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MAASiFiE

European MaaS Roadmap 2025

Deliverable Nr 2

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MAASiFiE

Deliverable Nr 2 – European MaaS Roadmap 2025

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Executive summary

Mobility as a Service for Linking Europe (MAASiFiE) is a two-year project funded by the trans-national research programme “Call 2014: Mobility and ITS” launched by the Conference of European Directors of Roads (CEDR). The project investigates the prerequisites for organizing user-oriented and ecological mobility services in order to provide consumers with flexible, efficient and user-friendly services covering multiple modes of transport on a one-stop-shop principle. In addition, opportunities to combine passenger and freight transport operations are included.

The main expected result of the project is the European MaaS Roadmap 2025 to be defined in Work Package 2, which this deliverable, Nr 2, presents. WP2 can be considered as an umbrella interacting with WPs 3, 4 and 5. WP3 analysed MaaS state-of-the-art and value networks, and develops business and operator models. Results are presented in Deliverable Nr 3 – Business and operator models for MaaS. WP4 performed socio-economic and environmental impact assessments of MaaS, and proposes a set of key performance indicators of MaaS. These results are presented in Deliverable Nr 4 – Impact Assessment. WP5 analysed technological requirements and interoperability issues of MaaS, including usability aspects, presented in Deliverable Nr 5 – Technology for MaaS.

The work in WP 2 was performed through a series of four workshops: Workshop 1 created national MaaS visions. Workshop 2 evaluated potential impacts of Maas based on national MaaS cases. Workshop 3 created national versions of Roadmap 2025 defining short- and medium-term actions and requirements to reach the visions created in the first workshop. Workshop 4 was an international workshop creating European Roadmap 2025, consolidating results and defining next steps in implementing MaaS. Workshop 4 was international, while the other workshops were organised similarly in Finland, Sweden and Austria.

The European MaaS Roadmap 2025 defines short- (1-3 years) and medium-term (4-9 years) actions and transitions needed to reach the vision formed in the first workshop. The Roadmap is divided into four functional perspectives: drivers, markets, MaaS services and enablers. Each perspective presents the results using the following classification: Academia and R&D, Business, Infrastructure & built environment, Policy & regulation, Technology & data, and Society & culture. The Roadmap also indicates the most important components identified in the workshop for the future development of MaaS.

Academia and R&D is mainly seen as an enabler for identifying best practices, conducting impact assessments, and developing living lab test environments. The business sector affects primarily market and MaaS services perspectives and acts as an enabler. Business is seen as responsible for e.g. creating new pilots and services, collaboration and new business models, and developing the one-stop-shop principle.

Infrastructure & built environment is mainly seen as a driver for land use and the change of urban structures and space solutions resulting e.g. in fewer parking lots. Guidelines e.g. for city planning and infrastructure are considered as enablers for MaaS. Policy & regulation touches all functional perspectives by creating an environment enabling and promoting interoperability, collaboration, the MaaS ecosystem and achievement of policy targets. Regarding technology, key enabling technologies for MaaS exist, but challenges are related to e.g. interoperability and open interfaces, privacy and standardization.

Society & culture aspects are mainly related to market and MaaS services perspectives. MaaS is expected to solve the life puzzle from the mobility perspective. Consumers can influence MaaS development depending on increased user acceptance and attitude change, as well as being a prosumer (producer/ consumer) by integrating e.g. private cars to the MaaS ecosystem.

The continuity needed to regularly update the MaaS roadmap was seen as important, as the path of MaaS development is currently uncertain. Also impact assessments and validated results are needed to see the real quantitative impacts of MaaS.

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1. Introduction

The trans-national research programme "**Call 2014: Mobility and ITS**" was launched by the Conference of European Directors of Roads (CEDR). CEDR is an organisation that brings together the road directors of 25 European countries. The aim of CEDR is to contribute to the development of road engineering as part of an integrated transport system under the social, economic and environmental aspects of sustainability and to promote co-operation between the National Road Administrations (NRA).

The participating NRAs in this Call are Finland, Germany, Norway, the Netherlands, Sweden, United Kingdom and Austria. As in previous collaborative research programmes, the participating members have established a Programme Executive Board (PEB) made up of experts in the topics to be covered. The research budget is jointly provided by the NRAs who provide participants to the PEB as listed above.

1.1 MAASiFiE project

Mobility as a Service for Linking Europe (MAASiFiE) is a two-year project that investigates the prerequisites for organizing user-oriented and ecological mobility services in order to provide consumers with flexible, efficient and user-friendly services covering multiple modes of transport on a one-stop-shop principle. In addition, the project examines the opportunities of combining passenger and freight transport operations, especially with respect to urban delivery and distribution in rural areas. However, D2 only addresses logistics as an add-on to MaaS rather than presenting stand-alone logistics solutions.

The project is organised in five work packages (Figure 1). The Roadmap 2025 for MaaS in Europe to be defined in WP2 is the main expected result of the project and can be considered as an umbrella for exchanging information, contributing and interacting with activities related to work packages 3, 4 and 5 (Figure 1). WP2 will be performed as a series of four workshops held in three European countries – Austria, Finland, and Sweden – with the following themes:

- Creating a MaaS vision,
- Impact assessment based on existing cases,
- Building a Roadmap 2025, and
- Implementation and consolidation of MaaS.

The roadmap includes roles and responsibilities of different stakeholders, and legal enablers and challenges.

WP3 analyses state-of-the-art and future trends of MaaS including multimodal traveller information services, ticketing/payment systems and sharing concepts. It also analyses MaaS value networks, and develops business and operator models.

WP4 performs socio-economic and environmental impact assessments of MaaS and proposes a set of key performance indicators of MaaS. WP5 analyses technological requirements and interoperability issues of MaaS, and gives recommendations.

The project is coordinated by VTT Technical Research Centre of Finland Ltd., and consortium partners are AustriaTech, Austria, and Chalmers University of Technology, Sweden. The steering committee consists of the Finnish Transport Agency and the Swedish Transport Administration.

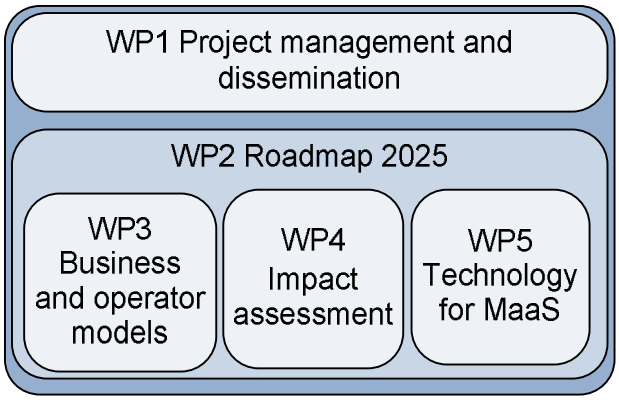

Figure 1: MAASiFiE Work Package structure.

1.2 Overview of the deliverable

Deliverable 2 describes the activities and presents the results of Work Package 2. The overall objectives of WP2 include:

- Clarify the MaaS concept and definitions for partners and stakeholders;
- Create a MaaS vision;
- Build a Roadmap 2025 for MaaS taking different actors and legal issues into account;
- Ensure the continuity of MaaS development in Europe by defining next steps towards implementation;
- In the definition of the final roadmap, WP2 summarizes and combines the results of WPs 3, 4 and 5 and confirms the most important elements in discussions with stakeholders.

The work in WP 2 was performed through a series of four workshops:

- Workshop 1 created national MaaS visions, and similar workshops were organised in Finland, Sweden and Austria.
- Workshop 2 assessed and evaluated potential impacts of Maas including socio-economic assessments based on MaaS experiences, taking into account the point of view of different stakeholders. Similar workshops were organised in Finland, Sweden and Austria, each of them concentrating on a national Maas case.
- Workshop 3 created national versions of Roadmap 2025 in Finland, Sweden and Austria. These roadmaps defined short- and medium-term actions and requirements to reach the visions created in the first workshop. Also roles and responsibilities were covered.
- Workshop 4 was an international workshop creating the European Roadmap 2025 and consolidating results. In addition next steps in implementing MaaS and ensuring the continuity of MaaS were discussed.

WP2 interacted with WPs 3, 4 and 5. The work performed in WP 3 was updated based on the information gained in WP2: an updated MaaS definition (Chapter 2) and MaaS ecosystem including roles and responsibilities (Chapter 4) are presented in this Deliverable Nr 2. MaaS cases presented in Deliverable Nr 3, have been updated and new pilots and

services added in Annex III. An updated MaaS literature list is presented in Annex IV. WP4 provided input for workshop 2 and vice versa. WP 5 presented the technical recommendations that were concluded in WP2 workshop 4.

This deliverable is organised as follows:

- Chapter 1: provides an introduction to the MAASiFiE project and this deliverable Nr 2 – European MaaS Roadmap 2025.
- Chapter 2: presents MaaS and MaaS component definitions updated from MAASiFiE Deliverable Nr 3.
- Chapter 3: summarizes the results of the Roadmap workshop series. This includes MaaS vision, impact assessment, national Roadmap 2025, and consolidation and implementation workshops.
- Chapter 4: presents the MaaS ecosystem updated from MAASiFiE Deliverable Nr 3 based on consolidation and implementation workshop input.
- Chapter 5: discusses MaaS business and revenue aspects based on the business models presented in Deliverable Nr 3.
- Chapter 6: presents the conclusion of the MAASiFiE project.

2. Introduction to Mobility as a Service (MaaS)

From a global perspective, the demand for travel and transport is steadily increasing. Especially in urban areas, where people are congregating, a solid, reliable transport system is vital, without forgetting a common goal to achieve viable transport in rural areas as well. However, at the same time pressure to reduce emissions is inevitably increasing and even some very radical environmental actions, such as prohibition of diesel cars in big cities, are starting to take place. This all sets a great demand to rebuild and/or reorganise the transport system and to decarbonise it, which will necessitate significant efficiency improvements and changes on both the system and consumer levels.

Urban areas in particular, where infrastructure is already densely built and where the construction of new infrastructure is challenging, are already facing capacity bottlenecks in terms of infrastructure and financial resources. Resource challenges together with increasing transport emissions causing air quality problems necessitate improved planning and innovative mobility solutions in order to overcome the bottlenecks and provide a more efficient and sustainable transport system. As infrastructure measures mostly entail high investment costs together with long payback times, and need to be covered by the public sector, planning measures delivering more efficient and sustainable use of existing infrastructure or resource utilization are of high relevance including digital networks, new ICT technologies, shared mobility, and new types of mobility offers. In this context, Mobility as a Service (MaaS), as an emerging key concept, aims at establishing combined and/or integrated mobility services.

2.1 Definition of MaaS

Mobility as a Service (MaaS) is a new concept in the transport sector, even though it utlilizes traditional public transportation.. MaaS provides a new way of thinking in terms of how the delivery and consumption of transport (or mobility) is organized and managed. However, while MaaS is an emerging concept and approaches mobility from a very holistic perspective, it was important for the project to agree upon a definition for MaaS. Thus, in order to have a common perspective within the project group, the definition of MaaS was generated. The MAASiFiE project consortium definition of MaaS is:

*"**Multimodal and sustainable mobility services addressing customers' transport needs by integrating planning and payment on a one-stop-shop principle**" (MAASiFiE - Definition of MaaS, 2016).*

The project consortium definition is made based on general understanding of the MaaS concept with respect of other existing definitions. S. Hietanen, CEO of MaaS Global Oy, describes MaaS as: *A mobility distribution model in which a customer's major transportation needs are met over one interface and are offered by a service provider. … The central element of Mobility-as-a-Service requires a mobility platform that offers mobility services across modes* (Hietanen 2014). Atkins mobility department provides the following definition for MaaS: *"The provision of transport as a flexible, personalised on-demand service that integrates all types of mobility opportunities and presents them to the user in a completely integrated manner to enable them to get from A to B as easily as possible."* (Burrows et al. 2015). Sochor, Arby and Karlsson (2017) explores additional definitions.

By this definition, MaaS comprises the following three main components that enable and provide integrated mobility services to end-users: ***Shared mobility, Booking/Ticketing and Multimodal traveller information.*** More thorough descriptions of what these entail can be found below from Chapter 2.2. Some mobility services put the main emphasis on only one or two component(s) (e.g. Uber taxi services), instead of providing integrated, cross-linked (among different transport modes) mobility services over one common mobility platform. As such, the project consortium decided to differentiate "MaaS-related services" representing

mobility services integrating only one or two of the three MaaS components, and “MaaS services” providing all three components according to the MAASiFiE definition of MaaS.

For instance in the MaaS feasibility study for London (UCL Energy Institute 2015), a differentiation of MaaS services is made depending on integration levels, covering: 1. Cooperation in terms of discounts for combined subscriptions, 2. Ticketing integration, 3. Payment integration, 4. ICT integration, 5. Institutional integration, and 6. Mobility packages. Currently only very few mobility services already available on the (digital) markets have high-ranked integration levels in terms of having all integration levels covered.

One potential and important aspect of the MaaS concept is to approach MaaS from the individual’s free time or activity point of view, thus in most cases transport and mobility demand is seen as a derived demand. MaaS services combined and offered in addition to people free time activities or events may be an interesting and significant part of MaaS development in the future. Additional and integrated mobility services of this kind could help and intensify event and activity accessibility and attract more customers.

As described above, MaaS consists of comprehensive transport and mobility related issues and even though MaaS is regarded as a major transport paradigm shift towards more environmentally friendly and efficiently used transport modes, there still exists relatively little literature and even less academic level literature on planning, concepts and impacts of MaaS systems (see Annex II literature list). In this respect, a strong focus is placed on the integration of different transport modes via mobile applications, with the aim to bring people to use more alternative transport modes instead of only using their own private cars. Furthermore, available ICT technology and related infrastructure are also seen as major preconditions, providing new mobility service concepts to the respective end-users. More details on technological requirements are provided in WP 5.

2.2 Definition of MaaS service components

As MaaS is strongly triggered by on-going and worldwide societal, technological and economic trends, such as digitalisation and ubiquitous connectivity, influencing the mobility of people, the following three key components were identified for the deployment of MaaS concepts: shared mobility, booking/ticketing and multimodal traveller information. While ICT technology has now achieved a significant role in transport sector, all the stakeholders and developers must focus on equity and the usability of services and applications, and also consider those user groups that are not so familiar with mainstream ICT technology, e.g. elderly and disabled persons. On the EU level, this issue is taken into account on the level of each transport mode regulation and new regulation is currently being developed (see European Commission 2015). Also on the national level, the accessibility of new digital transport services is taken into account, e.g. in Finland, where a new study (see Somerpalo et al. 2017) was produced as a part of the 2017-2021 action plan to develop the accessibility of digital services coordinated by the Ministry of Transport and Communications.

Shared mobility as an integral part of MaaS

The sharing economy is recognised as a global phenomenon influencing many consumer sectors, enabling new means of connecting people to share opportunities, assets and markets. The term ‘sharing economy’ refers to a market situation in which people share among them items and use of different services or resources. In contrast to owning all required equipment (like vehicles, flats or commodities) oneself, the sharing economy is gaining more attention and acceptance as people increasingly respect an effective use of resources and demand to omit maintenance, storage, insurance and/or high operating costs. As far as the transport sector is concerned, the sharing economy has historically been a part of transport. For example, hitch hiking and carpooling have been common in rural areas, but nowadays especially in urban areas passenger transportation is adapting new modes in a sharing culture. Carsharing, carpooling, ride sharing and bike sharing are all emerging services that are attracting new customers.

In MAASiFiE, all sharing opportunities applied to the transport sector are summarised under the term 'shared mobility'. Besides the integration of new business models, like crowdfunding making fast investment in new mobility concepts possible, the rise of shared mobility also represents an institutional development, where car manufacturers like Daimler or BMW have also moved into the service business (e.g. into car sharing) (Kallio et al. 2015). Nevertheless, there also exist other publicly organised business models supporting the deployment of MaaS. Under the shared mobility term, the project group has also chosen to include crowdsourcing, which nowadays provides a quick and relatively cheap solution for the transport/mobility sector to gather consumer feedback and mass data for impact assessment, but also to generate data for operations..

According to the literature and MaaS stakeholders, shared mobility is needed in order to intensify the transport system by e.g. reducing the number of private cars commuting daily on the road network, and promoting alternative options like carpooling, ridesharing or bike sharing as first/last-mile options. With all of this, the aim is to reduce the number of 'second car'-households (or ideally even some 'first car'-households) and enable a seamless transition from individual to multimodal public transport without needing to own a private car.

As also described below under the other two main components of MaaS service concepts (booking/ticketing and multimodal traveller information), ICT technology and especially the provision of smartphone or web-based applications can facilitate an easier access to available, shared mobility resources and services. ICT-development can also enable a more transparent presentation of available supply and hence improve general situational awareness about available services. Currently most services include sharing services, where companies offer rental or sharing services to consumers, but there are also increased opportunities for consumers to provide their resources and services to other consumers, i.e. a peer-to-peer economy, ride sharing or prosuming. Nowadays services of this kind are adapting more and more mobile and application-based functions, such as booking, reservation and payment of vehicles and rides.

The following four different sharing concepts being implemented and made available were identified:

- Full-service (station-based): Users are able to use the full service based on the terms of use. In the most cases such systems are station-based, meaning users return vehicles at predefined stations. In some other literatures, it is often referred to as two-way service. For instance classic car rental services are representatives of this sharing model.
- Semi-service (mostly station-based): Users have more obligations and are more involved in the sharing process, meaning that they are responsible for the organisation and appropriation of vehicles. For instance Wheels4All (NL) represents such a semi-service. (Steger-Vonmetz, 2011)
- Free-floating service (one-way): This sharing concept provides it users with a much sought-after flexibility as they can drive wherever they need to go and then terminate the rental of the vehicle by simply returning it within the same delimited area, using one of the authorised spaces. For instance Car2Go or DriveNow are representatives of this concept.
- Private sharing service/Peer-2-Peer: Vehicles/rides are shared among private persons without a company providing the equipment (e.g. car or bike). Depending on the bilateral agreements, vehicles are shared on a one- or two-way basis.

Booking/Ticketing as an integral part of MaaS

Based on internal discussion results, the project consortium decided to include the following service features under the umbrella term 'ticketing': reservation, booking, combined billing and payment. All of these functions are key when trying to combine different transport modes under one service, especially since different transport modes usually provide different pricing schemes for tickets.

