MAASiFiE

Business and operator models for MaaS

Deliverable Nr 3

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VTT Technical Research Centre of Finland Ltd.

AustriaTech

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MAASiFiE

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Executive summary

The transnational research programme “Call 2014: Mobility and ITS” was launched by the Conference of European Directors of Roads (CEDR). Funded within that program, 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. Megatrends like changing demographics in terms of population growth, ageing of population, new population requirements of millennials, and ICT technology transformation, play a major role enabling the evolvement of new mobility services.

Mobility service concepts are changing in the direction of combining and implementing new business models, enabling the development of innovative services and products in mobility markets. With this respect, Deliverable 3 as part of Work Package (WP) 3 of the MAASiFiE project concentrates on the identification of new business and operator models providing an insight into the new transport paradigm of Mobility-as-a-Service (MaaS). Based on a state-of-the-art survey covering interviews with experts, an online questionnaire, case examples of MaaS services and a literature review, a more thorough understanding of how transport-related stakeholders perceive and interact with the topic of MaaS is gained. Thus, an elaboration of responsibilities/roles, business models, related value chains and operator models in the context of MaaS is enabled and results are provided in this document. As a common point of reference, the consortium has agreed upon the following definition of MaaS: Multimodal and sustainable mobility services addressing customers' transport needs by integrating planning and payment on a one-stop-shop principle.

Mobility services are expected to increase the use of public transport and ride sharing and to provide the means for rationalising passenger transport and wherever possible freight transport as well as identified by the state-of-the-art survey within Deliverable 3. In addition, available freight transport and logistic operations are analysed wherever similar characteristics to MaaS-related passenger applications are identified. Overall, the state-of-the-art survey results focusing on international MaaS concepts have shown that there currently exist various smaller MaaS-pilots covering different geographical service areas, including for instance city, rural and/or regional areas. Very few larger MaaS services have been established with a wider geographical coverage, including national and international service coverage. Based on different MaaS service areas, different aims and requirements for implementing MaaS concepts arise. While for instance, urban areas focus largely on the reduction of private car usage, congestion and transport-related emissions, rural areas aim at promoting higher efficiency and utilization rates by emphasizing demand driven transport services. National and international MaaS services focus rather on providing combined all-in-one packages including for instance long-haul transport, accommodation, event and booking services.

Identified value chains of MaaS services illustrate changes of roles and responsibilities in the organisation of transport of people and goods. In this respect, changes in value networks and related organisational requirements are derived and applied to show different combinations of MaaS services. Basically four MaaS operator models were identified: Reseller, Integrator, Public transport operator and PPP models. Based on service combination characteristics, it could be concluded that the commercial Reseller model may best fit travel agencies and therefore national and international traveling. The Public transport (PT) operator model could be mainly used in cities, where comprehensive PT already exists. The PPP model may be preferred for rural areas, as public actors have an interest in increasing efficiency of subsidized transportation. The commercial Integrator model would probably fit well in both urban and suburban areas and national/international MaaS; thus it could be considered the most versatile and flexible model. However, as MaaS is continuously developing, and can be implemented in various ways, the presented models and categorizations should be read and interpreted as a current understanding of an emerging phenomenon.

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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, D3 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 in 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.

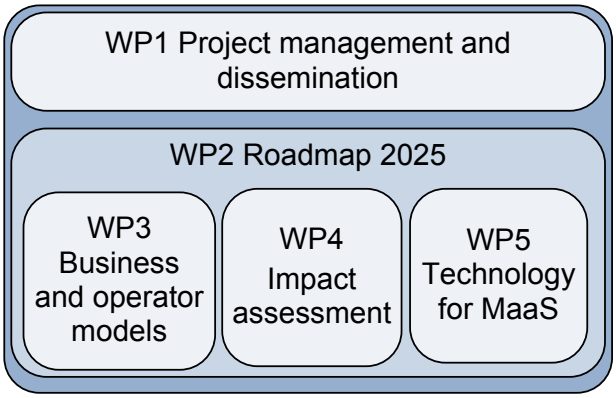

Figure 1: MAASiFiE Work Package structure.

1.2 Overview of WP3 activities

Deliverable 3 comprises all WP3 related task-results and activities, which are described in the work plan, covering the state-of-the-art survey on MaaS, value chain findings, analysis of roles/responsibilities within MaaS and presenting possible MaaS service concepts. Figure 2 gives an overview of how activities are processed.

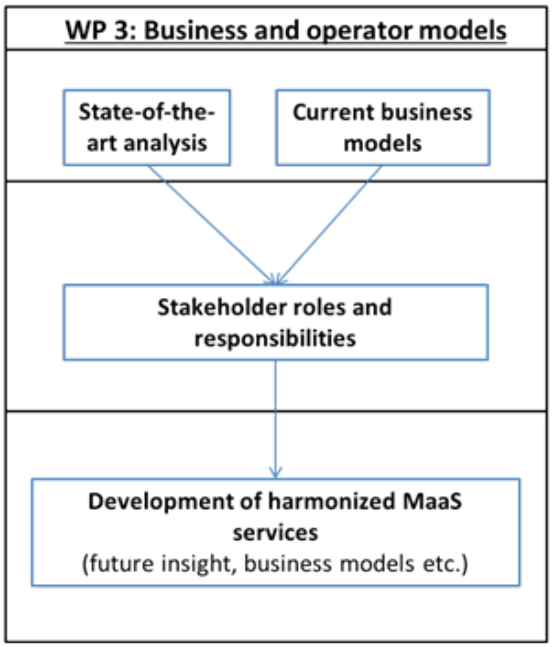

Figure 2: Overview of WP3 activities

In the first stage, different stakeholder perspectives found within the state-of-the-art survey together with available analysed MaaS business models (referred to task 3.1) served as the main bases for elaborating different MaaS service combinations. In this case several sources, like a literature review, results of interviews with experts and online state-of-the-art analyses are used in order to gain a comprehensive picture of how MaaS is currently perceived by different stakeholders. Based on this new big-picture, conceptual findings of MaaS-related deployment processes and strategies for rolling out MaaS on a large scale can be derived. All these results serve as main inputs for creating a roadmap for the development of MaaS in Europe and especially in CEDR member states (roadmap-related tasks are defined in WP2). Thus increasing the NRAs' understanding on how to implement MaaS on a large-scale is able to be achieved.

As a result different combinations of MaaS service concepts are presented and further implementation requirements discussed. In the final part of this document, feasible and possible MaaS service combinations are presented. State-of-the-art survey results, together with analysed MaaS operator models and respective elaborated value chains have contributed to set up those different MaaS service combinations. In order to understand coherent roles/responsibilities being integrated in MaaS concepts, value chain observations provide insights into organisational requirements for MaaS operator models. The main research focus was on available MaaS services being provided in Finland, Sweden and Austria. In particular, MaaS services/pilot projects like UbiGo in Sweden, Telia Company MaaS service in Finland and SMILE MaaS project in Austria together with associated services and applications are elaborated in more detail. In comparison, other European and International MaaS service examples are shown. Persons from and/or representing the following organisations were interviewed and thus contributed essentially with their perspectives on MaaS concepts:

- ASFINAG, Austrian national road operator
- ÖBB, Austrian national railway operator
- DLR, German Aerospace Center
- E-Mobility, Regional Austrian agency for mobility issues
- Telia Company AB (publ)
- Sito Liikkumispalvelut Oy
- IQ Payments Oy
- VR-Yhtymä Oy (Finnish Railways)
- Suomen Taksiliitto (The Finnish Taxi Owners Federation)
- Tuup Oy
- MaaS Global Oy
- Tieto Oyj
- Siemens Osakeyhtiö
- Mobisoft Oy
- Forum Virium Helsinki Oy
- Finnish Transport Agency
- Finnish Transport Safety Agency (Trafi)
- Ministry of Transport and Communications
- SNCF (French Railways)
- Gothenburg University, Sweden (Professor)
- Region of Västra Götaland, Sweden
- Samtrafiken, Sweden
- Sunfleet carsharing, Sweden
- Trafikkontoret, City of Gothenburg, Sweden
- Trivector consulting, Sweden
- UbiGo Innovation, Sweden

- Victoria Swedish ICT (research institute), Sweden
- Vinnova, Sweden's Innovation Agency
- Västtrafik public transport, Sweden
- ÅF consulting, Sweden (consultant formerly at Hertz car rentals)

The responsibilities for contributing this deliverable were:

- Chapter 1: VTT (Jenni Eckhardt) for 1.1, and AustriaTech (ATE) (David König) for 1.2
- Chapter 2: all authors
- Chapter 3: ATE (David König) and Chalmers (Jana Sochor and MariAnne Karlsson), all of whom developed the survey
- Chapter 4: VTT (Jenni Eckhardt, Aki Aapaoja) for Finnish cases, French cases and American 511 case. Chalmers (Jana Sochor) for Swedish cases and American cases. ATE (David König) for the rest of the cases.
- Chapter 5: VTT (Jenni Eckhardt, Aki Aapaoja) for Finnish cases, Chalmers (Jana Sochor) for the Swedish case and ATE (David König) for Austrian cases.
- Chapter 6: VTT (Aki Aapaoja, Jenni Eckhardt), Chalmers (Jana Sochor) and ATE (David König) for 6.1. ATE (David König) for 6.2 and 6.4, VTT (Aki Aapaoja) for 6.3, and Chalmers (Jana Sochor) for 6.5.
- Chapter 7: VTT (Aki Aapaoja, Jenni Eckhardt) for 7.1, ATE (David König) and Chalmers (Jana Sochor) for 7.2, and VTT (Jenni Eckhardt), ATE (David König) and Chalmers (Jana Sochor) for 7.3.
- Chapter 8: VTT (Jenni Eckhardt, Aki Aapaoja)
- Chapter 9: VTT (Jenni Eckhardt, Aki Aapaoja), ATE (David König) and Chalmers (Jana Sochor)

2. Introduction to Mobility-as-a-Service (MaaS)

From a global perspective, demand for travel and transport is steadily increasing. Urban areas in particular are already facing capacity bottlenecks in terms of infrastructural and financial resources together with increasing transport emissions causing air quality problems, all of which necessitate improved planning and innovative mobility solutions in order to overcome those bottlenecks and provide a more efficient transport system. As infrastructural measures mostly entail high investment costs to be covered by the public sector, planning measures delivering more efficient and sustainable 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; it provides a new way of thinking in terms of how the delivery and consumption of transport (or mobility) is managed. In order to have a common starting point within the project group, it was important to find a common definition for MaaS, describing all important MaaS facets relevant for determining the main research scopes. 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 on planning and concepts of MaaS systems. 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* (1). In this respect, a strong focus is placed on the integration of different transport modes with the aim to bring people to use more alternative transport modes instead of only using their own private cars. Further, available ICT technology and related infrastructure are seen as major preconditions as well, providing new mobility service concepts to the respective end-users. More details on technological requirements will be provided in WP 5.

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."* (2)

With these definitions and documented stakeholder viewpoints towards MaaS as input, the MAASiFiE project consortium formulated the following definition for MaaS to be used throughout the project: *"**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).*

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.

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 (3), 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.

2.2 Definition of MaaS service components

As MaaS is strongly triggered by on-going and worldwide societal, technological and economic trends 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.

Shared mobility as an integrated part of MaaS

The sharing economy is recognised as a global phenomenon enabling new means of connecting people to share opportunities and markets. The term 'sharing economy' refers to a market situation in which people share among them items and use of different services. In contrast to owning all required equipment (like vehicles, flats or commodities) by oneself, the sharing economy is gaining more attention and acceptance as people increasingly demand to omit maintenance, storage, insurance and/or high operating costs. As far as the transport sector is concerned, the sharing economy appears, especially in urban passenger transportation, in the form of carsharing, carpooling, ride sharing and bike sharing. In MAASiFiE, all sharing opportunities applied to the transport sector are summarized 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) (4). Nevertheless there exist other publicly organised business models as well supporting the deployment of MaaS.

By implementing shared mobility, the following main, direct effects are expected according to the literature findings and stakeholder assessments: reduce the number of private cars on the road network, and by that reduce the total number of daily private car trips by promoting alternative options like carpooling; reduce the number of 'second car'-households and enable a seamless transition from individual to public transport without needing to own a private car.

As described in the other main components of MaaS service concepts (Booking/Ticketing and Multimodal traveller information) as well, ICT technology can facilitate an easier access to shared mobility, especially by the provision of smartphone or web-based applications. Some sharing concepts integrate already booking, reservation and payment of vehicle 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. There are no other obligations or responsibilities. 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 for 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. (5)
- 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 the requirement of 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 integrated part of MaaS
Based on discussion results, the project consortium decided to include under the umbrella term 'Ticketing' the following service features: Reservation, booking, combined billing and payment. In most cases different modes of transport provide different pricing schemes for tickets, therefore a combined ticketing might already ease the access of different modes of transport.

The Urban ITS (Intelligent Transport Systems) group representing a group of European local authorities and partners initiated by the European Commission focusing on the guidance on deployment of urban key applications on ITS, has used the term 'Smart Ticketing' within the discipline of Intelligent Transport Systems (ITS). Ticketing though is not necessarily about having one ticket for the own journey but having one 'wallet' for several tickets (6). By creating a link between Travel Information, Journey Planning, Payment and Smart Ticketing the customer experience consistently meets their highest expectations, which can foster co-modality and intermodality. Interoperability in transport Ticketing implies removing the obstacles for the customer to combine modes in one trip. In this respect, Ticketing could contribute to the overall improvement of the transport network level of services, image, accessibility, with the main aim to facilitate and/or increase the use of alternative transport and so contribute to the overall political goal of developing a sustainable transport policy.

Ticketing as a MaaS component especially requires integration with other MaaS service components in order to be effective. Ticketing is just one step in the 'Customer Travel Experience' within MaaS concepts. From the initial Journey Planning through 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 credit cards, debits, etc.) (6). In this respect annual/seasonal/monthly cards, one-way ticket solutions and reservation services are under the same umbrella term of 'Ticketing'.

Multimodal traveller information (journey planning) as an integrated part of MaaS
With the evolvement of ICT technologies (web- and app-based), individualised transport information provided by integrated and multimodal traveller information services is an important factor for seamless door-to-door mobility integration. Providing travellers with accurate and multimodal information before and during the journey is not just aiming at providing benefits like reduced transport costs to individuals, there is also possibility to enable more efficient transport network operations. The 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 (7).

There already exist different locally and/or nationally available traveller information services within Europe, providing travellers with real-time traffic information. However such information services still remain fragmented in what they offer. 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 of sharing facilities. In this respect the ITS Directive 2010/40/EU is fostering the connection and integration of different multimodal traveller information service on a cross-border level as well, in order to provide a harmonized and seamless routing information on the European transport network.

Multimodal traveller information is a key for the integration of different transport modes on a digital level as well as on an organisational level. Under these circumstances multimodal traveller information provides the 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. Besides this three-component model, regulatory frameworks providing strong governance structures are considered at least as important as these three components in order to pave the way towards an integrated MaaS concept.

3. MaaS state-of-the-art survey

3.1 Method

In order to gain different stakeholders' perceptions on MaaS, a state-of-the-art survey has been conducted within WP3, task 3.1 and 3.2 activities. The survey includes an online questionnaire, results of which are presented in this deliverable, stakeholder interviews, and analyses of literature and available pilot implementations. The online questionnaire targeted different types of public and private stakeholders, mostly working in the field of transportation. The questionnaire included both quantitative and open items covering: understandings and characteristics of the MaaS concept; important modes, service features, geographical areas and stakeholders for MaaS; deployment issues including enablers and obstacles; and potential positive and negative impacts. As such, the results serve as a foundation for studying MaaS implementation requirements. No specific definition of MaaS was used in the questionnaire, as the intention of the questionnaire was to gain non-primed viewpoints from the participants. The questionnaire ran from the beginning of October until mid-November, 2015, and was distributed via multiple channels covering European and national ITS communities and stakeholder platforms. Additionally flyers were distributed at the 2015 ITS World Congress in Bordeaux. In total, stakeholders from 17 countries worldwide, including 12 European countries, have completed the questionnaire. Papers presented at the 2016 ITS European Congress in Glasgow and the 2016 ITS World Congress in Melbourne present the overall questionnaire results (the Glasgow paper highlights the European stakeholders' viewpoints with the aid of diagrams). Note that due to the different numbers of responses per country, different priorities could be assessed; therefore different diagrams may include different countries.

3.2 Stakeholder participation

In total around 400 stakeholders started the online questionnaire, of which around 100 completed the whole questionnaire, 56 from Europe. Of the total number of respondents, 84 % indicated that they are working in the field of transportation in some capacity. Figure 3 shows the distribution of the organisational background of the respondents. Most stakeholders who completed the questionnaire represented either public administrations and authorities (28 %) or universities and research organisations (24 %), although other types of organisations like consultancies participated as well (19 %).

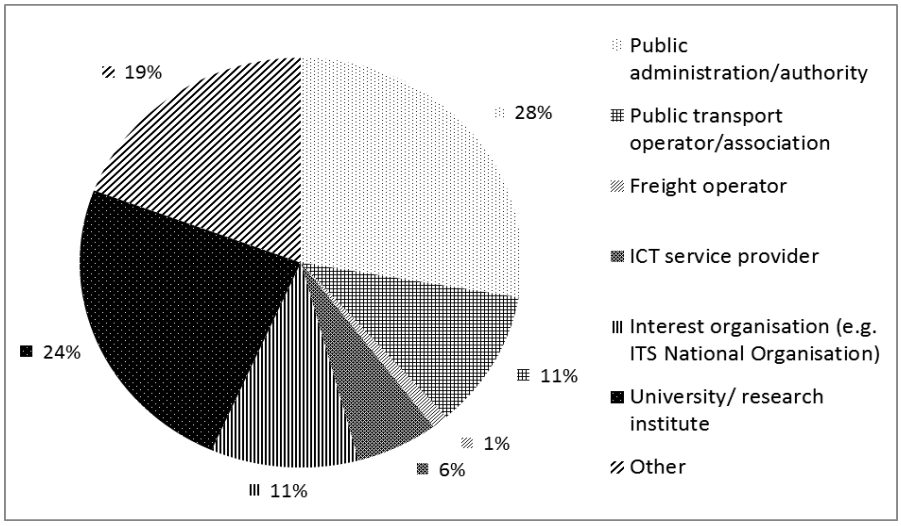

Figure 3: Organisational background of questionnaire respondents

Of the respondents, 81 % indicated that they had already heard about the concept of MaaS, and most (79 %) thought that MaaS entails a completely new concept of planning, organising and providing future mobility services (instead of representing just a new buzzword). When asked what makes MaaS a completely new concept, the following reasons were frequently mentioned: increasing digital connectivity enables integrated mobility service solutions; connecting different transport modes; reducing the number of privately owned cars; and offering customised, subscription-based services. Of those who felt that MaaS was just a new buzzword (21 % of the total), 31 % felt that MaaS is more or less the same as mobility-on-demand, 13 % the same as shared mobility, 12 % the same as seamless travel, and 19 % the same as some combination of multimodal travel, shared mobility and seamless travel.

The respondents identified several planned or implemented MaaS pilot activities and projects. In Finland there were several cities/regions identified already using or testing MaaS pilots, e.g. the Tuup application that provides different mobility options for travellers including bicycle, walk, taxi, shared car or public transport being booked over one common interface. Another Finnish pilot provided by Telia Company covers regional transport operators in a ski resort area (buses and taxis) connected to a train station and an airport. In Gothenburg, Sweden, the Go:Smart project ran a field operational test of the UbiGo service already in 2013-14, involving around 200 participants from private households. Access to public transport, bike sharing, car sharing, taxi and rental cars via a monthly household subscription significantly affected the users' mode choice, largely in a more sustainable direction, which was enabled by the low-risk trial environment (8; 15). In Austria, the VAO together with the BeamBeta pilot activity provides integrated, multimodal transport information, ticketing, sharing and booking solutions on a regional and national level.

3.3 Viewpoints regarding MaaS transport modes

A majority of respondents believed that MaaS concepts are strongly characterised by integrating regular public transport services (60 %), i.e. public transport is given the highest priority for inclusion in MaaS (Figure 4). In second place came increasing the number of commercially organised car-sharing services (~ 40 %), which was deemed to be an important measure for reducing the total number of privately owned cars. Further, there was considered a high potential for implementing on-demand public transport (~ 30 %) within MaaS. Very few respondents mentioned integrating air transport when rolling out MaaS systems.

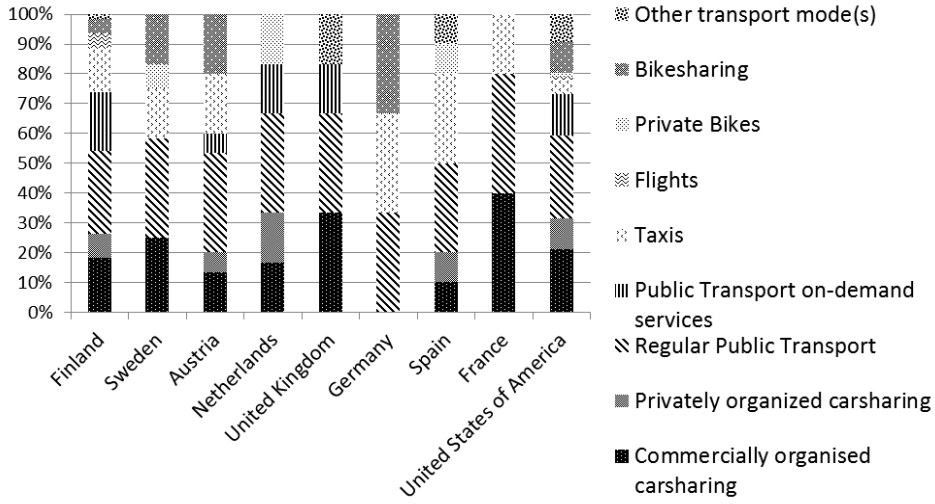

Figure 4: Relevant MaaS-related transport modes

3.4 Viewpoints regarding MaaS service features

In order to gain a common understanding on perceived implementation requirements, respondents were asked to assess the three most relevant service features to be included in MaaS concepts (Figure 5). Results showed that ticketing/payment, journey planning and customisation constitute the three main service features enabling MaaS. On average around 60 % believed that MaaS concepts have to include at least these service features facilitating easy access and providing a unique, integrated service supply over one common interface. Mainly respondents from the US considered customer service hotlines as an additional required service feature (7 %). Special offers to customers, e.g. implementing price advantages compared to common ticket pricing-schemes, and bonus systems are considered as potentially effective measures to motivate people to use MaaS.

