking through new regulations and the stimulation of new bike parking habits; (iii) reduce on-street parking; (iv) adopt new mobility concepts, such as shared mobility schemes, smartphone-driven traffic management, and water-based goods transport. For instance, electric car sharing and scooter sharing services and on-demand transit systems are successfully diffusing in Amsterdam, serving as an extension of the city’s public transport network. This is also demonstrated by the huge increase in car sharing usage of 376% since 2008 (Amsterdam Smart City, 2017). However, the use of shared-cars is less than 1% of the total car usage. The increase in car sharing usage has also been stimulated by the Green carsharing Deal, formed by leasing and insurance companies, municipalities such as Amsterdam, mobility start-ups and environmental group (Green Deal, 2018). Taxis were also included in the Amsterdam’s policy framework for traffic and transport. In fact, in 2013 Amsterdam introduced a new policy to regulate taxis that are engaged at a licensed taxi rank or hailed on the street (City of Amsterdam, 2020b), with the aim to improve service quality and consumer protection, reduce traffic disruption caused by taxis, and increase the number of cleaner taxis.

Apart from multiple platforms each offering shared-mobility services, ride-hailing service, ride sharing services, journey planner applications, a concrete shift to a MaaS model of transportation has not taken place in Amsterdam. However, the city is actively involved in a MaaS initiative, the MaaS Zuidas pilot project. This is one of the seven nationally scalable MaaS regional pilots that have been initiated in 2017 by the national government, specifically by the Ministry of Infrastructure and Water Management, to gain experience on MaaS and understand how MaaS can contribute to the different policy goals related to sustainability, accessibility, liveability, and inclusion. After a tender for framework agreement, the Ministry selected 24 consortia consisting of parties already involved in shared-mobility concepts or with MaaS for certain degree, such as IT and platform companies, bank and insurance companies, public transport providers, automobile companies and start-ups (Ministry of Infrastructure and Water Management, 2019). Specifically, consortium responsible to run the MaaS pilot in Amsterdam is made up of four parties, namely Radiuz, Amber, Over Morgen and Trandev. Together they have developed the Amaze app expected to be publicly launched for the first time in September 2020, while the full operational launch in the app store is expected for December 2020, as indicated by the four interviewees. The app is primarily created for business travellers and commuters, with the aim to ease their trips to and from the business district of Zuidas in Amsterdam. The accessibility of this area is under risk due to the increasing traffic and the large-scale roadworks which might reduce main roads capacity for the next ten years. The app will be then scaled up to other users groups, to then serve the entire Amsterdam Metropolitan Region and ultimately the whole country. The app has been developed to allow the end-users to plan, reserve, pay and receive personalised recommendations for their trips, and combine public transport with car sharing, bike and ride hailing, as an attractive alternative to the private cars. The launch of the app follows a trial called Zuidas Mobility Experience. During this project, a group of workers who currently drive to the



area received a mobility budget to spend for their trips and were challenged to give up their cars and change their mobility patterns for a month.

Overall, as pointed out by the four interviewees, the nationwide MaaS initiative and the MaaS Zuidas pilot projects offer valuable opportunities to stimulate healthy competition and collaborations. These were facilitated and steered by the Ministry of Infrastructure and Water Management and the local governments, which initially worked on bringing together all the different parties and frequently doing consultations with MaaS service providers, to ensure an effective link with the defined policy goals and the creation of the right (legal) conditions for a successful open working environment in which data and knowledge are shared between all stakeholders. It's interesting to note also that for example, in Amsterdam the tender has been designed in co-creation between national and local governments and prominent employers in the area. The co-creation process involved also future users, which actively participate in project experiments and an in-depth study aimed at delineating different target groups and underlying motivations (Ministry of Infrastructure and Water Management, 2019). This information together with all the data collected during the MaaS pilot by the selected parties and the involved transport operators have to be shared among each other and with the governmental organizations, while ensuring the end user's privacy. This is a requirement of the framework agreement. In this way a MaaS Learning Environment (Ministry of Infrastructure and Water Management 2018a) is set up, to monitor MaaS development and come up with data driven and adaptive policy and regulation.

From the interviews it emerged that barriers are mainly related to the system of public obligations and concessions given to public transport operators, which might position them in an advantage position compared to smaller transport operators, which therefore may experiencing some difficulties in gaining market share. Other barriers are related to the opening of the ticketing systems of transport operators, with public transport operators that need to make available their travel products to different MaaS providers, and to the presence of different regulations, requirements and permits procedure for shared mobility services. For instance, car sharing companies need to follow different procedures to obtain the parking permits in different cities, such as Amsterdam and Den Haag. A harmonized and uniform system of regulations and requirements is needed especially for small companies or start up that strive to adapt their business to each city in which they operate.

## International/European Regulations

A first aspect for which international and European regulatory frameworks could affect MaaS implementation in the Netherlands, and subsequently in Amsterdam, concerns the development of an integrated ticketing schemes and payment services, which currently are not homogeneous across the various countries of the European Union. As underlined by two of the interviewees, this is especially important in case of cross-border scalable platforms. To gain knowledge on how to successfully address this issue, the Ministry of Infrastructure and Water Management together with the Province of Limburg have initiated a pilot project focused on multimodal cross-border mobility as part of the nationwide MaaS initiative (Ministry of Infrastructure and Water Management, 2019). This is particularly challenging especially when it comes to public transport considering that the ticketing systems of the neighbouring countries are heterogenous, thus requiring an efficient cooperation with partners from abroad (Belgium). So European regulations on the provision of EU-wide multimodal

travel information services are expected to influence the implementation and development of a MaaS initiative with a cross-border scope also for the city of Amsterdam.