The Urban ITS (Intelligent Transport Systems) group representing a group of European local authorities and partners initiated by the European Commission has used the term 'Smart Ticketing', which is used to describe and connect travel Information, journey planning, payment and ticketing. And in this context, ticketing means ticket combinations rather than a single ticket for each journey. With more sophisticated ticketing, the customer experience can better meet customer expectations, which can foster co-modality and intermodality. However, before all transport modes can be combined, existing obstacles must be removed and common data and information interfaces must be created. In this respect, ticketing could contribute to the overall improvement of the transport network level of services, image, and accessibility, with the main aim to facilitate and/or increase the use of alternative transport and contribute to the overall political goal of sustainable transport.

Ticketing as a MaaS component especially requires integration with other MaaS service components in order to be effective. Ticketing is just one aspect of the 'customer travel experience' within MaaS concepts, but for some users unpleasant ticketing might be one of the barriers to use the services (König et al. 2017). From the initial journey planning to fare selection, it must be possible for the customer to seamlessly access ticketing through her/his preferred distribution channel, using the identity, purse or tickets in their preferred wallet wherever accounts and payment methods are established (e.g. via debit and credit cards, etc.) (Urban ITS Expert group 2013). In this respect annual/seasonal/monthly cards, one-way ticket solutions and reservation services fall under the same umbrella term of 'ticketing'.

Multimodal traveller information (journey planning) as an integral part of MaaS

Individualised transport information provided by integrated and multimodal traveller information services via web- and app-based solutions is a key factor for seamless door-to-door multimodal mobility. Accurate and multimodal information before and during the journey is not just a solution for transport operators to improve their service level, aiming at providing benefits like reduced transport costs to individuals; there is also the possibility to enable more efficient transport network operations, as common situational awareness and real-time traffic information can enable service and supply optimisation and integration. European Directive 2010/40/EU on the framework for the deployment of ITS provides priority actions on the setup of EU-wide multimodal travel information services (Directive 2010/40/EU).

There already exist different locally and/or nationally available traveller information services within Europe, providing travellers with real-time traffic information, but such information services still often remain fragmented along transport modes or regions. However, some services incorporate for instance: real-time information on PT (public transport) schedules, routing information for different transport modes, including journey times, fares and/or even in some cases information on sharing facilities. In this respect, the ITS Directive 2010/40/EU is tackling the problem and fostering the connection and integration of different multimodal traveller information services, including on a cross-border level. In order to provide seamless and connected transport network, multimodal traveller information is a key feature in the integration of different transport modes on a digital level as well as on an organisational level. Thus, it can be stated that multimodal traveller information provides a basis for the deployment of MaaS service concepts.

Even though information services are very fragmented in what they offer in regards to multimodal transport information, sharing or ticketing features, there are very similar ICT technologies being used for different applications, which already show a great potential to scale up existing MaaS-related services. Besides the three MaaS service components discussed here (shared mobility, booking/ticketing, and multimodal traveller information), regulatory frameworks providing strong governance structures and the possibility to test new innovative features are considered at least as important in order to achieve the vision of MaaS.

3. MaaS Roadmap

The MaaS roadmap is based on the 'LIFE' method, which derives from the methods called The Change Laboratory, Developmental Impact Evaluation and Road Mapping (Figure 2) (Halonen et al. 2010). The method as applied in the MAASiFiE project consists of a series of four workshops. Workshop 1 focused on future needs and visions for MaaS. Workshop 2 assessed and evaluated potential impacts of Maas including socio-economic assessments based on MaaS cases and taking into account the point of view of different stakeholders. Workshop 3 created national versions of Roadmap 2025 using the TAO method: Transition, Actors, and Obstacles addressing which changes are required to achieve the vision, which are the actors and their roles, and what are the challenges. Workshop 4 consolidated a European roadmap 2025 and defined next steps to ensure the continuity of MaaS implementation and promote the implementation of Maas on a European level. Workshops 1, 2, and 3 were organised separately in the countries of the project consortium (Finland, Sweden and Austria). Workshop 4 was an international stakeholder workshop held in Finland.

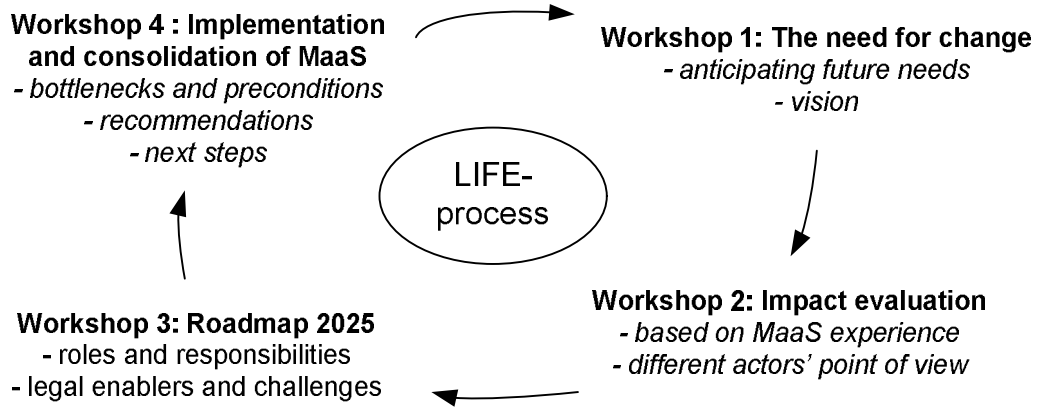

Figure 2. LIFE – method

3.1 Workshop 1: MaaS Vision

Workshop 1, Maas Vision, the first of four, was held in each of the three consortium countries. It was held in Finland with over 40 participants and in Sweden with over ten participants in December 2015, and in Austria with approximately ten participants in January 2016. Several experts from public authorities, interest organizations, industry and research organizations were invited to attend and discuss the needs of future mobility and visions for mobility services, mainly within their respective countries but also across Europe.

Each workshop was started with an introduction of the project and the content and objective of the workshop, followed by a 15-minute prepared presentation of the Finnish MaaS White Paper. Participants were ask to take notes of their reflections of the presentation including important issues which were or were not included, where they agreed and disagreed, etc. during the presentation. Next, the participants were divided into smaller groups (except in Austria, where participants worked in one group) to form a vision for MaaS, including how to achieve the vision and identifying key enabling and hindering factors. Finally, the results of groups were presented and consolidated, factors prioritized, and essential issues to consider in the roadmap identified.

3.1.1 Finland

The Finnish workshop was organized in Helsinki on December 3, 2015 with over 40 participants. Approximately a quarter of the participants represented national authorities, for example, the ministry and transport authorities. Another quarter worked for other public instances such as municipalities and local development organizations as well as regional and national development organizations, agencies and networks. A little over a quarter of participants were transport service providers, ICT companies and other commercial actors. The rest of the attendees represented research and consulting sectors. The most important and prioritized factors in the Finnish workshop involved branding, quality assurance, an ecosystem supporting MaaS implementation, and a user-oriented approach.

- Branding: MaaS conceptualization and branding is seen essential to increase interest in MaaS. Value-added services themselves create and increase demand, and MaaS is considered to be mainly market-oriented, although it may also consist of subsidized transport.
- Quality assurance: For users, it is vital to ensure homogenous services or at least minimum service level and criteria regardless of the service provider. Professionalism in service production is also needed and emphasized.
- The MaaS ecosystem is a complex stakeholder network and hence a functional service system requires clear roles and responsibilities. Regulations and political decisions need to support and enable mobility services. Open, common and defined technology and programming interfaces have to be specified, including international roaming as well. Test labs for MaaS services would have a positive impact on the implementation of functional MaaS services.
- User-orientation: MaaS services have to take user needs and ease of use (e.g. a one-stop-shop principle) as well as door-to-door travel chains into account. A holistic, life approach should be considered and integrated when defining service needs as MaaS, like mobility in general, serves as an enabler of e.g. working, hobbies and land use. MaaS services have to serve different user groups with varying mobility and transportation needs. Moreover, it was seen essential to take into consideration changes in urban structures and the enabling impact of MaaS to keep the entire country habitable from the mobility point of view.

Other factors or issues identified in the workshop included:

- Potential positive impact of MaaS on energy use and emissions, as well as on human health, well-being and quality of life.
- A new culture of work and MaaS: connection and effect.
- Implementation should take into account the practical benefits, data and information utilization, user interfaces, modal choice and time used for mobility.
- Considering individuals the service offering, consisting of the opportunity to choose, subsidized transport, and differing needs of urban and rural areas.
- Common, overarching vision taking into account mega trends, as well as change and transformation of systems.
- ‘Car ownership versus MaaS’ or similar ‘black and white’ categorisations should be avoided.
- A MaaS professorship should be established.
- Integration of freight and passenger transport.
- A champion is needed.

3.1.2 Sweden

In Sweden, the first workshop took place in Gothenburg on December 2, 2015. Eleven participants represented a mix of stakeholders including public transport and MaaS operators, interest organizations (transport operators and ITS), industry, research organizations, and a national funding agency. Ideally, national and local/regional governments would have been more strongly represented.

The Swedish workshop prioritized several key factors for the MaaS vision:

- Leadership is needed, but which stakeholder(s) would best act in this capacity is unclear.
- Policies and goals need to be established, including short- and long-term goals of what is to be achieved to be mapped against potential impacts (positive and negative) of different types of MaaS, so as to better guide the decision-making and implementation processes. Rules and regulations need to be modified, and a clear division of roles and responsibilities for various stakeholders will also facilitate moving forward. Other instruments such as urban planning and dynamic pricing need to be incorporated into achieving the larger vision.
- MaaS should be approached as an ecosystem with a user-oriented focus. Different types of MaaS will be needed to target different local contexts and needs. The traditional divisions of public versus private transport should be modified so as to focus more on collective and shared transport. MaaS should focus on need-based mobility e.g. on daily, seasonal, and phase-of-life bases.
- Sustainability must be a prioritized goal of MaaS, including both environmental and social sustainability, e.g. equity and accessibility. Although there are many expectations of MaaS in these respects, it remains unclear as to what degree MaaS will be able to contribute to related national and local political goals.
- Innovation is needed on multiple levels. Although physical barriers to MaaS need to be addressed, it is perhaps even more crucial to change mindsets and address mental barriers on both the individual and collective/organizational levels. The stage needs to be set for creative thinking and idea generation, and also to create the preconditions for other stakeholders to contribute to the MaaS ecosystem.

Other factors or issues discussed in the workshop included:

- Subsidizing mobility instead of modes.
- Non-travel or virtual travel as reasonable alternatives.
- MaaS as a potential deterrent to private car ownership. MaaS needs to be able to compete against one's entire mobility needs, daily, weekly, and seasonally, if to reduce private car ownership and use.
- Technology and standardization, e.g. digital maturity of both actors and users; common platform; payments; the question of open data leading to consolidation or fragmentation; resilience and access (no smartphone, dead battery, no network, etc.).
- MaaS infrastructures and user groups – access (physical, economic, etc.), MaaS for whom? (urban versus rural, vulnerable user groups, pricing issues, etc.), easily adaptable interfaces.
- Collaboration – public and private, a MaaS network as a potential barrier for new actors not already in the network, issues of profit for different types of actors.
- Promoting MaaS with incentives and marketing targeting both individuals and organizations.
- Value-added services, e.g. in-car delivery.

- Contract and procurement processes, within the public sector in particular.

Workshop participants also foresaw obstacles to implementing MaaS across Europe, such as mismatches in between countries, e.g. in the accessibility and available infrastructures of the current transport systems, including car- and bike sharing; in the maturity of the digital markets and differing approaches and viewpoints toward open data; and in differing political and organizational structures and the public's trust (or lack thereof) in them.

3.1.3 Austria

The first Austrian national MAASiFiE workshop took place in Vienna, on December 16, 2015. Stakeholders from different transport domains participated at the Austrian workshop, including representatives of the national Austrian road and expressway operator, national railway operator, Austrian ministry for transport, Austrian transport research organization, together with representatives of the national, multimodal Austrian traveller information system VAO and the German federal highway institute. Based on the distribution of participants different transport mode requirements could be taken into consideration. As different organizations like national road or railway operator provide already traveller information and booking and payment services, common and different perspectives were achieved in order to derive a common picture on the current mobility service ecosystem provided as a basis for MaaS evolvement. Besides, participation of transport ministry representatives allowed an overall view on mobility planning requirements covering the governance viewpoints on MaaS as well. Service key elements required for an extensive MaaS provision in future were identified covering data and end-user service requirements. With the identification of the mobility service ecosystem in Austria on the workshop, constants and trends shaping the vision of MaaS were discussed. Based on that the following induced factors determining the MaaS vision amongst other external factors are highlighted:

- MaaS is able to be further developed upon the already existing modular, mobility service architectures, including multimodal traveller information, ticketing and sharing information components.
- Standardised service interfaces and data formats implementing MaaS to a large scale, needs to be made available on a national and international level in order to link different services and provide commonly available mobility platforms fulfilling the one-stop-shop-principle.
- Since mobility needs to remain affordable to the society, a user-oriented approach understanding and fulfilling at its best the user needs and providing flexible services especially to vulnerable user groups as well, needs to be considered,
- Defining a clear MaaS framework having indicated roles and responsibilities required for the roll-out of the MaaS concept, together with applying new planning criteria and approaches (increasing the access to mobility) will path the way to a large scale MaaS deployment,
- Triggered by automation and digitalisation new meanings of different transport modes need to be considered for MaaS in future (Public transport will become more individualised, while individual transport will become more public). With this respect flexibility in terms of combining and integrating different transport services needs to be considered and made available in terms of MaaS deployment.
- Increasing usage of "electronic wallets" together with increasing mobile connectivity fostering the provision and accessibility of MaaS in future. Further wireless network developments and deployments (e.g. 5G) provide users with higher data rates and thus allow high-quality service experiences in future.

3.1.4 Summary/European-level vision

The results show that the three national workshops under Workshop 1 each provided different types of input for the European MaaS roadmap. The Finnish workshop focused on the policy and business perspective, the Swedish workshop took more of a general policy perspective, and the Austrian workshop concentrated on technology and data perspective. Obviously countries have different experiences of MaaS and are in various stages of MaaS development, implementation and organization, which influence their perspectives. In Finland, for instance, there has been a strong national commitment to promote and support MaaS and scrutinize regulation and legislation to enable new transport services/businesses, whereas UbiGo, the first example of MaaS in Sweden (and the world), was a local initiative which gave many insights into institutional enablers and barriers. Austria has put the effort in developing information provision through a national data platform. This points out the importance of bringing in different perspectives from multiple nations and diverse stakeholders when tackling a fundamental issue such as mobility and the development of MaaS in and across Europe. Although it is outside the MAASiFiE project's plan and resources, it would be beneficial to organize and hold similar workshops in more European countries in the future.

Despite the varying perspectives, the results of the workshops also show some clear overlap between the countries in the issues raised, containing but not limited to the need for:

- qualified leadership and a clearer division of the new roles and responsibilities of the various MaaS actors;
- a user-centered and holistic 'life' approach to mobility and traveler's needs and requirements that is also built upon a foundation of quality assurance, transparency, commonalities, and standards;
- a sustainability focus in order to address both short- and long-term local and national goals of e.g. equity, accessibility, and environmental and consumer protection;
- a (eco)system perspective to MaaS taken into account rules, regulations, policies, actions, and mindsets of both individuals and organizations need to innovate so as to better support and enable the MaaS development and implementation.

3.2 Workshop 2: impact assessment

The stated aim of the second workshop was to assess and evaluate impacts of Maas including socio-economic assessment based on MaaS experience and taking into account the points of view of different stakeholders. In each workshop, for which a guideline was provided, one began with a welcome and introductions followed by a presentation of the project including information on the workshop series and brief results from the first workshop. Next, the workshop turned to assessing the MaaS service (see below for the service focused upon in each national workshop). First individually and then in groups representing the same type of stakeholder (traveller/user, business, society), the participants were to reflect on the impacts of their MaaS experience – the practical consequences and meaning of the pilot/service on themselves and/or their organizations. After a break, as a whole group, the participants discussed each theme (traveller/user, business, societal) in terms of impacts gathered before the break. Prompts were included in the guideline to facilitate discussion of types of potential impacts in case they not spontaneously arise in the discussion, e.g. social exclusion (MaaS for everyone or only some customer segments), the consequences for various geographical settings, urban and transport planning, rules and regulations, collaboration, procurement procedures. The participants also had the opportunity to react to and discuss the expected impacts of MaaS as provided by experts via a questionnaire (see Deliverable 3). Finally, the participants were to discuss how to achieve positive and avoid negative impacts, under what conditions, and by whom. The workshop guidelines concluded with a summary, explanation of next steps, and thank yous.

Finland

In Finland, the impact assessment workshop took place on September 1, 2016 as a video conference between Espoo, Oulu and Kolari. The workshop discussed the Ylläs Around pilot in the Ylläs ski resort area in Northern Finland (described in Annex III). In the workshop, there were nine participants in total consisting of Ylläs Around users, the MaaS operator, transport operators, Ylläs Travel Information and the municipality of Kolari. Each stakeholder gave their impressions on the pilot and proposed development ideas for the future.

Generally the pilot was considered positive by all the stakeholders, and dialogue among the actors developing the service had been good. Users and transport operators found the mobile payment very positive due to time savings and no need to have cash. The digitalization of transport data was considered useful by the municipality.

The main challenge regarding the pilot was the delay in opening the service. The pilot was launched close to the end of the skiing season resulting in insufficient marketing and a low number of users. Proposed development ideas for Ylläs Around were mainly related to more detailed and precise information on the service and locations, pricing of the service and more extensive service packages.

Sweden

The second Swedish workshop on impact assessment took place on February 26, 2016 in Gothenburg. It focused on the UbiGo pilot from 2013-14 (described in Annex III) and included eight participants from that pilot representing MaaS and public and private transport operators, the region, and users, together with the transport administration.

The stakeholders, who can be viewed as representing the individual/traveller, business, and societal perspectives, each reflected on how the pilot had impacted them. The participants found the workshop rewarding, as they had not met after the pilot to exchange their experiences, which they felt was important in terms of deeping one's understanding of others' perspectives (e.g. why certain things had happened and why certain decisions had been made).

Overall, the pilot and experiences gained were considered positive. Users felt that the pilot provided added value to their lives, including reduced costs and facilitating making more sustainable choices; also, that it had necessitated increased planning but generally made things easier. Organizations (public and private) noted how the pilot had perhaps created some internal stresses, but it had also encouraged or sped up internal dialogues and strategies that otherwise may have languished on the sidelines for a longer period of time.

Additional discussion points that arose regarding the future of MaaS in general included: increasing accessibility but not necessarily demand/use; how to promote more environmentally sustainable choices (and vehicles) including sharing, active modes and not traveling; tying together digital and physical infrastructures; how to provide quality services for as many people as possible; and the division of roles and responsibilities.