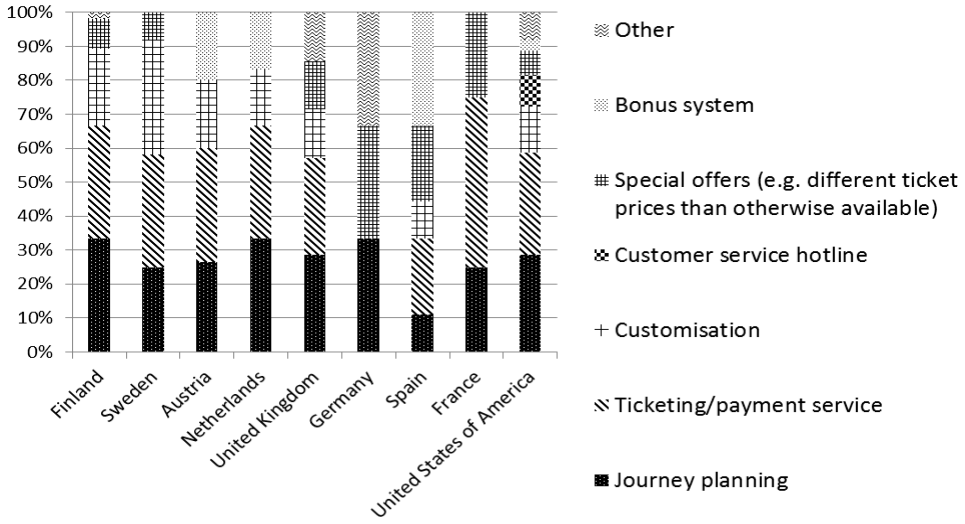

Figure 5: Relevant MaaS-related service features

3.5 Stakeholder involvement in MaaS

Based on a prioritisation of different potential roles, almost all believed that the organisation of MaaS services will be strongly triggered by public transport (PT) providers/operators,

which is in line with the prioritized transport modes in MaaS (Figure 6). Only very few (3 %) believed that PT operators are not that important to involve in MaaS. In contrast to public transport, the integration of road operators or private transport organisations such as motorist associations constituted only minor importance. One reason for this could be due to transport "silos" instead of a common, multimodal approach, to linking different means of transport. The second place, mobility service providers were seen as essential key-players.

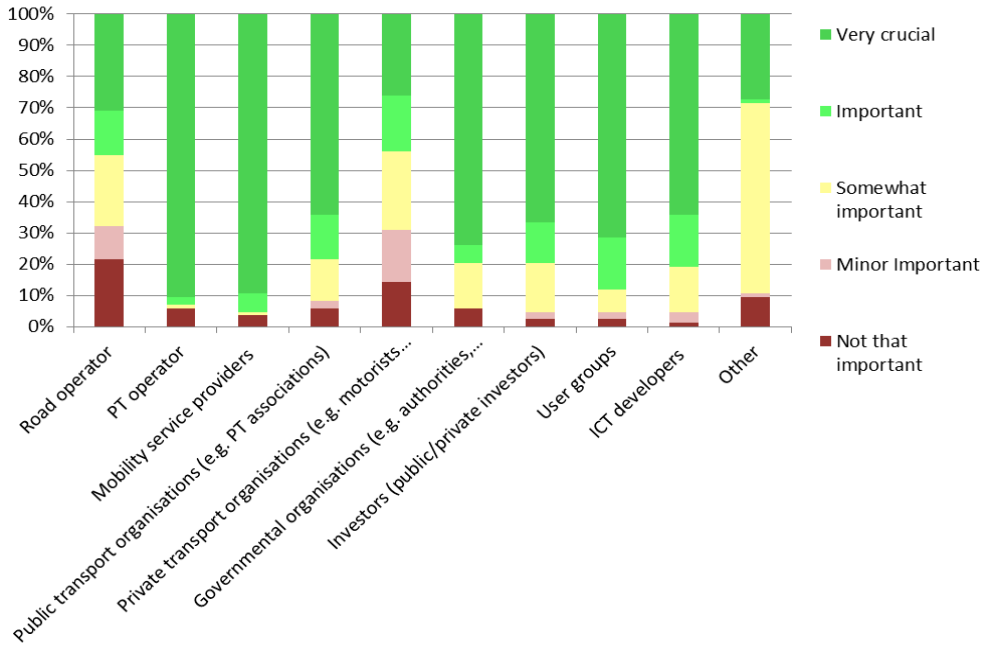

Figure 6: Assessment of stakeholders required for implementing MaaS

3.6 Spatial and temporal availability of MaaS services

Questionnaire results revealed a strong focus on implementing MaaS systems in urban and suburban areas in particular, as shown in Figure 7. More than 60 % of all respondents believed that MaaS concepts should be made available at least in urban and suburban areas. Rural areas (25 %) are still deemed to be quite challenging in terms of spatial service coverage. Nevertheless countries like Finland are working on multi-pilot MaaS deployment sites, going one step ahead and aiming at deploying MaaS on a national level and offering MaaS in both rural and urban regions (10).

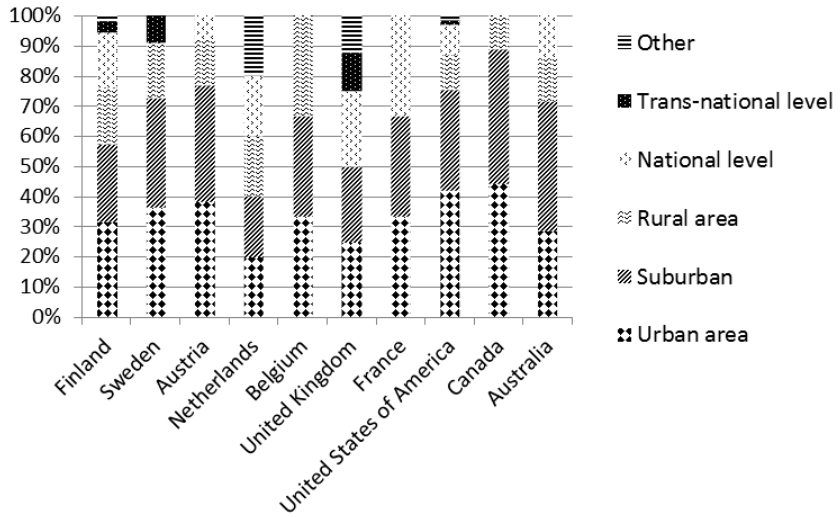

Figure 7: Assessment of spatial availability of MaaS services.

4. MaaS case studies – national and international mobility services

In addition to MaaS state-of-the-art analyses, the project consortium screened other MaaS and related services. An overview of mobility services representing MaaS case studies in different countries is shown in this chapter (while business/operator models are presented in the next chapter).

4.1 Available MaaS services in Europe and North America

The following case studies of MaaS services give an overview of different, offered service features, applied to different transport modes, covering different geographical areas. As the state-of-the-art survey has shown already, most of the MaaS and related services are provided in urban and suburban areas; only very few mobility services are provided in rural areas as well. Limited geographical coverage and transport mode integration are decisive factors establishing large-scale MaaS implementations. Only mobility services identified as going hand in hand with the definition of MaaS (related) services (see chapter 2.1) are analysed in more detail. The main information sources are interviews with experts and literature findings.

4.1.1 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, ASFINAG, the national Austrian road operator, provides real-time road network information, covering e.g. congestion or accident information. Also, real-time information on public transport and railway timetables are provided. Overall the traveller information services cover the following transport modes:

- Local public transport,
- National railways,
- High-priority road network,
- Bicycle/walking 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.

As a consequence the SMILE project has evolved to provide additional added value services like combined ticketing and a wider geographical coverage. The follow-up, known as BeamBeta respectively WienMobil-Lab, has integrated the following service features as well:

- Ticketing/Payment API's (integrated, ready-to-use smartphone application, combining different subscriptions, e.g. together with Car2Go API and Wien Mobil card API representing Vienna public transport seasonal ticket),

- Taxi information,
- E-Bike Sharing,
- Parking garage information

4.1.2 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. The goal was to test the business concept and the service looked to lessen or eliminate the need to own a (second) private car. 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).

UbiGo features and services included:

- Access to public transport, bike sharing, car sharing, taxi and rental cars
- A personalized, monthly household subscription (and single invoice), which could be modified on a monthly basis and which included the possibility to top up and roll over credit
- A customer service phone line open 24 hours per day
- Subscription access via web interface adapted to smartphones, in which users could activate tickets/trips, make/check bookings, and access already activated tickets (e.g. for validation purposes), check one's balance, bonus, and trip history, and get support (in terms of FAQ/customer service)
- a smartcard, used for instance to check out a bicycle from the bikesharing service or unlock a booked car, but also charged with extra credit for the public transport system in case there was any problem using the UbiGo service
- Compensation for not using a private vehicle during the FOT (Field-Operational-Test), i.e. to offset insurance, parking, etc. up to a fixed limit

4.1.3 Finland

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

Kutsuplus 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. The trial ran from 2012 to 2015 and the service was shut down because it was too expensive for HSL. The aim is to implement a market-driven Kutsuplus-type service.

Kutsuplus features and services included:

- Individual search and selection of trips
- Ride from (virtual) bus stop to (virtual) bus stop
- Driver's instructions in real-time

[1] http://ubigo.me/

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

- Rides can be ordered online or via SMS minimum 45 min in advance to a bus stop
- Different service classes, group discount, happy hour
- People going to the same direction can be efficiently collected in the same vehicle
- Walking route from the bus stop to the final destination will be provided on a map in the kutsuplus.fi account
- Advance payment, using the Trip Wallet, enables fast pick-up and delivery

In addition to HSL, the participants of the trial included the software developer Split Finland OY (previously known as Ajelo Oy), Aalto University and Finnish Transport Agency.

Sito: Seinäjoki

Sito is developing a MaaS service in Seinäjoki. The pilot takes place in 2016 with limited services for a test group: shared taxi and public transport (demand-responsive) rides. The aim is to have viable services in 2017. The services planned in the system include:

- Local and regional taxis
- Regional buses
- Long-haul buses to Tampere and to the airport of Vaasa
- Shared taxis/ marked-based Kutsuplus (demand-responsive)
- Car rental
- City bikes (bicycle sharing)
- Carpooling
- Car sharing
- Statutory social service transportation, i.e. legislated transport services related to schools, disabled persons, and social security
- Logistics services

Telia Company: Sonera Reissu

Reissu offers transport services in the city of Hämeenlinna for rail and (shared) taxi. Both taxi and train trips are on the same ticket, but having separate ticket IDs. Reissu is a mobile application using mobile payment and ticketing. The application is available in Apple's App Store, Google Play and Microsoft Store.

Telia Company: YlläsAround

YlläsAround is a MaaS pilot (spring 2016) in the Ylläs ski resort area in Northern Finland offering transport services in the Ylläs area and between Ylläs and Kittilä airport and Kolari railway station. The modes included in YlläsAround are buses, taxis and shared taxis, as well as their combinations. In the future, e.g. freight/parcel deliveries, meal/food deliveries and snowmobiles could be included in the service. YlläsAround is a mobile application using mobile payment and ticketing.

Turku: TUUP Mobile application

Tuup is a Finnish mobility service that provides users access to all the transportation options through one mobile application.

- The Turku Region Traffic, also known as Föli, is the first mobility service to offer purchasing via Tuup
    - Föli has been in use in Turku region since 2013
    - Föli covers the public transportation of Turku, Kaarina, Raisio, Naantali and

Lieto

- Includes some regional long-haul routes

- Purchasing of Hyvinkää public transportation tickets and Helsinki's city bikes will be available shortly
- Mobile payment is made by using PayiQ payment application and interface
  - Payment in one place, keeping and forwarding receipts and reports
- Other features of Tuup application
  - Integrated with the user's personal calendar and prepares the daily travel plan
  - Optimized according to personal preferences and behaviour
  - Reminds when it is time to leave
  - Provides alternatives when deviations occur
  - Utilizes the national Digitransit interface:
    - Journey planner (schedules, routes, fares of public transportation) across Finland
    - Real-time traffic information
  - Shows pick-up locations of rental cars and shared cars.
- Future
  - Taxi ticketing, booking and payment for a rental or shared cars will be included

MaaS Global: Whim[3]

Whim is a new MaaS application, which is currently in pilot testing and will be launched in Helsinki after summer 2016. Other intended markets include e.g. Turku and Tampere in Finland, and Tallinn in Estonia. MaaS Global, a Finnish start-up company founded in 2015, operates the service. 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, public transport and bike sharing. The application synchronizes with the user's calendar, helping to plan journeys in advance. Whim also learns about the user's preferences.

- At least three types of packages available:
  - Enterprise edition: includes a fleet of the latest rental cars for employees, predetermined number of kilometres of taxi rides
  - Monthly mobility: Unlimited use of local public transport and bike sharing with a pre-defined number of monthly taxi and rental car trips, long-distance train and value-added services.
  - Ultimate freedom: A customized package that allows traveling on any mode of transport, from every kind of public transport to local taxis and rental cars.

Related services:

- Tziip is a mobile application for carpooling/ ridesharing.
- CityCarClub[4] (http://citycarclub.fi) is a carsharing company for private persons and

[3] https://maas.global/

[4] http://citycarclub.fi

companies.

4.1.4 The Netherlands

De Verkeersonderneming/ Marketplace for mobility

In order to reduce congestion, provide travellers more choice and service, reduce journey times, improve the existing road network and to increase the carriage of goods over water, the Dutch government has implemented a common programme (called 'Better Benutten') to tackle all these issues with the aim of reducing congestion at the busiest points. 'De Verkeersonderneming' represents the implementing body for that programme. To achieve these objectives, the implementing body has agreed to use a mix of measures to be deployed.

A marketplace for mobility 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 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.

4.1.5 Germany

DB/DIMIS

The 'DB-Deutsche Bahn' (German Railways) provides an integrated car- and bikesharing mobility service concept available for subscribed train users. Thus travellers using trains are able to bridge their journey or last-mile connections with shared cars or bikes. Furthermore the DB provides (similar to other European national railway operators) a mobility platform providing 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.

Based on the expert interview results, the Fraunhofer Institute of Technology together with the DB is carrying out a project called DIMIS ('Durchgängiges Intermodales Mobilitätsinformationssystem') focusing on multimodal mobility information and provision to travellers. The main research scope is on how to fill identified information gaps between various transport modes in order to provide harmonized seamless travel chains to end-users. The project is financed by the German Federal Ministry for economics and technology (BMWI).[5]

Bayerninfo.de

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

Hannovermobil

Some other regional MaaS concepts are integrated in the urban areas of Hannover and Stuttgart. For instance 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. Currently there is still an open discussion on who will take over the leading role as mobility service integrator after the

[5] http://www.iis.fraunhofer.de/de/ff/lok/proj/dimis.html

project's lifetime. Figure 8 provides possible future business models that still need to be agreed on by participating stakeholders. With respect to the mobility service competencies, the public transport organisation 'Üstra' or the national railway organisation 'DB' are the best options for taking over the role of the MaaS integrator (in chapter 6 referred to as MaaS operator). Third parties, like the car industry and/or banking/payment industry, are also recognized as potential candidates for MaaS integration and operation in future.

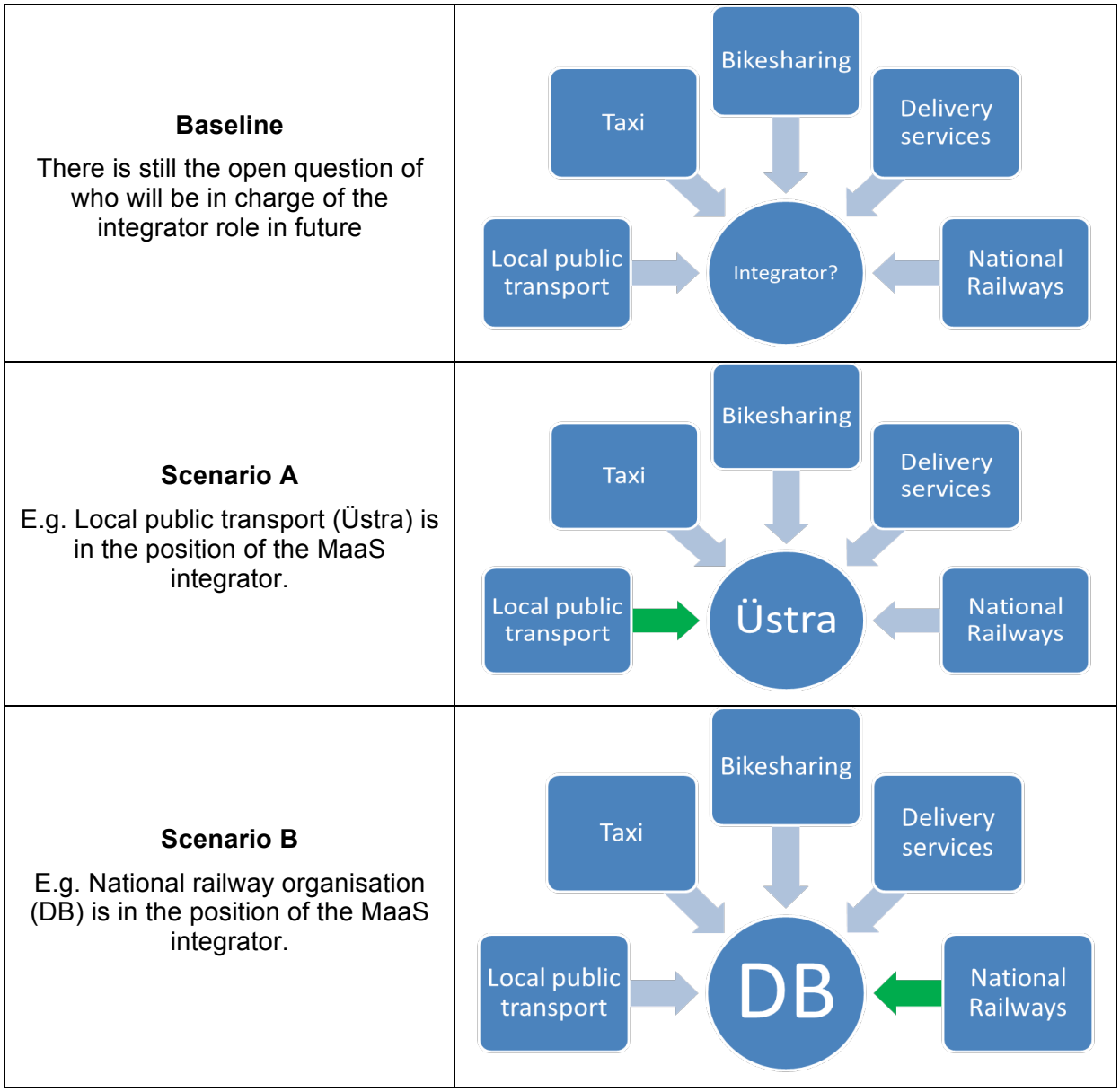

Figure 8: Potential MaaS integration models in the case of Hannover (18, amended)

In detail 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.

4.1.6 France

SNCF

SNCF is France's national state-owned railway company. SNCF has created several new multimodal services and service combinations. The aim of the development is to increase the use of trains and obtain new customers, which has been successful. The value proposition for customers is improved customer relations and integrated services.

The idea of mobility services is to offer door-to-door services and to develop first and last mile transportation. The aim is also to integrate them to global service platforms with access to all services. SNCF has several mobility initiatives:

- iDVROOM[6] is a car pooling service. Regular users have a guaranteed return journey by taxi if the driver unexpectedly cannot bring one back. iDVROOM users have also a free automatic toll badge, no management costs, and a monthly downloadable invoice.
- iDCAB[7] is a taxi or car-with-a-driver service with fixed price and advance payment. The reservation can be done in the web site iDCAB or using the iDPASS application.
- iDAVIS[8] service allows to book a rental car and train ticket simultaneously. iDAVIS gives reduced prices which vary depending on if the user has a SNCF discount or loyalty card. The service is available at over 170 railway stations in France and over 90 stations in Europe.
- iDPASS is a mobile application for door-to-door transportation planning proposing services for the first and last mile. The application is available in Apple's App Store and Google Play. The services included are[9]:
    - iDCAB (described above)
    - Wattmobile is a self-service rental service for electric vehicles: two-seater Renault Twizy and scooters. The service is 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. It is available in Paris and in few other locations, and is about to expand. The car doors can be opened by using a smartphone with the iDPASS application. The minimum rental time is one hour.
    - 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. By clicking on a parking place, the application shows the name, address and opening hours of the parking place. The application also shows the route to

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

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

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

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

the parking place.

SNCF has created several applications in order to respond to different customer expectations.

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.

TaM, Montpellier

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.

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 self-service bicycle stations and TaM parking in the city centre of Montpellier.

In addition to a regular mobility contract there are separate prices for students, elderly people and companies. The services are included in the yearly fee, except the parking in the city centre is charged according to actual rates. In addition the first hour of bicycle use is free, and the following hours are 0,50 euro per hour. The invoice is sent on monthly basis by email.

A mobile application is available in Apple's App Store and Google Play. The application also provides 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.[10]

4.1.7 Italy

MyCicero

Compared to other case study findings, myCicero goes very much in the direction of a MaaS service. MyCicero provides a traveller information platform covering international, national and local public transport and parking service features. The business model covers booking and payment of tickets 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.

