Stimulating a Transition to Sustainable Urban Mobility

JPI Urban Europe programming in the field of Mobility as a Service

Preface

In early 2017, JPI Urban Europe commissioned RISE Viktoria to conduct a study that would identify a set of research and innovation (R&I) priorities related to sustainable urban mobility, focusing on the novel concept of Mobility as a Service (MaaS). The study, which was financed by a grant from Vinnova (Sweden's Agency for Innovation), aims to deliver a white paper that serves to recommend a set of R&I priorities within JPI programming, focusing on the interlinkages between MaaS and sustainable urban development. This white paper represents the culmination of the study.

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Executive summary

Mobility as a Service (MaaS) is a novel concept that may radically transform the way we travel and transport goods in urban areas. It encapsulates a user-oriented approach to fulfilling transport needs and preferences via the combination and integration of different mobility services that can provide an alternative to private car ownership. As such, MaaS represents a significant innovation opportunity and a potential pathway towards sustainable urban mobility. There is currently a high level of interest for MaaS internationally with an increasing number of pilots and trials either planned or currently underway. Given the momentum associated with MaaS, this white paper aims to outline a strategy and a set of key priorities for JPI Urban Europe programming. It also builds on the Strategic Research and Innovation Agenda (SRIA) of JPI Urban Europe (Robinson et al., 2015), which outlined a comprehensive programme aiming to:

- Enhance capacities and knowledge on transitions towards more sustainable, resilient and liveable urban developments;
- Reduce the fragmentation in funding, research and urban development and to build critical mass for the realisation of urban transitions;
- Increase the profile of European urban science, technological development and innovation and foster the exploitation of European technological, social and economic models and solutions on the global stage.

This white paper may be viewed as an operationalisation of the SRIA, focusing more specifically on urban transport and mobility. The SRIA outlined key transport-related issues such as accessibility and connectivity, and more general problems linked to the environmental sustainability of urban areas. Accessibility, social inclusion and other aspects related to the social sustainability of the transport system are represented within key debates on MaaS. The latter is also billed as a means to alleviate climate change emissions; traffic congestion and urban air quality problems, and to facilitate more effective land-use strategies. Given the potential of MaaS to contribute to more sustainable and attractive cities, how can JPI Urban Europe support such developments?

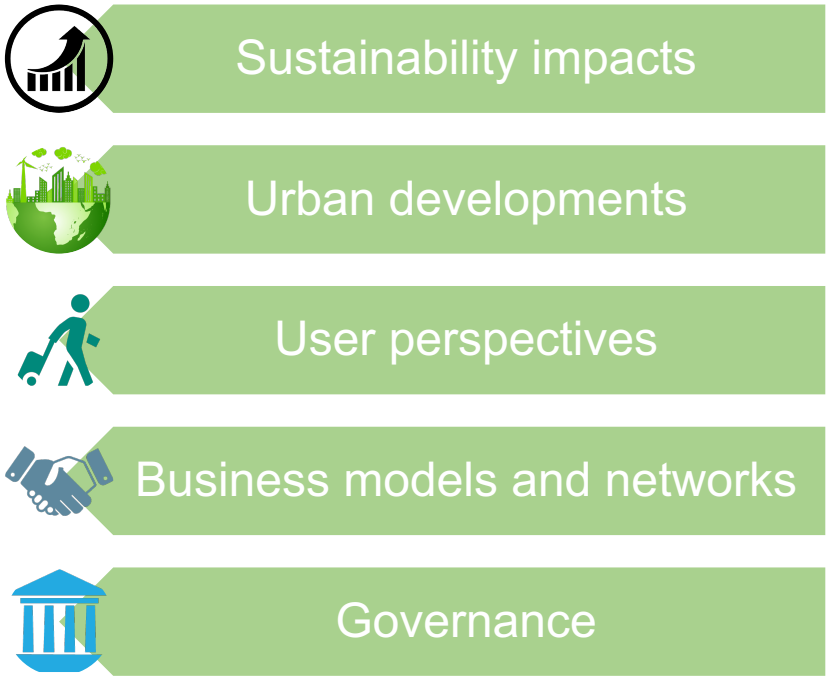
Recommendations

In this white paper, we argue that JPI Urban Europe can play a key role in terms of governing urban transitions to sustainable mobility by harnessing and channelling R&I programming in a strategic and effective manner. In particular, we make the following recommendations:

- An integrative, transdisciplinary approach to JPI Urban Europe programming and R&I activities that combines scientific perspectives that are relevant to the development of sustainable, MaaS-based urban mobility systems
- An approach inspired by transition management as a means to play a key role in governing a transition to sustainable, MaaS-based urban mobility systems within member countries
- The prioritisation of multi-scalar linkages with key actors and organisations that:
  - propagate for sustainable urban mobility and mobilise support for MaaS developments within broader networks
  - bring about institutional changes that support MaaS developments in cities and regions
- Support for R&I activities that aim to overcome barriers and threats to sustainable MaaS developments

Key R&I themes and challenges

As noted in the SRIA, a transdisciplinary and challenge-driven approach to urban sustainability is important. Following expert consultations and a research overview, the white paper identifies five thematic areas for R&I activities. Each thematic area is associated with a set of key issues and research questions that must be resolved for sustainable MaaS services to flourish in urban environments. A transdisciplinary approach that integrates R&I activities within these key thematic areas and across member countries is essential – treating them as separate fields of research will likely overlook the need create the necessary conditions for sustainable transformation.



Within each of these themes, a set of key challenges and issues must be resolved to allow for a transition to sustainable, MaaS-based urban mobility systems. These challenges relate to:

- Overcoming barriers to collaboration in MaaS ecosystems and networks
- Proving and legitimising the MaaS concept via pilots and trials
- Developing and validating MaaS business models
- Creating incentives for sustainable travel behaviour
- Understanding what motivates customers in different segments to adopt MaaS
- Creating institutional conditions that foster MaaS developments
- Evaluating and assessing the sustainability impacts of MaaS
- Creating collective visions
- Creating linkages between relevant policy areas

Governing transitions to sustainable urban mobility

We propose that JPI Urban Europe works to promote the consolidation of a *transition arena* in the field of MaaS and sustainable urban mobility. A transition arena is a network that facilitates interactions, knowledge exchange and learning among multiple stakeholders (Kemp and Loorbach,

2006). In the field of MaaS, there are several international networks and organisations that are currently active. JPI Urban Europe can work to consolidate existing efforts and complement these with its own programming activities in a manner that actively promotes the various governance activities that transition management advocates. In practice, we envisage that JPI Urban Europe can adopt a facilitating and/or a supporting role wherever necessary, as a means to ensure that strategic (visioning), tactical (positioning), operational (innovative, experimentation) and reflexive (evaluation, assessment) governance activities are adequately funded and coordinated within existing networks and organisations. Here a long-term perspective (ca. 25 years) is imperative to overcome the short-termism that plagues political cycles and the private sector (Loorbach, 2010).

JPI Urban Europe can play a significant role by ensuring that R&I activities aim to overcome key practical challenges related to urban MaaS developments. Urban settings are sites within which many practical issues can be resolved, but cities cannot act in isolation. By aiming to facilitate networks and channels for valorisation and dissemination activities, JPI Urban Europe can also ensure that R&I actors and practitioners are connected via open and innovative communities. To this end, R&I programming can be utilised as a tool to bring key actors and organisations into the urban mobility discussion, to coordinate efforts among such actors, and to ensure that R&I funding calls mobilise the active participation of relevant governance bodies within urban projects. As an international body that focuses on research and innovation within urban localities, JPI Urban Europe is arguably well-positioned to ensure that R&I activities serve to connect organizations acting at different spatial scales (local, regional, national, and supranational) in a manner that supports effective governance. Finally, an iterative approach is critical – this white paper must evolve in order to stay abreast of the new challenges and opportunities that emerge during the period of this transition.

1 Background

This study focuses on the delivery a white paper that outlines the role and position of JPI Urban Europe and its members with regard to MaaS, and consists of two main activities. The first is a *research overview* that examines scientific and grey literature to investigate the utilities of MaaS in terms of: the potential to bring about more sustainable forms of urban development; drivers/enablers of and barriers/obstacles to MaaS-related innovations; and linkages between MaaS and other thematic areas that relate to sustainability, such as environment-friendly transport technologies. The approach taken here acknowledges the transdisciplinary nature of sustainability problems, and identifies a set of thematic research areas that must be combined within R&I activities that focus on MaaS (Sarasini et al., 2016), including:

1. Sustainability impacts and the need for assessment
2. Urban developments
3. User perspectives
4. Business models and networks
5. Governance

The second activity focuses on identifying a set of *prioritised R&I themes and actions* for JPI Urban Europe and its members in the near to medium term. To this end, we conducted an open email survey with experts from different countries to: identify strengths, weaknesses, opportunities and barriers to the development of sustainable MaaS services; map key research themes and questions, including ongoing R&I activities that seek to address these questions; prioritise and rank research themes and topics in order of importance; and to comment on the utilities and shortcomings of existing R&I networks. In total, 36 individuals from 10 countries completed the email survey. The breakdown of respondents per country is shown in figure 1.

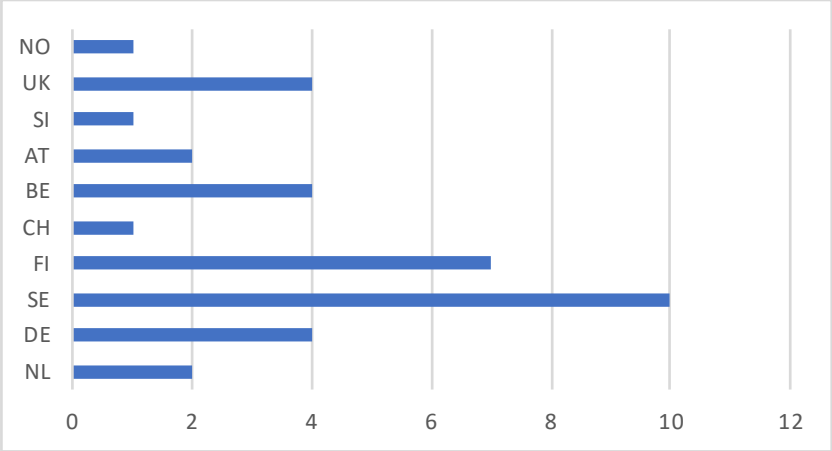


Figure 1: Email survey respondents per country (n=36).

2 Sustainable urban mobility systems

Urban transport systems must become more sustainable given current problems related to climate change, oil dependency, air pollution, traffic congestion, traffic safety, and the underutilisation of passenger and goods vehicles. In urban settings, where space and infrastructure are increasingly regarded as scarce resources, problems such as congestion, pollution and traffic-related injuries and deaths are conflated with inefficiencies in 'last mile' logistics (Goodman, 2005). Across the world, current trends are not encouraging: the increasingly wealthy citizens of East Asian megacities, spurred by the expansion of road infrastructures, are investing heavily in automobiles. In Europe, suburbanisation, regional growth and integration are facilitating similar patterns of growth in inner-city goods transport (Goldman and Gorham, 2006). The automotive industry also faces sustainability challenges (Dooley et al., 2010; Wells, 2010). Incumbent automakers in the West are faced with huge pressures to find new growth trajectories (Wells, 2010), partly due to new entrants in developing countries (Abrenica, 1998; Humphrey and Memedovic, 2003), but also following the emergence and enabling potential of information and communication technology (ICT) that has been harnessed by new transport providers such as Google, Apple, Tesla, Zipcar and Uber and the advent of electrified and autonomous vehicle technologies. To promote sustainable urban transport systems, a range of technological changes (e.g. alternative fuels and vehicle technologies) and improved vehicle efficiency must be implemented. However, transport problems cannot be resolved by these types of measures alone. Rather, sociotechnical approaches are required (Geels, 2002) that encompass a broader definition of innovation as consisting of organisational dimensions (Sarasini and Linder, 2017); that embrace the need for new social practices (Shove and Walker, 2010), and which note the importance of behavioural and attitudinal change (e.g. Anable et al., 2006; Banister, 2008; Steg and Gifford, 2005).