Austria

In Austria, the second MAASiFiE workshop took place on December 22, 2016. Stakeholders representing the national road operator, the PT operator of Vienna, the Austrian ministry for transport, the national multimodal traveller information service VAO, and the platform for flexible mobility supply participated. Based on the modular service framework identified in the first workshop and based on new, identified mobility service items, expectations and estimations considering already known and potential impacts with the further roll-out of MaaS services were discussed. Impacts, where evidence was available, were identified from the VAO service and other pilot test cases like the road pilot and the SMILE project. The discussions covered the domains of multimodal traveller information, ticketing and sharing.

Based on the specified workshop procedure, identified impacts were classified into user/traveller, business and environmental/societal categories. Furthermore, those three main categories were divided into already known respectively assumed impacts. Apart from

known impacts dealing with user/travellers, business and societal impacts were assessed as assumed impacts. With the upcoming, global, private mobility providers like Uber or Car2Go new market players coexisting with national/local mobility providers are additional elements to be considered when thinking of potential impacts of MaaS on business. Harmonized ticketing/payment systems are enabling a seamless end-user service experience. In this respect, different domains for selling common tickets are currently available, but it still remains open to which extent future ticketing systems will be able to combine pricing schemes. Event-driven user support during and off-trip seems to be especially important for influencing travellers' route choice behaviour. From a societal point of view, new access criteria may determine whether different user groups are advantaged or disadvantaged by inclusion or exclusion caused by digitalisation and thus by MaaS as well.

3.3 Workshop 3: national roadmap 2025

National MaaS roadmap workshops were organised in Espoo, Finland (September 2016 with 32 participants); in Gothenburg, Sweden (December 2016 with 13 participants); in Vienna, Austria (January 2017 with 12 participants.)

The aim of the roadmap workshop was to define short-term (1-3years) and medium-term (4-9 years) actions and transitions needed to reach the visions created in workshop 1. The work was performed through four functional perspectives (Figure 3):

- Drivers (social, technological, financial, ecological, political),
- Markets,
- MaaS services (incl. additional services, required technology), and
- Enablers (funding, networks, know-how, operation models etc.).

Actions and transitions were discussed in groups for each functional perspective and results were presented using post-it notes on a large roadmap paper sheet. Then the post-it notes were organised by topic, and the groups discussed responsible actor(s) for each topic and possibly other important and influential stakeholders as well. Finally, the group work results on responsible actors were presented and the participants prioritized them. For a pre-workshop orientation on roles and responsibilities in MaaS, the workshop participants were asked to fill in a "MaaS transformation" sheet (Annex I) in advance. There were minor variations in the MaaS transformation sheets between workshops in different countries.

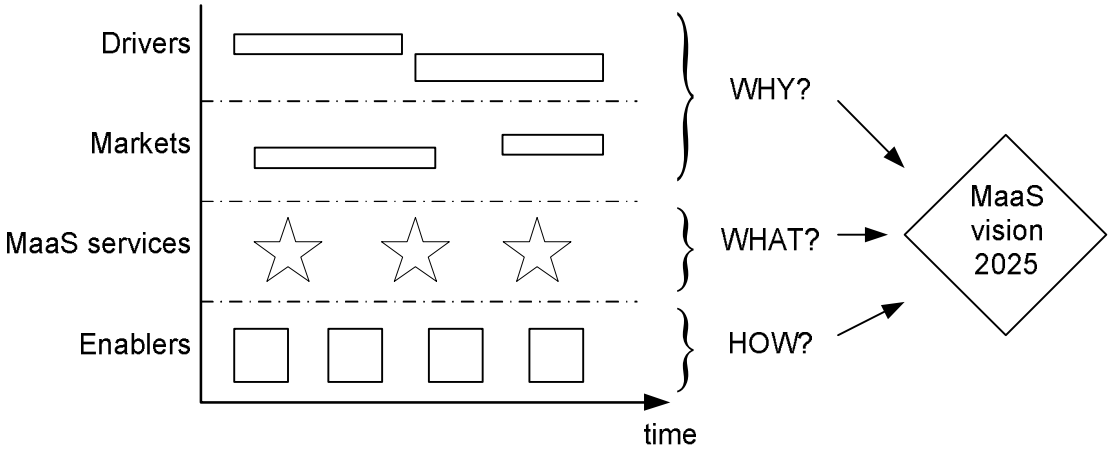

Figure 3. The creation of the roadmap

The results of the national roadmap workshops were then integrated into a European roadmap, which was further developed in workshop 4. The main aspects of the three national roadmap workshops are presented in Chapters 3.3.1-3.3.3. The European Roadmap 2025 is presented in Chapter 3.4.1 and Annex II.

3.3.1 Finland

The third Finnish workshop took place on September 16, 2016 in Espoo, Finland. Participants represented a mix of stakeholders including ministries and government agencies, transport operators and unions, car sharing and ICT companies, MaaS operators, municipalities, researchers and consultants, and interest and financing organizations.

In the Finnish MaaS roadmap 2025 workshop, the main aspects regarding drivers of MaaS in the short and medium terms were related to the decrease in public funding and the tightening of environmental requirements. The main enablers affecting MaaS in the short term include the development of the sharing economy, the solving of privacy issues (and My Data) and urbanization. The main identified medium-term enablers were robotization and automatization, changes in urban structures promoting public transport and sharing, as well as virtual services offering alternatives to mobility.

The aspects that arose regarding markets were the changes in user needs, numerous MaaS pilots and new MaaS services emerging. The main issues discussed regarding MaaS services were related to easy-to-use, customer-oriented, and versatile services including car pooling and sharing services. Also informing customers about services and ICT issues such as opening data and defining customer data needs came up in the discussions.

The main enablers identified in both the short and medium terms were international collaboration and benchmarking of MaaS best practices. Regarding legislation, the short-term focus is on deregulation and the medium-term focus is on legislation enabling automatization and robotization. In the short term, the main enabler is collaboration: between MaaS stakeholders creating new services, between transport modes and between municipalities and the national government. Other identified enablers included quality commitment to build trust, and the development of innovative procurement.

3.3.2 Sweden

The third Swedish workshop took place on December 9, 2016 in Gothenburg, Sweden. Participants represented a mix of stakeholders including public and private transport operators and MaaS operators, government agencies, and research organizations. Ideally, national and local/regional governments would have been more strongly represented.

For drivers and markets, the following themes were identified:

- **Economy/convenience** as it will become more expensive and more difficult to use a car, particularly in urban areas.
- **Sharing** becoming more accepted.
- **Competition** for regional budget resources.
- **Incentives** for sustainable transport, and for organizations to support such.
- **Procurement procedures** modified to support mobility instead of transportation.
- **Sustainability goals** for different actors as well as tied directly to MaaS.
- **Changes in mindsets**, e.g. opening up public transport.
- **Power structures**, e.g. shifting positions of money and power in the value chain.
- **Ticketing/payment systems** becoming more standardized.
- **Urban planning** including densification, changing parking norms, etc.

- **Vehicle fleet** shifts towards connected, automated, and shared vehicles.
- **Scalability/customer perspective**, i.e. a more fundamental understanding of customer needs and offering competitive, quality services that can be scaled up to larger solutions.

In terms of MaaS services, three themes were identified:

- **Service design** to promote services that: are of high quality, help solve the "life puzzle", enable sharing, and test new (vehicle) technologies.
- **"Real pilots"** that lead to implemented services; that test proofs of concept in various contexts; and that are allowed to fail as long as one learns from the experience.
- **On-demand services** (with automated vehicles), e.g. testing on-demand public transport with automated vehicles instead of low-occupancy vehicles during off-peak hours.

Finally, a number of themes were identified as potential enablers:

- **New business models** e.g. many smaller solutions that can become of a larger, systematic solution; b2x and not just b2c; and learning how to value a customer that is a *shared* customer.
- **Open up/building blocks** such as opening and sharing data, and opening public transport tickets for resale (including APIs, different types of ticketing and pricing).
- **Infrastructure**, e.g. hubs.
- **Contributions from agencies**, i.e. understanding how agencies can contribute in additional ways than only economic.
- **Laws/regulations**: adapt/adjust regulatory frameworks and provide clarity from the public sector regarding goals/visions as this can increase interest from investors.
- **Division of roles**: a clearer division so that key actors can emerge to drive value networks and find business models.
- **Knowledge exchange** in the form of common MaaS platforms, e.g. conferences.
- **Evaluations/new knowledge and new research**: more action research is needed to understand what works and what does not, so as to understand the underlying factors to build upon, as well as objective evaluations of the societal effects of MaaS.

3.3.3 Austria

The final national MAASiFiE workshop took place in Vienna on January 27, 2017. Different stakeholders from the transport sector participated. Based on the predefined workshop target, the main MaaS vision together with the elaborated national, state-of-the-art service ecosystem served as basis for further discussions required for identifying the national Austrian MaaS roadmap.

The increase in digital connectivity and higher degree of service integration were key discussion points paving the way towards an area-wide MaaS deployment. Increased data and service availability fosters further developments in e.g. high quality routing items in terms of multimodal traveller information and service provision. In this respect personalised MaaS service features will have emerged by 2025.

In order to foster MaaS deployment, making use of common data and service/interface standards was highlighted as an enabling factor. The ageing society needs to be considered for mobility planning in order to provide all demographics with user-friendly and accessible MaaS services. In this respect, 'generation management' needs to be considered, coping with different user needs. Identification of/and accessibility to data and service markets was

deemed as a decisive criteria for rolling-out MaaS on national and international levels.

The following issues considered as drivers and trends of MaaS deployment were discussed: Higher quality requirements (increased usage of common standards) improve the service experience and thus can increase the total number of users, increased use of mobile technologies (very high smartphone usage), ”using instead of owning” included in sharing mobility, increased (sub-)urbanisation, relocation of workspace to suburban regions, increased individualisation of user needs, and incentive systems fostering the provision of new mobility services.

Further, deployment of 5G technology, more popular/regular use of sharing economy services e.g. transport/vehicle sharing, and an even higher degree of individualisation and increased cross-linking of services were also included in the 2025 planning period.

From the service perspective, advanced real-time ability of service features, higher level of technical service integration and provision of personalised service functions pave the way towards MaaS.

Finally, potential roles and responsibilities required for deploying the national roadmap were evaluated. Especially new roles dealing with digitalisation and automation and related tasks were highlighted in order to organise sufficient MaaS value chains and thus achieving the prior defined vision. In this respect for instance qualified education (e.g. in terms of data analysts) is deemed as a supporting factor in order to achieve and operate new MaaS ecosystems.

3.4 Workshop 4: consolidation of results

The international consolidation and implementation workshop took place in Espoo, Finland on February 3, 2017. There were 13 participants from seven European counties (Finland, Sweden, Austria, Germany, the Netherlands, England and Belgium) representing authorities – road authorities and ministries – and research.

The main purpose of the workshop was to consolidate project results and recommendations, as well as to define next steps in MaaS implementation. The workshop covered the following items:

- European MaaS roadmap 2025 (presented in Chapter 3.4.1 and in Annex II). Based on the roadmaps from the Finnish, Swedish and Austrian MaaS roadmap workshops, the European MaaS roadmap was integrated and further developed in the final workshop. Similarly to the national MaaS roadmaps, the European roadmap 2025 consists of four time periods: status quo, short-term development (+ 1-3 years), medium-term development (+ 4-9 years) and finally the MaaS vision 2025. These four time periods are presented through four functional perspectives: drivers, markets, MaaS services and enablers. A pre-workshop-integrated European roadmap was presented to participants and they could discuss and add new aspects using post-it notes on a large roadmap paper sheet. Then the groups had a possibility to prioritize all the aspects by giving “+” or “-“ for the aspects they found important (+) or not relevant (-). Based on this prioritizing the most important aspects are in italic font in the roadmap in Annex II.
- Roles and responsibilities of stakeholders (presented in Chapter 3.4.2). In the workshop the roles and responsibilities as described in Deliverable 3 were presented and further elaborated upon using the “me-we-us” method, i.e. first thinking about the topic by oneself (“me”), then discussing in pairs (“we”), and finally discussing all together (“us”).
- Technical recommendations of the project were presented and discussed in the final workshop. They have been completed according to discussions and input from the final workshop and are presented in Deliverable 5.

- Implementation and consolidation of MaaS (presented in Chapter 3.4.3). This was performed with the help of two questions: What are the concrete tools/actions to promote MaaS? How to ensure continuity of the MaaS Roadmap process? These were discussed using the "me-we-us" method, concentrating especially on the government authorities'/agencies' point of view.

3.4.1 European Maas roadmap 2025

The European MaaS roadmap is presented in Annex II, and the most important aspects identified in the final consolidation workshop are indicated in italic font. After the workshop, the results were organised into subcategories to clarify the roadmap. These six subcategories are: Academia and R&D, Business, Infrastructure & built environment, Policy & regulation, Technology & data and Society & culture. A simplified roadmap with the four functional perspectives – drivers, markets, MaaS services and enablers – is presented in Figure 4.

On the 'drivers' side, policy & regulation is seen as the most significant factor to push MaaS development, since reregulation should blur the existing silos between MaaS stakeholders and transport modes, and facilitate the development of new business models. However, reregulation cannot be too open minded, since with policy and regulation decision makers should encourage and guide the development of the transport sector in using more efficient and sustainable mobility solutions. Although, policy and regulation is seen the most significant driver of MaaS development, businesses and end-users also play important roles in pushing development. The business sector should be able to collaborate more and integrate more sustainable solutions into their businesses. In terms of societal and cultural aspects, the sharing economy and end-users' demand for personalised services is seen as major drivers of MaaS development.

In the transport 'market' sector, the development of MaaS needs public-private-partnerships and support from policy and regulation. During the next ten years, the MaaS market is expected to grow and new market players will arise. From four to nine years from now, MaaS is expected to stabilise its role in the transport sector and it will become an essential part of the mobility market. MaaS business will be integrated with traditional mobility market actors such as the automotive industry and transport data will gain a significant role in the transport market. This development is supported by general ICT and digitalisation developments, where ICT platforms and standardised interfaces will expand through transport stakeholders and modes. The growth of MaaS business will also affect consumers and their awareness and acceptance of MaaS will increase. Better service offerings also mean more personalised services for different user profiles and hence, users can find mobility solutions fulfiling their transport demands and requirements.

In the roadmap, 'MaaS service' development is seen to be pushed by the business sector, which will use pilots to test and develop new services and business models. MaaS services are expected to spread modestly via pilots, but after three years, one-stop-shop services will be extensively available and there will be competition between MaaS services. MaaS services will first be for passenger transport, but in the 2025 vision, freight will be also integrated into MaaS services. In MaaS service development, the policy and regulation sector should be an active part of development and should share knowledge about best practices and continuously remove bottlenecks, which will be identified via MaaS pilots.

In MaaS service development, technology and data play an important role, since the MaaS vision cannot be achieved without ICT development. Issues related to personal data and quality of (open) data must be resolved so that MaaS business actors can offer flexible and retailed services for end-users. For end-users, MaaS service development needs to understand and encourage changing consumer habits from owning and consuming towards sharing and "presuming", which consists of consuming and producing, e.g. providing private cars to car and ride sharing networks. From MaaS service providers, i.e. the business sector, this requires easy to use and adaptable mobile applications that attract consumers. In the

roadmap, this development is first seen as quite modest and after three years useful services are envisioned to spread on a wider scale.

The fourth functional perspective in the MaaS development roadmap is ‘enablers’ of MaaS development. In the roadmap, the policy and regulation sector is again considered very import. During the first three years, decision makers should clarify regulatory frameworks and different roles of MaaS stakeholders. Decision makers should also provide new and innovative incentives and funding opportunities to support MaaS development and with the knowledge gathered from thoroughly evaluated pilots, decision makers should adapt new procurement methods to enhance and improve general procurement processes; which is expected to happen during the next four to nine years.

In the business sector, the collaboration is seen one of the most important enablers for MaaS development. During the next one to three years, collaboration should be established on the national, cross-sectoral level and from four to nine years on the international level. The business sector must also be able to provide required quality to services to attract customers during the first three years. In the roadmap, Academia and R&D activities are also seen important enablers. During the first three years research institutes should provide wide international benchmarking and objective impact analyses about MaaS, in order to improve knowledge and understanding about MaaS and its impacts on the transport sector, users, businesses, and society. During the next four to nine years MaaS studies should become a systematic part of transport- and service-related research and education and R&D should establish living lab test environments together with and for the business sector.

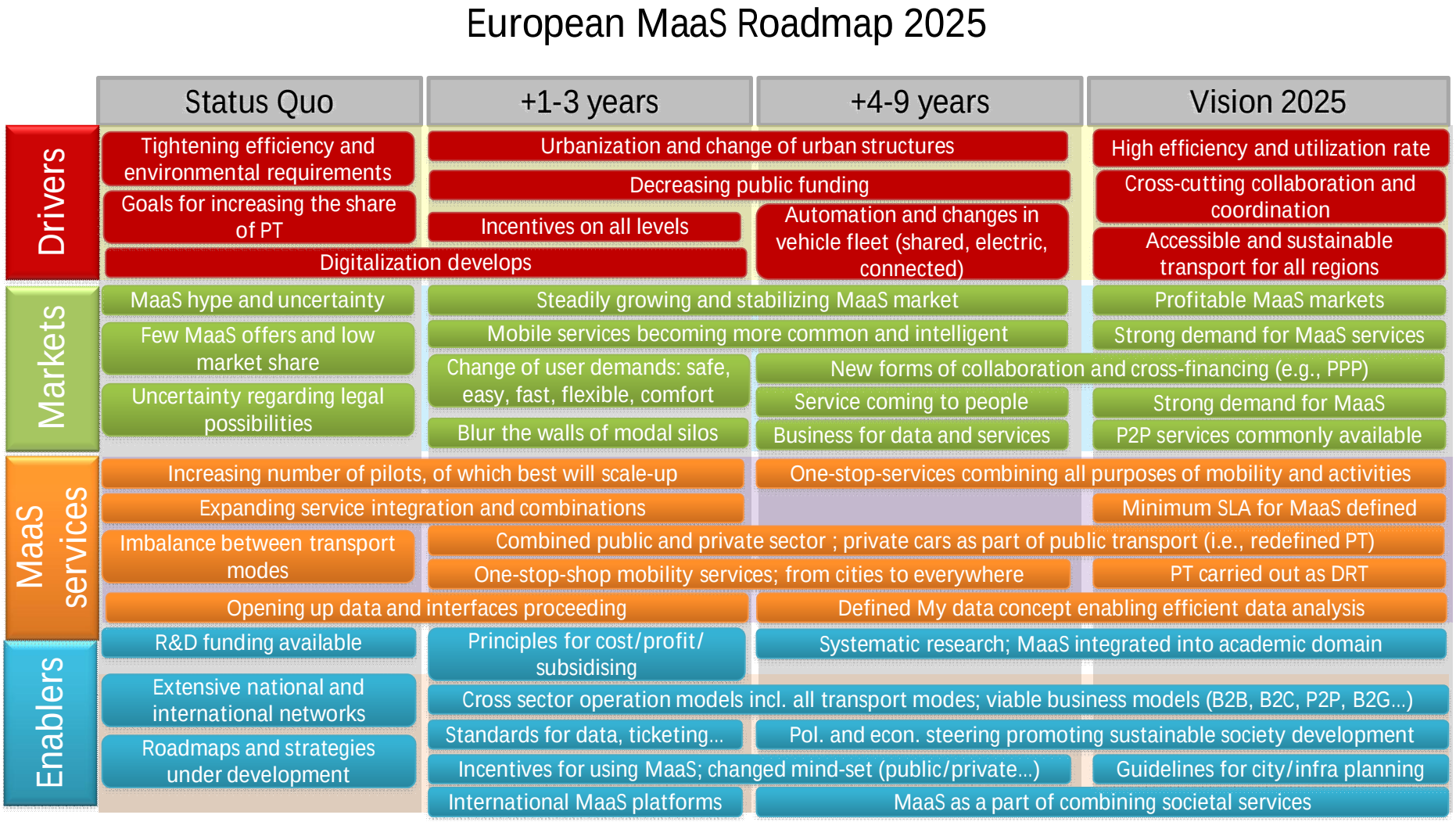

Figure 4. Simplified European MaaS Roadmap 2025

3.4.2 MaaS ecosystem: Roles and responsibilities

MaaS is a new transport paradigm, which targets the great vision of integrating all different transport modes and blurring existing boundaries. To adapt this integration on the operational level, interoperability and collaboration must first be achieved at higher levels. Thus, the emerging MaaS ecosystem and the roles and responsibilities of the MaaS stakeholders are an essential part of MaaS development.