Another important aspect to consider for the implementation of a MaaS service based on ticketing and payment integration relates to the facilitation of open exchange of data and information. Apart from EU Directives and Regulations on open data, also non-legislative initiatives are expected to positively influence MaaS implementation in Amsterdam, and in general in The Netherlands. For instance, one of the interviewees pointed out that the MaaS Alliance is putting particular efforts to facilitate a single, open market and to develop a common standard and harmonized API for digital mobility services. These standards can be adapted at national and local level, instead of inventing new ones. Currently, the Transport Operator to Mobility Provider API (TOMP-APIs) aimed at create a standardize interface for data exchange and service interoperability are being developed by an open working group with public and private stakeholders, in consultation with the MaaS Alliance Technology and Standardization working group.

Lastly, Amsterdam and the Netherlands can also make use of the developments made by the EU ITS Platform, considered as the technical European ITS Knowledge Management Centre. This platform aims to contribute to the use of ITS standards and specifications. One of the element of the platform concerns with data quality, and is looking with particular interest towards multimodal transport (Ministry of Infrastructure and Water Management, 2018c).

## National Regulations

A first set of regulations is related to public transport, widely considered as the backbone of MaaS. Specifically, one of the interviewees explained that in the Netherlands the concessions for public transport are regulated at two levels: the national level, which sets out the rules for the national rail system; and the regional level, which set out the concession rules for the local regional public transport operators. Therefore, the implementation of a MaaS scheme aimed at including public transport in its portfolio of offer will be inevitably influenced by those regulations. However, currently there is no regulatory scheme within the concession systems either at national and regional level that define the rules for opening up the ticketing system of public transport providers and to set out the environment for a smooth collaboration between public transport operators and MaaS providers. This might imply that there could be the possibility that public transport is not offered with a MaaS service, if the public transport operators do not agree to open its ticketing system and to collaborate with a MaaS provider, with potential negative consequences on MaaS implementation. To start to overcome this regulatory gap, at national level it has been defined a sort of agreement involving all the regional bodies in charge of public transport concessions (Ministry of Infrastructure and Water Management, 2018a). According to this agreement, they are requested to put in a set of rules within their concessions, to ensure that the parties that win the concessions will open up their systems to MaaS providers.

A second set of regulations relates to all the other transport modalities essential for MaaS implementation, such as taxi service, shared bike service, shared car service, etc. Specifically, three of the interviewees specified that it concerns the requirement for data sharing and the standardization of the communication system. One regulation that is coming into play aims to include

a regulatory measure according to which the willingness of a service provider to adopt the established standard for the communication system becomes a key element for the release of the permit requirement, which depend on the city regulatory framework. This means that it's up to the local government to adopt this standard within its own regulatory framework. On the other hand, at the national level and for the purpose of the seven MaaS regional pilots, the Ministry of Infrastructure and Water Management is facilitating the development of standards/APIs (Ministry of Infrastructure and Water Management, 2018b). An open working group (formed by on-demand car operators involved in deploying interoperable services to support MaaS-development in the Netherlands, the consortia that have signed the framework agreement and the participants in the precompetitive dialogue phase of the MaaS-Programme) have been established and is currently working to develop and specify the TOMP-API for use by Transport Operators and Mobility-as-a-service Providers (Ministry of Infrastructure and Water Management, 2020). In the Framework Agreement, one of the responsibilities of the service provider is, in fact, the acceptance and the adoption of standards and APIs established by the Ministry and in the context of the Pre-competitive dialogue.

Among the open standards and regulations in force in the government and applicable to MaaS, there is also the Digital Government Agenda (Rijksoverheid 2018), containing the rules on how the governments deal digitally with citizens (Ministry of Infrastructure and Water Management, 2018c).

## MaaS Governance Model

According to one of the interviewees, the Amsterdam MaaS pilot initiative can be seen as a market initiative following a kind of commercial approach. This means that the provider of the Amaze app (the MaaS service developed by the consortium in Amsterdam) takes all the risks. For instance, the responsibility of the customer-supplier relationship is up to the MaaS operator. Within this context, the role of the local government is to support the consortium formed to provide MaaS as it is a sort of start-up and ensure that the provided service is designed to effectively fulfil certain policies goals within the Amsterdam region. In other words, the City of Amsterdam and the Amsterdam Transport Authority (Vervoerregio Amsterdam) helped the consortium to set up the business, by encouraging the successful development of the service and removing possible barriers to MaaS development. This is done through funding provision, as an incentive to initiate the business and get the system running, and data and information provision, concerning for instance commuters travel patterns and trips origins and destinations. However, the public authorities do not share any risk with the MaaS provider, neither are responsible of the commercial agreements with transport operators.

Another interviewee pointed out that considering that the MaaS provider takes on the risks of the activity, such as missed payments, frauds, thefts, there might be some fragility in the system that the MaaS operator need to cope with. On the other hand, the governance model put in place for the MaaS pilot in Amsterdam overcomes some drawbacks that might come with a model in which the public transport operators are the MaaS providers. These are related for example to the duration of the concession period and the renewal probability of the concessions and to the possible disturbances in the open market regime, as stated during one interview.