In addition to sustainability problems, several 'megatrends' (i.e. landscape-level changes that can be felt across industries and sectors) are currently forcing change with the transport system. *Urbanisation* is one such megatrend. People increasingly move to cities, which can lead to more congestion, but has also resulted in a more acute focus on land use, 'attractive' urban development and sustainability in urban planning. The response from many cities has historically been to reallocate urban space from parking places and road lanes to allow for higher population densities with more residential areas, workplaces and open spaces. A further trend is the emergence of the *sharing economy*. By harnessing collaborative modes of production and consumption, the sharing economy is currently challenging dominant logics within the field of transport following the successes of AirBnB, crowdfunding, the maker movement and numerous applications in the field of transport itself (e.g. peer-to-peer vehicle sharing, vehicle pools and ride-sharing). As regards goods movement, potentially disruptive services like Shippies, Amazon Flex, Uber Rush and MyWays are likely to grow in the near future. These services rely on crowdsourced deliveries via individuals that deliver packages to other individuals or retailers, enabled by smartphone apps. Coupled to the sharing economy is a growing interest in *servitised product offerings* (e.g. sales of 'mobility' as a function rather than sales of automobiles) (Williams, 2007), whereby some demographic groups are showing less interest in owning products. A growing interest in sustainability is also partly responsible for changes in attitudes about shared ownership or non-ownership have made possible the growth of services for car sharing and ride sharing (Birdsall, 2014; Shaheen and Cohen, 2013) and attitudinal changes linked to health and the environment have accelerated everyday cycling (Fishman and Cherry, 2015). One final megatrend of relevance is linked to *digitalisation*, which has emerged following technological developments in the fields of embedded systems, wireless networking and automation, and is currently unfolding across

industries and sectors in innovative applications that can be grouped under the umbrella term 'Internet of Things'.

Through our survey, the JPI Urban Europe community noted numerous megatrends that give MaaS credence: urbanisation and urban densification; the growth of the sharing economy and shared/servitised transportation; climate change emissions; traffic congestion; urban air quality problems; smartphone penetration and digitalisation trends; demographic changes (ageing populations); rising environmental awareness among citizens; the unwillingness of younger generations to purchase vehicles; changing work structures; and changes in travel behaviour. In light of persistent problems and pressures for radical change in the transport system, respondents argued further that MaaS is currently hyped due to a lack of viable alternatives, and is spurred by scandals such as Dieselgate.

Regarding technological trends, survey respondents made several associations between MaaS and autonomous vehicles (cars and buses), arguing that synergies exist between developments in these fields. One respondent argued that automation will increase the attractiveness of MaaS in the longer term, and others made linkages between MaaS, automation and ICT technologies as a key fundament of informational functionalities within future urban mobility systems. Whilst some respondents made general statements about alignments between technological and MaaS developments, surprisingly none made reference to drivetrain technologies such as electric vehicles. Further, two respondents noted that autonomous vehicles may actually pose a threat to MaaS, in that low-cost vehicles may run counter to MaaS' aims, allowing for increased private ownership and urban sprawl. Others commented that the rapid pace of technological development is a generic threat, and that barriers to vehicle electrification (e.g. charging infrastructure, cost) may also pose a threat to MaaS developments.

Some survey respondents argued that MaaS is a concept that lacks a robust definition whose ambiguity means that actors are free to class their activities as befitting the MaaS rubric in order to ride the current wave of hype. Respondents also expressed that the current MaaS hype may be short-lived, and that unrealistic expectations may result in a concurrent disappointment cycle. Respondents also expressed concerns regarding the slow pace of MaaS developments; the lack of functioning services; and regarding the prescriptive approach adopted by many key stakeholders.

2.1 What is Mobility as a Service?

MaaS may be viewed as a natural consequence of the megatrends described above, alongside pressures for a sustainable reorientation of the transport system. MaaS encompasses changes that are not limited to technology, but that will include new ways of producing, delivering and consuming transport. Further, integrated, or combined, mobility solutions (i.e. bundled, servitised, intermodal transport offerings) such as MaaS are increasingly seen as a means to shift road transport onto a more sustainable path, with medium- to long-term prospects for radical transformations that are beneficial in each of the three sustainability dimensions.

The MaaS concept has now gained international recognition, with pilots and related R&I activities underway in the UK, the Netherlands, Austria, Sweden, Finland, Denmark, Australia and Singapore. Several international R&I projects in this field have received funding, such as MaaSiFie, Eccentric, IMOVE and MaaS4EU. International networks such as the MaaS Alliance, Polis and UITP, alongside conferences such as the ITS World and European Congresses, and IcoMaaS

(marketed as the first international conference on MaaS by the University of Tampere) are useful channels for knowledge dissemination and networking.

There is currently little agreement on how to define MaaS, on what constitutes a MaaS service, or on how to compare and assess different MaaS services. Some authors suggest that MaaS should contribute to sustainability challenges (Heikkilä, 2014; Mukhtar-Landgren et al., 2016a) whereas others see it more as a means to fulfil customer needs (Datson, 2016; Kamargianni et al., 2016). This is partly due to the novelty of the concept, and partly because MaaS is a prospective radical innovation. Generally, when radical innovations emerge, there is an initial 'fluid' phase of development that is characterised by experimentation with multiple competing product/service designs (Abernathy and Utterback, 1978). For example, (Datson, 2016) envisages two very different types of MaaS developments, one that is automobile-based and the other based on multimodal services.

At this stage, uncertainty prevails and the applications of the innovation in question are unclear. Uncertainty is resolved in a later, transitional phase, as the market consolidates to select a dominant design. The fluidity of MaaS poses at least two problems. First, as the hype grows, and as increasing numbers of practitioners engage with MaaS, questions remain about 'what MaaS is'. Yet defining the MaaS concept in terms of the content of the service and its applications can be considered, during the present, fluid stage of development, an unwise and premature undertaking. Second, the fluidity of the concept creates challenges in terms of governing a transition to a MaaS-based transport system. Yet if we do not know what MaaS is, how can we know what a MaaS-based transport system can or will deliver in terms of sustainable outcomes?

One way to deal with this uncertainty is to develop a characterisation of MaaS that embraces the fluidity of the concept. This approach has been taken by Sochor et al. (2017; see also: Kamargianni et al., 2016; Lisson et al., 2015), who have developed a MaaS 'topology' (figure 2). The topology builds on differing degrees of integration – a parameter that has been noted by other scholars as important to transport services (e.g. Kamargianni et al., 2016). The topology consists of different levels. Level 0 represents the status quo in several cities across the developed world, and is characterised by fragmented mobility services that each compete for customers. Level 1 refers to integrated informational services, such as multimodal travel planners (e.g. Google), which provide information on available mobility services and routes in different cities. Level 2 refers to services that facilitate online bookings and payments, such as Hannovermobil. Level 3, which is the current focus of much attention in and around the transport sector, refers to the integration of different mobility services into a single, seamless offering that is made available to users via subscription-based smartphone applications (see also: Beutel et al., 2014; Goldman and Gorham, 2006; Sochor et al., 2015). Organisations such as MaaS Global (FI) and UbiGo Innovation (SE) are active at level 3. Finally, level 4 refers to the integration of societal goals such as transport policy objectives and sustainability into MaaS ecosystems and services at levels 0-3. Rather than seeing MaaS as a fixed object, addressing it in topological terms is useful in that it allows for variance in the concept in both spatial and network terms (see Law, 2002). That is, a topology allows for variance in the way the MaaS concept is applied, what services it entails, the networks that support its development and operation, and with regard to geographical differences. MaaS may mean different things in different contexts, yet the topology is intended as a tool to include different elements whose flexibility allows for such variances. This is important given that MaaS will be adapted by those who adopt it, namely the multitude of different actors and organisations that contribute to socio-technical transformations (Akrich et al., 2002).

Figure 2: The MaaS topology developed by Sochor et al. (2017)

One aspect that is overlooked by the topology described above is the interactions between passengers and goods. In urban environments, where space is a scarce resource, MaaS could be designed in a manner that serves to integrate passenger and goods transport using intermodal services that serve to resolve the 'last-mile' problem for both passengers and goods. One of the main reasons for our dependence on privately owned vehicles is the opportunity to move bulky consumer goods such as groceries, furniture and electronics alongside personal belongings such as baggage and sports equipment whenever needed. Hence the integration of passengers and their belongings (i.e. goods) may be an additional aim for MaaS, and may crucial to convincing potential users that it is a viable alternative to car ownership.

An integrative approach to MaaS in practice requires a similarly integrative and transdisciplinary approach in R&I activities (Sarasini et al. 2016). Hence in what follows we focus on five perspectives which collectively represent the intricacies of sustainable development in the context of transport should form the basis of a new research paradigm within the MaaS field: sustainability impacts and the need for assessment; urban developments; user perspectives; business models and networks; and governance.

2.2 Sustainability impacts and the need for assessment

Mobility services are increasingly seen as a means to shift towards a more sustainable transport system, and are linked to better urban management; improvements in energy efficiency and urban air quality; greater use of renewable fuels; reduced congestion and improved accessibility (Greenblatt and Saxena, 2015; Greenblatt and Shaheen, 2015; Burrows and Bradburn 2014; Lerner et al. 2011; Rydén and Morin, 2005). Some mobility services, such as taxi services and public transport, have existed for a long time. Others, such as car and ride sharing have undergone rapid growth in the last decade following the emergence of ICT-enabled business models (Cohen and Kietzmann, 2014). The sustainability impacts of some mobility services is not yet clear, mainly due to their novelty. For instance, Marsden et al., (2015) argue that the "…evidence on the impact of carshare on travel dynamics is disparate and lacking robustness given the limited quality and

quantity of peer reviewed literature on the topic". New mobility services in the field of shared goods and freight transport are in their infancy (Trafikanalys, 2016), which limits the robustness of sustainability assessments.

Given the novelty of level-3 MaaS, its actual sustainability impacts are not yet known. In principle, this type of MaaS can deliver radical improvements as regards the environmental sustainability of the transport system due to the hypothesis that a MaaS solution requires fewer vehicles, and can thus reduce congestion, emissions and noise pollution – factors that also contribute to economic sustainability gains. However, gains from new services are thus far hypothetical. For example, while one might naturally conclude that increased car-pooling / ride-sharing would reduce congestion, rebound effects may serve to limit the overall sustainability gains (Trafikanalys, 2016). Some initial work has been done to outline a set of criteria for assessing the sustainability impacts of MaaS. The Arthur D. Little report, for example, provides outlines an urban mobility index that is applicable to MaaS, using 19 criteria (Van Audenhove et al., 2014). Similarly, as part of the MaaSiFie project, Karlsson et al. (2017) outlined a set of criteria and KPIs for assessing the sustainability of level-3 MaaS in each of the economic, environmental and social dimensions and at the level of individuals, business and society. Within the Swedish KOMPIS project, pilots will also assessed according to a similar set of sustainability criteria. These R&I activities each have in common a multi-stakeholder approach to identifying assessment criteria and associated KPIs – a useful approach if assessment frameworks are to gain a degree of credibility that allows for robust analyses and assessment standards.