Figure 5 below illustrates a general, high-level overview of MaaS ecosystems, as presented in Deliverable 3. The MaaS business ecosystem can be considered as a network consisting of several stakeholders linked to each other, and who benefit from each other and their mutual effectiveness (14). While MaaS aims to connect all transport modes, it is also apparent that the MaaS ecosystem is extensive and combines all levels in the transport 'hierarchy'. It can be argued that the MaaS ecosystem combines different variations of Public-Private-Partnerships (PPP) and consists of four different levels: 1) public and regulatory level; 2) transport and logistics service providers' level (i.e., supply side); 3) mobility service level (mostly acting as a MaaS operator), and 4) end-user level.

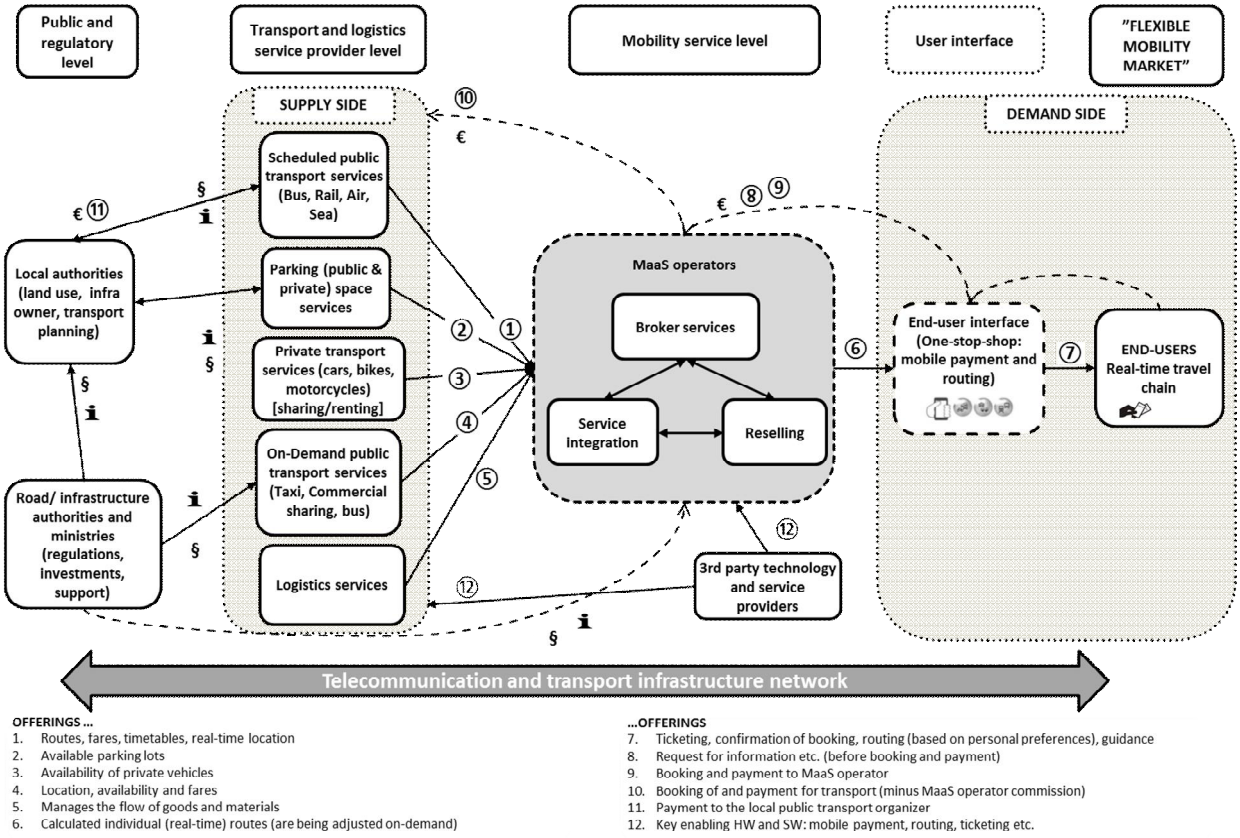

Figure 5: Overview of MaaS ecosystem (Aapaoja et al. 2016)

In addition to the four levels mentioned, the MaaS ecosystem is tightly connected to the consumer commerce business as well as event and activity organizers, generating mobility demand to be combined with available transport infrastructure, transportation services, modes, and transport information, ticketing and payment services. MaaS aims to connect mobility to a one-stop-shop solution, which offers new business opportunities for transport providers. For policy makers, MaaS could enable fundamentally new ways of thinking, as the purpose is no longer to improve the transport system by building more capacity but using the existing capabilities and capacity in a smarter and more efficient way.

The vision is to see the whole transport sector as a cooperative, interconnected ecosystem,

providing services reflecting the needs of customers and market actors, and seamlessly combining different transport modes, such as private vehicles, public and collective transport (bus, metro, light rail, car sharing), biking and walking. This requires a general understanding of roles and responsibilities of each ecosystem stakeholder. Table 1 below lists the main roles and responsibilities of MaaS ecosystem actors within different stakeholder levels. N.B. roles may vary in different countries, for example the actor responsible for tolling, thus one may need to adapt the table accordingly if interpreting it for a specific country context.

Table 1: Roles and responsibilities of stakeholders within the MaaS ecosystem

Level	Stakeholder	Roles, responsibilities and obligations	
National road authorities, ministries and government	Government	National incentives and disincentives; initiate new legislation processes; redefine subsidises and incentives from top till local level	Incentives and disincentives for MaaS, sharing sustainable transport; regulations and preparation of legal rules regarding the transport sector; data services; requiring MaaS evaluation
	Ministry (of Transport, Economics, Finance, Environment…)	Legislator; responsible for transport policy and strategies (including environmental); enabler of test and pilots through legislation; financing infrastructure investments; collaboration initiatives; public and research funding	
	Transport Agencies/ Road Administration	Implementation of transport policy, strategy and investments; (long-term) plans and guides for the national development of (new) transport services; (the owner of national transport infrastructure); provide available/open transport data (according to national policy); promoting collaboration between different transport modes and stakeholders; issues permits (e.g. robotisation, automation, operating permit); licenses; tolling	
	Infrastructure operator	Plan, finance, build, maintain, operate, monitor and collect tolls on the road network	
Local authorities	Regional/local transport agency	Plan, organize and manage public transport in the region and improve operating conditions; provide locations of stations and stops	Set sustainability goals; procurement processes; opening up PT (ticketing, APIs, data); congestion charges; incentives and disincentives (e.g. zero emission zones); on-demand services
	Municipalities and cities	Strategic urban and city planning and development; responsible for transportation and traffic planning; responsible for the local infrastructure; parking; enabler for robotisation and automation (permits and financing)	

MaaS operator **(new player)**	E.g. MaaS company, public transport operator or PPP...	Combine the existing transport services into a single mobile application on the "one-stop-shop" principle and provide personalised transport plans tailored to customer needs; responsible for customer service and user experience; customer-oriented and easy to use solutions; customer service; service level agreements; minimum service guarantee to customers; develop and test new services and business and collaboration models; scaling up, combining additional non-transport services	
Transport service providers (TSP)	Public transport	Provide schedules, fares as covered by ticketing and real-time information	Provide quality service; develop and test new business and collaboration models, redefining public transport; Open data and APIs, opening and reselling, provide new transport services; Responsible for customer service and user experience regarding one's own services
	Rail	Provide schedules, fares covered by ticketing and real-time information and booking information	
	Bike sharing	Offer fares, locations (bikes and docking stations) and availability	
	Car clubs (e.g. sharing, rental)	Provide fares, vehicle information, booking information, availability, locations	
	Ride sharing	Provide drivers and rides database	
	Taxi	Provide fares, vehicle information, booking information	
Logistics Service Provider (LSP)	Logistics operators, freight operators, third party logistics, etc.	Provide management of the flow of goods and materials between points of origin to end-use destination. May handle shipping, inventory, warehousing, packaging, security functions and dispatching	
Mobile service provider (MSP)	Third party technology, ICT and service providers	Provide key enabling technology and services (e.g., mobile ticketing and payment, information including parking, data services) to MaaS operators and transport service providers	
Users	Citizens, customers	Influence decision-makers and products/service development and operations, define relevant and important indicators (safety, customer service), provide services ('prosuming') (e.g. MaaS rural areas → car pooling and sharing)	

Funding agencies	National, international, private, public	Provide financial support and risk capital	
Academia	Universities, research institutes	Provide knowledge, methods, tools, evaluation, neutrality, and proactively seek new trends	
OEMs and Resellers	Automotive Industry	Produce EV fleet; implement new technology and create new business models through servitization (e.g. car sharing, rental services, leasing)	

The transport and business sectors, just like the rest of society, must obey local and national laws and regulations. Hence, different authorities and regulators must be taken into account when proving both transport services and mobility services. In this particular deliverable and context, “transport services” include all the services that are enabling the movement of people and goods from one location to another (i.e., tangible services). “Mobility services” comprise services (e.g., integration, brokering, ticketing, routing) that are making transportation more flexible, easier and hopefully sustainable. To make all the services available for the end-user, an end-user interface must exist, such as a mobile application combining transport and mobility services. Obviously, there are many stakeholders providing supportive services or technologies (e.g., mobile ticketing and routing algorithms) to mobility service providers/operators to make their MaaS services possible. Working transport and telecommunication infrastructure should not be forgotten either. Indeed, the rapid development MaaS and ICT and the number of new ICT applications in the transport sector is a megatrend which is facilitating breaking down the boundaries between the different transport modes.

When considering the integration of transport modes and how to blur existing boundaries, enabling and agile legislation and regulation is essential. The national public sector, including government, ministries, transport agencies, and national road infrastructure operators, has a major role as an enabler of service pilots, open data availability and a builder of the legislative framework that affects the potential of different modes and services. These actors are also responsible for setting incentives and disincentives, which should be focused effectively. The focus of regulation should be in ensuring transparent market conditions and fair market performance and securing the legal position of consumers and travellers. As described in Table 1, all the national public sector actors have their own roles and responsibilities, which should be coordinated among actors and in order to support and push towards a common vision.

While national authorities are setting regulation on the national level, local authorities are needed to integrate the needs of the business sector and consumers to the policy framework on regional and municipal levels. Local authorities play a significant role in public transport planning and organising but also in planning and developing effective and attractive land use. In the future, local authorities might also be one of the key stakeholders in MaaS business, because of their strategic positioning in PPP ecosystem.

In the MaaS ecosystem, the actual MaaS operator is seen as a totally new actor in the ecosystem, since in the current operation model, transport mode, ticketing, information provider and additional non-transport service integrator is missing. Hence, the MaaS operator’s main responsibility is to combine these features into a one-stop-shop function. For transport and logistics service providers (TSP and LSP), this requires collaboration on the business levels. TSPs and LSPs must be able to provide transparent information and data about their services and this data should be in a common interface, so that ecosystem partners can utilise it. LSPs and especially TSPs are also the main actors in the business-to-

consumer interface, since they are most often the only ecosystem stakeholder who has face to face communication with end users. Thus, high quality services should be a top priority for TSPs and LSP.

In the MaaS ecosystem, mobile service providers (MSP) can be seen as enabler of development, since working ICT infrastructure as well as intelligent and connected infrastructure (also known as C-ITS) are vital elements in making MaaS a reality. Using existing mobile networks, data and information can be shared and MaaS can be deployed in a cost-effective manner. Also, open interfaces (API, Application Programming Interface) further accelerate the emergence of new and innovative services that can reach substantial global markets. This all also enables collaboration in ticketing, routing, scheduling and paying, which all are necessary for MaaS business models.

In the MaaS development the role of funding agencies is to support emerging MaaS business solutions. These funding opportunities are significant for MaaS actors, since the MaaS operation model is a new way of thinking and it depends upon dramatic change in consumer habits, which definitely requires time and financial committments from business sector. In addition to business funding, research funding is also needed, since it is the only way to provide objective analyses of business models and their impacts on the current transport system and its equity. Impact analyses are a main part of academic responsibilities in MaaS development, but academia should also provide new thoughts about future transport systems and implement MaaS into education, reflecting broader societal changes. Academia together with funding agencies and the business sector should also keep interaction and communication about MaaS development vivid in the general transport development debate. A good example of this is the first international conference on Mobility as a Service, which focuses only on MaaS and wil be held in Finland in November 2017 (ICoMaaS 2017).

In the MaaS development, OEMs and resellers can act as a bottleneck or as a development booster, depending on the strategy they choose to adopt.. If OEMs and resellers strictly adhere to their current business and operation models, they could significantly slow down MaaS development, although the current development indicates the contrary, which is good for MaaS. Currently, OEMs and resellers are keen on developing new sharing and rental services and implementing new technologies, which definitely boost MaaS development, but can also be seen necessary for MaaS.

Without end user acceptance the entire MaaS business and concept is not possible, thus all MaaS ecosystem stakeholders should gain deeper understanding about MaaS as it relates to consumer requirements in order to provide attractive services to consumers. Consumers consist of heterogenous users groups, but those who can and who are able to test new solutions should be incentivized to act as early adopters, testing new mobility solutions and finding new more sustainable and effective ways to organise daily mobility, which will increase the observability of MaaS for a greater population.

As roles differ in different countries, Table 1 represents a generic framework. The roles and responsibilities of **Road administrations** could include more in detail:

- Implementation of transport policy & strategy:
    - Integrating MaaS into their policy & strategy;
    - Investments aligned with strategy;
    - Funding programme to develop and test MaaS in different contexts with thorough, objective evaluation as a requirement for funding. Evaluation would help to see how MaaS could potentially contribute to meeting additional national policy goals, e.g. emission reduction;.
    - Funding strategies for areas with less immediate commercial potential (e.g. rural areas), new service types, to try new incentives and disincentives, collect evidence (evaluation) for decision making and measuring policy achievements.

- (Long-term) plans and guides for the national development of (new) transport services:
  - Use best practices based e.g. on MAASiFiE results and other areas/countires, and disseminate information;
  - Adapt the vision to the local context:
    - Organize awaress-raising events and interaction with areas and cities (workshops, seminars, teams visiting areas etc.) for enabling investments and enabling possibilities to provide alternative transport modes. These events are also important for motivation and commitment.
    - Practicalities: inform/assist how to set up these services, and what are the procedures required (e.g. procurement).
- The owner of national transport infrastructure or infrastructure operator:
  - Take digitalization and automation into account;
  - Promote car sharing and alternative modes via pricing (e.g. SNCF).
- Provide available/open transport data (according to national policy):
  - Added value for services: transport data, public transport schedules, routes, open interfaces, maps, route planner;
  - Promote how data from MaaS can be shared to help other MaaS services and how to contribute evaluate performance according to policy goals.
- Promote collaboration between different transport modes and stakeholders:
  - Collect and disseminate best practices;
  - Organize thematic (targeted) workshops (e.g. opening APIs, procurement).
- Issue permits (e.g. robotisation, automation, operating permit) and licenses:
  - Set licensing and permit conditions that promote MaaS and sustainability.
- Tolling:
  - Integrate and incentivise MaaS to encourage more sustainable transport.

In Finland and in Sweden, the participants of the MAASiFiE workshop 3 had an opportunity to anonymously present their opinions about the roles and responsibilities related to MaaS (see Annex I). There were 17 responses, and the results indicate that expectations about MaaS are very positive. Transport specialists predict that MaaS will offer benefits for most of the stakeholders and only minor negative impacts on some stakeholders; traditional taxi services were seen to potentially be the most negatively impacted. Responses indicate that MaaS development requires collaboration between all stakeholders, but especially ministries, transport agencies, current public transport operators and future MaaS operators, who should play a big role and push MaaS development forward. MaaS operators are seen as the key MaaS stakeholder to work with the MaaS vision, but also supported by interest organisations and public actors.

3.4.3 Implementation of MaaS

Concrete tools or actions to promote the implementation of MaaS were identified in the workshop, and these include:

- MaaS should adopt a new holistic approach, e.g. combining transport and social & healthcare services. MaaS should also be connected to general technology and lifestyle developments and trends.
- Barriers hindering the implementation of MaaS should be removed. These include

e.g. legal, organizational, and attitude (mindset) barriers. In Finland, reregulation is ongoing (new transport code) facilitating the implementation of MaaS services. MaaS needs to be implemented in each local context, which depends on the country. Barriers to be addressed can be found on different levels: geographical (EU, national, local/regional), operational/business, regulatory, political and user.