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

4.1.8 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), 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[11]

The US Federal Transit Administration (FTA) is currently reviewing proposals for funding for Mobility on Demand public transportation projects. 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, part of the larger MOD research effort at FTA and the U.S. Department of Transportation, provides a venue through which integrated MOD concepts and solutions – supported through local partnerships – are demonstrated in real-world settings. FTA seeks to fund project teams to innovate, explore partnerships, develop new business models, integrate transit and MOD solutions, and investigate new, enabling technical capabilities such as integrated payment systems, decision support, and incentives for traveller choices. Project selections are expected to be announced in fall 2016.

Project100[12]

Downtown Project is launching Project 100, the code name for a complete transportation system designed to let you get rid of your car and be more connected to your neighborhood — all for less than the monthly cost of traditional car ownership. The effort is part of Downtown Project's goal to help revitalize downtown Las Vegas; transforming it into the most community-focused and connected city in the world. Project 100 will launch a mobile application during its invite-only beta program. The official roll out will bring together the ultimate in collaborative consumption: 100+ on-demand drivers, 100+ shared cars, 100+ shared bikes, and 100+ shared shuttle bus stops — all under one single monthly membership.

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,

As an example, 5-1-1 in the San Francisco (SF) Bay Area[13] covers the following modes and services:

- Traffic: travel conditions on Bay Area freeways (also an interactive map), incident and congestion information, current or future travel times, get non-emergency freeway assistance, real-time information on available spaces in San Francisco, sign up to prepay bridge tolls with FasTrak®.
- Ridesharing: carpooling, vanpooling, HOV lanes, park-and-ride lots, RideMatch Service to obtain a free list of commuters, Carpool Calculator to find out how to save money and reduce auto emissions.
- Public Transportation: routes, interactive maps, schedules, time estimates, fares, interfaces to transit agencies' customer service centres, current real-time departure time predictions for trains and buses. The interactive 5-1-1 Enhanced Trip Planner

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

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

[13] http://www.511.org/

compares transit, driving, or a combination of both.

- Bicycling: bicycle maps, bicycle safety tips and classes, tips for taking bikes on transit, etc.
- Parking: real-time availability, pricing information and facility information for spaces in San Francisco.

5-1-1 SF Bay is available as a phone service, Internet service, an SMS service and also the 5-1-1 SF Bay Transit app can be downloaded in Apple's App Store or Google Play.

Shared Use Mobility Center (SUMC)

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. SUMC is managing a two-year pilot project to explore peer-to-peer (P2P) carsharing in the Chicago metropolitan area. The pilot will explore the impact of P2P in three specific community types: low-density and suburban neighborhoods; low and moderate-income communities; and closed network communities in large residential developments.[14] Also, SUMC's Shared Mobility Toolkit is designed to help cities and public sector leaders better realize the benefits of shared mobility. It includes a shared mobility policy database, a mapping and opportunity analysis tool, and a shared mobility benefits calculator.[15]

Smart City Challenge[16]

The US Department of Transportation recently awarded the Smart City Challenge funding to Columbus, Ohio. It beat out over 70 other cities, including San Francisco, with its plans to use technology to solve transportation problems[17]. The city proposed to deploy three electric self-driving shuttles to link a new bus rapid transit center to a retail district, and to use data analytics to tackle health problems like infant mortality. The city also plans to distribute a smart card and app that cover transit expenses like bus fares and ride and car-sharing services, and could be used by those who are dependent on cash. Other apps that give residents and visitors real-time traffic and parking updates will be rolled out. And new connected traffic lights designed to improve the flow of traffic and "talk" to connected vehicles will be installed.

4.2 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 proposition on different levels. Thus, the identification of value chains of different MaaS

[14] http://sharedusemobilitycenter.org/demonstrations-and-pilot-programs/

[15] http://sharedusemobilitycenter.org/tools/

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

[17] http://www.govtech.com/fs/Why-the-DOT-Chose-Columbus-as-its-Smart-City-Challenge-Winner.html

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.

4.2.1 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

4.2.2 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.

4.2.3 Uber: Private Taxi and ridesharing organisation

- The Uber service is offering private taxi and sharing services worldwide. Uber has different forms 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.

4.2.4 BlablaCar[18] private carsharing

- Private ridesharing platform covering 19 European countries. BlablaCar is organised as a Peer2Peer ridesharing system.
- In contrast to Car2Go and DriveNow, the BlablaCar ridesharing platform was developed from the ‘Comuto’ consortium located in Paris, with the focus of establishin an European wide network of integrated ride-sharing services.
- As far as the pricing of offering rides to the platform is concerned, EU member states currently do not have a common practice deployed, meaning that in some countries, like Italy or France, users providing their rides are willing to pay an amount for providing their ride offers, while in some other countries is still no clear consensus of establishing advertisement fees as well. Compared to some other sharing economy areas like Uber or AirBnB, a higher willingness to pay for a considerable proportion of

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

participation charges is accepted by participants. [19]

4.2.5 Car2Go carsharing

Car2Go offers its service in more than 30 cities worldwide. It is a Daimler based carsharing service provided worldwide. 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.

The business model is very similar in all 30 different cities, although some rates differ by the location. 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 business models, Car2Go offers only one type of car considering its economy service, which is a Daimler car (Smart), similar as DriveNow is providing BMW vehicles (15).

4.3 MaaS related R&D activities

At the previous ITS European and World Congresses (2014, 2015 and 2016), MaaS was promoted and very much targeted to stakeholders of different industries. This especially resulted in the diffusion of the idea of providing MaaS concepts in Europe and even worldwide. As a result several national and international joint research programmes and innovative procurement procedures have been established, fostering the deployment of MaaS and coherent innovations in the mobility sector.

Besides the CEDR call on mobility and ITS 2014 programme, a significant representative of research programmes supporting MaaS developments is Horizon-2020 in Europe, providing a call specifically on MaaS (MG- 6.1-2016, Innovative concepts, systems and services towards 'mobility as a service'). Further national research programmes and procurement strategies promoting and supporting MaaS in Finland, Sweden and Austria are analysed in more detail below.

4.3.1 R&D projects in Finland

Tekes – the Finnish Funding Agency for Innovation[20] has research programmes related to MaaS. These include:

- Mobility as a Service (MaaS) - joint programme of Tekes and the Ministry of Transport and Communications.
- The Witty City programme aims at providing people with better living and working environments and companies with opportunities to bring new products and services on the market. Cities are in the main role in the programme.
- The Innovative Cities programme aims at creating internationally attractive innovation clusters in Finland. One of the programme’s themes is Smart City and Renewable Industry.
- The Smart procurement programme aims at improving market access for products and services developed by SMEs in particular and also at improving the productivity and effectiveness of public services.

Tekes funded MaaS projects include:

[19] http://www.zeit.de/mobilitaet/2016-08/blablacar-gebuehren-mitfahrgelegenheiten-kosten?page=3#comments

[20] http://www.tekes.fi/en/

- IQ Payments Oy – PEMO: The project aims at expanding API-layers to meet the requirements of the whole travel chain and involved service providers, also in international markets.
- Taksiliiton Yrityspalvelu Oy – TAKSIMAAS- service pilots: The aim is to ensure the connectivity of taxi services to mobility service packages.
- Tuup – Mobility as a Service: Co-piloting for travel cost savings, employee well-being and sustainability

In addition municipalities, regions, and authorities like Ministries, Finnish Transport Agency and Finnish Transport Safety Agency have financed numerous R&D projects related to MaaS.

4.3.2 R&D projects in Sweden

Vinnova, the Swedish Innovation Agency[21], has or is funding several projects related to MaaS. These include:

- The quadruple helix Go:Smart project (2011-12 Phase A, 2012-14 Phase B) culminated in the UbiGo[22] MaaS field operational test in 2013-14 (described above).
- The IRIMS – Institutional Frameworks for Integrated Mobility Services in future cities – project (2016-17) builds knowledge and proposes recommendations on how institutional frameworks can be modified to enable new, integrated mobility services capable of contributing to more sustainable travel in tomorrow's cities. Project partners include Lund University, Chalmers Institute of Technology, Viktoria Swedish ICT, Trivector, Samtrafiken and K2.
- The DenCity project in Gothenburg, Sweden aims to test innovative transport solutions in dense city centers.

The region of Västra Götaland (in which Gothenburg is located) and Västtrafik, the regional public transport provider, are currently in the process of a procurement of "combined mobility" services. The RFI Request For Information process was undertaken in the spring (2016). The region of Västra Götaland is also supporting an industrial PhD student, sitting at Chalmers University of Technology, who will follow this procurement process as part of the student's PhD research.

In late 2015 UbiGo Innovation AB and Ericsson AB announced a cooperation, based on Ericsson providing the technical platform, and Ubigo Innovations providing the business concept. It is hoped that a service based on this collaboration will be able to be tested soon (in 2016 or 2017).

Trivector, Malmö and Copenhagen are conducting a feasibility study for the EC2B concept (funded by Climate KIC).[23] EC2B, targeting new residential complexes, plans to offer mobility service packages where the user will choose between modes. Information, booking and payment should be simple and accessible via smartphones, and the digital platform will also provide a base for "social platforms" (community interaction, etc.).

Wallenstam Drive[24] offers Sunfleet carsharing and Hertz car rentals to companies leasing office space in Gothenburg, Sweden. These companies can then provide these services to their employees. An account per employee is set up online, and trips are booked online. Car rentals are paid via credit card and carsharing via invoice.

[21] http://www.vinnova.se/en/

[22] http://ubigo.me/

[23] http://www.climate-kic.org/projects/mobility-service-business-case-ec2b/

[24] https://www.wallenstam.se/sv/lokaler/kund-hos-wallenstam/wallenstam-drive/

Volvo's In-car Delivery[25] is a service for delivering goods directly to your Volvo. The idea is to use one's car to avoid planning one's life around deliveries. The customer decides the time and place for delivery. A temporary single-use digital key allows authorized partners to deliver their goods, after which the key is destroyed. This key can be tracked so that the customer knows when her/his car is opened and locked again. Delivery is confirmed via e-mail or SMS and the goods are also insured. The service is currently available in the Gothenburg, Stockholm and Malmö areas and partners currently include companies delivering food, sporting goods, consumer electronics, etc.

Samtrafiken is an 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.

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."

4.3.3 R&D projects in Austria

The Austrian Ministry of Transport, Innovation and Technology is funding and has funded several R&D projects related to MaaS via the Austrian Research Promotion Agency (FFG), which is the national funding agency for industrial research and development. The R&D activities of the ministry, for example the R&D funding programme "Mobilität der Zukunft" (Mobility of the Future), are directly linked to the measures set in the national ITS Action Plan. In the tenders of "Mobität der Zukunft" different focus topics like "Innovative design for mobility of people", "Urban mobility laps" or "Mobility of goods of the future" are highlighting ITS as a key issue. Another R&D programme KLI.EN (Klima- und Energiefond – climate and energy fund) is funding deployment projects with focus topics like "Basics for ITS Services in Rail Transport" or "Deployment Measures in the Framework of the national ITS Action Plan". In recent years many projects that are related to MaaS have been funded, these include:

- **GIP and VAO projects:** The development of a joint, nationwide digital transport network "Graphenintegrations-Plattform GIP" was the starting point for several projects. Starting in 2001 first steps towards a digital map of Austria's transport network were taken in the project VEMA (Vienna)[27], followed by "VIP Vienna Region" and "IWN Integriertes Wegenetz" in 2006 in which basic components for the GIP were developed. 2009 was the start of 3 big projects – VAO, GIP.at, GIP.gv.at – with the aim to develop a traffic reference system for all modes of transport (GIP.at) and based on that a tool for authorities, which they can use to keep the GIP up to date

[25] https://incardelivery.volvocars.com/

[26] http://www.drivesweden.net/en

[27] https://www.wien.gv.at/verkehr/verkehrsmanagement/vema/

(GIP.gv.at) and a multimodal transport information service (VAO).[28]

To guarantee permanent operation of the VAO, the project partners founded the company "VAO Ltd." together in October 2015. The content of the GIP is provided on the basis of the Open Government Data – strategy (OGD) since January 2016.

- **myITS:** A routing-planer-prototype, which is customizing the routing according to the needs of target groups like parents with small children or elderly people, offering the user traffic services personalized to their own requirements.[29]
- **SMILE:** Within the project prototypes of an integrated mobility platform and an app were created. The aim was to create a mobility platform that not only allowed the user to inform oneself about all available means of transport but to even let the customer book, pay and use them. SMILE had over 1,000 pilot users and integrated a wide range of different transportation providers. In May 2015 the project officially ended.[30] Based on the results of SMILE, the ÖBB (Austrian Railway Operator) did create the "ticketshop"[31] and the "Wienerstadtwerke" the now available test version of the app "WienMobil-Lab"[32], which integrated private car sharing, bike sharing, taxis, public transport, your own car or bike, and offering booking, routing, ticketing and payment.

In addition to to these national funding efforts, there are also regional and local R&D activities related to MaaS.

[28] http://www.gip.gv.at/gip-projekte.html

[29] http://www.kr.tuwien.ac.at/research/projects/myits/

[30] http://smile-einfachmobil.at/index_en.html

[31] http://www.oebb.at/de/angebote-ermaessigungen/oebb-app

[32] http://www.wienerlinien.at/eportal3/ep/channelView.do/pageTypeId/70396/channelId/-58030

4.4 Overview of MaaS and related services

The following table gives an overview of identified MaaS and related services. As mobility service markets are subject to rapid technological and organisational changes, the table has to be understood only as a currently valid overview of mobility services. All services listed in the table may not be described in-depth in this report.

MaaS service name	Country	Service/ Pilot	Multimodal information	Ticketing	Shared mobility
VAO	Austria	S	X		
Sonera Reissu/ Telia	Finland	S	X	X	X
YlläsAround/ Telia	Finland	P	X	X	X
Seinäjoki/ Sito	Finland	P	X	X	X
UbiGo	Sweden	P		X	X
SMILE / BeamBeta	Austria	P	X	X	X
GoogleMaps	International	S	X		
Moovel (Car2Go)	International	S			X
HannoverMobil	Germany	S	X	X	X
Uber	International	S			X
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 (London) / Germany (Berlin)	S	X		
Waze	International	S	X		
STIB+Cambio	Belgium	S	X	X	X
TaM	France (Montpellier)	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/QuicK bike)	Switzerland	S		X	X
DB mobility services	Germany	S		X	X
ZipCar	International	S			X
Tuup	Finland	S	X	X	
Whim	Finland	P	X	X	X

Table 1: Overview of MaaS and related services

5. MaaS business model cases

Based on available Mobility-as-a-Service concepts within Finland, Sweden and Austria different operator and business models are analysed in order to provide a state-of-the-art overview of different MaaS operator models. Note that this deliverable differentiates between operator and business models. While operator models describe organisational structures of MaaS service concepts, as shown in chapter 8, MaaS business models reflect the description of value creation on a strategic level. This interpretation goes hand-in-hand with the definition provided by Shafer et al. (12), who define a business model as: ”A representation of a firm’s underlying core logic and strategic choices for creating and capturing value within a value network” (12).

In this chapter the following structure for describing available **MaaS business models** is applied, wherever access to information was available:

- Organisational structure of the MaaS service (Background/roles of involved stakeholders)
- Description of the Service model (covering: Which service features are covered? How is the service being operated?)
- Legal status of the MaaS operator (e.g.: PPP, public, private, Shared responsibility?)
- Revenue model (e.g. commission, based on use, fixed, how the operator makes the profit, B2B, B2C?)

5.1 MaaS business models – Finland

In Finland, Tuup and Reissu are operating MaaS services. In addition several services are under development and some pilots are on-going. MaaS operator models of the following services and pilots are presented here:

- Telia Company: YlläsAround (pilot in spring 2016)
- Telia Company: Sonera Reissu (service)
- Sito Seinäjoki: (pilot stage)
- Tuup: (service)
- MaaS Global: Whim (pilot stage)

YlläsAround (by Telia Company)

Organisational structure:

- YlläsAround is a MaaS pilot (spring 2016) in Ylläs ski resort area in the Northern Finland. It is part of the Aurora Snowbox test ecosystem focusing on automated driving, digital transport infrastructure, intelligent infrastructure asset management, and Mobility as a Service.
- Actors include Telia Company as the MaaS operator, and regional taxis and buses as transport operators. Other actors involved are: Ylläs Travel Information, the municipality of Kolari and the Finnish Transport Agency.

Service model:

- YlläsAround offers transport services in Ylläs area and between Ylläs and Kittilä airport and Kolari railway station.
- YlläsAround is a mobile application using mobile payment and ticketing.
- The modes included in YlläsAround are buses, taxis and shared taxis, as well as their

combinations.

- In the future, e.g. freight/parcel deliveries, meal/food deliveries and snowmobiles could be included in the service.

Legal status of the MaaS operator:

- MaaS operator Telia Company AB (public) is an internationally operating telecom company.
- YlläsAround can be considered as Public-Private-Partnership (PPP). The service itself is privately operated, but the planning and setting up the pilot has received public funding.

Revenue model:

- MaaS operator has agreed on fixed prices with taxi companies.
- MaaS operator takes a minor commission on re-sold bus trips.

Sonera Reissu (by Telia Company)

Organisational structure:

- Actors include Telia Company as the MaaS operator, and Finnish Railways and regional taxi (Kanta-Hämeen Aluetaksi) as transport operators.

Service model:

- Reissu offers transport services in the city of Hämeenlinna for rail and (shared) taxi.
- Reissu is a mobile application using mobile payment and ticketing. Both taxi and train trips are on the same ticket, but having separate ticket IDs.

Legal status of the MaaS operator:

- MaaS operator Telia Company AB (publ) is an internationally operating telecom-company.
- Reissu is privately organised.

Revenue model:

- MaaS operator has agreed fixed prices with taxi companies.
- MaaS operator takes a minor commission on re-sold train trips.

Seinäjoki (by Sito)

Organisational structure:

- Actors include Sito as the service integrator, and regional bus and taxi companies as transport operators. Also some long-haul bus companies are included.
- Seinäjoen keskustaksi oy (central taxi of Seinäjoki) already has existing customer service 24/7, and is used as the service point of the MaaS service.
- South Ostrobothnia Centre for Economic Development, Transport and the Environment is an enabling authority to integrate long-haul public transportation.
- The city of Seinäjoki enables to integrate public transportation.
- Fluidtime operates payment and ticketing system for shared services.
- There have been preliminary discussions with Finnish Railways (VR) and Kela (independent social security institution).

Service model:

- In the pilot stage services include: shared taxi and public transport (demand-

responsive)

- Planned services in the future: local and regional taxis, regional buses, long-haul buses to Tampere and to the airport of Vaasa, car rental, city bikes, carpooling, car sharing, school and legislated transport services (disabled persons and statutory social service transportation based on regulations and laws) and logistics services. Statutory social service transportation in Finland refers to the majority of social and health services that are statutory, meaning that legislation obliges municipalities to arrange them. In addition, municipalities may organise other kinds of social and health services.

Legal status of the MaaS operator:

- Seinäjoki MaaS is a PPP. Sito, transport operators, and the municipality of Seinäjoki are planning to create a MaaS operator company.

Revenue model:

- Based on statistical analyses of transportation in Seinäjoki region, assumptions on cash flow changes in the system have been made.
- A profit distribution model already exists to fairly allocate additional revenue among partners.

Tuup

Organisational structure:

- Tuup Ltd. is privately owned mobility service provider (i.e., MaaS operator) and was established in 2014.

Service model:

- Tuup's mobile application allows users to buy mobile tickets on Turku regional public transportation (aka FÖLI) and plan public transportation journeys planner across the Finland (utilizes Digitransit interface)
- Föli covers the municipalities of Turku, Kaarina, Raisio, Naantali and Lieto
- Taxi ticketing, booking and payment for a rental or shared cars, and company-specified mobility service packages available in the future.

Legal status of the MaaS operator:

- Tuup Ltd. is privately owned and provides MaaS services the main business

Revenue model:

- Using the mobile application is free
- The prices are based on the bilateral agreements between Tuup and transport service providers
- Tuup takes a commission on each payment made through the mobile application

Whim (by MaaS Global)

Organisational structure:

- MaaS Global is a privately owned mobility service provider (i.e., MaaS operator) and was established in 2015.
- The biggest owners are Transdev, Karsan Otomotiv Sanayii and Ticaret AS, Veho Oy Ab and CEO Sampo Hietanen.

Service model:

- A mobile application-based MaaS service provides user access to many types of transport, from brand new cars to taxis, buses, trains and bikesharing.
- Enables people to find the most suitable and preferable way to get there with integrated ticketing and payment.
- Service currently piloted, official launch in Helsinki area in the autumn of 2016. Some international cities will follow later in 2016

Legal status of the MaaS operator:

- MaaS Global is privately owned and provides MaaS services as the main business

Revenue model:

- Using the mobile application is free
- The prices are based on the bilateral agreements between MaaS Global and transport service providers
- End-users pay for mobility packages, in addition to which pay-for-usage mobility services can be used.
    - Each Whim package gives you a quota of mobility points, which in turn gets you journeys on any mode of transport. The more points in your package, the lower the cost per point. Extra points can be earned by making smart travel choices.

5.2 MaaS business models – Sweden

In Sweden, UbiGo has been the main operative MaaS service, although it is currently be re-developed. The operator model from the 2013-14 UbiGo Field-Operational-Test (FOT) in Gothenburg will be presented here.

Organisational structure, involved stakeholders:

- UbiGo was part of a quadruple helix project (Go:Smart) involving public and private sectors, academia, and users. The project was funded by Vinnova (the Swedish Innovation Agency) with matching funding and in-kind contributions by the project partners (in alphabetical order): Arby Communication, the City of Gothenburg, Chalmers University of Technology, Lindholmen Science Park, Mistra Urban Future, Move About, Payex Finance, Region Västra Götaland, the Swedish Transport Administration, Tyréns, Västtrafik, Viktoria Swedish ICT, Volvo Buses, and Volvo IT/Commute Greener.

Organisational structure, roles of stakeholders:

- The UbiGo FOT was run by a project team, in which a key partner was Arby Communication. UbiGo (the FOT team) negotiated prices with the five transport providers, managed the customer subscriptions and invoicing, and provided higher-level customer service (lower-level customer service was contracted out). The ‘app’ (and HMI interface) was developed and maintained by Volvo IT/Commute Greener. Chalmers University ran the evaluation and analysis of the FOT.