Further, the intermodal nature of level-3 MaaS can, in principle, improve the resilience of the transport system and give users access to wider range of alternatives to fulfil their daily transport needs. Here resilience is also linked to opportunities to adapt and modify the transport system over time as, for example, new technologies become commercially viable. MaaS may thus be a means to blend efficiency with adaptability and flexibility, and could act as a base for new innovations that combine transport services, new vehicle technologies and ICT (Sarasini et al., 2016). For ecological reasons, it is crucial that MaaS increasingly utilises vehicle technologies such as hybrid and electric drives, biofuels, fuel cells, and autonomous and connected vehicle technologies (Alessandrini et al., 2014; Wadud et al., 2016). However, as noted above, the sustainability impacts of MaaS have not yet been assessed due to the novelty of the concept (and the lack of real world cases). The Swedish programme KOMPIS aims to rectify this issue by performing sustainability assessments on a series of pilots that will be initiated during the next four years (see also: Karlsson et al., 2017).

Survey respondents echoed the expectations described above related to sustainability gains, noting that MaaS, as a potential alternative to private car ownership, can deliver several benefits: increased vehicle utilisation; improvements to the efficiency and resilience of the transport system; emission reductions; social inclusion and accessibility; improved air quality; improved health; and, given associated innovation opportunities, contribute to economic development. However, respondents noted a lack of research and dissemination activities linked to sustainability impacts, and made mention of the fact that the sustainability impacts of MaaS have not been sufficiently documented. They also raised the possibility of unintended consequences and rebound effects (e.g. increased congestion). This risk is linked to the low capacity of some transport modes, such as peer-to-peer car-sharing, which may nonetheless be attractive in a MaaS system due to the affordability and comfort on offer. Further, respondents noted that the user-oriented approach associated with MaaS, which focuses on individualisation and customisation, may also have negative sustainability impacts. Respondents highlighted the following issues as topics for future R&I activities:

Can MaaS deliver a more sustainable transport system in the economic, environmental and social dimensions?

- How do different types of MaaS services influence sustainability outcomes?
- Can MaaS encourage sustainable modal shifts and sustainable travel behaviour?
- What are the potential rebound effects of a MaaS-based transport system?
- What sustainability objectives should MaaS aim to fulfil?
- How will the sustainability of MaaS be influenced by technological developments (e.g. autonomous vehicles)?
- How should the sustainability of MaaS be assessed and quantified?
- What criteria should be used to assess sustainability and what are the KPIs?
- How can we ensure that data for sustainability assessment is made available from different actors in the private and public sectors?

2.3 Urban developments

The development and deployment of MaaS must be examined in the context of rapid urbanisation, where mobility is interconnected with urban form within growing cities (Batty, 2013). Whilst a more effective transport system based on multimodal mobility services can serve to alleviate pressures on urban infrastructures, the trend towards urban densification necessitates a greater understanding of the relationship between urban form, mobility and accessibility. For example, centrally located streets typically involve intense movements of people and goods, and become prominent locations for retail (e.g. Bernow & Ståhle, 2011) such that these locations gather higher rents (e.g. DeSyllas, 2000; Netzell 2010). Urban form is also linked to crime (Hillier & Xu, 2004), social segregation (Legeby, 2013; Vaughan, 2007), and accessibility to green spaces (Ståhle, 2005). This perspective is used to examine the interplay between the built environment and mobility, and particularly on how urban developers can instigate positive change.

Respondents argued that MaaS is a concept that is increasingly linked to visions and concepts of modern, smart, sustainable cities that are attractive because car ownership is not essential. Respondents argued further that MaaS is increasingly recognised in discourses on sustainable cities, given the prospect of integrating mobility into social and urban developments and local environmental challenges. Here MaaS may be seen as a response to urbanisation trends, which simultaneously creates pressures for more sustainable forms of transport and for reduced car ownership. Respondents also noted the importance of other urban megatrends, such as individualisation and digitalisation, which are forcing cities to rethink and adopt a more innovative approach to urban mobility that enhance the quality of life. One respondent noted that MaaS may be seen as a "milestone" in such developments, given the potential to offer urban citizens new mobility options that overcome the problems of existing mobility schemes without sacrificing their comfort and privacy.

Within cities, respondents argued that MaaS also allows for a more efficient and better coordinated use of physical infrastructures such as roads and parking, reducing congestion and land-use pressures. Respondents further noted that opportunities exist for improved city planning (based on densification and accessibility) and policing (via road charging, parking policies, land use policy, etc.). MaaS is also seen as a solution to the transport problems of growing urban areas that can be tailored to local contexts. Respondents also argued that MaaS can: offer cities the opportunity to respond and adapt rapidly to fluctuations in customer demands by assigning different transport

modes according to their individual strengths (i.e. optimise urban traffic management); help car sharing schemes to extend to greater urban areas beyond the typical current focus on inner city areas; strengthen local economies and employments via the consumption of services rather than products; support the role of public transport operators who must provide high quality networks; allow urban stakeholders to improve customer experiences via digital solutions; and that MaaS can facilitate the deployment of new transport technologies in urban areas (e.g. cable cars, autonomous vehicles).

Respondents also noted that MaaS may be hindered by a range of factors in urban environments, including: a lack of capacity at times of peak demand; a lack of public transport coverage in some cities, in some areas within cities, and during night-times; a lack of individual mobility services in many cities around the world; the sluggish dynamics of urban change; a lack of relevant and adequate competences within city planning across many European cities; a need for infrastructural investments to facilitate improved user comfort and convenience; and the potential low cost of autonomous vehicles, which may prove to be cheaper than MaaS and enable urban sprawl. Respondents highlighted the following issues as topics for future R&I activities:

How will MaaS influence urban design and the built environment?

- How will MaaS influence housing developments, workplaces, commerce, the need for parking spaces, road infrastructures,
- Is there a need for new physical infrastructure such as interchanges and intermodality hubs?
- How will MaaS interact with existing infrastructures for public transport?
- How should transport corridors be developed such that they complement MaaS-based urban mobility?
- How will MaaS influence urban logistics?
- How will MaaS influence the urbanisation and densification trends?
- Is MaaS limited to cities or will the impacts be felt in suburbs and rural areas?
- How can we plan cities with significantly lower number of cars and higher number of public transport users?
- How can MaaS be integrated into urban and land-use planning?
- What is critical to establishing a MaaS solution successfully in urban areas? How do these factors differ from transregional/ national solutions?

What can cities do to support MaaS developments?

- How can local and regional policymakers and urban planners promote the development and deployment of MaaS in their cities?
- What types of instruments and mechanisms can support MaaS (e.g. parking availability, location and cost)?
- What local policies can promote sustainable behavioural changes?
- How can the local and regional fragmentation of urban/suburban planning be overcome?
- How can fragmentation between city and transport planners be overcome?
- How can the multidisciplinarity of MaaS be integrated into urban planning?
- How does MaaS influence travel demand modelling?
- How can MaaS contribute to local sustainability goals such as reduced emissions, congestion etc.?

2.4 User perspectives

User perspectives that focus on behaviours and attitudes elucidate barriers and obstacles to sustainable change at the level of the individual in a particular sociotechnical context, and illustrate the role of transport *vis-à-vis* accessibility. From this perspective, it is possible to examine users' motives and reasons for adopting MaaS services. For example, research in this field has a so called 'attitude-behaviour gap' exists among travellers, such that environmentally positive attitudes are not manifested in environmentally positive behaviour (Bamberg et al., 2011; Chesbrough and Rosenbloom, 2002; Kollmuss and Agyeman, 2002; Lane and Potter, 2007; Møller and Thøgersen, 2008; Peters et al., 2015; Pooley et al., 2013; Verplanken et al., 1994). Underlying reasons include conflicting goals between sustainability and other everyday activities, alongside demands for satisfaction, comfort, speed, as well as passengers and luggage (Anable and Gatersleben, 2005). Other barriers to behavioural change have been identified, such as lock-in effects linked to existing unimodal structures; loss aversion related to choosing an alternative (Pankratz et al., 2017); difficulties in finding ways to experiment with new types of behaviour; and a lack of support throughout the behavioural change process (Strömberg, 2015).

Some research has been conducted to identify the benefits of MaaS from a user or customer perspective. Much work on this is speculative, given the lack of real-world MaaS services. Examples include Datson (2016), who argue that MaaS can deliver personalised services; ease of use in terms of transactions and payments; journey planning and dynamic journey management. Similar results are reported in Kamargianni et al. (2017) and Polis (2017). Feasibility studies have also been conducted (or are underway) to examine the readiness of users to adopt MaaS and gauge market demand. Completed research includes Kamargianni et al. (2017), which indicates that a significant proportion of car-owners see car-ownership as a large financial burden, and notes that congestion and parking are problems that would reduce car trips if MaaS were to become available. Based on a survey of over two thousand customers of an e-car sharing service in Germany, Hinkeldein et al. (2015) labelled three types of customers as most inclined to adopt MaaS: 1) innovative technology-loving 'multi-optionals', 2) 'flexible car-lovers' and 3) 'ecological bicycle and public transit-lovers'.

There are a limited number of real-world cases whereby user perspectives have been deployed and documented. One exception is the well-renowned Go:Smart project, which comprised a field-operational test (i.e. pilot, FOT hereafter) of level-3 MaaS in Gothenburg during 2012-14 (Karlsson et al., 2016; König et al., 2016; Sochor et al., 2016a, 2016b, 2016c, 2015a, 2015b, 2015c, 2014a, 2014b; Strömberg et al., 2016). The FOT served to elucidate users' motives and reasons for trialling MaaS, and noted that these factors changed over time. Prior to the FOT, the foremost reason for participants to engage in the trial was curiosity. All other motives (convenience/flexibility, economy, environment, family member, gaining access to cars, test living without a privately-owned car) lagged behind curiosity. Sochor et al., (2015a, 2015b, 2014a, 2014b) argue that this focus on curiosity implies that those who expressed interest in UbiGo can perhaps be characterised as early adopters, that is, likely well-informed individuals with high levels of education and social status, and a willingness to take risks and experiment with new trends. Other significant motives prior to the FOT launch include the convenience and flexibility of the UbiGo service, and willingness to experiment with a lifestyle that does not necessarily rely on private car ownership. Despite the fact that willingness to relinquish car ownership was not one of the main motives to trial UbiGo, respondents that did cite this as a key factor and argued that car ownership is both timely and expensive, given the need for parking, maintenance, insurance, congestion charges, seasonal tire changes and so on. Others noted that their life circumstances had recently changed (e.g. a new job, moving, or children had moved out) such that they no longer needed a car (or two

cars) within their household. For these participants, the FOT provided a means to experiment with non-car ownership. During the FOT, the focus on curiosity was replaced with convenience and flexibility. At the end of the FOT, convenience and flexibility became the most dominant reason for participants to want to continue as UbiGo users. Economy also gained a stronger position during and at the end of the pilot.