- Agile policy and decision-making is required, and decisions need to be adjustable in a timely manner to support the long-term MaaS vision.
- Public transport needs to be redefined to cover new transport modes and solutions, e.g. sharing services. Also subsidies and incentives need to be redefined or refocused, especially if commercial and subsidised transport will be integrated in MaaS services.
- International collaboration is needed and clear roles have to be defined. Also a more horizontal approach at the EU level is needed.
- Ticketing APIs need to be opened. However, it is currently voluntary what information transport operators will include in an API platform. Tranport operators need also to decide which tickets (new and existing) and which payment models will be utilised. Payment models may be based on e.g. zones, time, distance.
- Applying agile and innovative procurement methods based on stakeholder collaboration and involvement.

It was emphasized that there is a gap between the MaaS vision and the current reality. It was also mentioned that the procurement of MaaS services or of something new that does not yet exist is extremely difficult, as such services do not fit well into the current procurement processes.

In order to ensure the continuity of the MaaS vision and MaaS development, a regular update to the MaaS roadmap is needed to adjust the development path. MaaS development is at an early stage and the near future may identify new aspects to consider in order to clarify the direction of the development. The actor responsible for organizing regular roadmap updates needs to be agreed upon. Transport agencies were proposed to take an active role in updating the roadmap. MaaS development should be connected to general societal developments. Thus, for example, technological development needs to be continually considered, and roadmap work needs to be connected to infrastructure investments. Also, impact assessments and validated results are needed to see the real quantitative impacts of MaaS in order to understand how to develop services to better meet user, business, and societal goals.

4. Discussion

As MaaS offers user-oriented services and promotes political goals, e.g. environmental and public funding efficiency, the expectations for MaaS are high. A number of MaaS services and pilots already exist, but it is uncertain how MaaS business models will develop and if they will be viable in the long term. MaaS revenue models are discussed here based on the MaaS business models presented in Deliverable 3.

Identified MaaS operator models are presented in Figure 6 and more in detail in Deliverable 3. Two identified commercial MaaS operator models are Reseller and Integrator. A reseller supplies transport services of different transport modes (e.g. a travel agency). An integrator in addition combines the services of several modes with digital services, e.g. an application for mobile ticketing, travel planning etc. For some integrators, MaaS is the main business and for some MaaS is a complement to their service offering. Municipality/city-owned and state-owned public transport operators can act as MaaS operators by integrating additional transport services and digital services into their existing public transport offer. In the Public-Private-Partnership (PPP), the public actor may integrate different types of actors and services in the system, which will rationalize the services for which the public actor is responsible, e.g. legislated special transport services and freight/delivery.

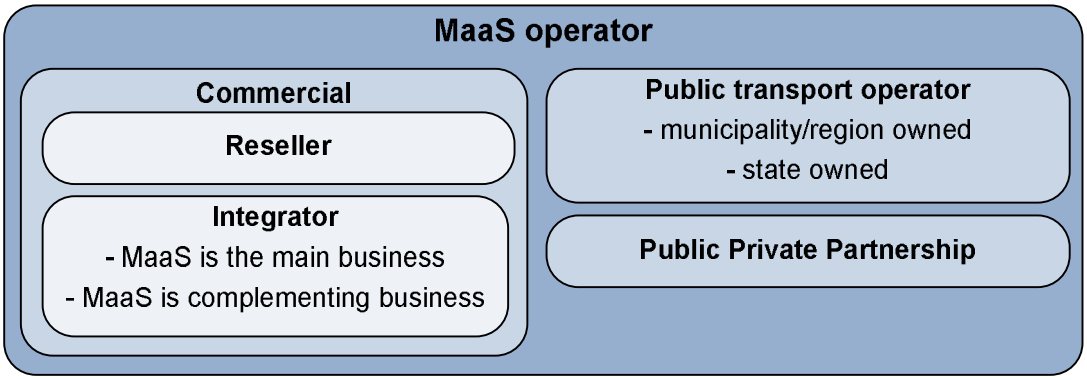

Figure 6: MaaS operator models (Eckhardt & Aapaoja, 2016)

The revenue model of the reseller business model can be based on agency and/or merchant models. The agency model is based on volume discount, i.e. the MaaS operator would purchase large volumes of transport tickets at a volume discount and get a marginal profit by reselling the tickets at normal price. The merchant model is based on commissions that the transport operators pay to the MaaS operators for reselling their services. Both options require high efficiency and the margin is probably low. The reseller model does not give much additional value, but it integrates different modes of transport on a one-stop principle.

In the integrator model, MaaS can be the main business, which would require large volumes. The revenue model would probably be mainly based in a similar way as in the reseller model thus on large volumes, discount or commission. Likely additional services combined with transport services would be required to increase volumes and profit. Also advertisement/marketing of other services and products could be used for additional income in the integrator model. Customers might be willing to pay a higher price on a trip sold by a MaaS operator, if the operator could guarantee a connection in a case of delay in a multimodal travel chain. The integrator may also offer MaaS services as a secondary, complementing business. In this case the aim would be to support and increase the sale of the primary business. For example if additional service providers (e.g. accommodation, entertainment…) act as MaaS operators, transport services can be considered as additional services from their points of view. This might also improve the image of the company offering

MaaS services.

When a public transport operator acts as a MaaS operator, the main aim is probably to increase sales and the average vehicle occupancy by offering a variety of first/last-mile services, more comprehensive services, e.g. carpooling and bike sharing, and additional services, e.g. digital and mobile services.

The PPP-operator may integrate different types of actors and services in the new system, which will rationalize the services for which the public actor is responsible. Thus, the PPP model does not necessarily aim at profits, but at cost savings for the public sector by increased efficiency and more comprehensive services e.g. in particular for various social groups or in rural areas. PPP may include and combine e.g. legislated special transport services and freight delivery transport.

Based on the developed MaaS business models, revenue models and MaaS objectives in different geographical areas (presented in Deliverable 3) it could be concluded with the current MaaS knowledge that the public transport operator-based business model would probably be successful in and between cities and suburban areas. The PPP model could bring cost savings for the public sector, thus it could be viable especially in rural areas and for other subsidised transport. The reseller model might lose its market share, as it may not offer much added value compared to new, emerging, more integrated services. The integrator model might provide the most variety in the ways of implementation, making it the most unpredictable business model. It probably also has the most versatile opportunities in different contexts and geographical areas, but creating viable services and finding successful revenue models might be challenging.

Freight transport has been considered in the MAASiFiE project as an add-on to MaaS rather than presenting stand-alone logistics solutions. Due to high competition and efficiency pressure, logistics often utilizes developed ICT systems e.g. for planning and delivery optimization. There are also several initiatives for logistics companies to collaborate e.g. by using urban consolidation centres. Integration among logistics actors has been much more efficient than has been combinig logistics with the mobility of people. Thus it could be concluded, that in cities and areas where the flows of people and goods are sufficient, combining them may not necessarily bring any advantage. However finding other solutions in collaboration with freight and mobility operators would be useful, e.g. installing automatic delivery boxes at public transport stations. In rural areas with long distances, sparse populations and low capacity utilization rates, combining all types of transport can increase efficiency. For example a MaaS operator could, in addition to mobility of people, include parcel, post, shopping, pharmacy products and meal deliveries. Also commercial and statutory social and health service transportation (e.g. health care, disabled persons) could be integrated.

5. Conclusions

MaaS service development is in an early stage and future direction is hence difficult to predict. However, several general drivers can be recognised and those have already affected the transport sector and MaaS development. Drivers such as service culture, technological developments, environmental targets and public sector efficiency requirements will push to create collaboration and MaaS services, but in the end the uptake and success of MaaS services relies on businesses and users. Because we are in the early phase of MaaS development, it is not yet clear yet how appealing, easy and useful MaaS services will be in the future. However, expectations for MaaS are significant, as stakeholders trust that MaaS will offer potential solutions to solve the life puzzle from the mobility point of view.

The revenue component of different MaaS models varies and there is not yet evidence on viability, since all MaaS pilots and services are relatively new. Even though a number of of MaaS services are available and new pilots are emerging, their use depends on user acceptance and the change in mind-set to try new services and adopt aspects of the sharing economy. Thus, it can be concluded that the future of MaaS is complex and every stakeholder needs to promote MaaS to make new transport services successful. In addition, it can be stated that the customer must be raised to the centre of development, but collaboration and successful business models also play a crucial role in the future of MaaS.

In general, MaaS business models can include a variety of service combinations of different transport modes, sharing services and parking. At the same time, MaaS business usually combines several transport actors and often some public author is linked to MaaS services. From political point of view, MaaS is also seen to promote political and societal targets and thus PPP (Public-Private-Partnership) is an important part of MaaS development. While the business sector is responsible for developing new service offerings, the public sector should support MaaS development and provide new incentives.

Based on a literature review, a web-survey to experts and stakeholders, and the knowledge and expert experience of the members of the MAASiFiE project team, a tentative impact assessment framework was proposed in WP4 consisting of 17 impacts altogether: six on an individual level, six on a business level, and five on a societal level. Compared to most other impact assessments, the business aspects of MaaS in terms of revenues, collaboration, and responsibilities were added. The framework was used in order to evaluate the case studies UbiGo and SMILE and additional MaaS and MaaS-related services where at least some information of relevance was available.

Overall, the assessment in WP4 suggests that a broader introduction of MaaS could result in overall positive impacts, in terms of for instance a modal and attitude shift and an increase in perceived accessibility of the transport system. However, some conflicts between impacts on different levels were identified where, for instance, increased accessibility of the transport system (a desired impact on an individual and societal level) may result in an increase in the number of trips made (possibly a desired impact on an individual level but an undesired impact on a societal level with negative implications for emissions as well as congestion). When planning for a further introduction of MaaS from a societal perspective, such conflicts must be addressed in order to best determine how to potentially integrate overall societal goals into the MaaS offer and business model.

As mentioned earlier, MaaS development is heavily linked to technological development and the general digitalisation trend. Thus, MaaS stakeholders' ability to adapt new technologies is essential. This connection between ICT technologies and more traditional transport sector actors opens up new business opportunities, but at the same time forces old business models to innovate. In the MAASiFiE project, several technologies required for MaaS deployment were identified within Work Package 5. At the moment, there are many different, mostly ICT-based technologies, with a special focus on smartphone applications popping up on the market, but many of them are still only used by a minority. However, the idea of deploying and operating common mobility platforms using common standards and acting as

one-stop-shops for customers/travellers could intensify collaboration and extend market size. It is also important to remember that as long as MaaS should be made accessible to the broader population, wireless communication networks are essential for MaaS development and 5G in particulary is seen as the upcoming, promising telecommunication network technology. More about MaaS-related technologies can be found in Deliverable 5.

In this, Deliverable 2, MaaS activities, general findings and a relevant literature list have been updated from the previous project deliverables. All the data and information has been gathered from literature and transport sector actors and stakeholders. Several international experts have been involved in the project via interviews and workshops. However, to see the real impacts of MaaS and user requirements, proper evaluations and more quantitative data are needed. Also the roadmap needs regular updates to track and influence MaaS development in the near future. Hence, the project group recommends that a similar roadmap study will be performed in the near future.

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Annex I – MaaS transformation

The MaaS transformation	Customers (end users)	MaaS operators	PT operators	Taxi operators	Car rental and carsharing companies	Bikesharing companies	Companies offering add-on services (deliveries, events...)	Companies offering information services	ICT companies, e.g. systems	Ministries	Agencies (transport, safety, ...)	Financing agengies	Research and consultancies	Municipalities and regions	Interest organisations (national ITS , MaaS Alliance...)		
Who owns the vision of MaaS?																	
Who gains from Maas?																	
Who risks losing something?																	
Who has the actual "power" to carry out the transformation?																	
Who should have the power to carry out the transformation?																	
Who is underrepresented in the transformation process?																	
Who is overepresented in the transformation process?																	
Who is responsible for the transformation?																	
Who contributes to the transformation?																	
Who is hindering the transformation?																	
Who needs to collaborate to achieve the transformation?																	

Annex II – European MaaS Roadmap 2025

Note that *italics* indicate prioritized actions, as identified in the final workshop

		Status quo (2016-2017)	+ 1-3 years	+ 4-9 years	MaaS vision 2025
Why?	Drivers (social, techno-logical, financial, ecological, political)	Academia and R&D Business Infrastructure & built environment Policy & regulation - Demand for efficiency improvements in public sector - Tightening environmental requirements - Goals for large increases in PT modal share - Deregulation Society & culture - Service culture becoming more common Technology & data - Digitalisation develops (e.g. mobile apps, digital data availability, API) - Political incentives for eEverything	Academia and R&D Business - Start "cultural transformation" (of organisations) co-operative attitude → collaboration Infrastructure & built environment - Land use considering MaaS development - Urbanization; parking norms, densification, greenification Policy & regulation - Public funding either decreases or is not sufficient - Incentives on all levels - Disincentives for private car use and ownership - Environmental requirements developed, e.g. zero emission zones, clear sustainability goals tied to transport, company image (transport, parking and travel policy) - New updated regulation Technology & data - Digitalization increases the availability of data and services and changes customer expectations Society & culture - Sharing economics become common, awareness increases and large sharing companies emerge	Academia and R&D Business - Environmental requirements implemented Infrastructure & built environment - *Change of urban structures and space solutions* Policy & regulation - Public funding continues to decrease Technology & data - Robotisation / automation develop - Technological development: 5G, improved real-time information etc. Society & culture - Expectations for personalised services (incl. pricing schemes) - Changes in vehicle fleet: connected, shared, electric, automated vehicle pilots	Academia and R&D Business - *Increased efficiency, occupancy and utilization rate* - More transparent cost and pricing Infrastructure & built environment - Fewer parking lots Policy & regulation - *Energy consumption, emissions and congestions have decreased* - *Increased collaboration and coordination, e.g. concerning subsidised transport and trips, between different public functions* - Norms and attitudes toward car usage and car ownership are changed - Limiting regulation has been adjusted or/and deregulated Technology & data - Necessary data is open, available (and free?), also for commercial application Society & culture - Accessible and sustainable transport for all geographies and user groups - New culture of working

		Status quo (2016-2017)	+ 1-3 years	+ 4-9 years	MaaS vision 2025
Why?	Markets	Academia and R&D Business - MaaS corresponds only a minor part of mobility markets, what is the market potential? - Few MaaS offers - Uncertainties regarding business models, impacts, roles & responsibilities, etc. - Fragmentation, cannibalization - Lack of trust among stakeholders - MaaS hype (new business & service opportunities) Infrastructure & built environment Policy & regulation - MaaS hype (redefining transport & mobility, servitization) - Fear of losing control (transport providers) - Unclear ecosystem (roles & responsibilities) - Uncertainties regarding legal possibilities Technology & data Society & culture - MaaS is not well known in general	Academia and R&D Business - *New market players, e.g. services that are alternative to cars* - Services for rush hours: e.g. bus, parking - Company travel management - Delivery of goods integrated to MaaS Infrastructure & built environment Policy & regulation - Building public awareness and trust - Blur the walls of modal silos Technology & data - Virtual, digital and mobiles services become more common - Developing ICT/ITS architecture guidelines Society & culture - MaaS awareness and acceptance in growing - Change of user demands: safe, easy, fast, flexible, comfort - Mobility comfort: e.g. safety, surveillance, covered bus stops - Social aspect in car sharing: e.g. hobbies, talking - Better accessibility: social aspects - Promoting healthy walking and cycling	Academia and R&D Business - MaaS markets are more stabile - Business for integrated data and service market place - Automotive industry affects markets Infrastructure & built environment Policy & regulation - Preconditions in place for innovation and new forms of collaboration (could this come earlier?) Technology & data - Optimised systems based on traffic forecast & user preferences Society & culture - *Services come also to people (generation management, user demands etc.)*	Academia and R&D Business - Strong MaaS brand and demand for MaaS services - Mobility services as a norm - Profitable MaaS market - Impact for PT. e.g. brand, role & market - What will happen to PT and subsidised transport (more commercial)? Infrastructure & built environment Policy & regulation - Both commercial and subsidised MaaS services, and public private collaboration (cross-financing) - Impact for non-servitised sustainable markets: e.g. biking and cycling Technology & data Society & culture - Demand for flexible, agile markets - Niches to be filled within “community” engagement (sponsorships)

		Status quo (2016-2017)	+ 1-3 years	+ 4-9 years	MaaS vision 2025
What?	MaaS services (incl. additional services, required technology)	Academia and R&D Business - Few pilots/service tests in Europe, even fewer properly evaluated - Low level of service integration - Platform thinking, e.g. ecosystem for EV management Infrastructure & built environment Policy & regulation - Imbalance between transport modes (e.g. private car prioritised) Technology & data - Need to open up data/ interfaces/APIs - Lack of digital information - No common platforms Society & culture	Academia and R&D Business - Plenty of pilots, of which the best ones will scale up and sharing lessons learned/best practices - One-stop-shop travel chain services mainly in cities and for commuters - Implementations (at least to some extent) - Service combinations available, e.g. including freight and additional services - Some more commercial services Infrastructure & built environment Policy & regulation - Best practises for open data regulation - Remove regulatory bottlenecks (which identified and challenged) Technology & data - *Opening up data, interfaces and APIs (modification of offers and tickets)* - My data management: secured information sharing between organizations under development Society & culture - *Private cars as a part of public transport (public-private commuters entity)* - *Useful easy, flexible services emerge, helps to solve the life puzzle* - Mobility "prosuming" (producing & consuming) - Easy access to information	Academia and R&D Business - *One-stop-shop services available everywhere (cities, rural, national..)* - Multiple one-stop-shop (MaaS) providers - Competition between services - Additional services, tailoring and service networks Infrastructure & built environment Policy & regulation - *Combining public and private sector transport* Technology & data - Extensive deployment of technology, e.g. augmented reality, improved wifi coverage - My data concept defined Society & culture - More useful services emerge integrated with other aspects of life - More sophisticated customer segments based on values and attitudes of people	Academia and R&D Business - Takes in to account all purposes of mobility (business, leisure, shopping,..) - *Freight transport integrated with MaaS* - Higher level of service integration - MaaS operators providing complementary services → new players and services - PT carried out as on-demand solution Infrastructure & built environment Policy & regulation - Common minimum service level agreement for MaaS needed - Redefined public transport - International roaming - PPPs commonly used Technology & data - User friendly interfaces and higher transparency, equity (e.g. pricing) - Common interfaces for service providers - Improved data (incl. user data) and use of data analysis to support decision-making Society & culture - Transparency in all triple bottom line aspects (economy, social and environment) - Customer oriented and the possibility of choice i.e. closer collaboration with users

		Status quo (2016-2017)	+ 1-3 years	+ 4-9 years	MaaS vision 2025
How?	Enablers (funding, networks, know-how, operation models etc.)	Academia and R&D - Actions to promote MaaS in academic research and education - Research and development funding available from several organisations: (innovation agencies, transport authorities, CEDR, EU...) Business Infrastructure & built environment Policy & regulation - National and international networks; e.g. national ITS organizations, MaaS alliance - Roadmaps and strategies are under development Technology & data Society & culture	Academia and R&D - Ad hoc MaaS research initiatives - Benchmark/ best practises / evaluation incl. societal impacts Business - *Principle for cost/profit/subsidising* - *Cross sector operation models* - Quality services offered to attract customers incl. minimum service guarantee - Increase visibility of start-ups to investors - Development of the one-stop-shop principle Infrastructure & built environment Policy & regulation - *Clear regulatory framework, adjustments to regulation, e.g. permission to resell PT tickets* - *Standardisation of and/or common ticketing/ payment system for public transport, data, service interfaces, APIs etc.* - *Change torwards goal achievement (functional specifications)* - Collaboration between service providers, sectors, administration levels (e.g. municipalities and state) - Increased coordination between different public functions concerning subsidised transport and trips - Developing new procurement & PPP models and procedures, and know-how about their application - Emerging international MaaS-collaboration (service and knowledge networks, conferences) - Develop national/regional political incentives to support MaaS - Marketing to public and politics → Financing to incentivise using MaaS - New ways of funding investments in e.g. metro - MaaS goals tied to policy goals and national goals Technology & data - *Digital PT-tickets* - Privacy and data protection principles and methods for MaaS are developed - Common national and international platforms Society & culture	Academia and R&D - Systematic MaaS research - Continued work on benchmarking/ best practises - Development of living lab test environments (inc. policies) Business - *Established international MaaS collaboration* - All transport modes involved (companies + private persons) - New transport services - Combining different societal services Infrastructure & built environment - Road capacity integrated with demand management Policy & regulation - Green mobility and green transport Established procurement knowhow, models and regulation - Legislation facilitating robotisation and automation in place Technology & data - Utilisation of augmented reality tech. to make travelling smoother Society & culture - Changed mind-set public/private, mobility/transport etc.	Academia and R&D - MaaS integrated into education and the academic domain - Impact assessment framework in place Business - Viable business models (b2b, b2b2c, b2b2e, p2p, b2g...) - Active collaboration in all levels, especially in business models (e.g. sharing risks, rewards, customers) Infrastructure & built environment - Guidelines e.g. for city planning and infrastructure Policy & regulation - *Clear short- and long-term goals for MaaS services tied to societal goals* - Clear roles and responsibilities of stakeholders - Holistic long term coordinated planning and decision-making - Modified political and economic instruments and steering to promote sustainable societal development Technology & data Society & culture

Annex III – MaaS case studies – national and international mobility services

The following case studies give an overview on different of MaaS services and pilots covering different geographical areas. The cases already presented in the MAASiFiE Deliverable Nr 3 are condensed or updated, when relevant, and also new pilots and services are included. Also new R&D activities are presented.