Service model:

- The UbiGo service model offered access to five transport modes: Västtrafik public transport, Sunfleet carsharing, Hertz car rentals, Taxi Kurir taxis, and Styr&Ställ bikesharing. The service operated via paid monthly household subscriptions to urban households in Gothenburg, Sweden. Subscriptions included a personalized combination of, and amounts of credit for, the different transport services mentioned above. Credit could be topped up or rolled over depending on how much credit the

household utilized, and the subscription could be modified on a monthly basis.

- To access their transport services, the UbiGo customer logged into a web interface adapted to smartphones (subsequently referred to as the 'app') via a Google- or Facebook-login, where they could activate tickets/trips, make/check bookings, and access already activated tickets (e.g. for validation purposes). The app also allowed them to check their balance, bonus, and trip history, and get support (in terms of FAQ/customer service). (Note that the app did not include pre- or on-trip journey planning or real time public transport information.) Each participant received a smartcard, used for instance to check out a bicycle from the bikesharing service or unlock a booked car, but also charged with extra credit for the public transport system in case there was any problem using the UbiGo service. UbiGo also included a customer service phone line open 24 hours per day.

Legal status:

- UbiGo, the MaaS operator, was, at the time of the FOT, part of the project, i.e. not an independent business venture. However, the project was organised as a Public-Private-Partnership (PPP).

Revenue model:

- In the UbiGo revenue model, the UbiGo service negotiated prices with the five transport providers based on volume purchases, i.e. UbiGo earned revenue based on travel service margins, or taking a percentage of the transactions between customer and travel service provider, made possible by getting cheaper prices by pre-paying trips in bulk. Other revenue streams could include interest on money generated by the pre-paid trips, possibilities for franchising fees and add-on services for businesses.

5.3 MaaS business models – Austria

In Austria MaaS services and pilot activities are already provided to the end-users as testing versions being further developed and integrated with various other digital services, wherever applicable.

The main focus of the Austrian MaaS services is on the integration of different transport modes covering public transport (road), taxi services, on-demand transport and ride-, car-, and bikesharing. The most notable examples of already implemented MaaS and related services and pilots are represented by:

- Pilot activities ('BeamBeta', 'IMobility', and WIenMobilLab) based on the national project results of 'SMILE', (13).
- WienMobil-card (including integrated ticketing for PT, taxis, parking and bikesharing)
- Other MaaS related services: Ticketshop (common ticket payment relevant for national train and PT services), Sharing services: Moovel (Car2Go), DriveNow, ZipCar, Flinkster, Citybike Vienna, Other on-demand transport services: common platform for Austrian alternative on-demand transport services[33]

Pilot activities – SMILE project

Organisational structure:

- The SMILE project, which ended in 2015, provided an integrated mobility platform, covering multimodal traveller information platform VAO (Verkehrsauskunft

[33] http://bedarfsverkehr.at/

Österreich), ticketing/booking and shared mobility features. The VAO was initiated through public transport associations and public financed projects VAO and VAO2. It is basically a Routing network which is based on an Austrian-wide commonly used Graph-integration-platform system (GIP).

- As a follow-up, Beam-Beta is in development and provides additional service features.
- Provided by cooperating partners of: bmvit (Austrian Ministry for Transport, Innovation and Technology), Wiener Stadtwerke, ÖBB, Car2Go, Vienna Citybike, parking garages of Vienna, OEM's, Vienna University of Technology, etc.Multimodal information provision (web- and app-based) including: Real-time routing based on dynamic timetables, LoS and traffic events information (including road, public transport, trains, cycling, walking and intermodal transfer points, known as P+R stations)
- Multi-tenancy interface (transport operators, associations and other transport-related organisations are able to provide their mobility data and service features over an individualised front-end system).

Service model:

- The central part of both pilots is providing integrated multimodal information services together with ticketing/payment and shared-mobility features.
- Both pilots provide all different services over one common interface and offer a one-stop-shop principle to travellers.
- Further developments: Extending the service availability to other Austrian cities as well, and increasing the degree of access to other transport modes.
- Having integrated service features/modules of the VAO implemented (common routing platform)
- FOT (Field Operational Test) conducted with 1000 external users having tested SMILE over several months with positive effects on transport mode usage (based on questionnaire results), e.g. 26 % have answered that they have changed their habits towards less use of private cars.

Legal status of the MaaS operator:

- Mainly public/or partly public-owned organisations are involved in the pilot activities (Wiener Stadtwerke + Austrian partnering cities with focus on the BeamBeta pilot)

WienMobil Karte – mobility card of Vienna

Organisational structure:

- Involved stakeholders/partners, providing a common mobility card: PT operator of Vienne (Wiener Linien), e-fuel-stations (Wien Energie), parking garages of Vienna (WIPARK Wien), three different taxi service providers located in Vienna, Citybike Vienna, Carsharing (DriveNow)
- There already exists an integrated organisational agreement providing shared payment strategies.

Service model:

- One common mobility card covering combined ticketing for PT in Vienna city, including three different taxi services, reduced car parking fees, free use of e-bike loading stations and bikesharing payment.

Legal status of the MaaS operator:

- Public and private organisations/companies having a common agreement

Revenue model:

- Reduced registration fees when joining DriveNow services through WienMobil card.
- Direct payment functionality over one common mobility card.
- Reduced city airport train tickets (10 %).
- Reduced private car parking lots.

WienMobil-Lab

In Austria there are on-going activities aiming at combining 'BeamBeta' and 'WienMobil Karte' that are organised under the umbrella of Wiener Stadtwerke (public transport organisation). All corresponding activities are summarised by the WienMobilLab organisation. The new, combined service is able to provide all respective service features of both projects based on a one-stop-shop principle.

5.4 International MaaS activities

The MaaS Alliance

The MaaS Alliance was launched at the 2015 ITS World Congress in Bordeaux with the aim to foster European MaaS developments. The main initial coordinator was ERTICO, which is a multi-sector, public/private association of more than 115 partners pursuing the development and deployment of Intelligent Transport Systems and Services.

The European Mobility as a Service Alliance builds upon the momentum achieved during the 2014 ITS European Congress in Helsinki, where MaaS received political support from the Finnish government. As there are several MaaS initiatives planned or starting already all over Europe, the MaaS Alliance aims at supporting these through a cooperative, shared work programme engaging MaaS stakeholders such as MaaS and transport operators, service providers, researchers, users, etc.[34]

UITP

The International Association of Public Transport (UITP, from the French *L'Union internationale des transports publics*) is a non-profit advocacy organization for public transport authorities and operators, policy decision-makers, scientific institutes and the public transport supply and service industry. UITP supports a holistic approach to urban mobility and advocates for public transport development and sustainable mobility. In April 2016 they released a policy brief, Public Transport at the Heart of the Integrated Mobility Solution, in which they advocate that: "a broader mix of mobility services is the answer to ever more complex and intense mobility needs. Public transport is the backbone of sustainable mobility and expert in the organisation of mobility solutions. Public transport has the broadest customer base and as a sustainable public service it is the natural integrator of all these services."[35] Although this is certainly one possibility for MaaS, which actor(s) can act as the MaaS operator will be discussed in section 8.

[34] http://maas-alliance.eu/

[35] http://www.uitp.org/sites/default/files/cck-focus-papers-files/Public%20transport%20at%20the%20heart%20of%20the%20integrated%20urban%20mobility%20solution.pdf

6. MaaS value networks

To provide a more detailed insight to MaaS business and operator models, this chapter elaborates on how identified MaaS services are implemented and how different stakeholders contribute to the provision of MaaS services. Based on the state-of-the-art survey results, different roles and responsibilities and corresponding business ecosystems and related networks were derived. In the following section, the process of adding value to the final MaaS service is described in more detail. Further stakeholder responsibilities are analysed, including data and information provision together with payment processes.

6.1 Overview of the MaaS ecosystem

MaaS is a new transport paradigm entailing 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 vision is to see the whole transport sector as a cooperative, interconnected ecosystem, providing services reflecting the needs of customers and seamlessly combining different transport means, such as private vehicles, public and collective transport (bus, metro, light rail, car sharing), biking and walking.

The boundaries between different transport modes are to blur or disappear completely. The ecosystem includes the transport infrastructure, transportation services, modes, and transport information, ticketing and payment services. The purpose is no longer to improve the transport system by building more capacity but using the existing capabilities and capacity in a smarter way.

Figure 9 below illustrates a general high-level overview of MaaS ecosystems. A business ecosystem can be considered as a network that consists of a vast number of loosely interconnected participants who benefit from each other and their mutual effectiveness (14). It can be argued that MaaS ecosystems consist of four different levels: 1) public and regulatroy 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.

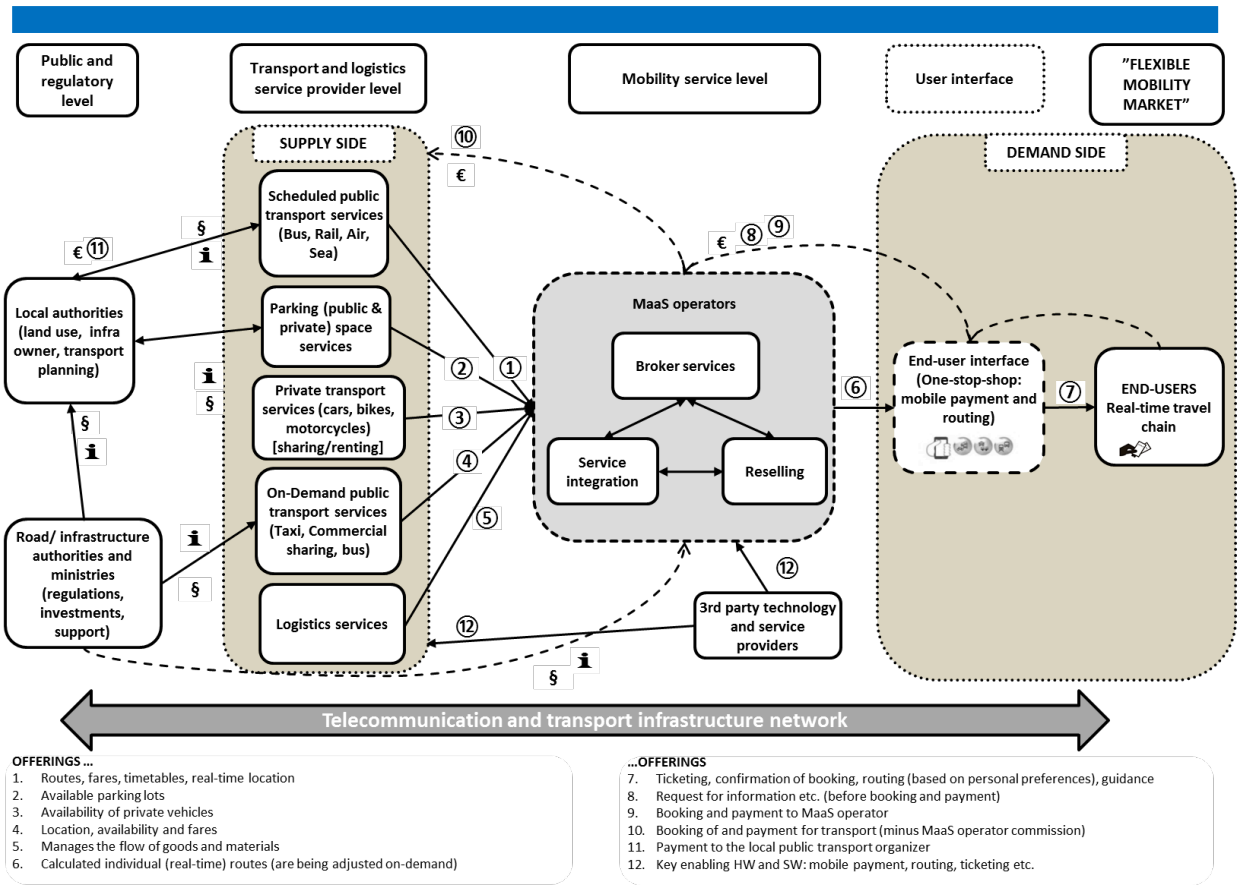

Figure 9: Overview of MaaS ecosystem

(copyright Aapaoja, A., Sochor, J., König, D. & Eckhardt, J. 2016)

The transport and business sectors, just like the rest of society, must obey the 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 service 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 breaking down the boundaries between the different transport modes.

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, MaaS can be deployed cost-effectively. Also, open interfaces (API, application programming interface) further accelerate the emergence of new and innovative services that can reach substantial global markets. When it comes to the legislation and regulation, the public sector has a major role as an enabler of service pilots and a builder of the legislative framework that affects the potential of different transport modes. The focus of regulation should be in ensuring transparent market conditions and fair market performance and securing the legal position of consumers and travellers. Table 2, describes the potential MaaS ecosystem stakeholders and their roles in more detail. The roles may vary in different countries, for example the actor responsible for tolling.

Level	Stakeholder	Roles, responsibilities and obligations
National road authorities and ministries	Ministry of Transportation	Legislator; responsible for transport policy and strategies; enabler of test and pilots through legislation; financing infrastructure investments
	Transport Agency/ 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)
	Transport safety agency/ authority	Issues permits; regulations, approvals and decisions; prepares legal rules regarding the transport sector;
Local authorities	Regional/local transport agency	Plans, organizes and manages public transport in the region and improves its operating conditions; provides locations of stations and stops
	The city and city planning department	Strategic urban and city planning; responsible for transportation and traffic planning; responsible for the local infrastructure
MaaS operator	MaaS company, public transport operator, PPP etc.	Combines the existing transport services into a single mobile application on the "one-stop-shop" principle and provides personalised transport plans tailored to customer needs; responsible for customer service and user experience
Transport service providers (TSP)	Public transport	Provide schedules, fares as covered by Ticketing and real-time information,
	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, 3rd party logistic, etc.	Provides 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)	3rd party technology, ICT and service providers	Provides key enabling technology and services (e.g., mobile ticketing and payment) to MaaS operator and transport service providers

Table 2: Roles and responsibilities of stakeholders within the MaaS ecosystem

In practice, the MaaS operator is the only new stakeholder in the value chain. Other participants are more or less the same stakeholders as have previously existed in the transport sector, although it is unclear to what degree their roles may or may not change with the emergence of MaaS. Various approaches exist for becoming a MaaS operator, for instance, a current and existing transport service operator or a regional transport agency could start to be an integrator of transport modes. For example, Helsinki Regional Transport is somewhat of a MaaS operator since they are organizing and managing multiple public transport modes – trams, subways, local trains, buses and ferries - in the Helsinki area. However, a full-scale MaaS operator would probably require at least integrating taxis (or equivalent demand-responsive transport services) to ensure greater flexibility. Another option is that some entirely new player comes to the market, makes a deal with transport operators and starts to sell different kinds of service packages to the travellers. This approach likely requires extensive marketing and a great value proposition because new MaaS operators do not usually have an existing customer base. On the other hand, an external and independent actor does not necessarily have previous commitments in any direction – as existing transport operators may have - and hence they can arrange new service combinations as they deem appropriate. However, if the local/regional transport is organized by the local authorities – as it many times is – MaaS operators are in reality forced to collaborate with them, in which case it is vital to find a collaborative model that brings value for all sides (and in which the service level remains at least the same).

6.2 MaaS value chain development

The MaaS ecosystem provides an overview of potential roles and responsibilities allocated to the value proposition process for generating MaaS services. In order to compare different MaaS services and/or MaaS-related service models, the processes for generating added value for end-users are elaborated in more detail in this section focusing on value chains of identified operator models located in Finland, Sweden and Austria. Therefore the generalized MaaS ecosystem model is used as a basis to assign different roles and responsibilities of identified MaaS services.

Basically a simple framework design for depicting different value chains and roles is applied for the purpose of comparing different MaaS services. In detail this framework design provides different stages for generating final added value of any MaaS service. The main value chain links represent the different stages of value generation, from data collection and information generation to service creation and provision.

Figure 10 shows the general value chain for MaaS service provision (upper part) and the different roles and responsibilities (lower part) as identified in the MaaS ecosystem are depicted. Based on the main findings regarding the MaaS value proposition, the MAASiFiE project group has analysed and identified all those roles and responsibilities along the general value chain as well. As there were different emphases and difficulties assigning different MaaS services onto a general value chain, the framework design allows for flexible and individualised MaaS value chain configurations. Taking into account comprehensive organisational settings, like for instance one organisation taking on several different roles along the general value chain, this framework design is able to be adopted accordingly, which is shown and described in more detail by the respective MaaS service models.

MaaS value chain levels

Within the general value chain (as depicted in Figure 10) the following five modular levels/functions that fulfil the specific requirements can be defined:

- **Data Level**: One basic function is data collection. This encompasses the collection of all statistical data (such as timetables and departure times) as well as dynamic raw data (e.g. traffic or weather data measured using sensors). This is done in strict

compliance with data protection laws. Together with the collection of the (raw) data, processing of these data is done at this stage as well. For instance updating and validating data is done at this stage together with gathering data on pricing schemes.

- **Information Level:** Based on the processed data, information is able to be gathered which is further required for the MaaS service implementation. At this stage for instance information generation and maintenance such as storage/update of dynamic information is done together with cross-linking of information.
- **MaaS Service Creation:** The information is analysed, pooled and interpreted to generate a wide range of MaaS service features. For instance analysis of information, routing capability, and forecasting processes are performed in this stage.
- **MaaS Service Provision:** Each MaaS service must be provided and accessed in a suitable form by respective end-user groups. Therefore appropriate HMI/MMI (Human-Machine/Machine-Machine) interfaces have to be available. In most cases, smartphone-based apps are established on this level. Ticketing and Payment procedures are defined at this level.
- **Mobility Market:** Describes the whole set of different available mobility services being provided to respective end-users/travellers/user groups.

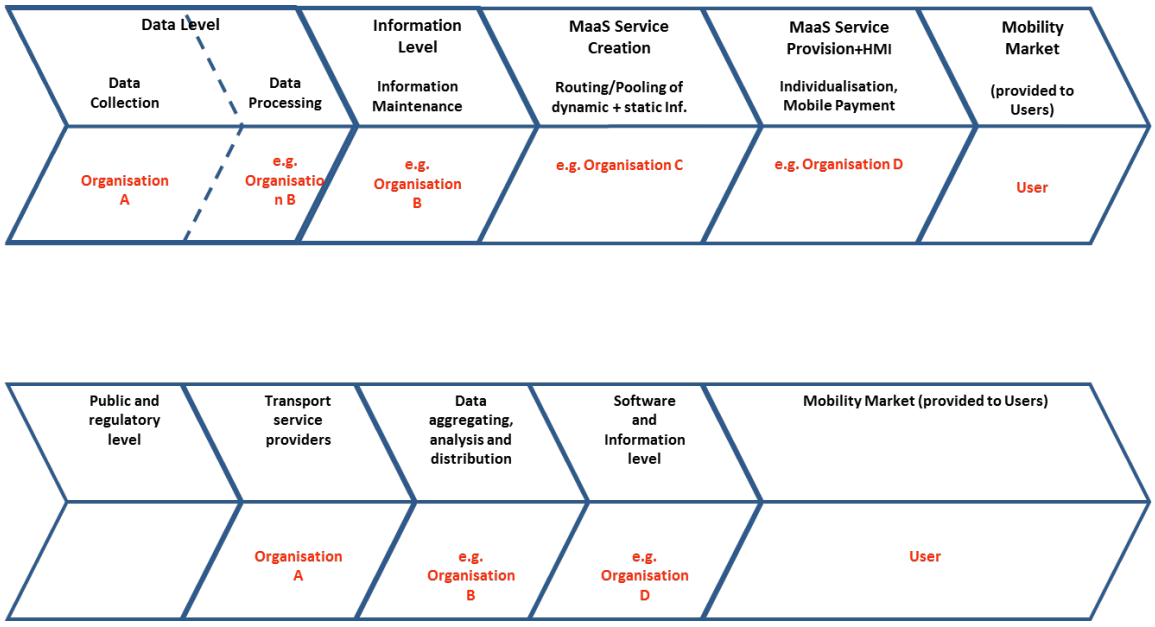

Figure 10: General MaaS value chain

For the assignment of the different MaaS services to the general value chain the following criteria were elaborated in more detail:

- **Cooperation structure:** Description of transport-related (or any other) organisations taking part in the MaaS service.
- **Value chain assignment** and description of roles and responsibilities (see assignment figures)
- **Description of geographical coverage/ Functional service descriptions**
- **MaaS operator model**: Single/Multi-operator models, which provides information on the main responsible organisation providing the MaaS service.
- **Organisational framework**: Description of interrelations between different organisations/roles/responsibilities along the value chain (including e.g. contractual models between different stakeholder organisations).

6.3 MaaS value chain assignment – Finnish case

A major factor in the development of MaaS is the organizing of platform services, as these facilitate innovations and services for efficient and sustainable mobility. Even though market-based services are regarded as the drivers of this mobility transformation, publicly supported and initiated pilots are often needed to demonstrate the potential of new innovative approaches and alternatives. Based on this, one publicly funded and two market-based pilots were selected for this value chain assignment. The first pilot focuses on providing mobility services at a ski resort for tourists who do not have their own cars to use. The second case is an application of a demand-responsive transport service in the Helsinki area, while the third pilot strives to provide "first- and last-mile" transport services for commuters by combining taxi and rail transport. Differences in the nature and context of these pilots were one of the reasons for selecting these cases. In addition, it is essential to show that MaaS can be implemented in different areas and contexts.

6.3.1 YlläsAround (a.k.a. Ylläs Ski Resort by Telia Company)

YlläsAround is a MaaS pilot developed by Telia Company (formerly TeliaSonera), the Finnish Transport Agency, the Municipality of Kolari and the Ylläs Travel Association. It aims at developing integrated one-stop-shop mobility services within the Ylläs area to allow the travellers – especially the ones having no car – to use local transport services and be able to spend their holiday without renting a car. The service can be used via the YlläsAround mobile application through which the users can search and find different options for the planned route with all the available transport modes. The mobile application allows the user to buy tickets for the journey by bus, taxi or a combination of both. Taxi rides can also be shared with other users and travellers. In the future, the service is planned to expand in a way that it covers the whole travel chain from home to a holiday apartment.