Overall, in Amsterdam the MaaS market acts as a free market aimed at opening up mobility in a more holistic way. An open system in which mobility options are linked not only to a single MaaS operator

but to all MaaS providers operating in the city is highly encouraged. To make the governance model really successful, public transport companies are also highly encouraged to participate actively and cooperatively in the development of the MaaS. This will allow the MaaS operators to provide the customers with a more comprehensive service, including bundles based on two-part or three part pricing schemes (e.g. discounts on standard fares, flat rates, etc.), similarly to the model adopted in Helsinki or Antwerp. Within this context, the Netherlands Authority for Consumers and Markets (ACM) is also looking at all the different types of MaaS initiatives, in order to protect consumer interests, making sure for instance, that the consumers at least are offered with fair prices, and that there's no market obstruction.

## Regulatory Scheme for MaaS Deployment

All interviewees agreed that currently in Amsterdam there is not an actual MaaS regulatory scheme, yet. This is expected to be in place in two years. However, the central and regional governments are both working to establish such scheme, whereby the service providers and transport operators are required to collaborate. Moreover, there is no exclusion, which means that every MaaS provider can act on the Dutch market.

At the city level, current regulatory schemes on public space and shared mobility services are influencing MaaS deployment. The city of Amsterdam is responsible of regulating how the public space is used. As explained by one of the interviewees, this means that it controls for instance the organization of the design of the streets to incentivize the usage of certain transport modes such as bicycles or public transport over others or it controls the usage of parking spaces. Specifically, by regulating parking spaces for shared mobility services, the city of Amsterdam can set up one of the key elements of MaaS regulatory scheme, which concerns the permits release for certain services. Currently, when shared mobility operators apply for these permits via a tender procedure, they will accept a number of rules and requirements, which are related for example to the need to use specific data and communication standards (i.e. TOMP-APIs) to connect with MaaS providers. Same rules are applied in a similar way to the permits release for other shared mobility operational schemes, which do not require the allotment of specific parking spaces but needed to be allowed to operate with a maximum number of free floating vehicles in the public space. Specific national and regional regulatory-requirements involving public transport operators (such as the national railway company, the municipal public transport operator) will be also taken into account in the transport concessions, so that these services are included in the MaaS ecosystem.

According to one interviewee, one of the key elements to include in the MaaS regulatory scheme to improve it is related to the introduction of a sort of steering measures that will allow the government in evaluating the provided services and ensuring the successful achievement of policy goals. For example, according to these measures, the government may intervene when some negative effects might occur and may help to steer the MaaS development in the right direction. Encouraging and enabling the data sharing is an important aspect to realize these measures. A first step in this direction has been already taken through the set-up of the MaaS learning environment. This represents an essential part of the entire MaaS ecosystem, since it helps the governments in understanding the underlying cooperation structures between transport operators and MaaS providers, in evaluating the provided service and thus developing well-informed policies.

Another element concerns the conditions that need to be put in place for guaranteeing an open and free market and to avoid monopoly situations, by realizing an open ecosystem so that everybody can join. Examples of measures to regulate this system provided by one of the interviewees might be related to certain technical and financial mechanisms for the design of well-balanced contracts, to some kind of financial rewards for those who demonstrate to successfully deliver the service and to quality labels so that both MaaS providers and transport operators are encouraged to deliver efficient and reliable services.

Overall, for MaaS future deployment a complete top-down approach is not considered as the best one. A desirable MaaS regulatory scheme for the future is one designed to enable and ensure that all the involved stakeholders that are part of the ecosystem had to offer something of value for a successful MaaS deployment (e.g. information, data, resources) in exchange of something which is valuable and beneficial for them.

## 6.2 Case 2: MaaS Regulation Scheme in Barcelona

### Case background

Barcelona is the second largest city in Spain with about 1.6 million living in the urban area and 3 million people in the metropolitan area (Barcelona Travel Guide, 2020). The area covers 636 km<sup>2</sup>, 46,5% of this surface is occupied, mainly around the central agglomeration. The rest of the area is mainly agricultural.

The city host either traditional transportation mode like metro, city buses, tram and suburban railways. They also have modern transportation mode, such as micr-mobility, car sharing and ride sharing. Figure 2 summarises transport modes in Barcelona.

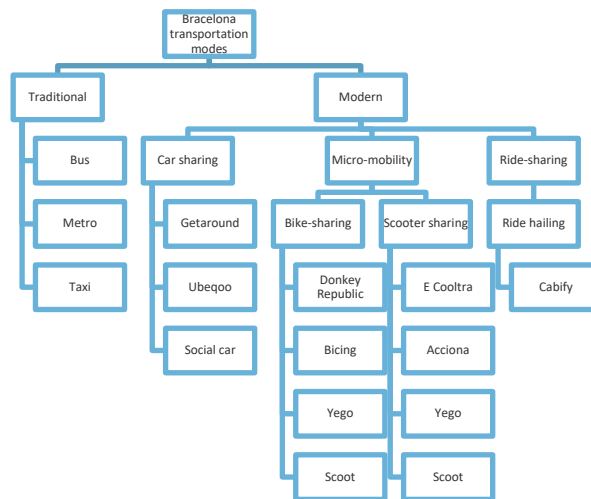


Figure 2 Barcelona Transportation Modes

This transport system is managed by different entities. Table 2 captures the role of each entity involved in the governance model.