Austria

VAO ('Verkehrsauskunft' Austria)

The VAO provides a multimodal traveller information platform, covering routing information for individual and public transport modes. Besides routing, different transport and integrator organisations provide additional transport data and information to the platform, for instance, real-time traffic information, congestion and accident information from highways public transport. Overall the traveller information services cover the following transport modes: public transport, national railways, highways, pedestrian routing, intermodal information (incl. e.g. Park&Ride, bicycle carriage in public transport); bike/- carsharing, and parking.

BeamBeta/WienMobil-Lab (initiated by the SMILE project)

Based on the SMILE project, ticketing as an integrated part of multimodal traveller information was established on the basis of the VAO routing platform. Ticketing and booking options are provided to test-users in the Vienna region. Compared to VAO, BeamBeta/ WienMobil-Lab provides added value services such as:

- Ticketing/Payment API's with Car2Go API and Wien Mobil card,
- Taxi information,
- E-Bike Sharing,
- Parking garage information

WienMobilLab/Upstream

WienMobilLab: During the MAASiFiE project period, the WienMobilLab has further evolved providing both, end user and corporate mobility management concepts. Besides already provided service features within BeamBeta, upstream has further developed real-time information provision together with ticketing services features.

TIM

TIM ('täglich, intelligent, mobil') has been established, providing emobility togheter with sharing and combined public transport services. Infrastrucutral facilities like e-charging stations, parking places for e-vehicles together with an integrated mobility service were implemented. The following services are deployed in the urban region of Graz. TIM has the following service features covered:

- Access to car-sharing booking and intermodal information via publicly accessible terminals in the urabn region of Graz,
- E-car sharing, e-taxi supply,
- Combined public transport ticketing,
- Information on bike sharing stations

Sweden

UbiGo

In Gothenburg, Sweden, the Go:Smart project ran a six-month field operational test of the UbiGo[1] service from November 2013 through May 2014, involving around 200 participants from private, urban households. Although the end-users were highly satisfied and used the service to test new and more sustainable travel behaviours, the service was discontinued after the pilot ended, mainly due to difficulties in finding a cooperative model that worked for both the region/PT-provider and UbiGo as an emerging *private, commercial* service (15; 21). See Deliverable 3 for further details.

Finland

HRT (Helsinki Region Transport Authority): Kutsuplus[2]

Kutsuplus (2012-2015) was an intermediate form of public transport and taxi complementing other HSL services (bus, local train, tram, metro) in the metropolitan area of Helsinki. Kutsuplus used a network of nine-seat minibuses. The service was an alternative to multiple-transfer trips and private car drives. Kutsuplus features and services included:

- Individual search and selection of trips (orders online or via SMS 45min in advance)
- Ride from (virtual) bus stop to (virtual) bus stop
- Driver's instructions in real-time
- Different service classes, group discount, happy hour
- People going in the same direction can be efficiently collected in the same vehicle
- Walking route from the bus stop to the final destination
- Payment in advance or to a driver

Sito: Seinäjoki

Sito together with local authorities and transport service providers are running a MaaS service pilot in Seinäjoki. The pilot was started in late 2016 with limited services for a test group of 20 people and will last until the summer of 2017: shared taxi and public transport (including demand-responsive) rides. Kätevä Seinäjoki is available in three different packages within the service area (radius approximately 7,5km from Seinäjoki city centre):

- Mukava ("*Cosy")*
    - Kätevä Seinäjoki mobile application
    - A monthly payment of 29€
    - Unlimited access to on-demand transport with reduced price, 4€/ride (normal 4,70€/trip)
    - 20 pre-ordered shared taxis with fixed price, 7€/ride
    - 8 taxi rides within the service area, 10€/ride
- Sopiva ("*Convenient")*
    - Kätevä Seinäjoki mobile application
    - A monthly payment of 39€

[1] http://ubigo.me/

[2] www.hsl.fi, https://www.hsl.fi/sites/default/files/uploads/8_2016_kutsuplus_finalreport_english.pdf

  - Unlimited use of public transport
  - Unlimited access to on-demand transport with reduced price, 4€/ride (normal 4,70€/trip)
  - 20 pre-ordered shared taxis with fixed price, 7€/ride
- Menevä (“*Busy”)*
  - Kätevä Seinäjoki mobile application
  - A monthly payment of 49€
  - Unlimited use of public transport
  - Unlimited access to on-demand transport with reduced price, 4€/ride (normal 4,70€/trip)
  - 20 pre-ordered shared taxis with fixed price, 7€/ride
  - 8 taxi rides within the service area, 10€/ride
  - Limitations regarding the use of taxi can be removed with 25€ per month

Telia Company: Sonera Reissu

Sonera Reissu offered transport services in the city of Hämeenlinna for rail/bus and (shared) taxi. The idea in the Reissu service was that end users coul pay their trip in a one-stop-shop basis via a mobile application. The Reissu application used mobile payment and ticketing and it combined both taxi and train/bus trips on the same ticket, but it preserved separate ticket IDs according to the service providers’ ticketing systems. Sonera Reissu used fixed prices with taxi companies and takes a minor commission fee on re-sold train tickets. Service pilot has ended and it is not available anymore.

Telia Company: YlläsAround

Telia Company’s Ylläs Around public-private-partnership (PPP) service is an open MaaS pilot in the Ylläs ski resort area in Northern Finland conducted in spring 2016 and winter 2016-17. The service is a part of the Aurora Snowbox test ecosystem and is operated by Telia Company in cooperation with other main stakeholders: local transport operators, local municipality Kolari, Ylläs Travel Information and the Finnish Transport Agency. The main idea in the Ylläs Around pilot is to offer one-stop-shop transport services in the Ylläs ski resort area and between the Ylläs area and the main local transport hubs, Kittilä airport and Kolari railway station. The Ylläs Around pilot includes multimodal transport services, which are all available for end users through a mobile application. The application also includes payment and ticketing features. All the fees and prices are based on bilateral agreements between the MaaS operator (i.e., Telia Company) and transport service providers, such as fixed taxi prices and minor commission fees on re-sold bus trips.

Ylläs Tiketti

Ylläs Tiketti mobile application is an easy and safe way to buy tickets to transport and non-transport services in Ylläs. Provided services are not limited and offering increases continuously. Currently at least the following services are available:

- Bus transport from Kittilä Airport and Kolari Railway station to Ylläs ski resort (the villages of Äkäslompolo and Ylläsjärvi)
- Tickets to Skibus
- Tickets to Ylläs Shuttle: Ylläs taxis provide an easy way of moving around and between the villages of Äkäslompolo and Ylläsjärvi.
- Bus tickets for Onnibus connections from Helsinki to Ylläs
  - Ylläs shuttle can be merged with Onnibus’s connections and booked in

advance

- Concert tickets to Restaurant Taiga and Lapland Hote Äkäshotelli
- Tickets to Lainio Snow Village
- Ski track payments

Ylläs Tiketti is provided by PayiQ ltd. and the service supports various payment methods such as Svea ekonomi, Danske MobilePay and debit and credit cards (Visa and Mastercard). Service in available in Finnish, Swedish and English. Once the payment and purchase is made, tickets are immediately available on your phone and ready for use.

Turku: TUUP [3]

Tuup is a Finnish service providing access for users to all the transportation options through one mobile application. The Tuup service is marketed for end users, cities and municipalities and for enterprises that want to enhance the cost-effectiveness of work-related trips and to ensure that employees use sustainable transport solutions. Tuup offers users information on the prices, routes and timetables of all kinds of transportation, be it public transportation, taxis, rental cars, bicycles or a combination of these. The Turku Region Traffic, also known as Föli, was the first mobility service offering ticket purchase via Tuup.

The Tuup mobile application has been available since April 2016 and currently the service includes the following features: a comprehensive route planner and daily travel plan optimized according to the user's travel history data, and integrated searching, paying and use of mobility services. The service also presents general statistics and some key societal effects about the mobility choices. The Tuup service also provides information and reminders about upcoming trips, deviations, pick-up locations and the general real-time traffic situation. In spring 2017, Tuup Ltd. and Vinka Ltd together with the Sohjoa project are planning to start a demand-responsive automated robot bus service in the city of Tampere. In spring 2017 Tuup will also launch an on-demand ride service called Kyyti (*Ride* in English) that opens new lucrative markets for taxi and bus operators by ensuring efficient fleet management through routing and matching of shared rides with dynamic pricing. For consumers, Kyyti provides flexible door-to-door traveling with affordable prices.

Fölix[4]

Fölix was a pilot performed in the city of Raisio close to Turku in the fall of 2016, and it is an extension of Turku Region Traffic, Föli, which covers the public transportation of Turku, Kaarina, Raisio, Naantali and Lieto, and is known for being one of the first Finnish regional public transports that started to use mobile ticketing and payment (powered by PayiQ Ltd.). Fölix provides on-demand shared taxi rides from two separate bus stops located in Raisio city centre within the demarcated service area. The service is mostly targeted to customers living areas outside the public transport service area. To enable merging the taxi rides, they have to booked two hours prior. By merging the rides, the service and rides can be also made profitable for the taxies too.

MaaS Global: Whim[5]

Whim is a new MaaS application launched in the late 2016 and is currently in pilot testing in Helsinki, Finland. The service is operated by MaaS Global, a Finnish start-up company founded in 2015. Whim offers mobility packages on a monthly basis and also travel on a pay-as-you-go basis.

Whim includes services like taxis, rental cars and public transport. The application

[3] http://tuup.fi/

[4] http://www.foli.fi/fi/f%C3%B6lix-vie-kotiin-asti (In Finnish only)

[5] https://maas.global/

synchronizes with the user's calendar, helping to plan journeys in advance. Whim also learns about the user's preferences. Currently three types of packages are available: Light, Medium and Premium.

The Light package (€89 per month) contains unlimited travel on public transport within the city of Helsinki (HSL buses, local trains, trams, metro and the Suomenlinna ferry). The package also includes 1000 Whim points, which can be used for taxi rides (e.g., two taxi rides in daytime journeys of median length) or rental car. If points are run out, more can be bought at any time.

The Medium package (a first month at a special discount price of €100, normal price €249 per month) includes unlimited travel on the various transport modes of Helsinki's internal public transport (same as in the light package). The package also contains 5500 Whim points which, for example, can be used for:

- 12 taxi rides (daytime journeys of median length) or
- 8 taxi rides + 2 days of car rental or
- 4 taxi rides + 4 days of car rental or
- 6 days of car rental

The Premium package (€389 per month) includes the unlimited public transport within Helsinki and 10000 Whim points which is equivalent to approximately 22 taxi rides (daytime journeys of median length) or

- 11 days of car rental or
- 6 taxi rides + 7 days of car rental or
- 10 taxi rides + 5 days of car rental

The length of the taxi rides or the number of car rental days is only restricted by the amount of points you have available. Medium and Premium packages also include a possibility to book the cost-efficient Whim Car (starting from only 950 points per day). The unlimited HRT regional update (+55€/month) for monthly packages will be added to Whim shortly.

MaaS related services:

- CityCarClub[6] is a carsharing company for private persons and companies. To have access to cars, club member are liable to pay the joining fee (50€), monthly fee depending on the package (10-50€) and usage fees depending on the vehicle type (10-20€ per hour) according to the pricelist. CityCarClub offers packages for companies too. The prices prices are linked to the amount of users. Price per user is 50 €/month (inc. VAT) or per 10 users 199 €/month (inc. VAT). Company users can use all cars for just 10 €/hour, including ALV, fuel and 20 km of driving. Company contract includes accounts for both company and private use. Also tailor-made packages and contracts are available to companies.
- ShareIt Blox Car[7] is specialized in a peer-to-peer car sharing service that helps car owners find someone to rent their car to when they do not need it. In the service, the car owner decides the rental price for the car. The owner also decides the price for the additional kilometers. The user will pay for the fuel used during the rental period. All Shareit Blox Cars are insured with insurance from If insurance company[8] and with the Shareit-Insurance. The excess is usually 1000 euros, but it depends on the car.

[6] http://citycarclub.fi

[7] https://www.shareitbloxcar.fi/

[8] https://www.if.fi/henkiloasiakkaat/vakuutukset/autovakuutus/auton-vaihto/auton-vertaisvuokraaminen?utm_source=Shareit&utm_medium=Ink&utm_campaign=Shareit

- Vedia taxi[9] is a mobile application enabling sharing taxi rides. The application helps users to find other people going to the same direction (your friends or new acquaintances) and share a taxi with them; application will calculate your share in advance and makes transactions from debit/credit card. The last passenger will pay the whole taxi and Vedia reimburse shares of other passengers to bank account
- 24 Rental Network Ltd.[10] manages and provides shared cars through two online and mobile services, 24Rent and go now! Go now! is a pay-per-minute shared city car service. Cars are available 24/7 through its mobile application; the service offers eco-efficient hybrid cars in the Helsinki and Vantaa service areas. Users need not worry about fuel and parking expenses, since the per-minute-fee includes all driving-related costs. The mobile application shows the location of free cars and provides easy access to the vehicles. 24rent is a self-service car rental service which have over 50 000 customers in Finland. 24rent offers various types of vehicles such as vans, passenger cars as well as electric and hybrid cars. The cars can be booked through the website or mobile application, and once the reservation is made, the car's doors can be opened with the user's phone.
- Perille Mobility Services Ltd. [11] is a start-up company providing Perille.fi multimodal (bus, taxis, flights, trains etc.) searching and routing engine for Finnish long-haul transport services. Service is offered through website (perille.fi) and application. In addition, the company provides free perille.fi search widget that can be added and displayed on the website. Later in 2017 Perille will releases door to door routing for Tallinn, Estonia, and API for mobile payment and ticketing.

The Netherlands

De Verkeersonderneming/ Marketplace for mobility

The Dutch government has implemented a common programme (called 'Better Benutten') to reduce congestion, provide travellers more choice and service, reduce journey times, improve the existing road network and increase the carriage of goods over water. A marketplace for mobility, "De Verkeersonderneming", supporting the implementation of different measures increasing overall transport efficiency was established in the Rotterdam area, including different end-user services. Over 30 different mobility services are offered in the marketplace, including: shuttle buses, travel information apps, e-bike rental, mobility management plans for employers and collective company transports.

Radiuz Total Mobility

Another mobility service platform is provided by 'Radiuz Total mobility'. It provides an integrated service platform including the following mobility service features: public transport information, bike rental, taxi services, parking, car rental and car sharing.

Germany

DB/DIMIS

The 'DB-Deutsche Bahn' (German Railways) provides an integrated car- and bikesharing mobility service concept available for subscribed train users who can bridge their journey or last-mile connections with shared cars or bikes. Furthermore real-time information on train schedules, together with a Booking and Payment feature provided as a web-based pre-trip ticketing and traveller information service are provided.

[9] http://www.vedia.fi/vedia-taxi-is-finally-here-for-beta-users/

[10] https://www.24rent.fi/tietoa-24rent/

[11] https://perille.fi/

Bayerninfo.de

In the Bavarian region a multimodal traveller information system, called bayerninfo.de, provides real-time information on road and PT networks.

Hannovermobil

Hannovermobil combines PT information and ticketing, taxi services, sharing concepts and other information (e.g. tourist POI's – Points of Interest) over a common mobility platform. The geographic service area covers the urban and surrounding region of Hannover. Initially Hannovermobil was a project conducted by Üstra (PT organisation of Hannover) and consortium partners.

The following service features are included in the Hannovermobil mobility service:

- DB (German national railway) mobility card,
- Urban PT ticketing and real-time information of Hannover (Üstra),
- Carsharing,
- Taxi services

Quixxit

Different to other MaaS service concepts, Quixxit integrates almost all transport modes and respective organisations that are available in Germany and thus provides rather a mobility consultancy service providing intermodal transport information on a meta-level by linking different digital mobility services on a virtual level to form one common information platform and so enabling easier mode access and transfers.