Cooperation structure

To enable MaaS in the Ylläs area, all the three transport service providers can be considered necessary. Skibus is operating within the ski resort area, while Rundgren's buses are mainly arranging rides between both Kolari railway station and Kittilä airport to Ylläs. Taxis can be used for all the rides. Naturally, taxis are convenient for last mile connections. The YlläsAround application enables users to share the taxi with other travellers as well.

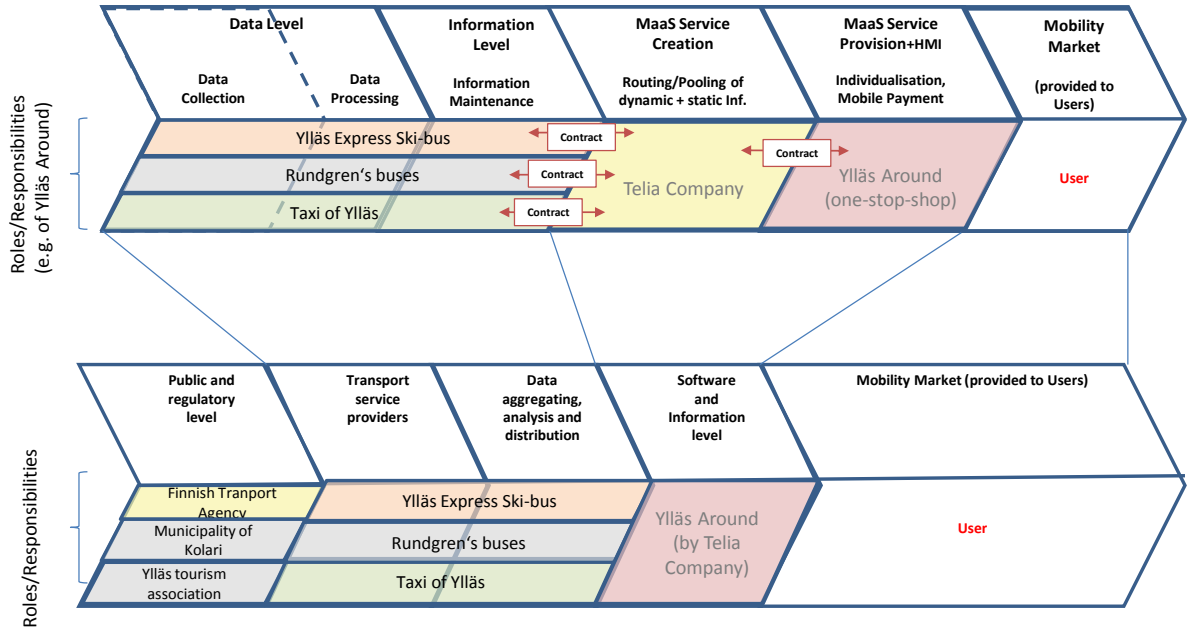

Figure 11: Identified Ylläs value chain

Description of geographical coverage/ Functional service descriptions

YlläsAround helps you get around the area of Ylläs. Examples of the journeys that can be undertaken (the mobile application shows the price too) are:

- From Kittilä airport or Kittilä railway station to one's accommodation, first with a bus and then with a taxi. When the order is made via the YlläsAround application, there will be a taxi waiting when the travellers arrive at Ylläs by bus
- from one's accommodation to Lainio Snowvillage. If others are traveling at the same time, the ride can be shared
- from one's accommodation to Konijänkä Petting Zoo or the supermarket. During the peak season, there are more than 50 different airport, train and ski bus routes daily in the Ylläs area. One may join the route even for shorter journeys.

MaaS Operator: Telia Company (formerly TeliaSonera)

Organisational framework

- MaaS pilot enablers (monetary and non-monetary support): Finnish Transport Agency (national (road) authority), Municipality of Kittilä (local authority) and Ylläs Travel Association (focusing on the development of local business)
- Mobility service providers: ski bus, taxis and Rundgren's buses

6.3.2 Kutsuplus

In one sense, Kutsuplus can be considered the first MaaS service experiment in Finland and even one of the world's first attempts to reinvent carpooling for the algorithm age. The public transportation service started in 2013, but the development project, led by Aalto University started already in 2007 and the mobile booking system was piloted since 2010. The main reason for the project was that the researchers at Aalto University wanted to solve one of the major limitations of Helsinki's mass transit system: the subway network was limited, and most of the bus routes run in a north-south direction. Hence, east-west trips can be especially difficult to make by transit. Also, the service was meant for passengers who were headed roughly in the same direction so that a minibus would allow them to share the ride at a higher cost than a regular city bus but a lower cost than a taxi.

Before the service was launched, one of the partner companies developed a routing algorithm and software, which was able to take in data about a fleet of buses, traffic and trips requested, and calculate optimal routes. The transit authority paid the drivers and operated the buses, which eventually grew to a fleet of 15.

For passengers, the system was relatively simple. To have a ride required one to log into a website and fill in the starting point and destination, and finally walking to the closest bus stop to wait for the pick-up.

Cooperation structure

Even though the customers were very satisfied, the Kutsuplus service was shut down at the end of 2015 since it was not profitable and required too much public support.

Helsinki regional transport was responsible for the service in full. The cities of Helsinki, Espoo and Vantaa, Tekes – the Finnish Funding Agency for Technology and Innovation, and the Ministry of Transport and Communication financially supported the service.

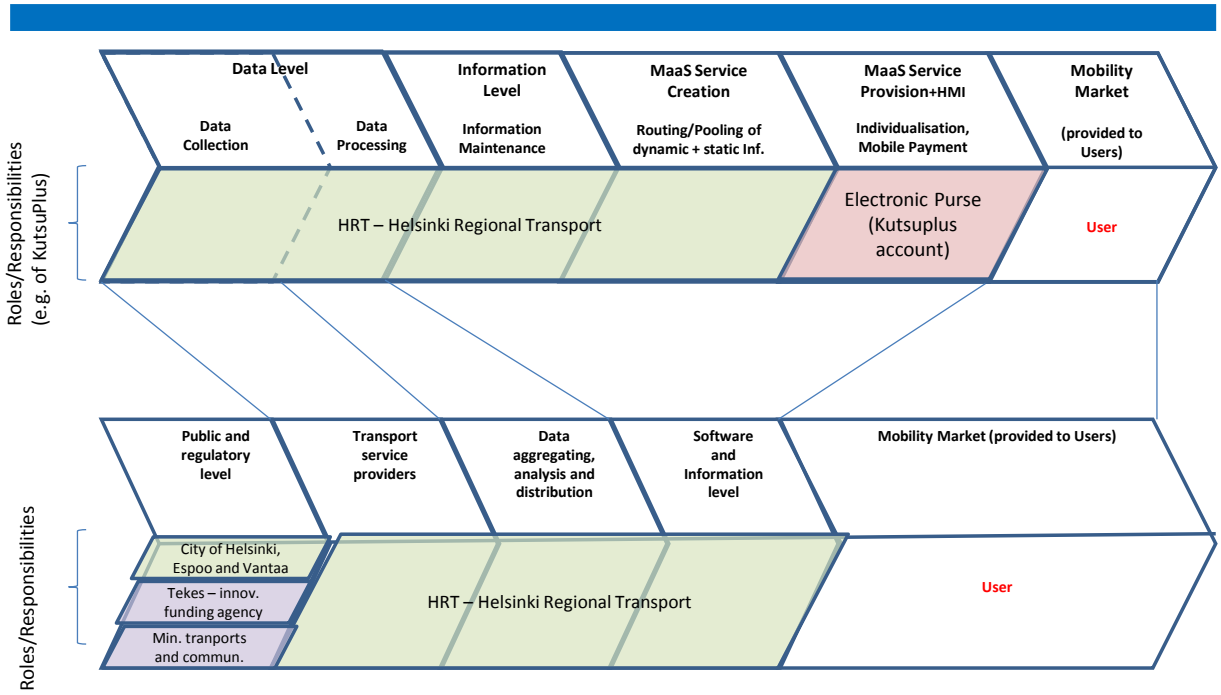

Figure 12: Identified Kutsuplus value chain

Description of geographical coverage/ Functional service descriptions

Service covered some areas within the cities of Helsinki, Espoo and Vantaa. Since the service is shut down, the route map does not exist anymore.

MaaS operator model: HRT – Helsinki Regional Transport (regional PT organisation)

6.3.3 Sonera Reissu (Helsinki-Hämeenlinna MaaS Pilot)

Reissu is the first MaaS pilot of Telia Company (formerly TeliaSonera) that enables the traveller to combine taxi rides and train connections into one travel chain and pay it all at once. The pilot covers the journeys between Hämeenlinna and Tampere or Helsinki. Taxis take care of the rides to and from the Hämeenlinna train station, and trains are used for journeys between the cities.

The mobile application used in this pilot allows users to plan the desired route, share taxis and have mobile tickets for the whole journey.

Cooperation structure

The pilot has not started yet, but at least VR-Finnish railways and Taxis of Kanta-Häme will be part of it. They are also necessary partners. The service is mainly meant for the commuters travelling from the region of Hämeenlinna to Helsinki. Transportation within the Helsinki area is not included in the service/pilot.

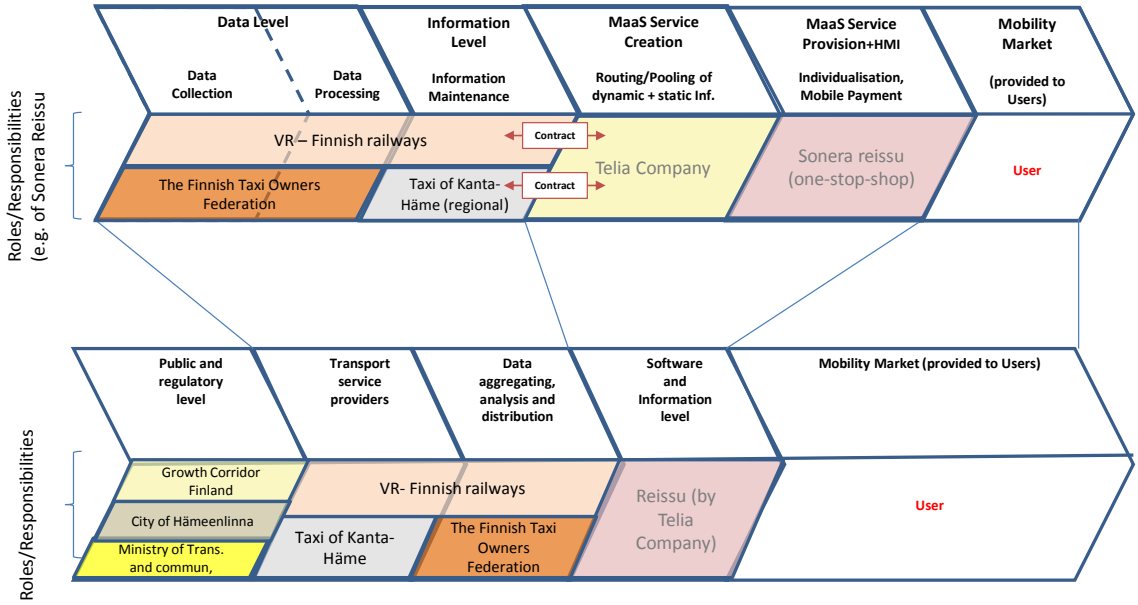

Figure 13: Identified Sonera Reissu value chain

Description of geographical coverage/ Functional service descriptions

Taxis in the Hämeenlinna region (i.e. Taxi of Kanta-Häme) and trains from Hämeenlinna to the Helsinki railway station.

MaaS operator

Telia Company (provides the application and has the contractual relationship with the customers)

Organisational framework

Public and regulatory level:

- Growth Corridor Finland stretches from the Helsinki to the Tampere regions as a string of cities. It creates the forefront for national competitiveness; more than 50 % of Finland's GDP is produced in this area. Growth Corridor Finland is the biggest workforce in Finland with more than 301 000 daily commuters. The project/partnership is dedicated to establishing Growth Corridor Finland as the leading experimental platform on Intelligent Transport Services and Systems in Europe. Making travelling within the region and between different regions of Finland smooth and reliable is one of the objectives of Growth Corridor Finland.
- The City of Hämeenlinna: monetary support and making the area and the city attractive place to live.
- Ministry of Transport and Communication: public support (including monetary support) and enabling pilots. Digitalization and MaaS are two of the ministry's spearheading efforts.

Transport operators

- VR: responsible for the railway traffic
- Taxi of Kanta-Häme: Responsible for the taxi traffic within Hämeenlinna area
- The Finnish taxi owners federation: responsible for the ICT-solutions (e.g., APIs) of the Finnish taxis, national taxi authority

6.4 MaaS value chain assignment – Austrian case

In Austria several projects and pilots were implemented and are running that include all three components of MAASiFiE's definition of MaaS. The VAO ("Verkehrsauskunft Österreich") was one of the first projects focusing on the development of an Austrian multimodal traveller information system, involving all major transport organisations, being able to contribute to the development of a common mobility information platform.

6.4.1 SMILE/BeamtBeta/WienMobilLab

The project of SMILE represents a prototype of an integrated mobility platform providing multimodal traveller information, sharing information and ticketing service features. The mobility platform integrates various means of transport services covering the Vienna region and combines them with a common routing and ticketing feature. As far as routing is concerned, the VAO (Verkehrsauskunft Österreich) traveller information service is integrated and used.

BeamBeta is the follow-up project of SMILE and incorporates several additional service features. In addition, the same integrator-organisation is working on a further follow-up project, called WienMobilLab providing extended service features covering sharing, parking and advanced ticketing and payment functionalities by implementing individual subscription services, including e.g. PT season tickets and/or subscriptions to commercial carsharing companies. The WienMobil-Lab represents a combination of the BeamBeta and WienMobil card, which will be described in chapter 6.4.2 in more detail.

Cooperation structure

The SMILE mobility platform was provided as a smartphone based application to the test users. The routing functionality is based on the VAO routing system. The main integrator-organisations responsible for the final mobility platform provision are represented by Austrian's largest PT provider organisations: Wiener Linien (Vienna's PT provider) and ÖBB (Austrian Federal Railways). Since the VAO integrates aggregated information on the road network and PT timetables, Austrian's road operator ASFINAG and Wiener Linien are responsible for the data/information provision as shown in the value chain figure.

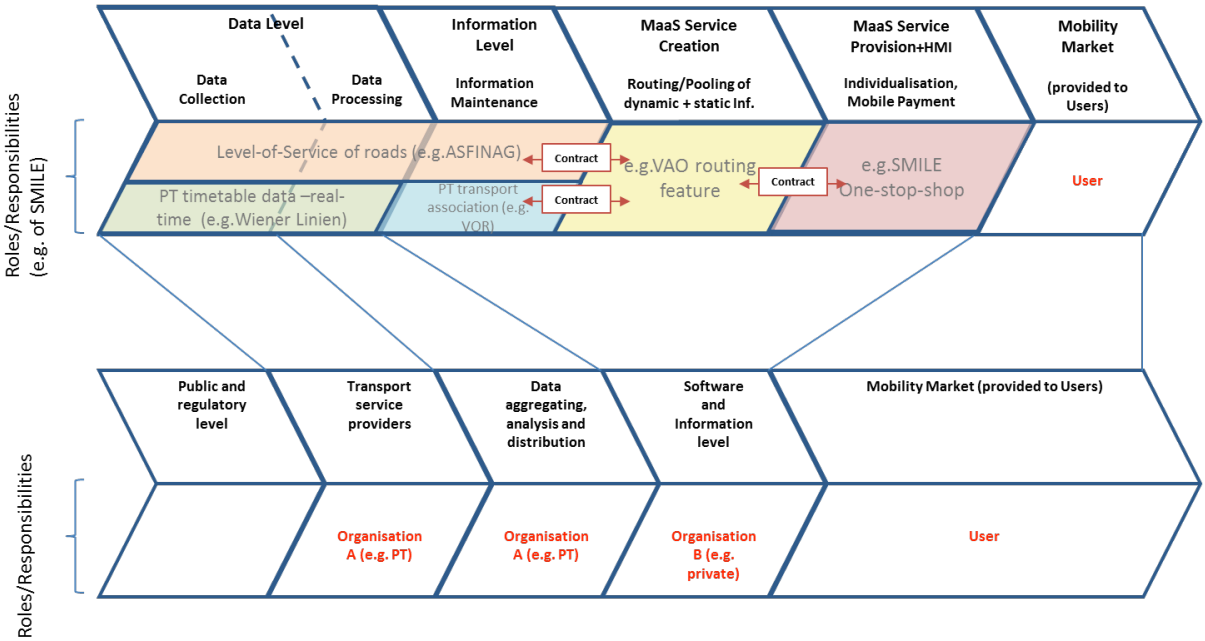

Figure 14: Identified SMILE value chain

Description of geographical coverage/ Functional service descriptions

Depending on the available transport modes there is difference in geographical availability. For instance, as far as the railways are concerned the whole Austrian rail network is provided in SMILE. On the other hand, some mobility service features are covered only by city regions like Vienna, Graz and Linz, including for instance: taxi organisations, carsharing (e.g. Car2Go), locations of free parking lots in garages and city-bike locations.

MaaS operator

Wiener Stadtwerke (Vienna Public services) and ÖBB (Austrian Railway Provider)

Organisational framework

SMILE was a research project that was funded by the Climate and Energy Fund under the Austrian Federal Government and is carried out as a part of the third call of the "Austrian Electric Mobility Flagship Projects" programme. The SMILE project was initiated by Wiener Stadtwerke. At the core of the project team is the cooperation between Austria's two largest mobility service providers (Wiener Linien and ÖBB, as mentioned before).

6.4.2 WienMobil card

In contrast to the SMILE project, the WienMobil card presents a combined payment/ticketing scheme without having any web-/app-based features integrated. This means users are able to consume different mobility services in the area of Vienna via one common pricing scheme. Based on the integration of different means of transport, users get different discounts when they make use of consuming these different services. Based on the electronic purse principle, the WienMobilcard provides an integrated pre-paid mobility card, which allows travellers to use PT in Vienna together with additional mobility service features for one year under discount conditions.

Cooperation structure

The WienMobil card is organised and provided by the Wiener Stadtwerke, in more detail it is provided by the 'Wiener Linien', as a common urban ticketing card. Together with consuming mobility service features, like parking and carsharing under special conditions, the municipality of Vienna is fostering an increase in purchasing annual season tickets instead of one-way tickets. In order to allow the integration of different discounts on mobility services, the following cooperation partners are participating in the WienMobil card by providing the following pricing schemes and discounts: the PT operator in Vienna provides the annual season ticket covering local PT; reduced registration fees when joining DriveNow carsharing; three different taxi organisations to be paid directly with the mobility card; payment and access features for bikesharing; free access to e-charging stations for cars and bikes; reduced parking fees at pre-defined parking garages; and reduced ticket prices for the City-Airport-Train (CAT).

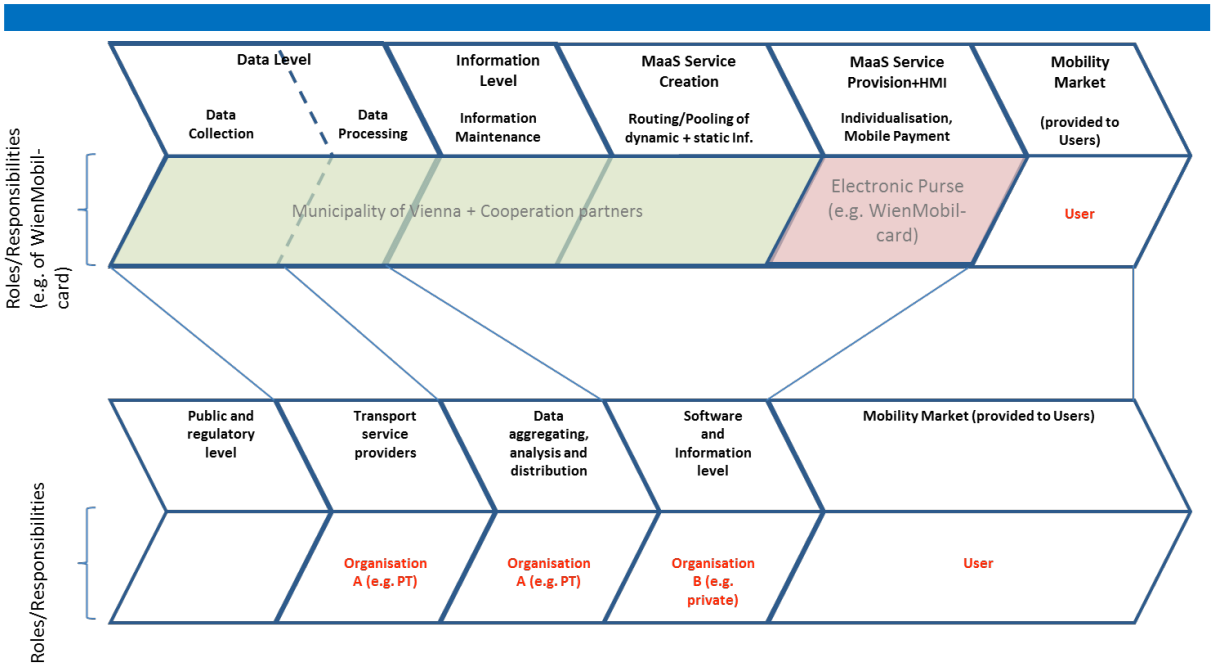

Figure 15: Identified WienMobil' value chain

Description of geographical coverage/ Functional service descriptions

The WienMobil card geographical coverage is limited to the Vienna urban and suburban areas. As described in the previous part, the main scope relies on the payment feature and reduced discount offers provided as mobility service features to end-users/travellers.