Table 2 Entities Involved in Governance Model

<p><b>AMB</b> <b>(Metropolitan Area of Barcelona)</b></p>	<p>It's a public entity that manage public transport in metropolitan area, including metro and bus of the city of Barcelona. They are also responsible of urban or suburban bus services connecting the 36 municipalities in the area.</p>
<p><b>ATM</b> <b>(Metropolitan Transport Authority)</b></p>	<p>It's a public entity formed by the consortium of Catalan Government, the AMB, the Barcelona City Council and the ATMU.</p> <p>Roles:</p> <ul style="list-style-type: none"> <li>• Manage suburban tramway</li> <li>• Manage and cooperate all planning instruments in the RMB (Regió Metropolitana de Barcelona)</li> <li>• Decide on public transport tariffs, establishing financial agreements, developing mobility plans</li> <li>• Develop public transport infrastructure</li> </ul> <p>They published in July 2020 the mobility master plan (2020-2025), where they describe governance, planning and digitalization of mobility directives</p>
<p><b>Ajuntament de Barcelona</b></p>	<p>It's the local government of Barcelona City Council. It regulates the modern transport in the city of Barcelona.</p>
<p><b>ATMU</b></p>	<p>It's a non-profit association of city councils that manage urban transport in Catalonia.</p>
<p><b>Generalitat of Catalunya</b></p>	<p>It owns exclusive competencies in the matter of land-use planning and management of transport services that operate completely within the Catalan region. It delegates the development of transport services in the metropolitan area of Barcelona to the ATM and AMB. Note that the Department of Territory and Sustainability of the regional government of Catalonia manage the concessions with the transport operators that are not managed by the AMB.</p>
<p><b>Other municipalities</b></p>	<p>Each municipality can regulate modern transportation mode in its area. Rules can differ from one to another.</p>
<p><b>MaaS related institution</b></p>	<p>Some other organizations are deeply involved in MaaS deployment in Barcelona like Carnet, Factual and Renfe.</p>

For 10 years, Barcelona is undergoing a smart city transformation. Barcelona is investigating several opportunities for the development of MaaS. To illustrate this development, Table 3 lists several private and public MaaS initiatives.

Table 3 Initiatives around MaaS in Barcelona

Initiatives	Creation date	Description
Iomob	2017	White label MaaS solution that combines proprietary algorithms enabling multimodal combinations of public and private services, and an application that allows end users to discover mobility services, receive multimodal combinations for their journeys, book and pay for a range of mobility services (Frost, 2019).
Smou app	January 2019	Barcelona app that provide information on street and below-ground parking services as well as electric charging points and the shared bicycles' network.
City trips	2018	Offer a multimodal door-to-door experience that is as seamless as possible in the current fragmented offer of our cities. Bike sharing, moto-sharing, car sharing, public transport, taxi and VTC are gathered in this application.
Maas Catalonia	2018	They developed a manifesto with 7 principles advocating the idea of a new mobility paradigm. The intention is to generate awareness and exposure for all formats of Mobility as a Service platforms over the world (Chadwick, 2019).
Galileo 4 mobility	2019-2020	Project with 2 pilots using New European Satellite Navigation Satellite System. One pilot is a MaaS aggregator and is around public transport on demand.
T-Mobilitat	2013	Project to create a card-based smart ticketing system which will enable and reinforce the MaaS eco-system (Palasi, 2019)
Virtual Mobility Lab	2018	CARNET implemented a cutting-edge simulation environment for the Barcelona Metropolitan Area. One of the first tests, of the Virtual Mobility Lab, showed that a fleet of 4,000 shared vehicles could serve 10% of daily car trip demand. This would lead to a considerable improvement in traffic in the city as well as a reduction of pollution levels.

With the development of MaaS, there is a challenge around the use of technology by citizens. According to a study done by Mobile World Capital Barcelona in 2016, 'The digital divide in the city of Barcelona'. Indeed, Barcelona is a well-connected city with high Internet usage and access rates. But it remains gaps regarding access, use, and quality of ICT usage. We explain it by variables such as age, profession, education level and income. Another difficulty is link to the density of people in Barcelona. Adding new transportation modes leads to an increasing risk of accidents. Each addition of service new to be study carefully, that is why they are very regulated in the city.

Today, a lot of services are not integrated into the public channel, the user has to use private platforms to make reservations and payment. The T-Mobilitat project will give some tools to reduce the problem. This topic raises up also economic, indeed there is implications around cost and revenue issues. The last difficulty that they face is the information management to ensure consistency. There are some questions to be solved, such as how agents must be trained to diffuse it and how it's shared around different partners.

For our public authority interviewees there is here a difference of vision between public authority who are looking at citizen who must have access to transport as a human right and private company who are more looking for clients and revenues. To encourage the development of MaaS regulation must be set to coordinates the different entities.

## International/European Regulations

There's no international or European level regulation of the MaaS as now. This type of regulation is complex, as it must consider country specificities. Main discussions at this level are around data access and General Data Protection Regulation (GDPR). They are discussing on how to regulate and open the right to access operational from transport operator and make it easier for digitalization services to make it accessible.