An important finding is that the opportunity to travel in more environment-friendly manner was not a major motivating factor among respondents, rather a bonus. The FOT also revealed a set of barriers to adoption, which may be broadly grouped into three categories: cost and payment models; mismatches with existing travel patterns; and a perceived lack of transport infrastructure. Participants in the FOT stated that they had changed their travel behaviour with respect to transport modes compared to before the trial. In particular, participants stated that they used private cars less and elected to travel via car sharing, car rentals, public transport, bicycle or walking more frequently. These behavioural changes are reflected in the fact that participants reported more positive attitudes to car sharing, car rentals, public transport, bicycling and walking and more negative attitudes towards private car travel after the FOT.

Many of the findings from the Go:Smart project are reflected in our survey results. Survey respondents noted that MaaS is an innovative, user-oriented concept that addresses users' actual transport needs. They reasoned that MaaS offers flexibility and ease of use, and argued that the seamlessness of the service, made available by a smartphone applications, is key to its convenience given the potential to replace existing, unintegrated ticketing systems. Respondents further commented that MaaS allows users the opportunity to trial different transport modes by providing access to a multitude of mobility services that, when combined, can provide a valid alternative to private car ownership. The survey further revealed that MaaS has the ability to promote and incentivise behavioural changes and alter existing travel habits such that users shift towards more sustainable transport modes in place of (costly) privately-owned vehicles. One respondent commented that MaaS has the potential to encourage more active modes of transport, with potential health benefits. By purchasing MaaS, as a bundled offering, respondents argued that users will gain a better awareness their travel costs, and that MaaS may be able to compete with private car ownership on price, allowing cost savings for users. Respondents noted that MaaS is likely to resonate with urbanites, who are increasingly unwilling to purchase cars, noting that certain segments (e.g. technologically mature customers and younger generations) are more likely to be open to the concept. Respondents further noted that customer needs and demands are in a state of flux, with concepts such as the sharing economy and demands for flexibility, accessibility and environmental sustainability taking hold in the market. Overall, MaaS is seen as a means to enable users to manage their mobility needs in flexible, convenient and cost-efficient manner.

However, our survey showed that there is a lack of valid knowledge regarding target groups, and that the concept has been developed with too little focus on how to generate value for customers. This is in part due to an exaggerated focus on the technical aspects of MaaS services, which overlooks the complexities of users' needs and behaviours. In conjunction with this issue, respondents noted that achieving behavioural changes is not an easy task given the extent to which travel habits, particularly those related to car ownership, are engrained among potential users. Respondents noted that attitudes (and therefore behaviour) do not change quickly, potentially hindering the adoption of MaaS by users. Further, respondents noted that several key issues related to user acceptance are yet to be resolved. These include: last-mile problems; providing access to technologically immature segments such as the elderly; the provision of travel guarantees;

acceptance for certain services such as ride-sharing; and the practicalities of travelling with children and baggage or other bulky goods such as groceries. Further, respondents argued that estimations of private car ownership are often incorrect, and that MaaS is often pitched as a lower-cost solution when in reality it is seen by many potential users as expensive. Overall, these weaknesses, barriers and threats illustrate a set of uncertainties regarding users' willingness to adopt MaaS, to modify their travel behaviour, and their willingness-to-pay for MaaS services, and reflect a general lack of knowledge on how to generate value for users in different segments. Respondents highlighted the following issues as topics for future R&I activities:

Which segments should MaaS target?

- What types of market demand exist for MaaS?
- What types of users will adopt MaaS services?
- What are potential users' attitudes towards MaaS?
- Are people willing to relinquish car ownership?

How can barriers to the adoption of MaaS be overcome?

- What are users' motives for adopting MaaS?
- What should be done to create user acceptance and attract users?
- What types of pricing models can attract users from different segments?
- What other mechanisms can be used to persuade users from different segments to adopt MaaS?
- What are the dynamics of the adoption and diffusion of MaaS?
- How can MaaS ensure that user integrity (e.g. data) and safety are protected?

What types of added value can MaaS deliver to users?

- Which functions and modes are needed to fulfil users' needs?
- Which criteria (e.g. comfort, convenience, flexibility) should MaaS aim to fulfil?
- How can MaaS be designed to facilitate different activities linked to passenger travel (e.g. commuting, leisure activities, etc.) and goods flows (e.g. shopping, holidays, etc.)?
- How can MaaS be designed to fulfil individual user needs and remain an efficient system?
- How can MaaS deliver improved accessibility for different user groups? What is an attractive pricing level for MaaS among different segments?
- Can MaaS be priced at a level that makes it attractive to car owners?
- Is there a willingness-to-pay for MaaS services and how can this be measured?

How can MaaS impact and influence travel behaviour?

- How will the use of intermodal services influence travel behaviour?
- What types of mechanisms and incentives (e.g. information, gameification, nudging) can be used to change existing travel habits and encourage sustainable travel behaviour?
- How will MaaS influence wellbeing?

2.5 Business models and networks

MaaS is generally viewed as a significant innovation opportunity. This is partly due to digitalisation and the application of ICT technology in the transport sector (Burrows and Bradburn, 2014; Motta et al., 2015). It is also due to the development of new business models that capture the value

inherent in collaborative consumption; multi- and intermodal travel; and big data analytics (Datson, 2016). MaaS business models rely on: 1) creating a value proposition in which mobility is bundled; and 2) data sharing, collecting and sharing data to better understand and match customer needs (Datson, 2016). Several actors from the private and public sectors, including data service providers, are now experimenting with mobility services in an attempt to capitalise on these opportunities and to diversify their business models (Firnkorn and Müller, 2012). Research has been performed to outline the benefits for different stakeholders within the MaaS ecosystem (Datson, 2016).

It has also been noted that MaaS business models may play an important role in the diffusion of new vehicle technologies such as autonomous vehicles and electric drivetrains (Sarasini and Linder, 2017). Business model innovation is also important for harnessing the potential of infrastructural or 'general-purpose' technologies such as ICT (Björkdahl, 2009; Gambardella and McGahan, 2010; Mason and Spring, 2011; Zott et al., 2011). In order to function 'seamlessly', MaaS requires the integration of different features such as ticketing and payments, season ticket ownership and the provision of a single, online interface that provides access to a range of transport modes (Kamargianni et al., 2016). Here ICT is a key enabling technology, and companies such as FluidTime, Ericsson and Xerox are currently experimenting with ICT platforms that can feature in MaaS offerings. ICT also creates new business opportunities linked to the collection and utilisation of real-time data from users, vehicles and other sensor-based technologies (Motta et al., 2015). The deployment of ICT in mobility services such as MaaS demonstrates the way in which business model innovations can co-evolve to harness technologies from different industry sectors, as noted some future-oriented studies. Spickermann et al. (2014), for example, shows that industry experts foresee that future urban transport systems will converge around new MaaS business models that harness technological innovations from the mobility, energy and ICT sectors. Others have noted the potential for sustainability gains via the integration of passenger travel and urban logistics in MaaS-based services (Sarasini et al., 2016).

Although they are still in an emergent phase, MaaS business models can be initiated by entrepreneurs and start-ups, by public transport operators, or via public-private partnerships. It has been noted, however, regardless of who the initiating entity is, that public authorities are critical to the initiation phases (Audouin and Finger, 2017). Given that MaaS business models require new forms of public-private collaboration, research has acknowledged the importance of understanding the different processes that underpin the creation of MaaS networks (ecosystems) together with barriers and obstacles to business model innovation. A lack of collaboration restricts the development of new MaaS business models, and different types of institutional and legal barriers have been identified as barriers to change (Audouin and Finger, 2017; Mukhtar-Landgren et al., 2016b; Smith et al., 2017b; Sochor et al., 2015a). For instance, local transit authorities' willingness to open their tickets APIs is key to the realisation of level 3 MaaS services (Audouin and Finger, 2017). Allowing third parties to sell tickets is not a natural proposition for public authorities as they often are responsible for issues such as affordability and access to service (Polis, 2017). The perceived risks of allowing third party sales are shared among value chain actors, and similar risks hinder data sharing in the value chain (Audouin and Finger, 2017; Polis, 2017). Overcoming these barriers is no simple task, and a case for the importance of individual champions can be made, as is the case in Finland (Audouin and Finger, 2017; Smith et al., 2017b). Melis et al. (2017) suggest that addressing concerns regarding shared data may be possible architectures with sanitation and masking protocols.

It is also recognised that MaaS necessitates the creation of new roles and associated responsibilities (i.e. practices), such as that of a MaaS operator and integrator. Here the question of who takes the role of MaaS operator is a particularly sensitive issue, since some existing transport service providers view MaaS as a potential threat in terms of brand, image and customer relationships. Hence a discussion has emerged regarding roles in MaaS ecosystems, and scholars have noted that different models for ecosystem collaboration may emerge in different contexts (Holmberg et al., 2015; Kamargianni et al., 2016; König et al., 2016a; Smith et al., 2017a; Trivector, 2016). This discussion has permeated international organisations such as UITP, who advocate the role of public transport in the MaaS ecosystem (UITP, 2016) and have also facilitated workshops to discuss different ecosystem models.

In discussions regarding different schematic ecosystem models, a common theme is the discussion of the division of roles between private actors and public organizations. For example, Smith et al., (2017a) outline three ways in which MaaS developments may evolve: via market-driven activities; as a result of state interventions; or as part of public-private collaborations. A similar discussion on roles in MaaS ecosystems regarding who will deliver ICT functionalities is underway (for an overview, see: Rudmark and Holmberg, 2017). In practice, research has noted that ecosystem models have emerged and vary according to the contextual specificities of different localities, which is contingent upon politics, history, culture and other situational factors (Audouin and Finger, 2017; Rooijakkers, 2016; Smith et al., 2017b). In Finland, for instance, MaaS is driven by the need to rejuvenate the economy following the economic downturn and the fall of Nokia (Smith et al., 2017b). One example of a MaaS ecosystem model is shown in figure 3.