France

SNCF

SNCF is France's national state-owned railway company, who has several succesfull new multimodal services and service combinations aiming at increasing the use of trains and obtain new customers through better customer experience and integrated services. The idea is provide door-to-door services and to develop first and last mile transportation. SNCF has several additional mobility services:

- iDVROOM[12] is a car pooling service with a guaranteed return journey by taxi if the driver unexpectedly cannot bring one back. Users have free automatic toll badge, no management costs, and a monthly downloadable invoice.
- iDCAB[13] is a taxi or car-with-a-driver service with fixed price and advance payment. The reservation can be done in the website or via iDPASS mobile application.
- iDAVIS[14] service allows to book a rental car and train ticket simultaneously. Users can have reduced prices when a SNCF discount or loyalty card is presented. The service is available at over 170 railway stations in France and over 90 stations in Europe.
- iDPASS[15] is a mobile application for the first and last mile services. The services included are:
    - iDCAB (described above)

[12] https://www.idvroom.com/

[13] https://idcab.sncf.com/

[14] http://www.sncf.com/fr/se-deplacer/idavis

[15] http://idpass.sncf.com/

  - Wattmobile is a self-service rental service for electric vehicles that are available at 11 railway stations. The iDPASS card with RFID can be used to start the vehicle.
  - Zipcar is a self-service car rental/sharing service. The car doors can be opened by using a smartphone with the iDPASS application.
  - Bicycles: the application shows the locations of self-service bicycle stations and the number of available bicycles.
  - Parking places: the application visualizes the parking places available nearby and shows the route to the parking place.
- For students, a dedicated service 'Pack mobilité' has been launched in 20 cities and the aim is to have all university cities included. The services included and prices vary as they are agreed with local actors. Pack mobilité services include local trains, metro, bicycle, carpooling, car sharing and discounts for long-distance trains.

Transport de Montpellier, TaM

TaM offers multimodal transport services in the metropolitan area of Montpellier. The following services are included:

- 4 tramway lines,
- 36 bus lines,
- 51 Vélomagg bicycle stations,
- 9 P+Tram offering nearly 5000 parking places for tramway users,
- 8 parking establishments in the city center with nearly 4 000 places,
- 13 000 parking places on the roads of Montpellier,
- 22 carsharing stations in collaboration with Modulauto.

These modes can be combined with each other and they are connected with Hérault department (département) buses, and regional and national trains. Service are available through mobile application providing routes, real time information on next arriving buses and trams, availability of bicycles at bicycle stations, the number of available parking places, and availability of Modulauto car sharing stations.[16]

TaM offers mobility contracts on a yearly basis. Mobility contract includes access to the following services: the entire TaM network including transfers, P+Tram parking, Vélomagg bicycles and TaM parking. There are also separate prices for students, elderly people and companies.

Italy

MyCicero MyCicero provides a traveller information platform covering international, national and local public transport and parking service features. Booking and ticketing are based on NFC (Near-Field-Communication) technologies and active optical validation (based on QR codes). Several national transport service providers like TrenItalia, ATM (Azienda Trasporti Milanesi S.p.A.), Marino Autolinee, Arriva and Mobilita a Parcheggi are collaborating and providing their data to the myCicero mobility platform.

North America

The phrase "Mobility as a Service" had not caught on as much in North America as in Europe. In North America, the nearest concept to MaaS is Mobility on Demand (MOD),

[16] http://www.tam-voyages.com/index.asp

although one often speaks of other related concepts such as microtransit, shared mobility, etc. Listed here are a few examples of MaaS and related efforts in North America:

Mobility on Demand (MOD) Sandbox Program[17]

The US Federal Transit Administration (FTA) developed the Mobility on Demand (MOD) initiative to envision a multimodal, integrated, automated, accessible, and connected transportation system in which personalized mobility is a key feature. FTA's MOD Sandbox Demonstration Program funded eleven projects for a total of nearly eight million USD during fiscal year 2016.[18]

Project100[19]

The startup SHIFT (formerly Project100), described in Deliverable 3, in Las Vegas shut its doors before receiving its full order of electric vehicles and running its beta program.

Service '5-1-1'

5-1-1, initially designated for road weather information, is a transportation and traffic information telephone hotline in some regions of the United States and Canada. 5-1-1 services in the United States are organized by state or region and some states/regions have associated websites as a vital part of 5-1-1 services. See Deliverable 3 for further details.

Shared Use Mobility Center (SUMC)[20]

The Shared Use Mobility Center collaborates with cities to scale shared mobility systems, including helping design and launch pilot programs and designing interactive tools cities can use to identify service gaps and more. Deliverable 3 describes some of their activities.

Smart City Challenge[21]

Initially described in Deliverable 3, the US Department of Transportation (USDOT) awarded the Smart City Challenge funding to Columbus, Ohio in Fall 2016.[22] Not wanting many good ideas to go wasted, also in Fall 2016, the USDOT announced an additional 65 million USD in grants to support community-driven advanced technology transportation projects in cities across America, including four of the finalists in the Smart City Challenge.

Multinational MaaS (related) services

In contrast to identified national MaaS (related) services, there are only very rarely cross-border MaaS services available. In considering sharing as part of the MaaS concept, carsharing services (especially carsharing business models of private companies) have quickly become established on a multinational level. For instance Car2Go provides its services in around 30 cities in 8 countries all over the world. With this respect the focus is only on big players as there are several car-sharing services in different countries. But, there are still hardly any international MaaS (related) services available, providing in addition common ticketing and multimodal traveller information at least on a cross-border level. One simple reason for this phenomenon is a lack of cooperation on organisational and technical levels between different national and multinational transport organisations. Therefore it remains a very important issue to connect stakeholders responsible for the MaaS value

[17] https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program.html

[18] https://www.transit.dot.gov/research-innovation/fiscal-year-2016-mobility-demand-mod-sandbox-program-projects

[19] http://www.goproject100.com/

[20] http://sharedusemobilitycenter.org/

[21] https://www.transportation.gov/smartcity

[22] https://www.columbus.gov/smartcolumbus/

proposition on different levels. Thus, the identification of value chains of different MaaS services allows for more transparency and learning, which are the bases for connecting different MaaS service models with each other. From an international point of view, there are currently very rare global players sharing the mobility market in terms of MaaS related services. Mainly some car-sharing organisations are providing their services even on a multinational level. With this respect, in the following part, some multinational examples of carsharing organisations are mentioned.

Moovel[23]

Moovel is service founded by Daimler and IBM, who provider a free mobile application available for Android and iOS. Application and service combines offers from various mobility service providers and offers the ability to comfortably compare different transportation options with one another regarding travel time and cost. Many services (see below) can already be booked and paid directly via the app. One single account handles booking and payment – making it easier to review all trips. Moovel offers new ways to connect the urban mobility ecosystem with our three complementary products: moovel app, moovel transit and RideTap

- Moovel app: Search, book and pay for rides with a single application. Services available include for instance car2go, mytaxi and Deutsche Bahn. The moovel mobility app is available throughout Germany, while public transportation mobile payments are available in Stuttgart and Hamburg.
- Moovel transit enables to pay for and access public transit with cutting edge mobile ticketing capabilities. A U.S. market leader, the moovel transit platform offers a suite of white-labeled mobile ticketing and payment solutions for the most innovative public transit authorities in North America. The app also allows access to mobile services including trip planning, arrival times, service alerts and deals at nearby retailers.
- RideTap is based on levaraging a network of transportation partners through one easy SDK integration. RideTap enables any app to offer their users multiple real-time transportation options with a single tap. RideTap helps riders discover alternative ride options nearby that can help them with their first or last leg of the trip: rideshare, carshare, bikeshare etc. and hence the core transportation offering can be expanded with local ride services.

ZipCar carsharing

ZipCar sharing is a company subsidized by the Avis Budget Group, focusing on the provision of a full carsharing service in USA, United Kingdom, Spain and Austria. Very similar to other incumbents within the shared mobility market, ZipCar has established based on its initiator, the global car rental organisation, Avis. In contrast to free-floating car-sharing systems, ZipCar provides only fixed parking locations

DriveNow carsharing

DriveNow is a Joint Venture organisation between the car manufacturing and automotive company BMW and the global car rental organisation Sixt car. BMW is providing the vehicles and Sixt car rental enables the carsharing system architecture. The service is provided in European countries, USA and Canada.

DriveNow is a free-floating car-sharing system, providing a higher degree of liberty considering the parking establishments, as their vehicles are allowed to park on public parking areas wherever contracts between municipalities and the company are available.

[23] https://moovel-group.com/en

Uber: Private Taxi and ridesharing organisation

The Uber (including UberPool) offersprivate taxi and sharing services worldwide. Uber has different service classes of provided ridesharing services. For instance, taxi or private drivers are able to provide rides based on the general provided Uber pricing schemes adopted within the differently provided countries. In some countries only licenced Uber drivers with specific taxi-like vehicles are allowed to provide their Uber services in order to reduce to high competition effects with other local taxi service providers.

BlablaCar[24] private carsharing

Private ridesharing platform covering 19 European countries and providing a Peer2Peer ridesharing service.

Car2Go carsharing

Car2Go offers its service in more than 30 cities worldwide (established by Daimler). Users are able to reserve and access cars wherever parked via a downloadable smartphone app. It is provided as a free-floating car-sharing system, meaning users are able to begin and end their rides “wherever they want” within Car2Go operating areas. Users are charged by a per-minute rate, including discounted fixed rates applied to hourly and daily usage. Rates are basically all-inclusive and cover insurance, maintenance, rental and fuel. Compared to some other carsharing services, Car2Go offers only one type of car considering its economy service, which is a Daimler car (Smart), similar as DriveNow is providing BMW vehicles.

[24] https://www.blablacar.co.uk/blog/blablacar-about

Overview of MaaS and related services

The following table gives an overview of identified MaaS and related services. Shared trip/vehicle is defined as: Multiple travellers simultaneously in the same vehicle (commercial or private) or several users for the same vehicle (traditional public transport is not included). On-demand is defined as: flexible scheduling and routing based on multiple customer demand (traditional taxis and similar services are not considered as on-demand services).

MaaS service name	Country	Service/ Pilot * ended	Multimodal information	Ticketing/ Mobile Payment	Shared Trip/ Vehicle	On-demand
VAO	Austria	S	X		X	X
Sonera Reissu/ Telia	Finland	S*	X	X	X	
YlläsAround/ Telia	Finland	S	X	X	X	X
Yllästiketti	Finland	S	X	X		
Seinäjoki/ Sito	Finland	P	X	X	X	X
UbiGo	Sweden	P		X	X	
SMILE / BeamBeta	Austria	*/ P	X	X	X	
WienMobilLab	Austria	P	X	X	X	X
TIM	Austria	S	X		X	X
GoogleMaps	International	S	X			
Moovel (Car2Go)	International	S	X	X	X	X
HannoverMobil	Germany	S	X	X	X	
Uber (Uber pool[1])	International	S		X	X[1]	
Bayerninfo.de	Germany	S	X			
MyCicero	Italy	S	X	X		
BMW (DriveNow)	International	S			X	
MyWay	Greece/Spain/ Germany	P	X	X		
Quixxit	Germany	S	X	X	X	
Moovit	Germany	S	X			
Citymapper	UK/ Germany	S	X			
Waze	International	S	X		X	
STIB+Cambio	Belgium	S	X	X	X	
TaM	France	S	X	X	X	
Radiuz Total Mobility	The Netherlands	S	X	X	X	
BlaBlaCar	International	S			X	
SHIFT	Los Angeles, USA	S	X	X	X	
SBB services (Publibike/QuicKbike)	Switzerland	S		X	X	
DB mobility services	Germany	S		X	X	
ZipCar	International	S			X	
Tuup	Finland	S	X	X	X	X
Whim	Finland	P	X	X	X	
KutsuPlus	Finland	S*		X	X	X
Fölix	Finland	P		X	X	X
City Car Club	Finland	S			X	
ShareIt Blox Car	Finland	S			X	
Vedia Taxi	Finland	S		X	X	
24Rent	Finland	S				
Perille Mobility	Finland	S	X			
SNCF	France	S	X	X	X	

Overview of MaaS projects

Some national and international MaaS project that are ongoing or about to start are presented here.

IMOVE

IMOVE (Unlocking Large Scale Access to Combined Mobility through a European MaaS Network) is a Horizon 2020 project during 2017-2019 (30 months). Thank you to the project for providing the information below.

In the IMOVE project, innovative business and technology enablers will be investigated able to concretely put into action, accelerate and scale up the MaaS market deployment in Europe, ultimately paving the way for a “roaming” capability for MaaS users at the European level. IMOVE research and innovation action is based on investigation, development and validation of bottom up novel solutions able to define sound MaaS business models, smoothing their efficient and profitable service operation. A suite of ITS elements empowering MaaS schemes will be delivered by IMOVE, including technology components for real-time collection of fine-grained data on mobility user needs, habits and preferences as well as components enabling the exchange of information and enhancing seamless interoperability among different MaaS subsystems and multiple MaaS schemes.

IMOVE solutions will be investigated and validated in European Living Labs, currently engaged in or having plans for MaaS development. The participation of UITP will ensure active participation of PTAs as well as key private stakeholders from other sites and will further guarantee a multiplier effect.

The overall objective of the IMOVE project is to accelerate the deployment and unlock the scalability of MaaS schemes in Europe, ultimately paving the way for a “roaming” service for MaaS users at the European level.

To this end, IMOVE will investigate and validate advanced solutions for improving MaaS deployment and operation and their underlying business models. Core ITS elements enabling MaaS development will be delivered, including enhanced real-time collection of data about user needs, habits and preferences and tools for the (controlled) exchange of information and tools to enhance interoperability among different service components and between different MaaS schemes.

The IMOVE impact will be tested at four sites, all strongly engaged in the MaaS domain and setting specific actions on existing or new MaaS schemes (Gothenburg, Sweden; Manchester, UK; Berlin, Germany; Turin, Italy). The sites have been selected according to their complementarity, where success and failure factors for any specific measure and context will be investigated and evaluated. The resulting knowledge and lessons learned will be made available and shared with any interested MaaS operator.

The following key operational tasks are needed to reach the overall objective:

- Create solid and resilient business models, adapted to the specific segments of mobility users, local frameworks, transport operator cooperation models, able to adjust service offering and business operation in response to behavioural changes and tendencies detected through continuous monitoring and real data collection about user needs, habits and preferences.
- Develop Open APIs enhancing the interoperability of MaaS proprietary platforms with other relevant third- party ITS services (e.g Journey Planners, Travel Booking tools, mobile Apps) and allowing users to keep using their preferred applications when interacting with MaaS services, thereby widening their accessibility and outreach.
- Enable roaming between different MaaS schemes by supporting business

cooperation between MaaS operators through the exchange of an “agreed minimum amount” of information, and improving user experience through enhanced user profiling and unique identification across multiple services, applications and MaaS providers.

- Unlock the potentials of a very valuable set of integrated information about mobility choices and behaviour obtained connecting existing data (e.g. across a journey, a day, months, etc.) that today can be hardly related to the same user and used to improve MaaS operation and provide value-added user services.

MaaS4EU

Thank you to the project for providing the information below.

To realize the MaaS era, we need to achieve seamless integration and synchronisation of different mobility services by leveraging on the rapid expansion in Intelligent Transport Systems (ITS), the availability of open data and the wide use of smartphones. Moreover, we need to address issues related to a fragmented transport supply sector, with regulations varying across EU countries delaying the adoption of transport innovation and the realization of the EU single market. In addition, there is an imperative need to define end-users’ rights to secure successful implementation and high acceptance of MaaS services. Although activities in this field are on-going in some of the EU Member States, at present there are no established frameworks and quantifiable evidence about MaaS’ costs and benefits, users’ needs, as well as its influence on travel patterns and car-ownership of various population groups. Against this background the vision and main goal of MaaS4EU, a Horizon 2020 project launching in 2017, is to: **Provide quantifiable evidence, frameworks and tools to remove the barriers and enable a cooperative and interconnected EU single transport market for the MaaS concept, by addressing challenges under four pillars: 1. Business, 2.End-Users, 3.Technology, and 4. Policy.**

This will be achieved by defining sustainable business models that support the cooperation across transport stakeholders, understanding user needs and choices, implementing the required technological infrastructure (a MaaS mobility hub) and identifying the enabling policy and regulatory frameworks. The project will provide quantifiable evidence about MaaS costs and benefits in 3 real-life, complementary pilot cases, demonstrating the concept in urban, intercity and cross-border trips at 3 EU areas (UK-Greater Manchester, LUX-DE, HU-Budapest). The consortium disposes all necessary competences and has been formed to be able to handle all tasks involved in the project, consisting of 17 partners from 9 countries, among them leading industries, renowned research institutions, transport authorities and operators, consultants and one ministry of transport.

Denmark

New Mobility[25], Copenhagen area

New Mobility offers residents of Krusågade, Copenhagen and Henrik Ibsen’s Road, Frederiksberg the opportunity to test mobility packages that can provide the benefits of a car without needing to own a car. Mobility Pack aims to cover all the transport needs of a person or family with moderate car consumption via transport services including city bikes (bycykler), city cars (bybiler), carsharing (delebiler), car rentals (lejebiler) and public transport. Via the mobility package, one can try the latest e-bikes and electric vehicles, and have the freedom to choose between modes.

[25] https://www.nymobilitet.dk/

During the trial period (April 1 - June 30, 2017), there is access to the following discounts:

- Twice as many minutes in a city bike subscription (300 min. per month instead of 140 min.).
- Free subscription + free minutes with DriveNow (30 free min./mon.) and Green Mobility (60 free min. total).
- 56% off regular LetsGo shared cars or a 20% discount on the + cars. In addition you get the 1st month free and 100 DKK in credit that you can use for payment or consumption of vehicles.
- 50% discount on the “small” and 60% discount on the “large” monthly subscription with Hertz cars. 1 month free.
- Advantageous rates on car hire from Europcar.
- 15% discount on car hire from Sixt, and access to special rates for members of Green Mobility.
- A voucher for 100 DKK for car hire with GoMore
- For the first 20 car owners who choose to store their car during the trial: A Flex travel card with a pre-paid balance of up to 2520 DKK corresponding to commuting to work in 3 zones for 3 months, which can be used freely during the test period. (One’s car is stored in secure conditions in covered parking.)

The project is run by Frederiksberg municipality (kommune), Copenhagen municipality, Copenhagen Region (Region Hovedstaden), BMW group in cooperation with DriveNow, GoMore, Sixt, Hertz carsharing (delebilen), Copenhagen public transport, City Bikes (Bycyklen), GreenMobility, letsgo, Europcar, Movia, as well as Vesterbro Local Committee (Vesterbrolokaludvalg) and e-on.