Today, the right of accessing any transport data is regulated by the ITS directive (2010) but this directive is from many years ago and at that time the mobility services didn't exist as the value proposition. It's said the transport data should be accessible to third parties. But it's not going into details, which kind of data, operational data etc, it doesn't include critical information beyond shadows and static data which are easily accessible from data.

## National Regulations

Currently regional regulations are the one that impact the most the current development of MaaS as it answers concrete questions on the field. Regulation of services are quite mature, as an example there is a decree to regulate shared vehicle services in Barcelona. It establishes the number of permits in the city and per company, it also defines terms and conditions of use. It was updated in February 2020 [10]. Also, after strikes from the city's taxis, they create a regulation in January 2019 that set some rules for ridesharing app. This regulation set different rules like a minimum booking time of 15min for those app.



There is also some work around share and access to data. As there is no national or EU regulation around it, the regional and local administration have had to regulate themselves to some extent. For example, administrations such as the AMB are allowing the user to access the service of some private operator on the platform but the user can't make reservations or payments yet. At the national level, there isn't regulation in place yet, only best practices and pilots.

## MaaS Governance Model

For now, Barcelona is developing their MaaS scheme with partnerships especially with private operators and then include public transport information. It seems that at the beginning of a MaaS project, cities must develop the best appropriate partnership to grow confidence between partners and increase knowledge on each activity. From the private stakeholder interview, the broker model can appear as an ideal, as it offer a clear unique point of contact for all services. But it seems not feasible today due to the lack of confidence between actors." But as it was said per one person I'm not sure it can be written here.

## Regulatory Scheme for MaaS Deployment

The MaaS regulation model should inspire itself from the Scandinavian one as observed in Finland because it's an urban market where competition can evolve in the benefit of user. Based on our interviewees, Helsinki figure out how to implement the MaaS platform combining public and private services. It's interesting to observe the legal issues they have and what regulations they applied.

Today, Barcelona evolves according a partnership model. In the evolvement of MaaS regulatory scheme, the economic issue to make sure all the parties have a benefit must be taken carefully. There is also further work around the regulation of information to ensure a consistency between all user point of contact. Finally, it's also the role of administrations to make sure that the service stays open with public participation. Indeed, it's important to make sure that there's no company that manages several departments on its own and has thousands of licenses or permits. Step by step, MaaS become more and more structured in Barcelona. The Mobility master plan (2020-2025) clarify the vision of MaaS to make it viable from technical, economical and legal point view, but also attractive from a user point of view.

## 6.3 Case 3 MaaS Regulation Scheme in Helsinki Metropolitan Area

### Case background

This case is based on four interviews conducted with individuals working on different aspects of MaaS in the Helsinki Metropolitan Area (HMA), and Finland. Three of them conducted with people working in different levels of the public sector and one conducted with an individual from the private sector. This case intends to give a general overview of the current situation of MaaS in the HMA and a glimpse into the opinions held by some of the stakeholders.

There are several sources that explain different parts of the history of MaaS in Finland at greater depth (e.g. Audouin and Finger, 2018; MaaS Global, 2019; Hirschhorn et al, 2019). Although, the concept of MaaS can trace its origins back to at least 2006 according to MaaS Global (2019), the interviewees highlighted Finland's strategy for intelligent transport (Ministry of Transport and Communications, 2009), as an important step towards current regulation. According to Audouin and Finger (2018), this was only the first in a line of incremental reports and strategies relevant for the national support for MaaS in Finland.

In 2013, the City of Helsinki collaborated with Hietanen on supervising a master's thesis at Aalto University during which time the regulatory needs posed by MaaS (Heikkilä, 2014). In 2015, MaaS Finland Oy (which is now MaaS Global) was founded following a business meeting and funding from the Finnish Funding Agency for Technology and Innovation (Audouin and Finger, 2018). As Hirschhorn et al. (2019) pointed out, public transportation in the HMA is coordinated by the Helsinki Regional Transport Authority (HSL), which is funded by the municipalities in the area. They further indicated that HSL has played an important part in enabling MaaS. Although there has clearly been difficulties along the way, they have slowly opened up their APIs starting in 2017. This enabled MaaS Global to launch what they call a full MaaS service in the HMA at same year .

The interviewees unilaterally agree that the most important step towards MaaS in Finland was the Act on Transport Services (2017), which demands that public transport providers openly share service information and open APIs. Since then Ministry of Transport and Communications (LVM) has been working to establish codes of conduct which enables service providers to achieve the state that was intended by the Act on Transportation Services, including necessary aspects of bilateral contracts and how to ensure efficient services (Traficom, 2019).

## International/European Regulations

The interviewees agree that international regulation with significant relevance for MaaS in Finland, is limited to the EU level. Most of them named the EU directive on package travel and linked travel arrangements, which regulates package travel covering a period longer than 24 hours and sets rules on consumer rights, including information requirements and the liability of service providers (Directive 2015/2302). Another relevant aspect is the Commission delegated regulation supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide multimodal travel information services (Regulation 2017/1926), which one interviewee said will slowly replace the Finnish national regulation concerning MaaS.

Other regulation that they mentioned related to data protection and emerging technical standards which may play an important role in the future. One interviewee wanted to stress that the Finnish Act on Transportation Service has refrained from establishing standards (such as which form an open API must take), but that it seems like the EU will impose those in the near future, which will then require Finnish legislation to adapt to such a situation. They further pointed out that LVM may have chosen to leave out standards in order to leave enough room for flexibility as the legislation was defined before the actual services had been established, which may have resulted in unexpected redundancies in the standardisation.