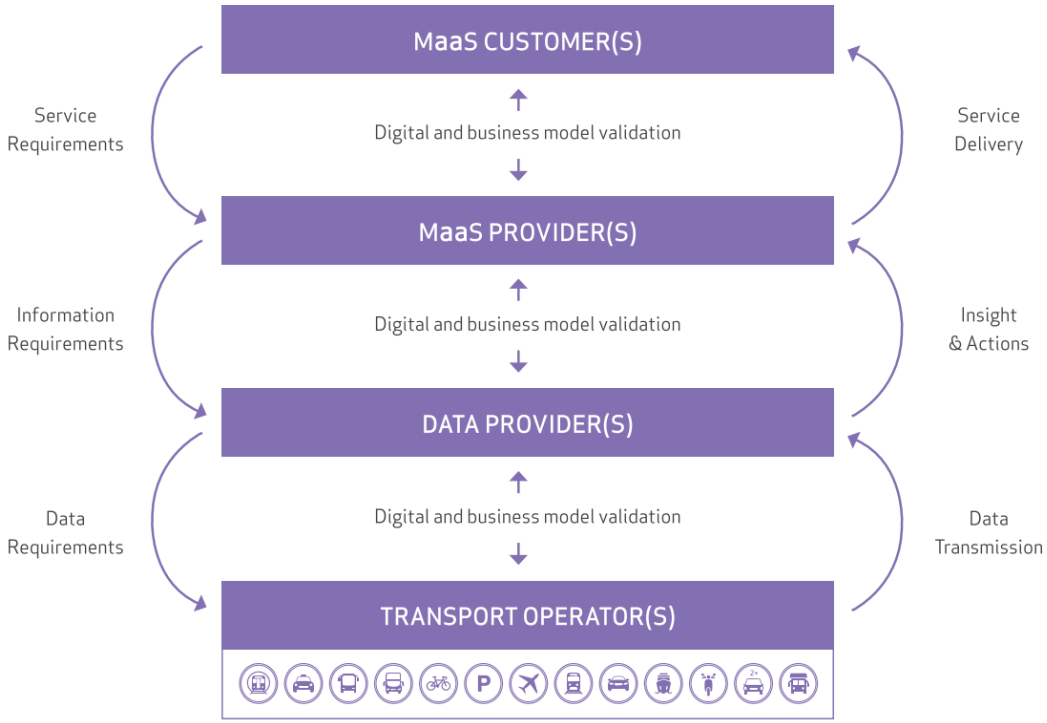


Figure 3: one of several prescriptive models of the MaaS ecosystem (Source: Datson, 2016)

The overall question of 'who does what' is important in determining the overall aim of MaaS business models because trade-offs may exist between, for instance, profitability and sustainability (Holmberg et al., 2015). For example, private and/or public actors can own the assets (i.e. vehicles)

made available to users via MaaS business models. That is, firms can provide access to vehicles via car clubs, similar to the way public transport operators provide access to busses, trams and trains. Alternatively, private individuals can provide access to vehicles via peer-to-peer services such as Uber. Again, these distinctions can play an important role for the profitability and sustainability of the business model (Holmberg et al., 2015). In the absence of real-world services, some conceptual work has done to identify MaaS business model archetypes (Van Audenhove et al., 2014); to address what characterises sustainable MaaS business models (Sarasini et al., 2017); and to examine the role of business model innovation in sustainable transitions (Sarasini and Linder, 2017).

In terms of *strengths and opportunities* related to business models and associated collaborative networks (ecosystems) of mobility service providers, respondents mirrored the notion that MaaS represents a significant innovation opportunity. Respondents noted that this potential is reflected in the growing number of shared mobility initiatives in urban regions, supported by innovative business communities and, in some locations (particularly Finland), an enthusiastic start-up culture. Respondents argued that there is a "huge market potential" associated with MaaS, noting that transport is ordinarily the second biggest household expenditure. This potential is connected to the idea that MaaS, as a user-oriented, "door to destination", intermodal service, can attract customers from private car segments, where monthly travel expenditures are significant. It is also linked to the potential for MaaS to combine new transport services with existing modes, particularly public transport, such that services are of a quality that can rival private car ownership and, as noted in the previous section, bring about sustainable behavioural changes.

Respondents also noted that business model innovation in this field can build on the current wave of innovations linked to the sharing economy, and argued that MaaS business models are scalable (i.e. have the ability to diffuse at low cost) due to the "asset-light" operations of MaaS integrators, who need not make significant upfront capital investments. This is because MaaS, as a combined service, integrates existing services and does not require heavy investments in new vehicle fleets, for example. Respondents noted that MaaS allows for low-cost, incremental improvements once the ecosystem is in place, and can be utilised as a marketing channel for new, sustainable mobility services as they become available. Respondents also argued that MaaS can piggyback on parallel developments such as those in the field of demand-responsive transport.

Respondents noted that the innovative potential of will be realised via the development of collaborative business models that encompass new partnerships between private and public sector actors. Opportunities are seen to be strong given the current multi-stakeholder interest in MaaS, who are entering into new collaborative networks, and the shared expectation that MaaS is a future mobility solution. Among stakeholders there is a reported understanding of the need for new forms of collaboration, coupled with the notions that 1) existing partnerships (e.g. related to smart cards and ticketing) provide a strong base upon which to build; and 2) previous problems of fragmentation between sectors and service providers are already being resolved. Respondents argued that the benefits of new networks and collaboration include the opportunity to share knowledge, ideas, resources and competences; the attraction of funding from the private and public sectors; the attraction of new entrants to international markets (e.g. MaaS Global's pilots in the Netherlands, the UK, and elsewhere); the investment of resources from big players in the auto-industry; and the ability to create business opportunities for companies from different sectors that are related to back-end (technical) and front-end (operational) elements of MaaS ecosystems. Respondents from the public sector further noted that MaaS ecosystems and networks promote a

more innovative mindset in public transport. The nature of MaaS also allows for transport management via integrated ecosystems, which can be advantageous in urban settings.

In terms of *weaknesses, threats and barriers* related to business models and networks, respondents comments (of which there were many) can be divided into two salient issues. The first is the lack of a proof of concept regarding the functionality and viability of MaaS business models, and the second relates to significant barriers to collaboration in the MaaS ecosystem. Regarding the first point, numerous respondents noted that there is a high degree of uncertainty and a lack of proven (validated) business models in the MaaS field. This highlights one of the major obstacles to MaaS developments, and is underpinned by various uncertainties regarding: the profitability of MaaS business models given low margins; how profits should be distributed in MaaS ecosystems; business model scalability and market potential; which actor/s should take the role as MaaS aggregators/integrators; the risk of high production costs and low margins; and regarding the added expense of MaaS in comparison to public transport. Respondents also noted a lack of understanding regarding: user' needs and wants; what prices users should pay; the types of mobility services that should be included in MaaS offerings; and regarding how to create business models that are sustainable for multiple stakeholders; transport system dynamics. Respondents also noted that business model innovation is hampered by: the inability to attract funding and investments (particularly from actors from outside the transport sector) and a general lack of risk capital; misalignments in the value chain related to divergent funding for tickets (e.g. public transport vs. private operators) and existing payment systems; poor quality public transport systems; the need for a critical mass of users for financial viability; the lack of a single market; a lack of funds for pilots and trials; and a need for large upfront capital investments.

Regarding barriers to collaboration in the MaaS ecosystem, respondents noted: that some key stakeholders are not convinced by the MaaS concept; that there is a lack of collaboration given a divergence of interests and characteristics; that there is a lack of models and agreements for public-private collaboration; uncertainties regarding the renegotiation of roles and an unwillingness to redefine roles; competition, a lack of trust and divergent norms and organisational logics among key partners; a refusal to share knowledge and data among key organisations; silo-effects, fragmentation and an unwillingness to undergo organisational change; a lack of knowledge and experience of this type of collaboration; a lack of human capital and an under-prioritisation of MaaS in key organisations; a general sense of defensiveness, protectionism and risk-aversion rather opportunity-finding; a perceived risk that MaaS may result in further fragmentation in the transport system; risks of key partner (e.g. public transport) withdrawal; disinterest from the automotive industry; an unwillingness to take on liabilities for customers; a lack of coordinating intermediaries; a lack of platforms to facilitate MaaS business models; a lack of engagement from public transport authorities and operators; the risk of private sector control of public organisations; a lack of interoperability between existing technical systems (e.g. ticketing) and a concurrent a lack of actors with appropriate technical competence; a lack of cooperation between international MaaS operators; and a general lack of knowledge on MaaS within key organisations.

In terms of *strengths and opportunities* related to ICT, respondents commented that MaaS is strongly enabled by digital technologies, noting that many cities demonstrate a technical readiness given the existence of open data policies, back office competences and data availability. Respondents also noted that digitalisation allows for enhanced linkages between different MaaS initiatives, as part of a "digital solutions common" that can spur new ICT solutions and put data to use in refining MaaS services. Particularly Finnish respondents noted that regulations coming into effect during 2018

will allow for open ticket interfacing – a key criterion for an open MaaS ecosystem. In terms of *weaknesses, threats and barriers* related to ICT, respondents noted that a lack of technological interoperability (in the form of non-standardised ticketing interfaces, for example) pose a barrier to Maas developments in many cities. Further, MaaS is hampered by unresolved data protection issues; a lack of real-time information; and a lack of integration between different ICT platforms. One respondent also noted that MaaS, if made available only via smartphone applications, will be affected on tedious issues such as internet access and battery capacity. Respondents highlighted the following issues as topics for future R&I activities:

How can barriers to ecosystem collaboration be overcome?

- How can we cultivate trust among ecosystem members?
- Must ecosystem members be convinced to relinquish control of their brands, customer relationships and margins?
- How can ecosystem members that operate according to different logics and revenue models (e.g. public vs. private sector) collaborate?
- What roles should different organisations adopt in the MaaS ecosystem?
- Should MaaS be commercially driven, publically controlled or something else?
- What is the role and appropriate distribution of public subsidies in the MaaS ecosystem?
- How can ecosystem members be encouraged to allow third-party sales?
- How should the use of user data be governed in the MaaS ecosystem?
- What role/s can be taken by MaaS providers?
- What models for ecosystem collaboration exist?
- How can we safeguard equity in the MaaS ecosystem?
- How do ecosystems vary between cities in different countries, and in suburban/rural areas?

How should MaaS markets be governed?

- How can an open MaaS market be created?
- How can unsustainable / monopoly positions be avoided?
- How can we facilitate roaming given the divergences between different geographical contexts?

What types of business models exist for MaaS?

- What types of value propositions should MaaS business models offer? What types of services should be included?
- What pricing and payment models are suitable?
- How can MaaS be designed to be profitable?
- How can MaaS reach a critical mass of users?
- Who is responsible for the customer/user?
- Who sets service levels and grants concessions?
- What are the incentives and requirements for different players to join MaaS?
- How can we find a business model that fits the needs of public and private actors?
- Is it possible to develop a viable business model without public transport?
- How are viable contracts with partners designed and enforced?
- Where does revenue come from in a MaaS business model?
- Who decides on how revenue and costs are shared?

- Who will fund the development of MaaS services?
- What is the potential of MaaS outside cities?
- How can MaaS business models be designed such that they are scalable?
- What is the right balance between profit and sustainability?
- What characterises sustainable MaaS business models?

ICT-related issues:

- How can the need for large data sets be balanced against privacy and user integrity?
- What types of ICT platforms are needed to support MaaS and what should be their functionalities?
- What types of ICT solutions and data standards are needed to facilitate the integration of different transport modes and service providers?
- How can the interoperability of operating and hardware systems be ensured?
- What are the key capabilities for developing capable back- and front-end MaaS solutions?
- Do ecosystem members possess relevant ICT capabilities?
- What is the willingness from different industries and actors to share data?
- What types of ICT solutions and capabilities are needed to facilitate demand-driven MaaS?
- How can ICT support real-time situational awareness and transport system predictability?
- How can MaaS harness the potential of blockchain technology?
- How can we ensure that ICT platforms are resilient to shocks and potential attacks?
- How can MaaS make use of virtual reality and automation?
- Who should pay for ICT developments?

2.6 Governance

The complexity of the transport system implies that a sustainable transition to MaaS must overcome a complex set of barriers and obstacles to change, some of which are so deeply entrenched that they have been described using the idiom 'techno-institutional lock-in' (Unruh, 2002, 2000; Whitmarsh, 2012). The Swedish project IRIMS (Institutional Frameworks for Integrated Mobility in Future Cities) has developed a framework for examining the way in which institutional factors at macro (society), meso (municipalities, networks and organisations) and micro (individual users/customers) levels influence MaaS developments (Mukhtar-Landgren et al., 2016b). The framework, which is intended for generic use, has been applied to cases in Finland and Sweden to identify various formal and informal institutions such as legislation and public policy, norms and roles, cultural understandings, attitudes and travel habits enable and hinder the development and deployment of MaaS services. Some other work has been done to examine the governance of MaaS developments, again focusing on Finland as a case study (Audouin and Finger, 2017). Sarasini and Linder (2017) draw upon business model perspectives and transition theory to outline a governance programme that may be useful in promoting transitions to sustainable, MaaS-based urban mobility systems.