Belgium

People owning a car are often not aware of the accompanying travel costs. Touring, a Belgian car users association, will introduce a Mobility as a Service (MaaS) package as a transport broker in the city of Ghent (Belgium). Via a smartphone application, users *are provided* easy access to several sustainable public and private transport modes such as shared bicycles, public transport, shared cars, and taxis. This pilot project is the first MaaS-project conducted in Belgium. The project will be launched in April 2017 and ends in June 2017. During this three-month field operation approximately 75 participants will test the new transport service for daily travel. According to their car dependency they receive a mobility budget of €150 (low dependency), €250 (average dependency) or €350 (high dependency). The data will be collected from the data logs of the application combined with online questionnaires and a travel diary included in the application. The aim of this research is to analyse whether a change in travel behaviour is noticeable and to discover what the incentives are for car users to adopt or not? The outcomes of this project will also be useful for policymakers who want to evaluate the impact of a mobility budget on people’s travel patterns in order to reduce car ownership and car use. Thank you to the project for providing this information.

Sweden

Samtrafiken is a Swedishn interest organisation owned by 38 transport companies and their primary mission is to make collective transport simpler, more accessible, and more reliable. They currently have several projects that could be important enablers for MaaS in Sweden. The “white paper” project promotes a future mobility in which all modes are used in

combination independent of if they are classified as “public transport” or not. The white paper focuses on coordinating technologies and business models. The “ticketing and payment” project addresses standards and interfaces within the ticket systems various components. The goal is to create the conditions for integrating different actors’ systems and make it easy for travellers to purchase tickets. And the “SiS technology” project on coordinated information systems aims to make it easy for the traveler to find, book, pay, and execute her/his public transport trip no matter the type of public transport (scheduled, on-demand, or a combination), including supporting transfers and disruptions. Their most recent initiative, the Swedish Mobility Program, will attempt to establish a national integration platform. The aim is to enable and promote combined mobility services on a large scale, and third party sales in general by making PTA and PTO services available via a national access point and ensure a common regulatory framework. The starting point is PTA services in the Gothenburg area in 2017/18, then Stockholm and Malmö etc. 2018/19. Samtrafiken wants to see new combined mobility services and sales channels emerge in Sweden, and they are searching for a technical supplier/partner and selling partners.

The Drive Sweden[26] innovation program started in the spring of 2015. It is funded by the Swedish Energy Agency, the Swedish Research Council Formas, and Sweden’s Innovation Agency Vinnova. It aims to take advantage of the possibilities and the challenges that can arise from a future automated transport system. The work stream “Systems and services for mobility” aims to realize “the first steps that will lead to the following long-term goal (2022): a full-size MaaS pilot with self-driving vehicles and real-time traffic management for both, individual, shared and public transportation.”

Annex IV – Literature list

* indicates a forthcoming publication

Title	Author	Published by/ Country/ Year	Type of Source	Key topics
MaaS service combinations for different geographical areas*	Aapaoja, A., Eckhart, J., Nykänen, L., Sochor, J.	24th ITS World Congress, 2017*	Paper/Article	service combinations, geographies
Enabling intermodal urban transport through complementary services: From Flexible Mobility Services to the Shared Use Mobility Agency: Workshop 4. Developing inter-modal transport systems	Ambrosino, G., Nelson, J. D., Boero, M. & Pettinelli I.	Research in Transportation Economics Vol. 59, pp. 179–184, 2016	Paper/Article	Flexible Transport Services, Sharing mobility service, Public transport management, Innovative business model, Intelligent transport systems
A proven business model for combined mobility	Arby, Hans	Go:Smart Project, Sweden, 2015	Paper/Article	MaaS ecosystem, MaaS business models, Integration of MaaS, Customisation
Journeys of the Future - Introducing Mobility as a Service	Burrows, Alex	AtkinsMobility, UK, 2015	Report	MaaS concept planning
HERMES, Healthy, Safe and Ecological Road Transport, Mobility and Energy use for better Sustainability in Finland with ITS-Intelligent Transportation Systems	Czako, Josef A.	Ministry of Transport and Communication (MINTC) Finland, and Moving Forward Consulting, Germany, 2016	Report	MaaS , Impacts, SWOT, Policy recommendations, Mobility pricing, Freight & logistics innovations
Developing Intelligent Mobility and exploring Mobility as a Service	Datson, James	Atkins, support to WMITA, UK, 2016	Report	MaaS concept planning, ingration, requirements
MOBILITY AS A SERVICE - EXPLORING THE OPPORTUNITY FOR MOBILITY AS A SERVICE IN THE UK	Datson, James, et al.	Transport Systems Catapult, UK, 2016	Report	MaaS concept planning, Integration of MaaS
Mobility as a Service - Emerging Technology-	De Santis, Michael	Lynx Technologies Inc., 2014	Other	MaaS concept planning

Enabled Trends in Transportation				
myCicero multiservice platform: towards Mobility as a Service paradigm	Di Pasquale, Guido	Viajeo PLUS City Showcase, Singapore, 2015	Other	Journey planning, Ticketing and Parking
Mobility as a Service business and operator models*	Eckhart, J., Aapaoja, A., Nykänen, L., Sochor, J.	12th ITS European Congress, 2017*	Paper/Article	business and operator models
Zusammenfassung des Praxisdialogs „Mobil in ländlichen Räumen“	Eich, Yvonne; et al.	Demografie-Portal, Germany, 2014	Paper/Article	Sharing Economy
Mobility-as-a-Service: from the Helsinki experiment to a European model?	Finger, Matthias; Bert, Nadia; Kupfer, David	Florence School of Regulation- Transport Area, Italy, 2015	Report	MaaS Ecosystem
Dienstleistungen in der Zukunftsverantwortung	Ganz, Walter; Hilbert, Josef; Bienzeisler, Bernd; Kluska, Denise	Friedrich Ebert Stiftung, Germany, 2011	Report	Impacts on society and economics
Gami ed application concept to advance Mobility as a Service	Haavisto, Mikko; Karjalainen, Topi; Kurki, Marleena; Le, Hien	Aalto University , Finland, 2015	Report	MaaS app concept
An Integrated Perspective on the Future of Mobility	Hannon, E., McKerracher, C., Orlandi, I. & Ramkumar, S.	McKinsey & Company and Bloomberg New Energy Finance, 2016	Report	Vision, Uptake, Cross-sector effects
Mobility as a Service, Enhancing End to End Journeys and the Internet of Things Networking Event	Hazel, George; OBE, On behalf of Scottish Enterprise	Scottish Enterprise, UK, 2015	Other	MaaS concept planning
Mobility as a Service – A Proposal for Action for the Public Administration	Heikkilä, Sonja	Aalto University, Finland, 2014	Thesis	MaaS Ecosystem, Roles of the public and private sectors
‘Mobility-as-a-Service’ – the new transport model?	Hietanen, Sampo	ITS Finland, 2015	Paper/Article	MaaS concept planning, Integration of MaaS, Roles of the public and private sectors
MOBILITY AS A SERVICE- Describing the framework MAAS	Holmberg, Per-Erik; Collado, Magda; Sarasini, Steven; Williander, Mats	Viktoria Swedish ICT, Sweden, 2016	Report	MaaS Ecosystem
International Experiences on Public Transport Provision in Rural Areas	International Transport Forum	International Transport Forum, OECD countries, 2015	Report	Seamless travelling

App-Based Ride and Taxi Services	International Transport Forum	International Transport Forum, OECD countries, 2016	Report	Sharing Economy
Urban Mobility System Upgrade - How shared self-driving cars could change city traffic	International Transport Forum	International Transport Forum, OECD countries, 2015	Report	Sharing Economy
MaaS Services and Business Opportunities	Kallio, Jukka; Tinnilä, Markku; Raulas, Mika	Research reports of the Finnish Transport Agency, Finland, 2015	Report	MaaS ecosystem, Market development, Business models, Sharing services
The Mobility-as-a-Service Business Ecosystem	Kamargianni, M. and Matyas, M.	96th Annual Meeting of the Transportation Research Board, 2017	Paper/Article	MaaS ecosystem
A Comprehensive Review of "Mobility as a Service" Systems	Kamargianni, Maria; Li, Weibo; Matyas, Melinda	UCL Energy Institute, University College London, UK, 2015	Paper/Article	MaaS concept planning, Integration of MaaS,
A Critical Review of New Mobility Services for Urban Transport	Kamargianni, Maria; Li, Weibo; Matyas, Melinda; Schäfer, Andreas	Transportation Research Procedia Vol. 14, Pp. 3294-3303, 2016	Paper/Article	Mobility as a Service; new mobility concepts; mobility integration; index
Feasibility Study for Mobility as a Service concept in London	Kamargianni, Maria; Matyas, Melinda; Li, Weibo; Prof. Schäfer, Andreas	Department for Transport London, UK, 2015	Report	MaaS ecosystem
Developing the 'Service' in Mobility as a Service: Experiences from a Field Trial of an Innovative Travel Brokerage	Karlsson, I.C. MariAnne, Jana Sochor, & Helena Strömberg	Chalmers University, Sweden, 2016 (Transportation Research Procedia, Vol. 14)	Paper/Article	MaaS concept planning, MaaS integration
Konsekvenser av Mobility as a Service: Jämförelse av alternativa scenarier för implementering av nya mobilitetstjänter (förstudie) (in Swedish)	Kerttu, J., Smidfelt Rosqvist, L., Wendle, B.	Trivector, 2016.	Report	implementation scenarios
Towards Seamless Mobility: Individual Mobility Profiles to Ease the Use of Shared Vehicles	Kuemmerling, M., Heilmann, C. & Meixner, G.	IFAC Proceedings Volumes, Vol. 46, Issue 15, Pp 450-454,2013	Paper/Article	Adaptive Systems, Mobility, Profiles, Personalization, Human-Machine-Interaction, User Modeling

State-of-the-art survey on stakeholders' expectations for Mobility-as-a-Service (MaaS) - highlights from Europe	König, David; Sochor, Jana; Eckhardt, Jenni	MAASiFiE project, Sweden/Finland/Austria, 2016 (Proceedings of the 11th ITS European Congress)	Paper/Article	MaaS vision, Stakeholder expecations
State-of-the-art survey on stakeholders' expectations for Mobility-as-a-Service (MaaS)	König, David; Sochor, Jana; Eckhardt, Jenni ; Böhm, Martin	MAASiFiE project, Sweden/Finland/Austria, 2016 (Proceedings of the 23rd ITS World Congress)	Paper/Article	MaaS vision, Stakeholder expecations
LOGISTICS TREND RADAR	Kückelhaus, Markus; DHL Trend Research	DHL Trend Research, Germany, 2014	Report	Logistics, Freight Transport, Integration of MaaS
The Future of Urban Mobility	Lerner, Wilhelm	Arthur D.Little, Germany, 2011	Report	MaaS concept planning, Integration of MaaS
Digitalisation of Finland's transport sector	Leviäkangas, P.	Technology in Society Vol. 47, Pp. 1–15, 2016	Paper/Article	Digitalisation, Transport sector, PESTEL
Yhteiskunnan korvaamien kuljetusten tehostaminen – esiselvitys Pirkanmaan alueella	Liimatainen, Heikki; Pasi Metsäpuro, Lasse Nykänen	Transport Research Centre Verne Tampere University of Technology, Finland, 2015	Report	Society subsidized transport rationalization
Liikkumisen palveluistamiseen (MaaS) tarvittavan digitaalisen datan inventaario kasvukäytävällä	Luoma, Arto; Ylisiurunen, Kimmo	Regional Council of Häme, Finland, 2015	Report	Digital data, Information resources and services
VAO (Traffic Information Austria)	Mayr, Stefan	ARGE ÖVV, Austria, 2014	Business Models	Journey planning , Seamless , Roles of the public and private sectors
EDITS (European Digital Traffic Infrastructure Network For Intelligent Transport Systems	Menzel, Gerhard; Böhm, Martin	AustriaTech, Austria, 2013	Report	Journey planning , Seamless travelling
Institutional conditions for integrated mobility services (IMS). Towards a framework for analysis. K2 Working paper 2016:16.	Mukthar-Landgren, D., Karlsson, M., Koglin, T., Kronsell, A., Lund, E., Sarasini, S., Sochor, J. & Wendle, B.	K2 Swedish Knowledge Center for Public Transport, 2016	Paper/Article	barriers and enablers, levels, analytical framework

WHITE PAPER Mobility as a Service – Finnish Transport Revolution	Mynttinen, Sami; Kulmala, Risto; Manninen, Ari-Pekka	Forthcoming	Report	MaaS vision, Transport policy
The impact of Mobility as a Service concept to land use	Rantasila, Karri	Aalto University, Finland, 2015	Thesis	Impacts to land use
HANNOVERmobil geht in die zweite Runde: Lessons learned und neue Ansätze für die Weiterentwicklung	Röhrleef, Martin	Hannoversche Verkehrsbetriebe AG, Germany, 2014	Paper/Article	MaaS concept planning
Pyöräily palveluistuvassa liikennejärjestelmässä	Salermo, Marek; Hublin, Patrick; Aalto-Setälä, Niklas; Suomela, Helena; Hämäläinen, Timo; Antikainen, Janne	Research reports of the Finnish Transport Agency, Finland, 2016	Report	Integration of MaaS, MaaS concept planning, Other
Carsharing Wien – Evaluierung	Schuster, Markus; Steinacher, Irene; Tomschy, Rupert	MA18-Stadtentwicklung und Stadtplanung, Austria, 2015	Report	Sharing Economy
Shared Mobility: Definitions, Industry developments and Early understanding	Shaheen, S., Chan, N., Bansal, A. & Cohen, A.	TSRC, UC Berkeley, A sustainability & technology workshop, 2015	Report/whit e paper	Sharing economy
Shared mobility and the transformation of public transit	Shared Use Mobility Center	TRB, TCRP 2016	Report	Sharing, Ownership, Equity, Collaboration, PPP
The first MaaS services on our journey towards MaaS vision	Sintonen, Jouni	TeliaSonera, Finland, 2015	Report	MaaS concept planning, Integration of MaaS
Mobility as a Service: Implications for future mainstream public transport	Smith, G., Sochor, J., Karlsson, I.C.M.	15th International Conference on Competition and Ownership in Land Passenger Transport (Thredbo 15), 2017 (forthcoming)	Paper/Article	implications for public transport
Procuring Mobility as a Service: Exploring dialogues with potential bidders in West Sweden*	Smith, G., Sochor, J., Karlsson, I.C.M.	24th ITS World Congress, 2017*	Paper/Article	procurement, stakeholder perspectives
Future Needs and Visions for Mobility as a Service: Insights from European Workshops	Sochor, Jana; Eckhardt, Jenni; König, David; Karlsson, I.C. MariAnne	MAASiFiE project, Sweden/Finland/Austri a, 2016 (Proceedings of the 23rd ITS World Congress)	Paper/Article	MaaS vision

The topology of Mobility as a Service: A tool for understanding effects on business and society, user behaviour, and technological requirements*	Sochor, J., Arby, H., Karlsson, I.C.M.	24th ITS World Congress, 2017*	Paper/Article	topology of different types of MaaS, implications
Trying Out Mobility as a Service: Experiences from a Field Trial and Implications for Understanding Demand	Sochor, Jana; Karlsson, I.C. MariAnne; Strömberg, Helena	Chalmers University, Sweden, 2016 (Transportation Research Record: Journal of the Transportation Research Board, No. 2542)	Paper/Article	Impacts of MaaS, MaaS concept planning, MaaS integration
More Than the Sum of Its Parts? The Finnish Public's Perspectives on Mobility-as-a-Service and ITS	Sochor, J. & Sarasini, S.	12th ITS European Congress, 2017	Paper/Article	stakeholder (user) perspectives
UBIGO: TRAVELERS' MOTIVES FOR ADOPTING A NEW, INNOVATIVE develoTRAVEL SERVICE: INSIGHTS FROM THE UBIGO FIELD OPERATIONAL TEST IN GOTHENBURG, SWEDEN	Sochor, Jana; Strömberg, Helena; Karlsson, I.C. MariAnne	Chalmers University, Sweden, 2014 (Proceedings of the 21st ITS World Congress)	Paper/Article	Integration of MaaS, MaaS concept planning, Other
An innovative mobility service to facilitate changes in travel behavior and mode choice	Sochor, Jana; Strömberg, Helena; Karlsson, I.C. MariAnne	Chalmers University, Sweden, 2015 (Proceedings of the 22nd ITS World Congress)	Paper/Article	MaaS concept planning, Integration of MaaS, Customisation
The Added Value of a New, Innovative Travel Service: Insights from the UbiGo Field Operational Test in Gothenburg, Sweden	Sochor, Jana; Strömberg, Helena; Karlsson, I.C. MariAnne	Chalmers University, Sweden, 2015 (Internet of Things Infrastructures, IoT 2014, LNICST 151)	Paper/Article	MaaS concept planning, MaaS integration
Implementing Mobility as a Service: Challenges in Integrating User, Commercial, and Societal Perspectives	Sochor, Jana; Strömberg, Helena; Karlsson, I.C. MariAnne	Chalmers University, Sweden, 2015 (Transportation Research Record: Journal of the Transportation Research Board, No. 2536)	Paper/Article	MaaS concept planning, Integration of MaaS, Other
The Impact of New Mobility Services on the Automotive Industry	Spulber, A., Dennis, P.E., Schultz, M. & Richard, W.	Center for Automotive Research, 2016	Report	Trends, Implications

Fachkonzept mobilität miteinander mobil	Stadtentwicklung Wien	Stadtentwicklung Wien, Austria, 2014	Report	MaaS concept planning
Trying on change – Trialability as a change moderator for sustainable travel behaviour	Strömberg, Helena; Oskar Rexfelt, I.C. MariAnne Karlsson, Jana Sochor	elsevier.com (Travel Behavior & Society), Sweden, 2015	Paper/Article	MaaS concept planning, Integration of MaaS, MaaS deployment guide
Raportti: Liikkuminen palveluna – esiselvitys	Tampereen Yliopisto; Mattersoft	Tampereen Yliopisto, Mattersoft, Finland, 2015	Report	MaaS state-of-the-art, Architecture
Private mobility, public interest – how public agencies can work with emerging mobility providers	TransitCenter	TransitCenter 2016	Report	Planning, Collaboration, Roles, PPP
Car Club Parking, Carplus good practice guidance	Transport for London and Transport Scotland	Transport for London and Transport Scotland, UK, 2014	Report	Sharing Economy
Between Public and Private Mobility: Examining the Rise of Technology-Enabled Transportation Services	TRANSPORTATION RESEARCH BOARD 2016 COMMITTEE	TRB Special Reports, USA, 2016	Report	MaaS integration, Digitalisation, New mobility planning concepts
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