## National Regulations

As presented before, the current Act on Transport Services (2017) regulates MaaS nationally. Its main point from the perspective of MaaS is that it requires service providers to open their APIs and bilaterally decide on the practicalities. According to the interviewees, it is currently quite sufficient as far as legislation goes. Although they agreed that it lacks in detail (e.g. technical standards or more exact definitions of the shared data), they found that such level of detail could easily be created through other forms of agreements or codes of conduct. These could be set locally in a specific urban region or nationally, like the work initiated by LVM in 2017 (Traficom, 2019).

All the interviewees pointed out that regulation in the HMA functions differently to several other urban regions in Europe because Finnish cities' power to impose local regulation is mostly restricted to land use. Hence, MaaS in the HMA is regulated in mostly the same manner as the rest of the country. However, one interviewee considered land use to be of great importance, since all mobility services depend on the infrastructure that is governed by the cities; the example being that multimodal travel may require transportation hubs, and any travel modes require sufficient infrastructure to be desirable to the consumer.

## MaaS Governance Model

When presented with the two distinct governance models for MaaS presented in chapter 4, the interviewees concluded that it seems overly simple. They all agreed on the reality most often being some sort of a mix between those two, but that the broker model is the one which is closer to what will happen in the HMA. One interviewee said that the current legislation demands it, referring not only to the Act on Transport Service, but also indicating that when it comes to travel chains, there are several regulations that the providers have to abide by, such as the liability of transport providers, which may regulate by different directives depending on the situation and, therefore, liability can never truly be equally shared between all actors in the partnership. However, all interviewees pointed out that in the HMA they are working towards reaching a situation where you have multiple brokers. One interviewee considered multiple equal brokers to be necessary to ensure a good service for end user.

One interviewee said that it is impossible to objectively know which one of the mentioned models is better, because the current evidence is insufficient to draw any conclusions. However, they could not recall any partnership-like model that would work well. It was also pointed out that the broker model would look different if the broker and the public transport provider is one and the same. These models were also stated to lack the situation where the MaaS operator, public transport provider and operator is one single entity.

## Regulatory Scheme for MaaS Deployment

Finally, all interviewees agreed that forcing providers to open their APIs in order to resell tickets and make services available to all is needed, but they also mentioned that the scheme should focus on enabling, not restricting operations and development.

The aim of the regulation can be achieved in several ways depending on the circumstances, such as local business culture. One suggested that the current situation in the HMA could have been achieved through agreed upon codes of conduct, but that national legislation enables fair and equal treatment and perhaps is more typical for Finland. Furthermore, one interviewee highlighted the importance of a space that enables continuous dialogue and collective development of the MaaS system.

The biggest concern that the interviewees collectively raised, is the importance of a holistic planning of the regulation and the effect of adjacent areas of regulation that need to be acknowledged. In Finland for instance, they found taxation to cause concern, because the question of how to tax resold tickets had not been considered, which needed to be settled before they legally could be resell these tickets. Lastly, the interviewees agreed that MaaS regulation has to be customized to the region where it is imposed, be it national or local and that the step up from pilot to actual implementation brings unimagined complexity to the issue of regulating MaaS.

## 6.4 MaaS Regulation Scheme in Greater Manchester

### Case background

Greater Manchester is a large city region with 2.79 million residents. It is one of the UK's combined authorities, representing 10 local authorities working together. This combined authority has been working on various areas of urban policies, including growth, environmental sustainability, technology and innovation, and quality of life (Mourey, 2019). Greater Manchester has encountered several urban mobility challenges that are shared by many urban areas, including over-dependence on car, traffic jams caused by high number of individual car trip, fragmented public transport system of highly uneven provision, air pollution hotspots, and investment on infrastructure that focused on the city centre.

Transport for Greater Manchester (TfGM) is the public body responsible for coordinating transport networks throughout Greater Manchester and deciding where to invest transport funding. It delivers the transport policies set by the Greater Manchester Mayor and the Greater Manchester Combined Authority. TfGM owns the Metrolink network, manages walking and cycling infrastructure investment, and strategically plan the key route network. It subsidises the socially necessary bus routes and coordinates the city region requirements to secure national funding for investment. TfGM oversees the 2.1 billion journeys that are made across the region each year; 59% of these journeys are made by car (Wray, 2019). The objectives of TfGM is to enhance the availability, reliability and affordability of public transport, improve air quality, and decrease traffic congestion.

TfGM initiated 2040 Greater Manchester Transport Strategy on behalf of the Greater Manchester Combined Authority and the Greater Manchester Local Enterprise Partnership. Its vision is the “world class connections that support long-term, sustainable economic growth and access to opportunity for all” (see Figure 3). The strategy focuses on creating an integrated, sustainable, and well-coordinated transport system that supports a variety of travel needs. The core principles of 2040 Transport Strategy are : (1) Integrated – allow customers to move seamlessly between modes and services, (2)

Inclusive – provide accessible and affordable transport, (3) Healthy – promote walking and cycling for local trips, (4) Environmentally responsible – deliver lower emissions, better quality environment, (5) Reliable – give customers confidence in journey times, (6) Safe and secure – reduce road accidents and deaths, and (7) Well maintained and resilient – able to withstand unexpected events and weather conditions (TfGM, 2017). Overall, 2040 Greater Manchester Transport Strategy will deliver a viable transport system which make residents, business and visitors in Greater Manchester to travel to wide range of different destinations easily.