With regard to the governance of MaaS developments, our survey respondents noted that there is a strong political will among public sector stakeholders to support MaaS, with some respondents noting a "strong nation state-level vision to promote MaaS development and deployment", and others noting political interest at the local level. Respondents also mentioned the availability of funding among public sector agencies, who are also willing to support MaaS developments, and

the development of legislation to support MaaS, particularly in Finland. Respondents commented that MaaS aligns well with other transport policy objectives, and noted that climate policies in particular provide support for MaaS developments given its propensity to reduce transport sector emissions via reduced car ownership. They further argued that MaaS can help to fulfil transport policy goals at zero cost to the public purse, and to streamline public spending on passenger transport (via more optimised public transport systems, for instance). Respondents also noted the importance of international organisations such as the MaaS Alliance that can facilitate thought leadership, exchanges regarding best practices and knowledge dissemination, and brainstorming activities. One respondent noted that MaaS can provide a better overview of travel patterns and behaviour, allowing for improved traffic management. Several respondents noted the importance of pilots and trials for the development and deployment of MaaS. These individuals argued that the pilots underway will serve to strengthen the credibility of the MaaS concept, prove its viability, pioneer the concept and improve user acceptance, and to increase knowledge and competence among relevant stakeholders and service providers.

However, respondents also noted that ongoing pilots and projects are too limited in scope, hampering their consolidation and ability to scale. They also argued that there is a general lack of leadership and a lack of coordination between ongoing initiatives, such that knowledge is not adequately shared, also hampering scaling activities. Aside from these issues, respondents highlighted numerous regulatory barriers that hinder MaaS developments. These include: fragmentation between different policies and policy areas (e.g. taxation, parking policies, urban planning and land-use policies); incompatible technical and quality standards; existing policies and legislative path dependencies that support private car ownership; outdated subsidies for public transport; slow decision cycles in the public sector; ineffective public sector mechanisms (e.g. public procurement); uncertainties regarding the allocation of public funds in future mobility systems; the strength of the automotive lobby, which is in favour of diesel engines; a lack of supportive policies for some transport modes (e.g. parking for car-sharing initiatives); uncertainties regarding legislation for data and for shared/autonomous vehicles; and uncertainties regarding the overall regulatory framework for MaaS. These issues demonstrate that innovative developments in the service dimension must be coupled with institutional changes if MaaS is to flourish. Respondents highlighted the following issues as topics for future R&I activities:

Who should do what in governing MaaS developments?

- What roles should be taken by governments, pubic authorities and private sector actors in governing MaaS developments?
- What institutional frameworks support MaaS developments and implementation?
- How can fragmentation in governance activities, policymaking and with regard to the activities of different public authorities be overcome?
- What is an appropriate use of public subsidies in a MaaS-based transport system?
- What types of KPIs should be included in city /regional strategies?
- How to can key stakeholders describe and communicate the sustainability potential of MaaS to garner support?
- How can policymaking become more dynamic?
- How can policymakers create incentives for sustainable MaaS developments?
- What institutional barriers – formal and informal – create barriers to the development and dissemination of MaaS?
- How can policymakers ensure fair competition in MaaS ecosystems?

- What policies, regulations and standards are necessary to allow safe, secure, fair and interchangeable MaaS systems worldwide?
- How can governance efforts ensure that adequate funding is directed towards pilots and trials?

2.7 Summary of survey results

To summarise, our email survey garnered 98 comments on strengths of the MaaS concept, 121 regarding opportunities, 105 comments on weaknesses and 87 regarding barriers/threats. As noted previously, we categorised these responses into five R&I themes: sustainability impacts and the need for assessment, urban developments, user perspectives, business models and networks, and governance. The distribution of survey responses across these themes is described in figure 4.

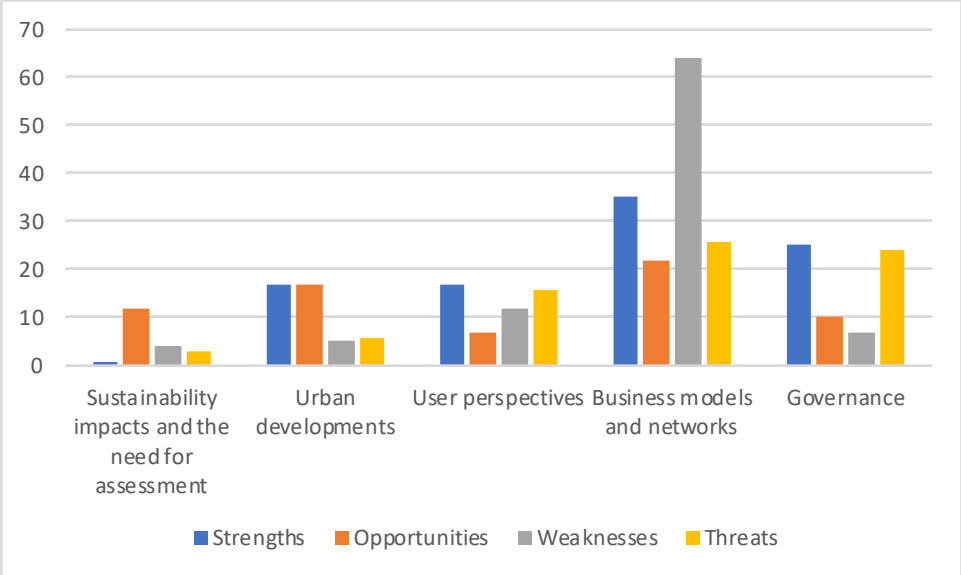


Figure 4: Distribution of respondents' perceptions of the strengths, opportunities, weaknesses and barriers/threats associated with the MaaS concept.

Issues related to business models and networks make it the most populated category (147 responses), followed by governance-related issues (81 responses), user-related issues (52 responses), urban development (45 responses) and sustainability (20 responses). Our research overview identifies a similar range of issues, which are also categorised within these themes.

3 Recommendations

In this section we outline a set of recommendations based on the findings of our expert consultations and literature review. We delineate two categories of recommendations. The first is associated with the need for a transdisciplinary approach in R&I activities that have sustainable urban mobility as their target. The second relates to the potential role taken by JPI Urban Europe in terms of governance activities that can enable and promote transitions to sustainable urban mobility within member countries.

3.1 The need for transdisciplinary approaches

The identification of R&I themes in this white paper is intended as part of challenge-driven approach that is common within transdisciplinary research that targets sustainable transformation. Within the discourse on sustainability research, transdisciplinarity is generally conceived of as a fruitful approach for dealing with complex, 'real-world' problems where traditional disciplinary frameworks fail to provide a proper understanding of such complexities (Hirsch Hadorn et al., 2010; Jahn et al., 2012). In the field of transport, transdisciplinarity is motivated by the fact that research initiatives lack the requisite nous to deal with sustainability problems, having been described as 'fragmented', 'policy-oriented' and "aimed at predominantly technology-led solutions to societal problems" (Miciukiewicz and Vigar, 2012; see also: Schwanen et al., 2011). Jones (2012) argues that transport is plagued by a 'vehicle-based paradigm' that, despite having evolved to include new perspectives, is dominated by an approach that developed over 50 years ago. The identification of R&I themes within this white paper reflects the need for a combination of disciplinary perspectives within R&I initiatives in order to tackle the multitude and complexity of practical issues that must be resolved to facilitate a transition to sustainable, MaaS-based urban mobility systems.

To reiterate, R&I initiatives that combine scientific perspectives associated with sustainability impacts and assessment; the relationship between mobility and urban developments; users' needs, desires, attitudes and travel behaviour; business models and multi-stakeholder networks; and governance (i.e. new institutional arrangements) are needed to ensure that sustainable urban mobility systems take hold. To this end, *we recommend an integrative, transdisciplinary approach to JPI Urban Europe programming and R&I activities* that combines relevant social scientific disciplines and perspectives as a means to embrace the diverse socioeconomic and cultural contexts within which transport systems operate; that situates user subjectivities and behaviour at the centre of analysis; that critically examines the relationship between transport policy and land-use; and which serves to engage multiple stakeholders as a means to overcome conflict and to develop progressive, socially inclusive practices and policies (Miciukiewicz and Vigar, 2012). These (and other) perspectives should feature in R&I proposals via explicit calls for transdisciplinary approaches.

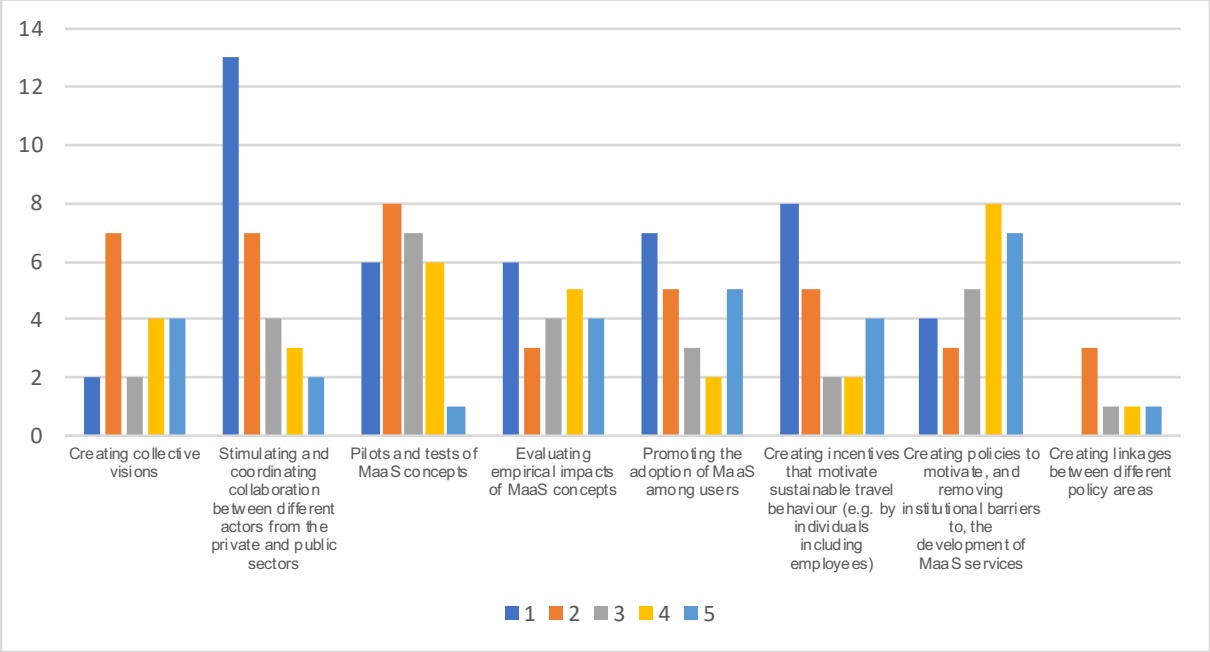


Figure 5: Ranked R&I priorities within different themes.