MaaS operator

Wiener Stadtwerke (Vienna Public services)

6.5 MaaS value chain assignment – Swedish case

The UbiGo MaaS service was envisioned and under development before the phrase “Mobility as a Service” even existed. It can be considered the first example of a MaaS service in the world and won the International Transport Forum’s 2015 Promising Innovation in Transport Award (passenger category). Under the project “Go:Smart”, a pre-study was conducted in 2011-12 and the service was developed and piloted in 2012-14. 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 (8). A re-launch of the service is planned.

6.5.1 UBIGO

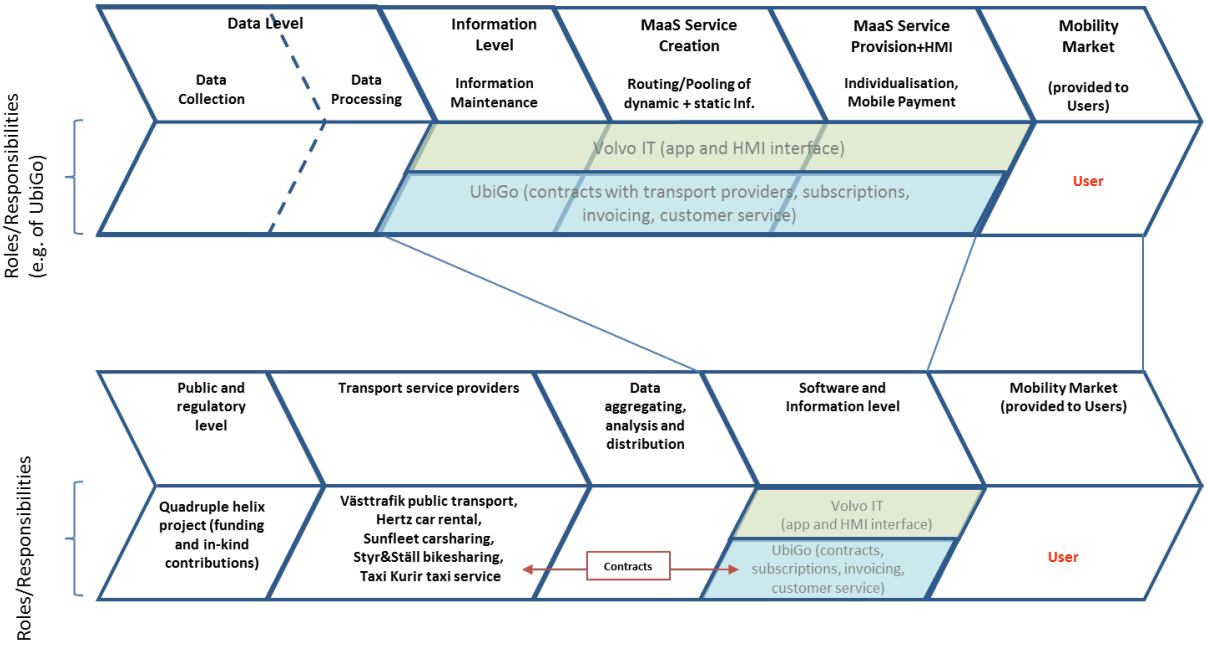

Figure 16: Identified UbiGo value chain

Cooperation structure

Five transport providers participated in UbiGo: Västtrafik public transport, Hertz car rental, Sunfleet carsharing, Styr&Ställ bikesharing, and Taxi Kurir taxi service.

Description of geographical coverage/ Functional service descriptions

The intended audience for the UbiGo mobility service pilot was urban households in Gothenburg, Sweden, who were judged to have sufficient access to the existing transport solutions, in particular to carsharing and public transport, and large enough travel needs for the service to be financially competitive with their current solution. UbiGo was tested under realistic conditions, i.e. real households paying real money for real services, in a six-month field operational test (FOT).

UbiGo customers, in the form of households, paid a monthly subscription adapted to their transport needs, which included a personalized combination of, and amounts of credit for, the different transport services mentioned above. Credit could be topped up or rolled over depending on how much credit the household utilized, and the subscription could be modified on a monthly basis. In order to encourage participation in the FOT, any unused credit was refunded to the participants at the end of the test. Also, the project could compensate participants for not using a private vehicle during the FOT, i.e. to offset insurance, parking, etc. up to a fixed limit. This incentive resulted in 20 deliberately unused private vehicles during the FOT (17 from single-vehicle households).

To access their transport services, the UbiGo customer logged into a web interface adapted to smartphones (subsequently referred to as the 'app') via a Google- or Facebook-login, where they could activate tickets/trips, make/check bookings, and access already activated tickets (e.g. for validation purposes). The app also allowed them to check their balance, bonus, and trip history, and get support (in terms of FAQ/customer service). (Note that the app did not include pre- or on-trip journey planning or real time public transport information.) Each participant received a smartcard, used for instance to check out a bicycle from the bikesharing service or unlock a booked car, but also charged with extra credit for the public transport system in case there was any problem using the UbiGo service. UbiGo also included a customer service phone line open 24 hours per day.

At the end of the FOT, in accordance with the project's intentions, a company UbiGo AB was established that intended to continue offering the UbiGo service. Despite this, the UbiGo service was unable to continue due to, in hindsight, a lack of time to establish all the necessary processes as well as a lack of shared vision between the project partners.

Responsible MaaS operator: UbiGo

Organisational framework

UbiGo was part of a quadruple helix project (Go:Smart) involving public and private sectors, academia, and users. The project was funded by Vinnova (the Swedish Innovation Agency) with matching funding and in-kind contributions by the project partners (in alphabetical order): Arby Communication, the City of Gothenburg, Chalmers University of Technology, Lindholmen Science Park, Mistra Urban Future, Move About, Payex Finance, Region Västra Götaland, the Swedish Transport Administration, Tyréns, Västtrafik, Viktoria Swedish ICT, Volvo Buses, and Volvo IT/Commute Greener.

In terms of the practicalities of running the UbiGo mobility service, UbiGo (the FOT team) negotiated prices with the five transport providers, managed the customer subscriptions and invoicing, and provided higher-level customer service (lower-level customer service was contracted out). The 'app' (and HMI interface) was developed and maintained by Volvo IT/Commute Greener. The functionalities included in the app are described in point 3 above.

7. Identification of MaaS service combinations

A more efficient use of transport in urban areas and promoting a more sustainable way of living along with ever-accelerating urbanization and digitalization have been the main drivers for MaaS. MaaS is needed to solve mobility challenges in cities and simultaneously new business concepts can be easily tested in more densely inhabited environments first. However, a huge number of people with various demands for mobility services live in smaller communities and rural areas as well.

MaaS could have an impact on city planning in both urban and rural areas although these impacts may differ. In urban areas, MaaS may improve the quality and efficiency of the transport system, while in rural areas MaaS may facilitate the possibilities for people to have more demand-responsive and flexible transport services. Hence, MaaS can increase an area's attractiveness and improve well-being.

Although the availability and coverage of MaaS services vary between geographic areas, common features exist. In fact, these features create a recognizable identity for MaaS by framing or defining it. The common features are as follows:

- One-stop-shop
- Mobile ticketing and payment. Mobile refers to ticketing and payment that can be done anywhere (via e.g. smart phone, tablet, smart card, PC…).
- Multimodal traveller information and routing are being adjusted in real-time if necessary.
- Perceiving individual preferences and priorities: time, sustainability, price, special needs and constraints (e.g., disability, special packages, child seat, etc.)
- Special offers and frequent customer programmes

7.1 MaaS service combinations

In this section, different service combinations in different geographical regions are discussed. The discussed regions are cities (i.e., urban), suburban and rural. Since there seems to be a demand for Pan-European services and a single market (16), MaaS service combinations on national and international levels are also discussed.

MaaS service combinations are analysed through three elements: *value proposition (i.e., offering)*, *value creation system*, and *revenue model (i.e., value capturing*). Together these elements form a company's business model framework.

Successful companies have always found the way to create customer value (17), but only some companies have been capable of defining or measuring the value created to their customers (18). To make customers focus more on total costs (i.e., mid- or long-term costs) rather than on acquisition price only, a supplier must have a clear understanding of what is of value to their customers. The offering covers the output of the value creation system including both products and services. Companies strive to solve customers' problems and satisfy their needs with the offering (19).

Many companies fail to define last part of the business, i.e. value capturing (12). Unfortunately, this means that companies cannot capture revenues relative to the value they create. Value capturing measures a company's ability to translate its value proposition into revenue streams that are essential to its long-term survival. Usually, companies do not have just a single revenue stream, because they may have different pricing models for different services or products. Therefore, their revenue models should be in line with the markets and customer segments (20).

7.1.1 MaaS in urban areas

As already pointed out, cities are the first places where MaaS is going to be implemented due to the high population and fruitful environment for testing and piloting. It is also worth noticing that cities have most of the transport modes, and hence different service combinations already exist and new combinations can emerge. Figure 17 illustrates the initial service combinations in cities and urban areas.

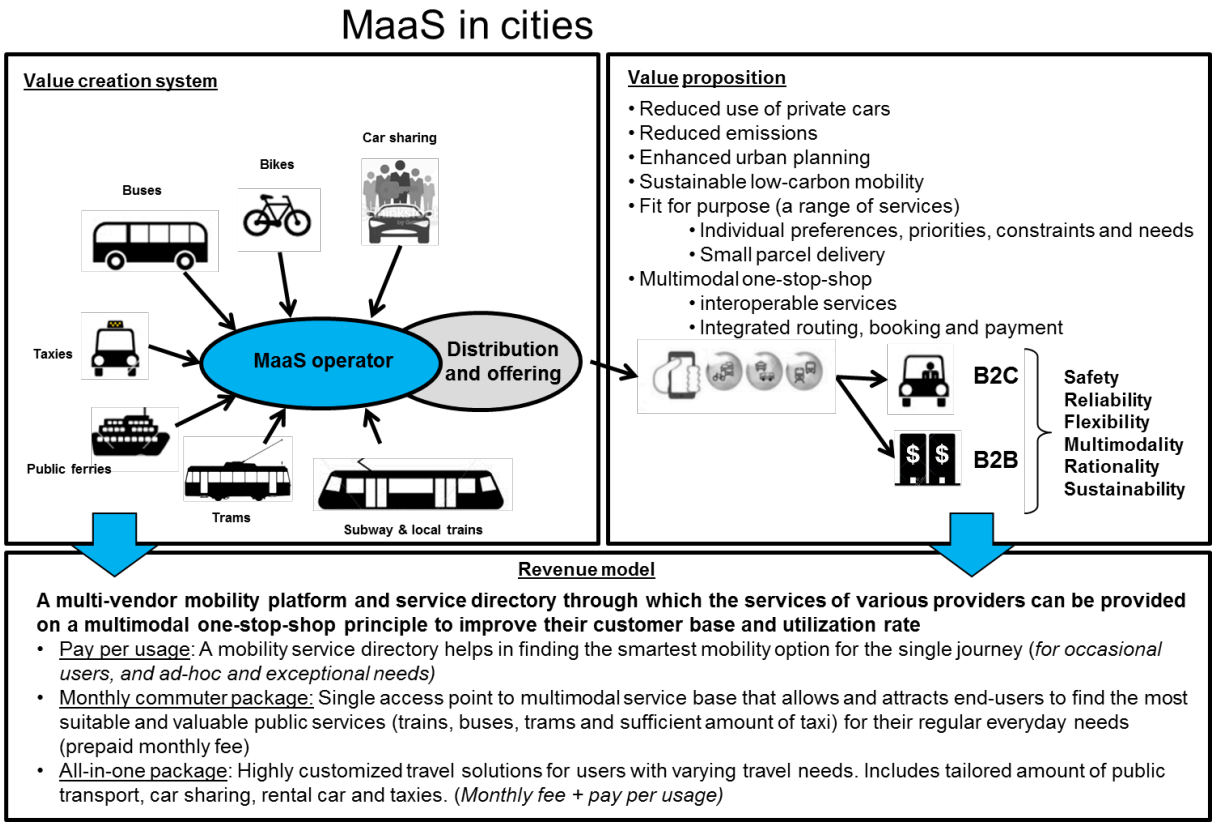

Figure 17: MaaS services in urban areas (copyright Aapaoja, A. & Eckhardt, J. 2016)

The main objective of MaaS in urban areas is to reduce the ownership and use of private cars and by that reduce the traffic congestion, emissions and parking problems. As the number of private vehicles lessens in city areas, these environments can be made more liveable through more efficient urban planning. Practically the only way to reach the objective or even make private cars unnecessary in cities is to include all the available transport modes in the service coverage. At least car sharing, bike sharing, buses, taxis, ferries, trams, subway and local/commuter trains are available – or are going to be available shortly – in most of the big cities all over the world.

In cities, MaaS services can be offered to both private consumers and company employees. A significant amount of potential users enables different revenue models for the MaaS operators. In addition to the traditional pay-per-use model, fixed or customized monthly packages can be offered as well.

7.1.2 MaaS in suburban areas

Organizing MaaS in suburban areas is one of the most interesting cases regarding sustainability because families mostly inhabit these areas. Since the availability of public transport can be limited to some extent, families have many times a perceived and/or real permanent need for two cars.

MaaS is expected to improve service levels (i.e., trams, buses, subway) by integrating taxis and other modes of demand-responsive transport with public transport. In addition, suburban

areas are potential locations for carpooling and ride-sharing if effective tools and platforms for managing those are available. By proving extensive park and ride facilities, at least emissions and problems cause by private cars in urban and suburban areas can be diminished.

Based on these arguments, the elimination of private cars is not plausible, but most probably the need for owning the second car be reduced. Since the inhabitants' and families' requirements vary a lot, services must take personal preferences, needs and even constraints into account to make MaaS credible.

When it comes to the payment system, pay-per-use seems to be the most obvious. In this way, the differing needs of the travellers and users can be managed. Monthly packages may be feasible if they can be customized at a reasonable price. Figure 18 summarizes the service combinations in suburban areas.

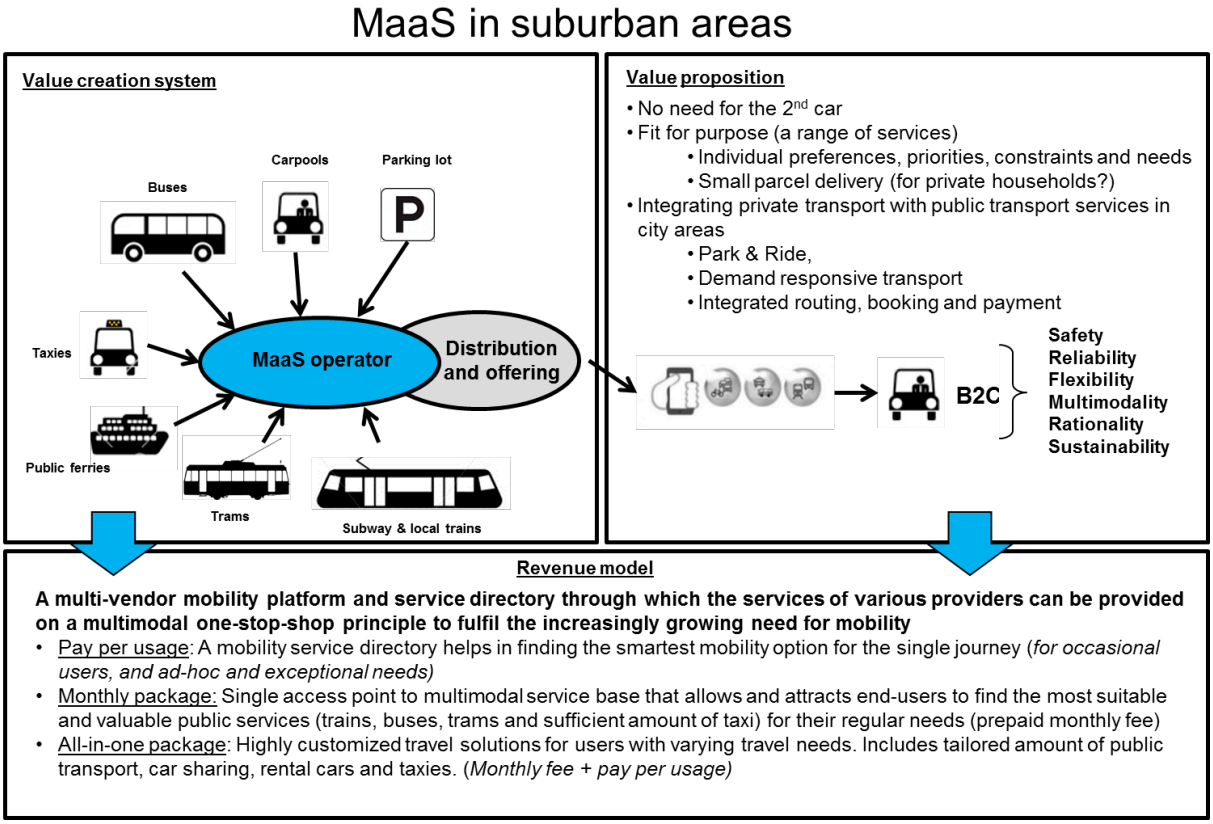

Figure 18: MaaS services in suburban areas (copyright Aapaoja, A. & Eckhardt, J. 2016)

7.1.3 MaaS in rural areas

Even though the potential of MaaS in urban and suburban areas are emphasized, a vast number of people are still living in the countryside and rural areas. In fact, 16% (0,9 million) of Finnish people, 34% (2,9M) of Austrian people and 14% (1,4M) of Swedish people are living in rural areas. To some extent, desired MaaS services in rural areas are equivalent to the desired services in suburban areas. However, rural areas are suffering from a lack of connections to long-haul and scheduled services and therefore MaaS-enabled first- and last-mile services might provide significant benefits as the current service level could at least be sustained, and the utilization rates could be increased.

Another big issue, at least in Finland, is how the socially and publicly supported transportation (including school and statutory social service transportation) could be made more efficient and effective (including cost effective) through MaaS. Because taxis handle most of these rides, generally it is about increasing efficiency rates by combining rides instead of driving individual customers as now it usually done. Also, embedding other

services, e.g., library services and small patch deliveries (medicine and food), as part of the MaaS package has been discussed.

Since the demand is hard to predict and the availability of services is more important than the price, pay-per-use will probably be the most practical way of dealing with customers. Figure 19 presents the service package in the countryside.

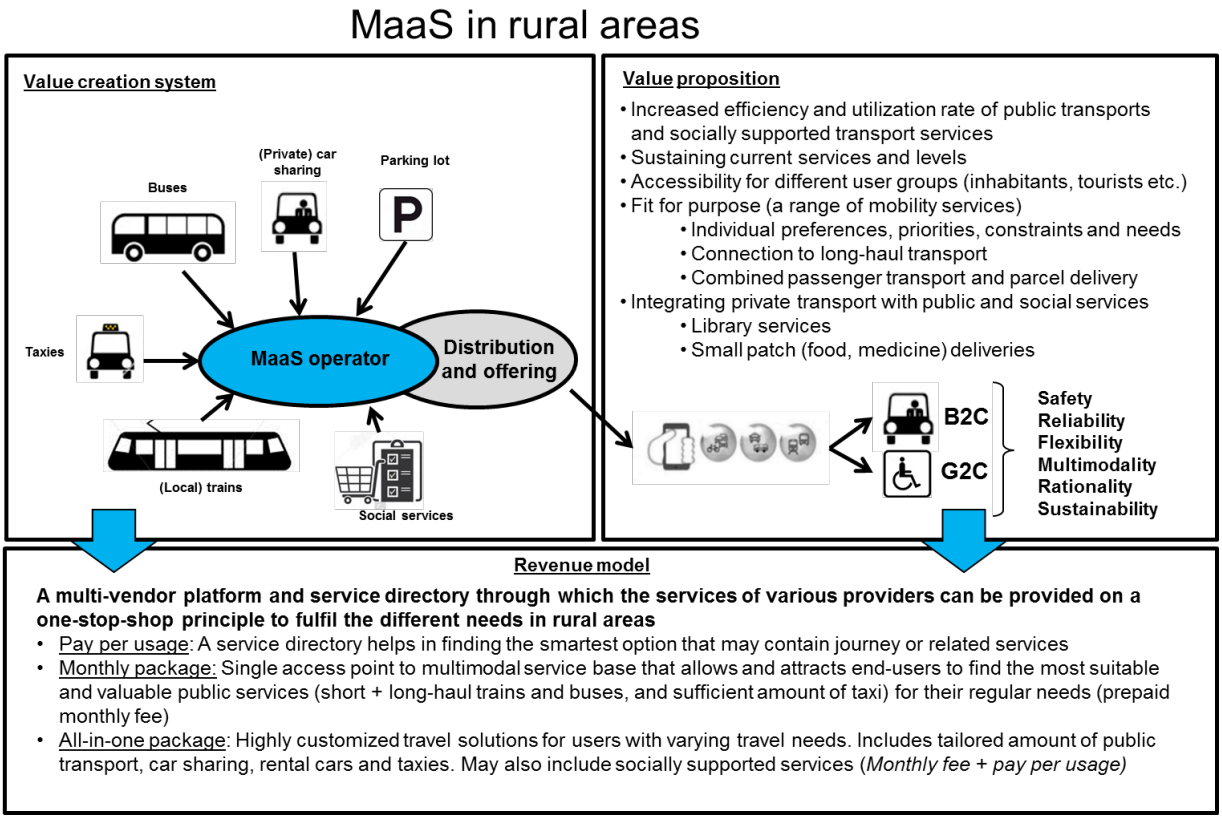

Figure 19: MaaS services in rural areas (copyright Aapaoja, A. & Eckhardt, J. 2016)

7.1.4 MaaS on national and international levels

MaaS on national and international levels is usually related to long-haul travel either for work or leisure purposes. There are examples of long-distance and cross-border commuting, but they can be considered more similar to the suburban MaaS scenario (Figure 18). Almost without exception, long-haul travel is the means and not the end goal, thus this type of travel is associated with the need for some other services as well. These additional services can include accommodation, tickets, leisure activities, tours, etc. In the case of national and international travel, air traffic becomes an essential component of the MaaS service.