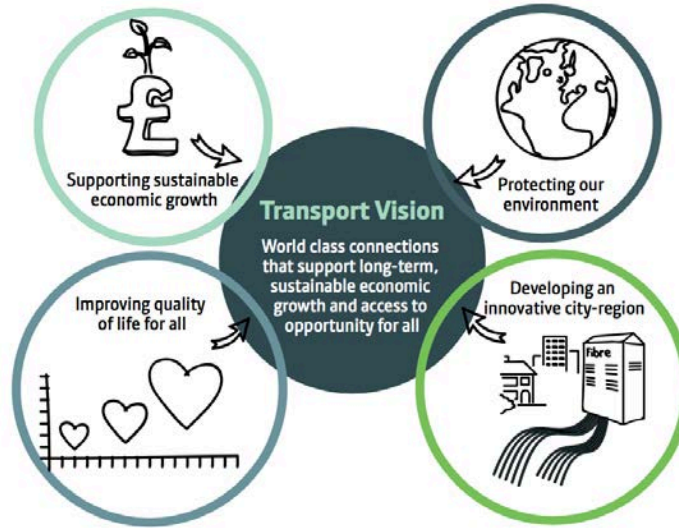


Figure 3 Vision of Greater Manchester Transport Strategy 2040

To achieve above objectives, TfGM has also been engaged in a wide range of MaaS pilots, such as IMOVE and MaaS4EU. In the IMOVE project, TfGM worked in partnership with Fleetondemand’s award-winning MaaS platform Mobbileo to create an integrated travel solution for the people of Manchester. It consolidates multiple modes of transport for the project into a single IMOVE branded app, with instant access to TfGM’s Local Link Service, Metrolink trams, car hire , trains and buses This app allows passengers to plan, book and pay for each journey conveniently using any iOS or Android device (de Prez, 2019). In the MaaS4EU project, TfGM acts as the MaaS operator in the pilot to provide a testbed for door-to-door urban and intercity, multimodal and intermodal trips and offer the opportunity to identify and test the B2B as well as B2C models.

### International/European Regulations

The EU regulations are important for MaaS implementation in Greater Manchester as it will set standards for integration. More concrete EU regulations would provide constructive guidance for cities which plan to implement MaaS. For example, regulations on integrated ticketing and payment would increase the efficiency of cross-border mobility. With the support of unified standards, MaaS operators are able to set out a long-term business strategy and make a commercialisation plan across

Europe. Other regulations in the areas of data exchange, data standardisation and harmonised APIs are critical to the development of MaaS. As one interviewee mentioned, “data and other technical standards at the EU level would partially determine the MaaS market readiness level and therefore influence the demand side and supply side of MaaS”.

The analysis also indicates that current regulations on passenger rights are largely differ across modes, due to a unimodal approach in the EU legislative framework. How to protect passenger rights in the context of MaaS is another direction for future EU regulations. Finally, one of the interviewees pointed out that “Brexit might also be a potential concern for the application of European regulations in the UK”. As the result, there is an uncertainty for future MaaS deployment though the standards at EU level should still be referred by policy makers.

## National Regulations

Based on the interviewees’ best understanding, there is currently no MaaS regulations in the UK. Most regulations are still fragmented and focused on specific transport mode such as rail, tram and bus. There is no mandatory requirement for MaaS; only MaaS guidance is available in the UK. The Transport Act 2000 which outlines regulations for local transport in the UK might be one of the most relevant regulations. It includes information such as transport plans, bus services, ticketing and partnership schemes. Transport Act 2000 is the main regulatory framework for Greater Manchester which includes following key implications (Galli et al., 2019):

- 114 - Quality partnership schemes “A local transport authority, or two or more such authorities acting jointly, may make a quality partnership scheme if they are satisfied that the scheme will to any extent implement the policies set out in their bus strategy or strategies.”
- 135 - Joint and through ticketing schemes “A local transport authority, or two or more such authorities acting jointly, may make a ticketing scheme covering the whole or any part of their area, or combined area, if they consider that the proposed scheme (a) would be in the interests of the public, and (b) would to any extent implement the policies set out in their bus strategy.”
- 139 - Information about bus services “Each local transport authority must from time to time determine, having regard to their local transport plan (a) what local bus information should be made available to the public (“the required information”), and (b) the way in which it should be made available (“the appropriate way”).” In this section “local bus information”, in relation to a local transport authority, means: (a) information about routes and timetabling of local services to, from and within the authority’s area, (b) information about fares for journeys on such local services, and (c) such other information about facilities for disabled persons, travel concessions, connections with other public passenger transport services or other matters of value to the public as the authority consider appropriate in relation to their area.”

Although Transport Act 2000 provides some implications for MaaS, it is not sufficient enough for successful MaaS implementation. Policy makers need to provide concrete technical standards for MaaS. The emergence of MaaS platforms and other new mobility services should be better regulated

nationally though these regulations should not significantly influence the market. The national regulations should also consider the customer rights and avoid unintended consequences.