Moreover, our consultations with experts in MaaS and urban mobility revealed a set of challenges and issues that must be faced and resolved the near future if sustainable MaaS-based urban mobility is to become a reality (figures 5 and 6). Of these, it is clear that the primary objective must be to identify innovative ways to promote collaboration between actors that have not previously pursued co-creative innovations. In fact, successful collaboration in the MaaS ecosystem is the foremost barrier to the resolution of other practical issues, such as the development of sustainable MaaS business models and services, finding more efficient ways to utilise land within cities, and the identification incentives that will promote sustainable travel behaviour among individual travellers. When seen from the perspective of different scientific disciplines, the diversity inherent in these practical issues further warrants a transdisciplinary approach.

Unlocking the potential for ecosystem collaboration and co-creation will likely also require novel approaches to institutional innovations that are tailored to the specificities of different cultural contexts. Our survey further demonstrated the need to create collective visions, and to create institutional conditions (including R&I funding) for MaaS developments to flourish. With regard to the latter, it is important that R&I activities are not limited to pilots and experiments (although these are of paramount importance!), but extend to experimentation with new policies and institutional frameworks that can support collaboration in MaaS ecosystems; the development, deployment and diffusion of MaaS business models; and ways to promote sustainable travel behaviour. Given the importance of overcoming barriers to ecosystem collaboration prior to the development of MaaS business models, multi-stakeholder processes are also paramount in different urban settings. *Hence we recommend that JPI Urban Europe supports R&I activities that aim to overcome the barriers and threats to sustainable MaaS developments* as they apply to each of the five themes outlined in this document.

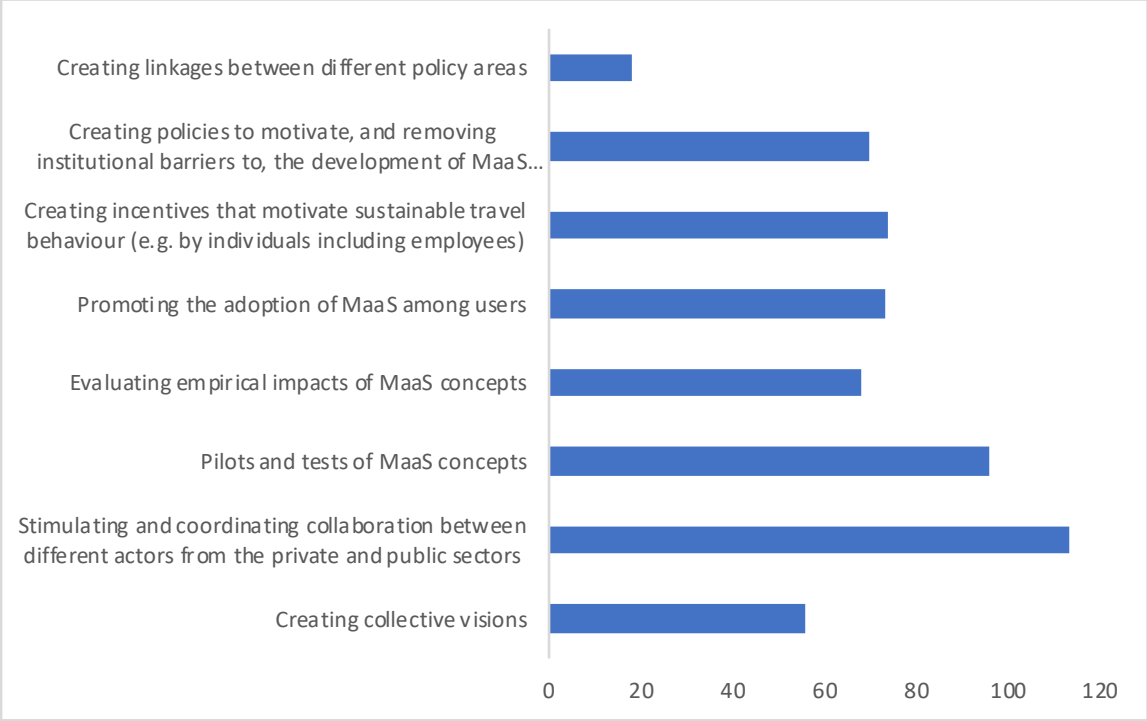


Figure 6: Aggregated R&I priorities within different themes.

Cities are ideal forums to trial and test experimental innovations in different domains, including new mobility services and products, social and policy innovations. However, cities cannot act isolation when seeking to bring about institutional change. The question that follows is related to how the transformative power of cities can be harnessed in a manner that benefits the broader programmes of systemic change that will ultimately result in more sustainable urban mobility systems. In short, this is a governance problem that must be tackled with nuance and care.

3.2 Transition Management

To tackle this problem, frameworks have been developed (e.g. Geels, 2012) to examine how sustainability transitions can be 'managed' from governance and policy perspectives. Of these, transition management is a useful means to engage multiple actors within diverse urban constellations. Transition management embraces the complexities of sustainable transitions, which can occur over periods of several decades, by adopting a long-term, multi-stakeholder approach that recognises the transformational influence of a broad set of actors, among them private enterprises (Loorbach, 2010; Loorbach and Wijsman, 2013). That is, transition management parallels developments in the field of environmental governance, where one can observe a shift in the understanding of governance from a traditionally state-led, or government-oriented activity (based on regulatory interventions, legislation and public policy) to a broader, multi-stakeholder activity that involves actors from the public sector, industry and civil society (e.g. Driessen et al., 2012; Glasbergen, 1998). Whatever the nature of the MaaS service introduced in a given city or region, there appears to be a need for the public sector to play a key role in governing developments, to ensure quality, affordability, access and inclusiveness (Polis, 2017). Yet the essence of MaaS, as a cross-sectoral innovation, means that the public sector cannot act in isolation.

As a means to elucidate governance activities that can harness and overcome systemic sources of change and inertia, transition management often starts with analyses of existing sociotechnical systems. In practice, scholars often utilise the Multi-Level Perspective (MLP) (Geels 2002) – and particularly the concept of a sociotechnical regime (Kemp, Schot, and Hoogma 1998) – to identify drivers and barriers of systemic transitions. Sociotechnical regimes are viewed as a major source of stability, inertia, and lock- in effects, which makes them, arguably, the main source of barriers to sustainable transitions. Regimes are multi-actor networks within which the propensity of well-established, incumbent organisations to utilise existing search heuristics results in predominantly incremental, not radical, innovations. The structuring qualities of regimes issue from numerous sources. First, regime organisations are embedded within a system of institutional arrangements that enables and hinders certain activities (Geels 2004). Second, organisations within regimes are bound by network interdependencies, such as existing value chains (Geels, 2002). Third, the artefacts and material elements of regimes acquire a certain durability over time. For instance, artefacts such as road and fuel infrastructures are seen to acquire 'a logic of their own' due to complementarities with other system elements and sunk costs (Rycroft and Kash 2002).

Applying the regime concept to MaaS (given the aim to provide an attractive alternative to private car ownership and use) draws attention to a multi-layered institutional context that contains various regulations, norms, and cultural understandings, and also relies upon different types of physical infrastructure, markets and the car as an artefact. This regime may described in terms of "the system of automobility" (Urry 2004). However, the development and implementation of MaaS-based services in most urban contexts, given its heavy reliance on public transportation, means that MaaS developments are also influenced by the institutional arrangements associated with the public transport system. Others have noted the complexities of this transition, with MaaS described as being 'caught between two regimes' (Parkhurst et al. 2012). Hence while the governance of a sustainable transition to MaaS within cities is no simple task, in practice it necessitates a deep understanding of the sources of inertia that emanate from two sociotechnical regimes. The various barriers to collaboration within MaaS ecosystems described in this white paper may arguably result from the presence of these regimes, yet require further investigation given that existing R&I efforts are limited.

Transition management advocates a governance model based on four types of activities. *Strategic* activities creation of adaptable, long-term visions that acknowledge the complexities of societal problems using tools such as backcasting. Strategic activities are collaborative, inter-organisational (or multi-stakeholder) processes which aim to ensure that long-term visions are shared and embedded among collectives. By contrast, *tactical* activities serve to link individual actor strategies to the shared long-term visions created via strategic activities, aiming to overcome short-termism within different societal sectors (e.g. politics, business). They also aim to tackle the difficulties in implementing solutions by acknowledging complex sources of inertia within extant mobility regimes, and directing activities such as corporate political action and lobbying towards the reformation of such structures. *Operational* activities aim to link everyday activities such as innovative experiments to long-term visions, broader policies and change agendas, and can include experimentation with new mobility services (pilots and trials) in addition to experiments with new steering mechanisms and policies (e.g. parking norms). *Reflexive* activities include the ongoing monitoring, assessment and evaluation of policies and practices as a means to revise overarching visions and plans where necessary (Kemp and Loorbach, 2007; Loorbach, 2010, 2007; Rauschmayer et al., 2015; Rotmans and Loorbach, 2008; Voß et al., 2009; Loorbach and Wijsman, 2013).

We recommend that JPI Urban Europe espouses an approach inspired by transition management as a means to play a key role in governing a transition to a sustainable, MaaS-based transport system within member countries. In particular, we propose that JPI Urban Europe works to promote the creation or consolidation of a *transition arena* in the field of MaaS and sustainable urban mobility. A transition arena is a network that facilitates interactions, knowledge exchange and learning among multiple stakeholders (Kemp and Loorbach, 2006). In the field of MaaS, there are several international networks and organisations that are currently active in terms of ongoing strategic, tactical, operational and reflexive activities. These include: the MaaS Alliance, Ertico, Polis and UITP, alongside several national organisations and research councils. Hence our recommendation, more specifically, is that JPI Urban Europe works to consolidate existing efforts and complement these with its own programming activities in a manner that actively promotes the various governance activities that transition management advocates. In practice, we envisage that JPI Urban Europe can adopt a facilitating and/or a supporting role wherever necessary, as a means to ensure that strategic (visioning), tactical (positioning), operational (innovative, experimentation) and reflexive (evaluation, assessment) governance activities are adequately funded and coordinated within existing networks and organisations. A useful starting point may be to organise a symposium to discuss the creation and coordination of a European transition arena that focuses on sustainable urban mobility, with MaaS as a key component. A long-term perspective (ca. 25 years) is imperative to overcome the short-termism that plagues political cycles and the private sector (Loorbach, 2010).

Within such a transition arena, urban sites (and stakeholders therein) should act nodes in broader network that shares a common vision, albeit with differentiated means to fulfil that vision in terms of experiments with different variants of MaaS and with different types of policy and institutional innovations. Although one could claim that a vision for sustainable, MaaS-based urban transport systems already exists (as noted by the various expectations outlined in this document), this vision has not yet been explicated at a level that may be deemed legitimate among JPI members and with respect to the multiple stakeholders within diverse urban settings. Nor have cities and regions explicitly positioned themselves tactically with respect to the potential that MaaS offers. To these ends, JPI Urban Europe could seek to facilitate multi-stakeholder processes via R&I initiatives that aim to generate a legitimate and robust set of expectations and roadmaps for member countries[1]. In practice, this entails a set of strategic *and* tactical activities that builds on and finds common ground between: existing transport policy goals within European cities and member countries; existing MaaS roadmaps and position papers, international advocacy associations such as UITP, and so on. In addition, it is paramount that such initiatives seek to include networks and sectors that have thus far remained at the periphery of collective efforts, such as the European automotive sector. The outcome of such an initiative should be a robust, overarching vision for sustainable MaaS-based urban mobility (with MaaS as a centrepiece) supplemented by a clear plan as to how multiple stakeholders (and cities!) can contribute to the realisation of this common vision via their own tactical and operational initiatives.