Creating this kind of long-haul MaaS requires collaboration with multiple different operators from several business fields. There have been some suggestions and examples of combined transport and event tickets in Finland. However, in all of these cases, the event organiser has made a deal with transport service providers. The same goes with a traditional package of accommodation and travel. Different kinds of special offers are always possible. However, as national and international MaaS remains more or less at the conceptual stage at the moment, there is no point in speculating regarding payments, etc., because no real use cases or even examples exists.

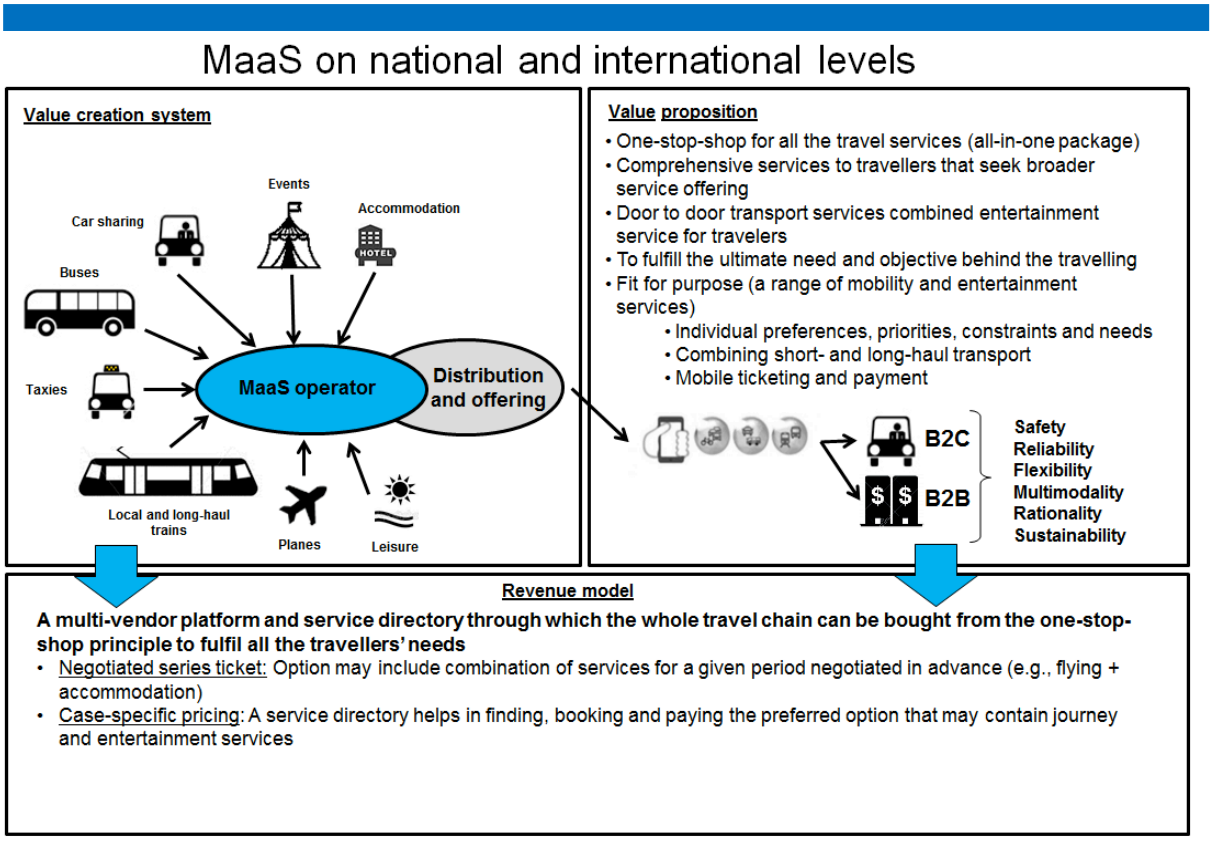

Figure 20: A concept of MaaS services on national and international levels (copyright Aapaoja, A. & Eckhardt, J. 2016)

7.2 Road pricing as part of MaaS

In the context of digitalisation and automation in the transport sector, several business and process optimisation opportunities exist not only for supplier companies, like car manufacturers, but also for infrastructure operators. In this respect, ticketing and road pricing and/or congestion charging are of high importance for preserving revenue streams.

As MaaS concentrates on the reduction of total transport emissions and provision and usage of non-private car and environmentally friendlier transport modes, the polluter could potentially pay for the externalities. In other words the polluter-pays principle is understood as a further measure to attract people to using MaaS and related services.

By thinking of MaaS in general, there is a strong sense of service in the foreground. In this context, and by going through analysed case studies and identified operator models and relevant literature, the main focus of interest for stakeholders is on local and national PT service providers considering MaaS integration. From the perspective of road operators, new potential opportunities in terms of new business models and service combinations arise regarding integrating road pricing into MaaS concepts as well.

As there is no road pricing applied to Finnish roads, the main focus was put on Sweden and Austria considering current road pricing/congestion charging schemes being applied and how these pricing schemes can be applied to MaaS.

In Sweden, road pricing (called "congestion tax"), both Swedish and foreign vehicles, currently exists in the two largest cities, Stockholm and Gothenburg. The aim of the tax is to reduce congestion, improve the environment and contribute to financing infrastructure improvements. Cars, trucks and buses that weigh less than 14 tonnes have to pay the congestion tax. However, emergency vehicles, EC mobile cranes and buses with a total weight of at least 14 tonnes, motorbikes and mopeds do not pay the tax.

The road pricing schemes are each based on a cordon controlled by cameras. The payment system is completely automatic. When one drives past a control point, this is registered. At the end of each month, the Swedish Transport Agency sends out a payment slip to owners of vehicles registered in Sweden. If the vehicle is registered abroad, the Swedish Transport Agency has entrusted a notification partner to identify the owner of the vehicle, send out invoices to and obtain payments from the owner of the vehicle via EPASS24.[36] The amount charged depends on the day and time, and there is a maximum amount per vehicle per day.

For heavy goods vehicles (HGVs), Sweden currently uses the time-based vignette system for both Swedish and foreign vehicles by which one pays according to how much time one drives within the country (versus the distance-based vignette system). However, it is difficult to monitor compliance. The EU commission recommends the distance-based system and more and more EU countries are migrating to that system. In 2015 the Swedish government has appointed a commission to make proposals on how a distance-based road-user-charging (RUC) scheme for heavy trucks can be designed. The aim is that through road user charging the heavy freight traffic to a larger extent will pay its societal costs, such as road wear and pollution. The tax shall include Swedish and foreign trucks on Swedish roads. The commission's report is due in December 2016.[37]

In Austria there are two different road-pricing schemes applied to private cars (vehicles not exceeding a max gross weight of 3.5 tonnes) and trucks (vehicles above 3.5 tonnes max gross weight). Road pricing is applied to national highways, operated by the Austrian Motorway and Expressway Network Operator (ASFINAG). As far as car road pricing (up to 3.5 tonnes) is concerned, a valid motorway vignette must be installed behind car windscreens. The motorway vignette is available for purchase on an annual respectively monthly basis. On the other hand, trucks (vehicles above 3.5 tonnes) are charged on a distance-based road-pricing scheme. The system behind it is called Go-Maut, which consists of an On-Board Unit (OBU) that trucks have to carry in order to collect truck tolls correspondingly over an ICT-based air interface. The system is compatible with other toll collecting schemes in the following countries: Germany, Denmark, Norway, and Sweden.

Another example is France where 'IDVroom' carpooling users are provided with free automatic toll badges, without needing to pay any additional management costs, and including downloadable monthly invoices.

Based on the expert interview results, some road transport-related stakeholders believe that in the future there will be a trend towards distance-/ride-based charging schemes applied at least to the higher-level road network. This goes hand in hand with the polluter-pays principle and would represent a very similar pricing scheme compared to public transport ticketing. For instance business, commuter and/or leisure-based trips on the higher priority road network would have then to be booked/reserved apriori (before the ride) in order to allow the provision of specific road capacities/level-of-service based on demand in order to try to avoid congestion. In this case road pricing would require an integrated planning tool for enabling flexible, demand-based road traffic management.

Emerging automated driving further enables the implementation of new digital services based on vehicle-to-vehicle and vehicle-to-infrastructure communication interfaces. Depending on the level of vehicle automation (from e.g. SAE level 1 No Automation, to level 5 Full automation, respectively according to the NHTSA level classification, 0 No automation, to level 4 Full automation), there is an observable convergence of the individual transport mode towards public transport modes. In other modes, a high degree of autonomous driving enables new mobility opportunities which will also demand for new pricing schemes.

[36] http://transportstyrelsen.se/en/road/Congestion-taxes-in-Stockholm-and-Goteborg/

[37] http://www.arena-ruc.se/en/2015/05/08/swedish-governmental-investigation-on-truck-tolling/

7.3 Freight as part of MaaS

Identified MaaS operator/business models and value chains provide a strong focus on passenger transport even though expert interviews have shown that the intention is to combine MaaS service concepts with freight transport as well. For both passenger and freight transport, digitalisation and automation enable connectivity and facilitate improved management processes. By combining lessons learned from both fields of transport, synergy effects are very likely to result. For instance, the purpose of logistics in freight transport represents a means to achieving gains in transport efficiency; just as MaaS concepts try to promote using environmentally friendly transport modes and fewer private vehicles.

MaaS could be combined with parcel and small logistics deliveries by using e.g. taxis, buses and minibuses. Pilots like Seinäjoki (by Sito) and YlläsAround (by Telia Company) are planning these kind of services. Also some MaaS-type freight services exist (see below), and they could be combined to MaaS ecosystem.

Geographical areas where freight combined with MaaS would probably fit the best are urban areas and rural areas although the aims and implementation differ. In urban areas a wider range of different freight MaaS services are possible due to the dense population, and public transport could be used. The societal aim is to reduce emissions and congestion, and enhance land use planning. In rural areas distances are long and there is often free capacity in transportation. Thus the main aim is to increase efficiency and maintain sufficient service levels. The customer perspective is also important in both geographical areas.

The following freight MaaS type services are presented here:

- PiggyPaggy, Finland
- Volvo In-car Delivery, Sweden
- Checkrobin.com, Austria

PiggyBaggy, Finland[38]

PiggyBaggy is a ridesharing service application for goods where you can request a delivery and/or become a transporter. The use of service is easy:

- Request delivery and give needed information (what, where, when and suitable price option).
- A suitable transporter will contact you within the service or on the phone to arrange details.
- Door-to-door delivery of your item.

Volvo In-car Delivery, Sweden

As referred to 4.3.2 as well, Volvo's In-car Delivery[39] is a service for delivering goods directly to your Volvo. The idea is to use one's car to avoid planning one's life around deliveries. The customer decides the time and place for delivery. A temporary single-use digital key allows authorized partners to deliver their goods, after which the key is destroyed. This key can be tracked so that the customer knows when her/his car is opened and locked again. Delivery is confirmed via e-mail or SMS and the goods are also insured. The service is currently available in the Gothenburg, Stockholm and Malmö areas and partners currently include companies delivering food, sporting goods, consumer electronics, etc.

[38] http://piggybaggy.com/

[39] https://incardelivery.volvocars.com/

Checkrobin.com, Austria[40]

'checkrobin.com' represents an online platform for private goods delivery organisation, which aims at connecting private people according to enable a simple, flexible and fast transport of all parcels and things in general possible. According to the role model of sharing economy, the platform aims at connecting people, needing items to be delivered with drivers and couriers 'going there anyway'. Further the platform is open to individuals and professional service providers (other couriers and taxi drivers). There arise several advantages for both logistic providers and their customers, including e.g.:

- Lower freight and in-transit inventory costs,
- Greater forecasting flexibility,
- Supply chain risk reduction, and
- Improved speed-to-market (for customers)

[40] https://www.checkrobin.com/

8. Conceptual MaaS business and operator models

A business model illustrates and defines how an organization creates, delivers, and captures value (including economic, social, cultural or other contexts). Therefore, the process of business model construction is a crucial part of forming the business strategy and assessing the market potential and position (22). Probably the best-known tool for this is Osterwalder and Pigneur's (2013) business model canvas. It allows for describing new or existing business models through offering (value proposition), infrastructure (key activities, resources, partners), customers (segments, channels, relationships) and finance (cost structure, revenue streams). Figure 21 presents a general business model for a MaaS operator and services.

The business model canvas below reveals two particularly interesting things: a wide range of 1) key partners and customers, and 2) revenue streams. A wide partner and customer base in different segments can indicate the business potential of MaaS services and platforms. From an ecosystem point of view, some partners and customers attract more participants but also enable the extensive development and provision of interoperable and integrated services. Platform-based ecosystems (e.g., managed by a MaaS operator) are a new way of managing an offering of individual service providers. Ultimately this increases the added value for customers by concretizing the synergic benefits of the business ecosystem approach. This change towards high-value integrated solutions in other industrial fields has been witnessed in recent years (24). These integrated solutions not only require a more comprehensive understanding of available solutions and customers' needs, but also exploitation of new revenue models to strengthen the interdependence of ecosystem participants. Being at the crossroad of providers and customers, a MaaS operator indeed plays the essential role of being the one who can enable the development of these integrated solutions by providing a working middleware environment or B2C interface with various fit-for-purpose payment methods. Revenues can be based on the traditional one-off or fixed payments, but different kinds of periodic payments, pay-per-use charges or commissions are valid options too.

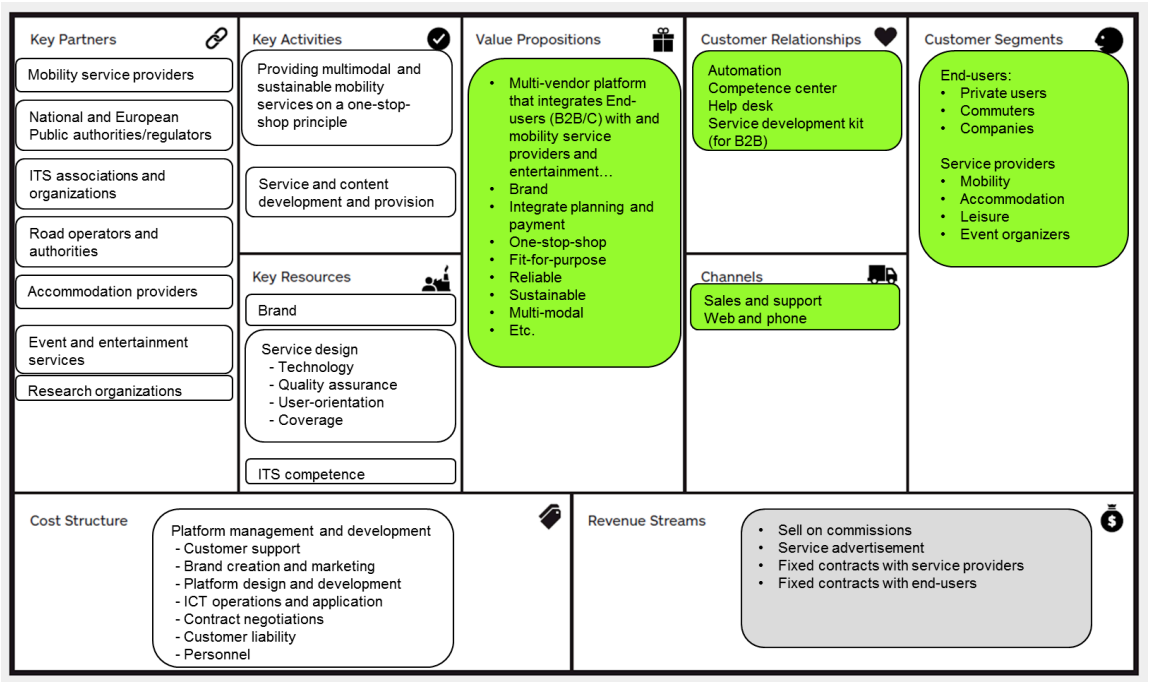

Figure 21: Business model canvas for a MaaS operator (copyright Aapaoja, A. & Eckhardt, J. 2016)

Basically, two different models of MaaS operator business models and revenue streams exist: 1) the agency model and 2) the merchant model. The agency model is primarily based

on reselling, where the MaaS operator is purchasing transport tickets in a significant volume and hence receiving some volume discount. MaaS operators get their marginal profit by re-selling the tickets at the normal price. The merchant model rests upon commissions that the transport operators are paying to the MaaS operators for reselling. These two options are not mutually exclusive, and can be used simultaneously. Probably mass product articles, such as public transport tickets, where volumes are large and demand is assured can be sold using the agency model, while more exclusive and individual transport modes (e.g., rental cars) are best sold via the merchant model, which fits situations where volume is small and demand is hard to predict, but commissions are higher. In addition, some extra income can be gained from the 3rd party advertisements, but it cannot be the primary revenue model.

Identified MaaS operator models are presented in Figure 22. Commercial MaaS operator models are Reseller and Integrator. A Reseller supplies transport services of different transport modes; a travel agency is a good example of a Reseller. An Integrator in addition combines the services of several modes with digital services, e.g. an application for mobile ticketing and/or travel planning. For some integrators, MaaS is the main business; for example MaaS Global and Tuup have been established for the MaaS operator purpose. For some commercial operators, MaaS is a complement to their service offering. For example Telia Company is a MaaS operator, whose core business is telecommunication. Public transport operators can act as MaaS operators by integrating additional transport services and digital services with their existing public transport. The Public transport operator may be owned by the municipality/region, like HSL in the Helsinki area (Finland), or owned by the state, like SNCF in France. 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 the public actor is responsible for. These may include legislated special transport services and freight/delivery. The MaaS operator models are illustrated more in detail below.

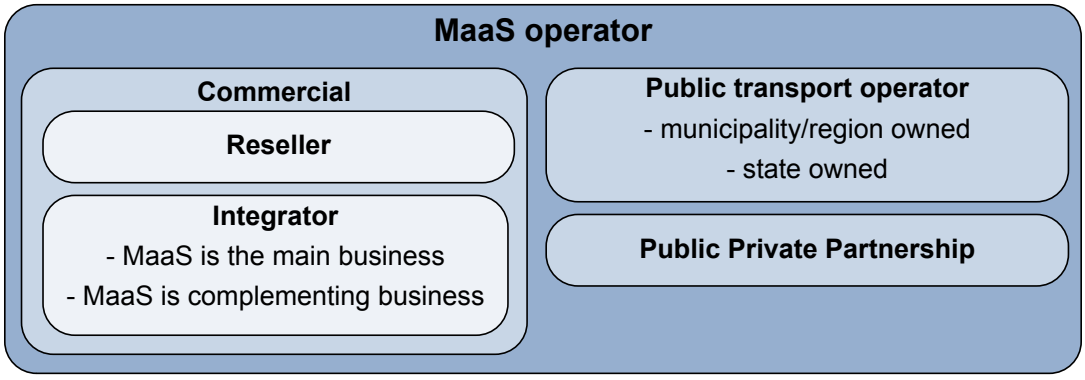

Figure 22: MaaS operator models (copyright Eckhardt, J. & Aapaoja, A. 2016)

The Figure 23 illustrates commercial MaaS operator models. In the Reseller model, multiple services from different transport service providers (TSPs) are offered to users via one interface. The Integrator model includes in addition a mobile service provider (MSP) that provides key enabling technology and services (e.g. mobile ticketing and payment).

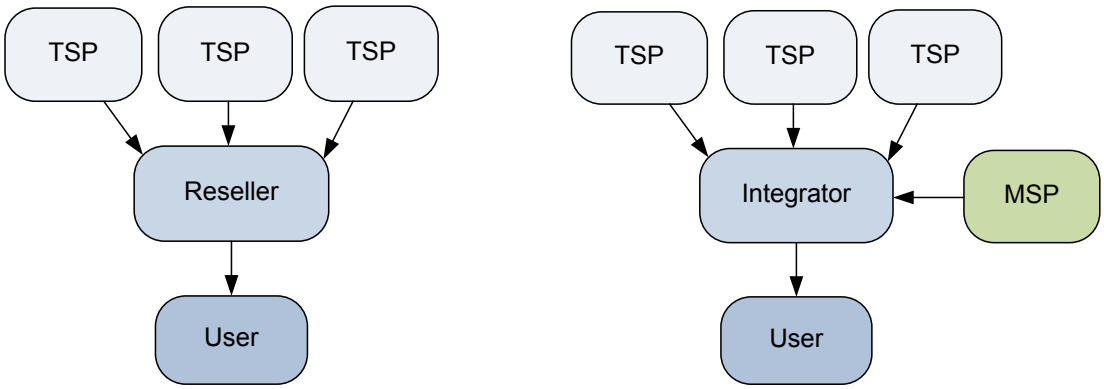

Figure 23. Commercial MaaS operator models (copyright Eckhardt, J. & Aapaoja, A. 2016)

The Public transport operator (Figure 24) integrates other transport services e.g. taxis, carpooling and city bikes with public transport. Digital services, e.g. mobile ticketing and payment and multimodal planner and (re)routing are provided by mobile service provider (MSP).

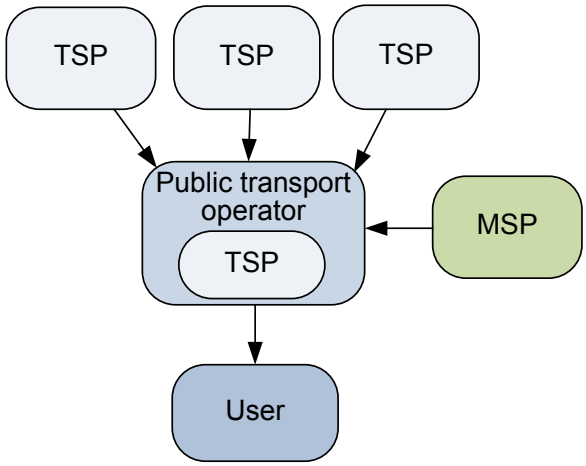

Figure 24. Public transport operator as MaaS operator (copyright Eckhardt, J. & Aapaoja, A. 2016)

Figure 25 illustrates the PPP MaaS operator model, which is mainly based on the Seinäjoki/Sito case in Finland. In Seinäjoki, the MaaS pilot is a collaboration of Sito (consulting and planning company), the municipality of Seinäjoki, and transport operators. These actors are planning to create a common MaaS operator company. In addition to transport and mobile service providers (MSP), logistics service providers (LSP) may be included. Organizations responsible for statutory social service (SST) transportation, related e.g. to disabled and elderly persons, collaborate with MaaS operator. The PPP model could be especially suitable in rural or sparsely populated areas where combining logistics services as well as school and statutory social service transportation with MaaS is important for efficiency and maintaining an appropriate service level.