## MaaS Governance Model

TfGM has conceptualised 6 models that could be potentially adopted:

1. TfGM is the MaaS operator and uses in-house resources.
2. TfGM is the MaaS operator but outsources all of its responsibilities (becomes commissioning authority).
3. TfGM is the MaaS operator but outsources all of its responsibilities except financial transactions.
4. TfGM is part of a MaaS joint venture formed to manage and operate the system.
5. TfGM is the MaaS operator but shares platform/resources with other providers to make financial savings and bring efficiency.
6. Private sector is the MaaS operator and has its full control on its operation.

Each model has own strength and weakness. As one interviewee said, “TfGM currently considers themselves as adopting model 3, which is the MaaS operator but outsources all of its responsibilities except financial transactions”. This governance model has an open and regulated back-end platform to manage both mobility demand and supply sides. It has greater flexibility and can integrate other new types of data (e.g., smart city data) into the platform. Standardised data is the key for this model to implement successfully. One of the disadvantages of this model is that it might slow down innovations because the MaaS operator needs to collect and analyse various data than other models before making strategic decisions.

## Regulatory Scheme for MaaS Deployment

As mentioned above, there is currently no MaaS regulatory scheme in Greater Manchester. In fact, one of key challenges for MaaS implementation in Greater Manchester is the deregulated and multi-operator market environment. There is a very complex transport system in this area, with two dominant bus companies, several small bus companies, multiple train companies, a light-rail company, and other mobility service providers. This complexity is detrimental to the MaaS deployment because it leads to several problems, such as inefficient data sharing, inconsistent fares, and different standards in transport services. Although the interviewee mentioned that other national regulations might to some extent be applicable to MaaS, they are still too focused on specific transport mode.

To address these issues, TfGM has initiated 2040 Greater Manchester Transport Strategy and implemented a series of plans. For example, TfGM has worked in partnership with the different public transport providers to create a multimodal and multi-operator ticketing structure, called “System One”, which was further enhanced by TfGM’s multimodal smart ticketing platform “Get Me There” (Mourey, 2019). This integration allows customers to purchase travel tickets in one application and travel seamlessly across operators.

As one interviewee noted at the end of the interview, “the regulations in terms of data sharing and standardisation, ticketing and APIs might be the most important things for future MaaS regulatory scheme because the unregulated market opens up wider challenges for cooperation”. It is therefore critical for policy makers to address these issues when designing MaaS regulatory scheme in the future. Policy makers need to design the consistent standards in order to facilitate data sharing and maximize the benefits of real-time data application. It is also important for policy makers to commit to establish a system of APIs which covers a range of mobility services that are typically not managed by local authorities.

Finally, the results of interview shows that public authorities might use MaaS to influence right transport mix in a city. For example, based on big data analytics, the city can manage and optimise the number of bike sharing, ride hailing and other forms of new mobility services, with support of appropriate MaaS regulatory scheme. However, this needs to find a balance and avoid market distortion.



# 7. Conclusion and Implications for Policy Makers

This chapter synthesizes the aforementioned analyses and offer 3 key implications for policy makers. First of all, the review in Chapter 4 shows that there is a limited understanding of MaaS regulations and regulatory schemes in the existing literature and projects. Although there are many recommendations or reports on MaaS, the concrete standard of MaaS implementation is still not obvious, which create uncertainties for current MaaS operators and other mobility service providers. Most of interviewees mentioned that they are not aware of concrete MaaS regulations at international, European or even national level, which supports this conclusion. However, our further analyses show that there is a huge potential to leverage existing transport policies at national level and extend them to MaaS, given the integrated nature of MaaS. For example, Transport Act 2000 in the UK might offer insights on the ticketing solution and cooperation model between public and private sectors. From a long-term perspective, the MaaS operators expect that EU will impose concrete standards relevant to MaaS in the near future, which might gradually replace the regulations at national level. Therefore, the policy makers might experience an evolving process to extend their existing national regulation to MaaS and then adapt it based on the update of EU regulations. It is critical to take this evolving process into account when designing a city transport plan.

Second, the findings in chapter 5 identify 12 factors that might potentially influence MaaS regulatory policies and governance models. These factors are further categorized into 3 groups: economic factors (i.e., market competition and market entry barrier), political factors (i.e., taxation, subsidies, incentive to consumers, data sharing and standardization, data privacy and security, use of public resources, and vulnerability) and social factors (i.e., accessibility and equity, environmental benefits, and health and well-being of citizens). For policy makers, it is important to examine these factors and evaluate how the design and implementation of MaaS regulatory schemes might be positively or negatively influenced by these factors. The design of best MaaS regulatory scheme will largely depend on the status of these factors.

Finally, the aggregate analysis of 4 case studies suggest that the European regulations might be the most important one for MaaS implementation although there is currently no specific MaaS regulation at this level. The findings suggest that policy makers need to pay more attention on the standard of data sharing, APIs, multimodal travel information and ticketing integration. With the concrete European regulations on MaaS, this innovation will be diffused quickly and adopted by cities across regions. Moreover, the case study analysis also shows different preferences of governance model in each city. When choosing the governance model, policy makers must consider the fit between specific governance model and exiting regulations in order to maximise the effectiveness of MaaS regulatory schemes. The future MaaS regulation scheme is likely to be a flexible one because these case studies demonstrate that the success of MaaS regulatory schemes might be determined by the attributes of cities. It is therefore critical for policy makers to regulate MaaS in a flexible way and leverage the existing advantages of their cities.

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