With regard to operational activities, cities can play a key role in tackling each of the practical issues outlined in the previous section. Here R&I programming can ride the current wave of popularity surrounding living labs, as reflected in the multitude of R&I initiatives that have mobilised the concept in recent years. In fact, the living lab concept encapsulates many of the tenets of transition management in a satisfactory way: "geographical embeddedness, experimentation and learning,

[1] Note that roadmaps have been established in some countries (e.g. Sweden) and via some projects (e.g. MAASiFie).

participation and user involvement, leadership and ownership, and evaluation and refinement" (Voytenko et al. 2016). As a user-centric approach to fulfilling mobility needs, it is paramount that operational activities in the form of pilots and experiments with MaaS services are designed to engage users (and urban citizens) – a criterion that could be applied in R&I funding calls.

With regard to reflexive activities, our study demonstrated the criticality of assessing the sustainability impacts of MaaS across the economic, environmental and social dimensions. Again, such assessments should address each of the five thematic areas detailed in this paper, and should form the basis of an iterative approach that serves to inform and refine strategic, tactical and operational activities as new opportunities and challenges emerge. As a facilitator, JPI Urban Europe should aim to support reflexive activities within the transition arena, by supporting knowledge exchange among members regarding assessments of MaaS pilots and best practices regarding service design, institutional innovations, and behavioural aspects.

Figure 7: A transition management approach in JPI Urban Europe programming.

3.3 Practical considerations

One of the main critiques of transition frameworks, and the application of the regime concept in particular, is that researchers wilfully delineate system boundaries, with most studies consequently focusing on national settings (Coenen et al., 2012). The temptation exists to mirror this approach by treating countries as institutionally homogenous entities whereby MaaS developments unfold. Yet the essence of this critique, which has been pitched by economic geographers, is that transition theories such as transition management and the MLP obscure the role of spatial scales in transitions, focusing instead on temporal and structural variables (Raven et al., 2012). The argument is that countries are not institutionally homogenous but rather multi-scalar entities within which focal organisations operate on a local scale, often with supranational ties and influence (Hansen & Coenen 2015). Alternatively, one may argue that cities are an applicable spatial scale, given that MaaS may, initially at least, target urban and suburban citizens. Indeed, some work has been done to apply the tenets of transition management to urban settings using terms such as urban transition labs (Nevens et al., 2013). Still, while cities may be essential in governing transitions by, for instance, creating niches for experimentation, scholars have also noted that cities do not act alone in seeking to transform regimes, and those that do succeed have ties with regional/national governments and agencies, and other supranational entities (Hodson & Marvin 2010). Such relational ties are key when aiming to establish new institutional arrangements that are conducive to the development and diffusion of radical innovations.

When considering the role of spatial scales, a distinction can be made between *absolute* spatial scales (those that are territorial) and *relative* spatial scales (those that are socially constructed) – where the latter are seen to be more relevant to sociotechnical transitions (Raven et al., 2012). The importance of relative spatial scales has been noted in terms of concepts such as 'institutional thickness', defined as: "the comparative performance of governance bodies in terms of their ability to work together locally, and persuade or compel sufficient external agents to support their activities" (Coenen et al., 2012). Similarly, cognitive, organizational, social, and institutional proximity are known to be conducive to innovation (Raven et al. 2012). These terms refer to, among other things, the social capital and network capabilities that exist among organisations which act at different spatial scales that can play a key role in governing sustainable transitions. In practice these may include: national, regional and local governments; local, national and international businesses, financial organisations, industry organisations, and so on.

Given these insights, the question that remains is related to how the tenets of transition management can be operationalised in practical ways via JPI Urban Europe R&I programming. To this end, *we recommend that R&I programming should prioritise multi-scalar linkages with key actors and organisations that can propagate for sustainable urban mobility and mobilise support for MaaS developments within broader networks, and that can bring about institutional changes that support MaaS developments in cities and regions*. In practice, this can be realised via R&I programming activities that serve to bring key actors and organisations into the urban mobility discussion, that coordinate efforts among such actors, and by ensuring that individual calls for proposals require the active participation of relevant governance bodies within R&I projects. The need for coordination is motivated by a further critique of transition management where, in practice, some of the key tenets of transition management are 'lost in translation' when transferred from one national context to another (Voß et al., 2009). As an international body that focuses on research and innovation within urban localities, JPI Urban Europe is arguably well-positioned to ensure that strategic, tactical, operational, and reflexive transition management activities serve to connect organizations acting at different spatial scales (local, regional, national, and supranational) in an effective way.

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5 Appendix: Email survey questions

The email survey comprised the following questions:

1. Reflecting on MaaS, please highlight the key strengths, weaknesses, opportunities, and threats/barriers (SWOT) by filling the following table. Please focus on the potential contribution of the MaaS concept to the sustainability of greater urban areas and regions.

Tips for completing a SWOT analysis:
Strengths and Weaknesses are deemed to be *internal factors* within the MaaS ecosystem or community, or within a specific MaaS stakeholder organization. Examples may include:

- Human resources – competence and skill, employees, volunteers, leadership, target population
- Financial - grants, funding agencies, any other funding or income sources
- Activities and processes – collaboration or knowledge sharing across sectors/organizations/departments; programmes or projects already implemented, systems employed (e.g. ICT)
- Past experiences - building blocks for learning and success, collaboration or knowledge sharing, reputation of key players in the community.

Opportunities and Threats are deemed to be *external factors* deriving from societal forces or from outside the MaaS ecosystem or community (or stakeholder organization). Examples may include:

- Future trends in the field (technology, etc.)
- The economy - local, national, or international
- Funding sources - foundations, donors, government
- Demographics - changes in the age, race, gender, culture, habits of the community members
- The physical environment (Is the city/region developing, e.g. new residential areas, and/or changing land use strategies? Is the city/town cutting down availability of private parking spaces? Is the city/region implementing new infrastructure, e.g. charging stations, car sharing sites, multimodal hubs?)
- Legislation (Are new national/l/local requirements/bills enabling or hindering the emergence of MaaS?)
- Local, national, or international activities, initiatives, policy goals/visions.

INTERNAL FACTORS to the MaaS ecosystem	STRENGTHS 1. 2. 3. …	WEAKNESSES 1. 2. 3. …

EXTERNAL FACTORS to the MaaS ecosystem	OPPORTUNITIES 1. 2. 3. …	THREATS/BARRIERS 1. 2. 3. …

2. For the purposes of this project, we have selected the following R&I themes: user perspectives; business models and networks; urban/regional planning, development and design; ICT; institutional frameworks; sustainability assessment. For each theme:
    a. Please outline **key questions** that are critical to the development and deployment MaaS in urban and regional settings;
    b. Note any completed or ongoing R&I projects and activities that seek to address these questions;
    c. Add information regarding **key people** (private or public practitioners, researchers, etc.) within this R&I theme.

Themes	a. Key questions	b. Projects/Activities	c. Key people
User perspectives			
Business models and networks			
Urban/regional planning, development and design			
ICT			
Institutional frameworks			
Sustainability assessment			
Other			

3. In your opinion, what should be the main focal points of R&I projects/activities related to the MaaS concept in urban and regional settings? **(Please, pick and rank five of the following options, with 1 being the most important.)**

Your ranking (choose max 5 and rank; 1 = most important)	Focal points
	Creating collective visions
	Stimulating and coordinating collaboration between different actors from the private and public sectors
	Pilots and tests of MaaS concepts
	Evaluating empirical impacts of MaaS concepts
	Promoting the adoption of MaaS among users
	Creating incentives that motivate sustainable travel behaviour (e.g. by individuals including employees)
	Creating policies to motivate, and removing institutional barriers to, the development of MaaS services
	Creating linkages between different policy areas
	Other…
	…
	…
	…

4. This question focuses on the role of different types of networks for sharing knowledge and information regarding MaaS R&I efforts; for creating expectations and visions; for political actions (e.g. lobbying for policy and legislative change); and for evaluating R&I efforts.
    a. What **types of networks or collaborative arenas** (formal or informal, national or international) do you participate in? (please list).
    b. What are the **main strengths and weaknesses** of each network?

	a. Network/arena/forum/conference	b. Strengths and weaknesses
1.		
2.		
3.		
4.		
5.		
6.		
7.		

5. Are there any stakeholders who are important for the development of MaaS, but who are currently lacking or underrepresented in your networks and collaborative arenas (or in the MaaS discussion and activities in general)?

6. Do you have any recommendations of other key persons and/or organisations from your country that could provide valuable input to this project? If so, please list them here:

7. What type of organization do you represent?

8. What is your organisation's role and interest in MaaS?

9. Do you wish to be kept informed about this project?

6 List of survey respondents

Name	Organisation	Country
Birgitte Hatvan	ConPLusUltra	AUSTRIA
Susanna Hauptmann	Kapsch	AUSTRIA
Caroline Cerfontaine	UITP	BELGIUM
Leen De Paepe	University of Ghent	BELGIUM
Julie Castermans	Ertico/MaaS Alliance	BELGIUM
Piia Karjalainen	Ertico/MaaS Alliance	BELGIUM
Henriette van Eijl	DG Mobility and Transport (MOVE)	EC
Krista Huhtala-Jenks	Finnish Ministry of Transport and Communications	FINLAND
Asta Tuominen	Finnish Transport Agency	FINLAND
Marko Forsblom	ITS Finland	FINLAND
Jenni Eckhardt	VTT	FINLAND
Heikki Liimatainen	Transport Research Centre Verne, Tampere University of Technology	FINLAND
Jukka Lintusaari	Tampere University of Technology	FINLAND
Milos Mladenovic	Aalto University	FINLAND
Andreas Volz	Forschungszentrum Jülich GmbH	GERMANY
Ralf Barron	AD Little	GERMANY
Helga Jonuschat	InnoZ-Innovation Centre for Mobility and Societal Change	GERMANY
Filippo Logi	Siemens	GERMANY
Colette Bos	NWO - Netherlands Organisation for Scientific Research	NETHERLANDS
Marije de Vreeze	Connekt	NETHERLANDS
Janne Lonsethagen	Sör-Trondheim Kommun	NORWAY
Marko Javornik	Comtrade	SLOVENIA
Clas Roberg	Trafikverket	SWEDEN
Torbjörn Bengtsson	Trafikverket	SWEDEN
John Hultén	K2	SWEDEN
Hans Arby	UbiGo	SWEDEN
Adam Laurell	Samtrafiken	SWEDEN
MariAnne Karlsson	Chalmers University	SWEDEN
Dan Andersson	Chalmers University	SWEDEN
Sinisa Krajnovic	Chalmers University	SWEDEN
Ulrika Bokeberg	Västra Götalans Region	SWEDEN
Erik Grip	Västtrafik	SWEDEN
Michael Browne	Handels/Gothenburg University	SWEDEN
Emma Lund	Trivector	SWEDEN
Arnd Bätzner	Baetzner Metropolotan	SWITZERLAND
Jennie Martin	ITS UK	UK
Maria Kamargianni	UCL	UK
Beate Kubitz	TravelSpirit Foundation, University of Cambridge	UK
Chris Lane	Transport for West Midlands	UK