All operator models can include logistics services and other additional services. However, the PPP model usually integrates logistics services from the beginning due to free capacity in transportation and long distances. Other operator models more likely start with mobility of people, and later on integrate freight and other additional services.

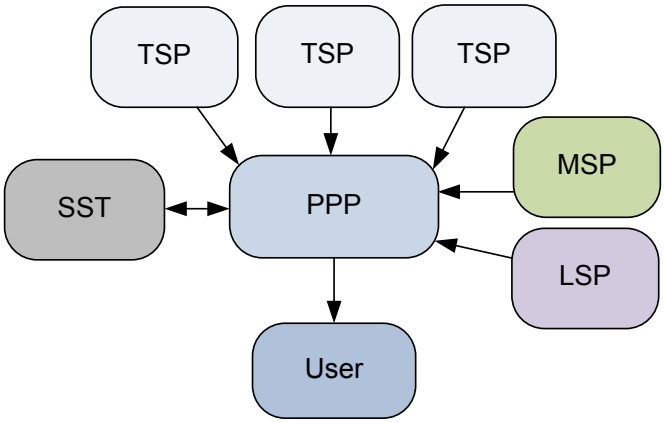

Figure 25. Public Private Partnership MaaS operator model

(copyright Eckhardt, J. & Aapaoja, A. 2016)

Regardless of the MaaS operator model, service agreements between the MaaS operator and transport operators vary. One MaaS service can include different service agreements. The identified service agreement types are re-sold services and negotiated services and they are presented in Figure 26. Re-sold services can be based on list fares, like between Telia Company and VR (Finnish Railways) in Sonera Reissu, or on fixed reduction percentage, like in SNCF iDAVIS. Negotiated services are based on bilateral agreements, and examples include e.g. Telia Company and taxis in Sonera Reissu, and SNCF Pack mobilité.

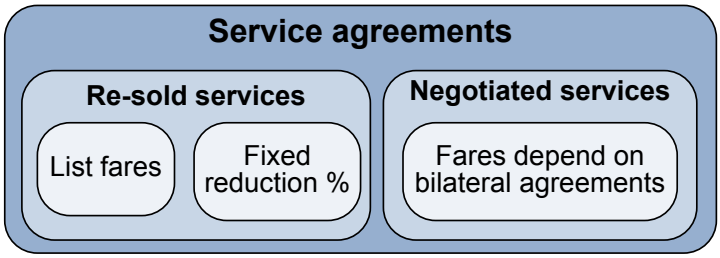

Figure 26. MaaS service agreement types (copyright Eckhardt, J. & Aapaoja, A. 2016)

9. Conclusions

Stakeholder expectations have shown that MaaS is perceived as a feasible and reasonable mobility concept. However, MaaS is still largely viewed as the integration of different passenger transport modes. Although only 1 % of all participants represented freight transport operators, there is a strong need to involve more freight-related stakeholders for planning future MaaS services in order to combine both passenger and freight last-mile delivery issues.

A fundamental basis for facilitating MaaS services is to establish a corresponding regulatory framework in order to apply new commonly integrated business rules within mobility markets. Currently there are still a lot of dispersed business models applied in the different national and international transport markets that need common interfaces in order to create combined mobility solutions for personal transport (e.g. combined ticket/information/payment solutions across different transport modes). There are strong dependencies between how the total transport system (interaction of respective key players) itself is organised and financed, which entities are obliged to provide which data and/or service features, and how the legislative framework is set up. However, digital service and data provision for MaaS forms an integral part of building the transport ecosystem as a whole in the future. In this respect, the questionnaire has revealed potential opportunities and priorities on how to organise and implement MaaS concepts in the future.

There are still hardly any international MaaS (related) services available providing common ticketing and multimodal traveller information at least on a cross-border level. With this respect MaaS is currently a regional and national mobility service phenomenon although MaaS is expected to expand internationally in the near future. The creation of MaaS services requires new ways of collaboration, whether it is local, national or international. One potential barrier for international Maas is a lack of cooperation on organisational and technical levels between different national and international transport organisations. However, state-of-the-art results have revealed that there are already many different small pilots of which some have already established larger service integration and proven the concept. In other words the feasibility of MaaS has already been demonstrated by several cases although on a local/national rather than on a European (international or global scale (to-date). As MaaS is still emerging, although there is some empirical evidence of positive, direct impacts on social behaviour and environment (6, 7, 13), the evidence base needs expanded in order to validate the transportation community's expectations of MaaS' potential impacts.

With the identification of different MaaS business models, value chains and operator models, insights into organisational requirements on MaaS concepts are provided. There are several different approaches shown on how MaaS value creation for customers and service providers can work. While elaborated value chains provide an overall picture on roles and responsibilities together with the process of adding value - from data collection, data fusion, and information aggregation to a final service provision – business and operator model findings provide an insight into revenue streams, organisational structures including legal status of MaaS operators, and the service model itself.

MaaS can include a variety of service combinations of different transport modes, sharing services and parking. Even though the service combination depends on the local context and market demand as well as the business idea and offering of the MaaS operator, typical characteristics of MaaS service combinations in different geographical areas could be identified. The aim of MaaS in cities is to reduce the ownership and use of private cars in order to reduce congestion, emissions and parking problems, and enhance urban planning. MaaS services in cities are typically based on existing public transport, enlarged with sharing and rental cars, city bikes, parking facilities, etc. In suburban areas MaaS aims at reducing the need for a second car for families. On-demand services, park & ride and other services integrating with MaaS services in cities are characteristic in suburban areas.

Rural areas are sparsely populated and distances are long causing low capacity utilization rates in transportation. Thus the objective of MaaS in sparsely populated areas is to increase efficiency and utilization rates. This is also important for organizations responsible for statutory social service transportation and school transportation. MaaS in rural areas also aims at sustaining appropriate service levels despite of the low number of travellers. Accessibility is important for both for inhabitants and tourists in rural areas. Services in rural areas emphasize on-demand services, taxis, buses, and first- and last-mile connections to long-haul transportation. Additional services combined with MaaS increase efficiency and could include parcel deliveries, library services, food and medicine deliveries, etc. MaaS on national and international levels aims at the ease of travelling and additional services. Services typically combine air traffic with other long-haul transport and may include all-in-one packages combining e.g. accommodation, event tickets, transport, etc.

No matter the geographic area, there exist typical characteristics for all MaaS service combinations including a one-stop-shop principle, mobile ticketing and payment, and multimodal planner and (re)routing. Also, personal preferences may be taken into account in the service options: travel time, sustainability, price, special needs (disability, ski box, child seat, etc.). MaaS services could also cover special offers and frequent customer programmes. In every case, MaaS also aims at being customer-oriented and providing added value to user.

Four MaaS operator models were identified: Reseller, Integrator, Public transport operator and PPP model. A Reseller supplies transport services via different transport modes. An Integrator, in addition, combines the services of several modes with digital services, e.g. an application for mobile ticketing, payment and/or travel planning. Public transport operators can act as a MaaS operator by integrating additional transport services and digital services with their existing public transport. A Public Private Partnership (PPP) may integrate different types of actors and services in the system, which will rationalize the services the public actor is responsible for, such as statutory social service transportation, school transportation as well as freight and delivery. Based on service combination characteristics and operator models, it could be concluded that the commercial Reseller model would best fit travel agencies and thus national and international traveling. The Public transport operator model could be mainly used in cities where comprehensive public transport already exists. The PPP model could be especially suitable for rural areas, where the public actor has in its interest to increase the efficiency of subsidized transportation. The commercial Integrator model would probably fit well in urban and suburban areas as well as national/international MaaS; thus it could be considered the most versatile and flexible model. However, as MaaS is continuously developing, and can be implemented in various ways, the presented models and categorizations should be read and interpreted as a current understanding of an emerging phenomenon. As far as freight transport and MaaS is concerned, there are different approaches shown by case examples available in Finland, Austria, and Sweden. However, there is currently a consensus on how freight delivery is organised. Similar to how ride-sharing is applied to passenger transport, privately owned resources like vehicles are often used to provide combined passenger and freight transport options. Furthermore, different requirements for deploying combined MaaS and freight delivery services between urban and rural areas were identified.

Together with the main findings of this deliverable (WP3) and the first workshop results, next steps of MAASiFiE will be to continue with the workshop series on evaluating potential impacts of MaaS together with the development of the MAASiFiE roadmap for implementing MaaS. Work Package 4 is on-going, which aims at identifying different available and potential impact indicators suitable for MaaS concepts, and upcoming workshops will be used to discuss possible environmental, transport and economic impacts of MaaS. Also, Work Package 5 will focus on technological requirements dealing with the identification of ICT-related architectural requirements and interoperability issues like roaming.

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Annex I – Online Questionnaire

Survey: MaaSiFiE-Questionnaire

Survey about MaaS (Mobility as a Service) concepts

Dear Visitor,

You are invited to participate in our survey about MaaS (Mobility-as-Service) in the context of the project MaaSiFiE (Mobility as a Service for Linking Europe), financed by CEDR (Conférence Européenne des Directeurs des Routes/ Conference of European Directors of Roads) Mobility & ITS programme. Please note that previous or expert knowledge about MaaS is not required for completing the survey.
The purpose of the survey is to map the understanding of the MaaS concept in order to develop a roadmap. More information about the project is provided at the end of the survey. It will take approximately 15 minutes to complete the survey. It is very important for us to learn your opinions. Your participation is completely voluntary. The data from this survey will only be reported in the aggregate.

If you have questions at any time about the survey or the procedures, you may contact david.koenig@austriatech.at!

Thank you very much for your time and support!

Please start the survey now by clicking on the Continue button below.

Introduction - Personal Information

1. Please select your country. *

-- Select --

2. Do you work with transportation? *

- ◯ Yes
- ◯ No

3. Please categorise your field of business:

3. Please categorise your organisation: *

- ☐ Public administration/authority
- ☐ Public transport operator/association
- ☐ Freight operator
- ☐ ICT service provider
- ☐ Interest organisation (e.g. ITS National Organisation)
- ☐ University/ research institute
- ☐ Other

General MaaS related Questions

4. Have you ever heard about the concept of MaaS (Mobility-as-a-Service)? *

- ◯ Yes
- ◯ No

4.1 What does MaaS mean for you? (1-3 sentences):

4.2 How did you learn about MaaS? *

- ☐ personal experience
- ☐ project results

- [ ] scientific papers
- [ ] ministries/government communication materials
- [ ] international stakeholders/organisations
- [ ] Other

4.3 Do you think MaaS is a completely new concept or is it only a new buzzword?

- ○ Yes, it is a new concept
- ○ No, it is only a new buzzword

4.3.1 What, according to you, characterizes MaaS and makes it a completely new concept?

4.3.2 No, MaaS is more or less the same as ... (pick one)?

- ○ Seamless travel
- ○ Integrated travel
- ○ Multimodal travel
- ○ Shared mobility
- ○ Mobility on Demand (MoD)
- ○ Other

4.2 When you hear the term Mobility as A Service (MaaS), what associations come to mind (1-3 sentences)?

One interpretation of the MaaS concept is a comprehensive range of mobility services offered to customers by a service provider in order to promote more efficient, safe and clean passenger and freight transport.

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5. Which, according to you, are the three most relevant transport modes to be included in MaaS in order to provide sustainable, economic and convenient mobility solutions? (pick maximum 3 alternatives) *

- [ ] Commercially organised carsharing
- [ ] Privately organized carsharing
- [ ] Public Transport, regular lines, bus and trams but also trains and ferries
- [ ] Public Transport on-demand services
- [ ] Taxis
- [ ] Flights
- [ ] Private Bikes
- [ ] Bikesharing
- [ ] Other transport mode(s)

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6. MaaS offers can include other service features. Which, according to you, are the three most relevant service features to be included in MaaS in order to promote more sustainable, economic and convenient mobility solutions? (pick maximum 3 alternatives) *

- [ ] journey planning
- [ ] ticketing/payment service
- [ ] customisation

- [ ] customer service hotline
- [ ] special offers (e.g. different prices or types of tickets than otherwise available)
- [ ] bonus system
- [ ] Other

7. Which geographical areas do you consider as most relevant for MaaS concepts? (pick maximum 3 alternatives) *

- [ ] urban area
- [ ] suburban
- [ ] rural area
- [ ] national level
- [ ] trans-national level
- [ ] Other

8. How important is it to involve the following stakeholders in order to implement MaaS concepts? Please indicate the importance if the following stakeholder involvements on a scale of 1 (not at all important) – to 7 (crucial)!

	Not at all important			somewhat important			Crucial
Road operator *	○	○	○	○	○	○	○
Public transport operators *	○	○	○	○	○	○	○
Mobility service providers (incl. e.g. Multimodal Transport Information providers, navigational service providers) *	○	○	○	○	○	○	○
Public transport organisations (incl. e.g. Public Transport associations, passenger advisory boards) *	○	○	○	○	○	○	○
Private transport organisations (e.g. motorists associations) *	○	○	○	○	○	○	○
Governmental organisations (e.g. ministries, authorities, municipalities) *	○	○	○	○	○	○	○
Investors (governmental funding organisations, private investors) *	○	○	○	○	○	○	○
User groups *	○	○	○	○	○	○	○
ICT developers *	○	○	○	○	○	○	○
Other (If no other item, please indicate with 'somewhat important'!) *	○	○	○	○	○	○	○

8.1 Which 'other' item did you consider in question 8? If no 'other' item, leave it empty.

The potential of MaaS

9. Do you anticipate that concepts such as MaaS will become more common? *

- ○ Yes
- ○ No

9.3 What are the major reasons you think concepts such as MaaS will not become more common?

9.1 What are the major reasons you think concepts such as MaaS will become more common? (1-2 sentences)

9.2 In which time frame do you think concepts such as MaaS will become more common? *

- ○ Short-term (1-6 months)

- ◯ Medium-term (6-48 months)
- ◯ Long-term (4-10 years)
- ◯ Other

10. Assuming MaaS is implemented on a broad scale, how do you think the following will be impacted? Please indicate the following impacts of the items on 1 (high decrease) - to 7 (high increase)

	very high decrease	high decrease	low decrease	no impact	low increase	high increase	very high increase
Accessibility of the transport system as a whole *	◯	◯	◯	◯	◯	◯	◯
Private car use *	◯	◯	◯	◯	◯	◯	◯
Private car ownership *	◯	◯	◯	◯	◯	◯	◯
PT use of public transport *	◯	◯	◯	◯	◯	◯	◯
Use of active modes (walking, biking) use *	◯	◯	◯	◯	◯	◯	◯
Congestion *	◯	◯	◯	◯	◯	◯	◯
Emissions *	◯	◯	◯	◯	◯	◯	◯
Land use *	◯	◯	◯	◯	◯	◯	◯
Travel cost for the individual *	◯	◯	◯	◯	◯	◯	◯
Infrastructure investment for society *	◯	◯	◯	◯	◯	◯	◯
Business opportunities *	◯	◯	◯	◯	◯	◯	◯
Number of new business actors *	◯	◯	◯	◯	◯	◯	◯
Other (If no other item, please indicate with 'no impact'!) *	◯	◯	◯	◯	◯	◯	◯

10.1 Which 'other' item did you consider in question 10? If no 'other' item, leave it empty.

11. Do you foresee any negative impacts (e.g. for individuals, businesses, cities/regions, society)? If yes, please specify.

12. Do you know of any private/public organisations, action plans, or projects working with MaaS, or any implemented MaaS services (or similar)?

- ◯ Yes
- ◯ No

12.1 If 'Yes' in question 12, please provide more detailed information about the measures for implementing MaaS (e.g. names of plans/projects,including responsible organisations or contact persons):

Implementation issues

13. To what degree, according to you, are the following items enablers of a broad implementation of MaaS concepts? Please indicate the following items according to their relevance: 1 (irrelevant) - to 7 (crucial)

	irrelevant			somewhat important			crucial
Societal trends, e.g. shared resources *	◯	◯	◯	◯	◯	◯	◯
Political initiatives *	◯	◯	◯	◯	◯	◯	◯
New business *	◯	◯	◯	◯	◯	◯	◯
Increased cost of private car ownership and use *	◯	◯	◯	◯	◯	◯	◯
Public demand / customer base *	◯	◯	◯	◯	◯	◯	◯
ICT platforms / standards *	◯	◯	◯	◯	◯	◯	◯
Other (If no other item, please indicate with 'somewhat important'!) *	◯	◯	◯	◯	◯	◯	◯

13.1 Which 'other' item did you consider in question 13? If no 'other' item, leave it empty.

14. To what degree, according to you, are the following items obstacles to a broad implementation of MaaS? Please indicate the following items according to 1 (not an obstacle at all) to 7 (critical obstacle)!

	Not an obstacle at all			Somewhat of an obstacle			Critical obstacle
Existing regulatory frameworks *	○	○	○	○	○	○	○
Lack of cooperation between stakeholdersn .... *	○	○	○	○	○	○	○
Negative user attitudes *	○	○	○	○	○	○	○
Lack of infrastructure such as bike- and -, car sharing schemes etc. *	○	○	○	○	○	○	○
Lack of financing *	○	○	○	○	○	○	○
Lack of business models *	○	○	○	○	○	○	○
Technology (lack of standards, lack of ...../platforms) *	○	○	○	○	○	○	○
Concerns regarding privacy or data security *	○	○	○	○	○	○	○
Other *	○	○	○	○	○	○	○

14.1 Which 'other' item did you consider in question 14? If no 'other' item, leave it empty.

Further Contact

Thank you for your time and contributions to this survey, conducted within the MaaSiFiE project. The next steps of the project will be to conduct in-depth interviews about MaaS, as well as workshops. We have one final question for you regarding your potential interest in the future of the MaaSiFiE project.

15. Please tick all that apply:

- ☐ I want to be informed of the survey results
- ☐ I am willing to potentially be interviewed about MaaS (as a part of the MaaSiFiE project)
- ☐ I am interested in receiving information about future workshops (within the MaaSiFiE project)

16. If you ticked any of the above, please provide your contact information

First Name :

Last Name :

Phone :

Email Address :

MaaSiFiE Project Information

The main scope of MaaSiFiE is to identify and analyse possible and available MaaS concepts in order to develop a medium-term roadmap 2025 including roles and responsibilities of different stakeholders and providing corresponding recommendations. In this context, the survey contributes to developing a common understanding of MaaS for use by infrastructure and transport operators, as well as for all involved stakeholders.

Contact info:
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Partner: MariAnne Karlsson (University of Chalmers), mak@chalmers.se
Partner: Martin Böhm (AustriaTech), martin.boehm@austriatech.at

THANK YOU for YOUR PARTICIPATION in the MAAS survey!

Annex II – Literature List

Title	Author	Published by/ Country/ Year	Type of Source	Key topics
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-Enabled Trends in Transportation	De Santis, Michael	Lynx Technologies Inc., 2014	Other	MaaS concept planning
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, Enhancing End to End Journeys and the Internet of Things Networking Event	Dr Hazel, George; OBE, On behalf of Scottish Enterprise	Scottish Enterprise, UK, 2015	Other	MaaS concept planning
Feasibility Study for Mobility as a Service concept in London	Dr. Kamargianni, Maria; Matyas, Melinda; Li, Weibo; Prof. Schäfer, Andreas	Department for Transport London, UK, 2015	Report	MaaS ecosystem
LOGISTICS TREND RADAR	Dr. Kückelhaus, Markus; DHL Trend Research	DHL Trend Research, Germany, 2014	Report	Logistics, Freight Transport, Integration of MaaS

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
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
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,
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

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
The Future of Urban Mobility	Lerner, Wilhelm	Arthur D.Little, Germany, 2011	Report	MaaS concept planning, Integration of MaaS
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 Infrastrucutre Network For Intelligent Transport Systems	Menzel, Gerhard; Böhm, Martin	AustriaTech, Austria, 2013	Report	Journey planning , Seamless travelling
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;	Research reports of the Finnish Transport Agency, Finland, 2016	Report	Integration of MaaS, MaaS concept planning, Other

	Antikainen, Janne			
Carsharing Wien – Evaluierung	Schuster, Markus; Steinacher, Irene; Tomschy, Rupert	MA18-Stadtentwicklung und Stadtplanung, Austria, 2015	Report	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
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/Austria, 2016 (Proceedings of the 23rd ITS World Congress)	Paper/Article	MaaS vision
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
UBIGO: TRAVELERS' MOTIVES FOR ADOPTING 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, 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	Paper/Article	MaaS concept planning, Integration of MaaS, Other

		Research Board, No. 2536)		
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
Esiselvitys liikenteen uusien palveluiden ympäristövaikutuksista ja niiden arvioinnista	Tuominen, Anu; Auvinen, Heidi; Aittoniemi, Elina	Research reports of the Finnish Transport Agency, Finland, 2016	Report	Environmental impact assessment
GUIDELINES FOR ITS DEPLOYMENT IN URBAN AREAS - SMART TICKETING	URBAN ITS EXPERT GROUP	URBAN ITS EXPERT GROUP, EU, 2013	Report	Ticketing
Joukkoistetut kuljetukset – Esiselvitys, Taksipalvelut, kimppakyydit ja tavarakuljetukset	Waris, Heikki; Paloheimo, Harri	Trafi Research Reports, Finland, 2015	Report	Integration of MaaS
Future of Mobility 2020	Winterhoff, Marc	Arthur D.Little, Germany, 2009	Report	MaaS concept planning, Integration of MaaS, Automation/ Robotisation
ITD Directive – Priority Action ´c´– Proposal for Deployment Plan in Finland	YLISIURUNEN, KIMMO; LUOMA, ARTO	Research reports of the Finnish Transport Agency, Finland, 2014	Other	Technology