# MOBI-MIX insight report

The MaaS scene

Executive summary

Cities have become a playground for experimentation, as more and more mobility initiatives aim to reduce car-dependency, congestion and environmental pollution. The MOBI-MIX project supports five European cities to plan, implement and analyse their mobility solutions, in an endeavour to decarbonise road transport and reduce the number of private cars. Within the project, local authorities collaborate with the private sector to more effectively implement shared electric mobility (e-bikes and e-cargo bikes, e-scooters, e-cars) and Mobility as a Service (MaaS) pilots.

This *MaaS Insight Report* - the first of a series of four reports - compiles a state of the art outlook on the potential impact of MaaS on urban environments. MaaS offers an opportunity to approach mobility from the user's perspective. Like other mobility solutions, its positive impacts are intricately connected to the quality of infrastructure, policy, and communication.

This report draws from previous European projects and publications, as well as interviews with MaaS experts and practitioners from across Europe. The report starts with an overview of the MaaS ecosystem and its potential configurations. Then, it delves into the roles and interests of different stakeholders, as well as some crucial considerations that make MaaS affordable, resilient and sustainable. The final part contextualizes the Sustainable Urban Mobility Plans (SUMP) principles within MaaS, and offers some ways to analyse a city's readiness for MaaS.
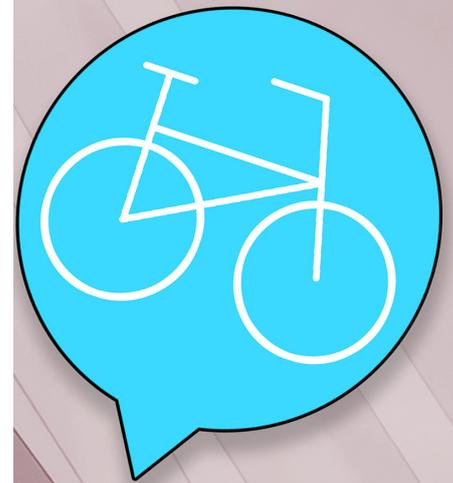
Part 1 – Understanding MaaS

1. What is MaaS?

Mobility as a Service (MaaS) should be understood as a concept or a tool, rather than a given solution. MaaS is a process where several actions are taken in order to offer seamless multimodality or mobility as a service, and it differs from the mere delivery of a product. The following elements characterize MaaS:

- **MaaS is user centric.** MaaS places the user at the centre, matching individual travel needs with customised mobility packages.

- **MaaS is multimodal**. The viability of the MaaS solution depends on the mix of mobility services offered, as travel needs are addressed by offering users the most appropriate combination of travel modes.

- **MaaS is integrated**. Multiple services are offered in an integrated manner through a user-friendly platform (e.g a smartphone MaaS app).

2. The MaaS ecosystem

The following graph represents the MaaS ecosystem, indicating the different actors/levels and how they relate to each other (through the arrows). The dashed arrows reflect the flexibility of the process, depending on the regulation and the conditions established. For instance, the data that MaaS service providers can provide to transport operators will depend on the contracts and the existing data regulations.
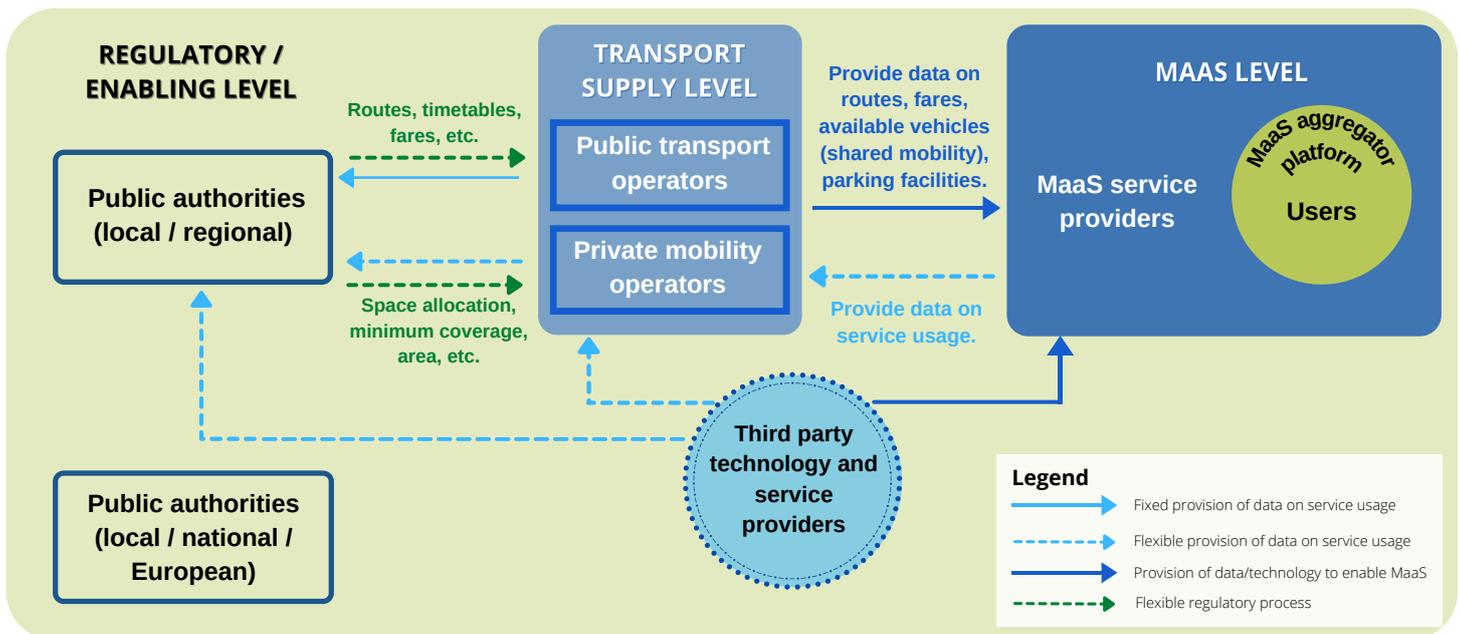

Figure 1 The MaaS ecosystem

In the regulatory/enabling level we find the public authorities. Local public authorities regulate service conditions for transport operators and set policy objectives (e.g. reduce emissions, increase social inclusion, safety, etc.). Public authorities are also responsible for providing the framework and recommendations for data governance, privacy and security, fair competition and financing. These frameworks can be set at the local, regional, national and European levels.

In the transport supply level we find the public transport and private mobility operators. The actors in this level provide the mobility offer (public transport; shared bikes, e-scooters, cars; taxis; parking, etc.). MaaS concepts are not limited to transport and can include other services (such as hotels, restaurants, etc.), in which case this can be considered the "service supply level".

The MaaS level includes the MaaS service providers and the users, connected through the MaaS aggregator platform (often a mobile app, although not necessarily). The MaaS service providers, which can be public or private, integrate services into a single platform to seamlessly offer the best combination of travel models. The users interact via the MaaS aggregator platform that offers them seamless bundles of services provided by different operators.

The different levels of integration are explained in Table 1. The different levels are not necessarily hierarchically listed, as the situation depends on the user and their needs. Similarly, the levels do not depend on each other, as some platforms might allow payment without providing a route planner.
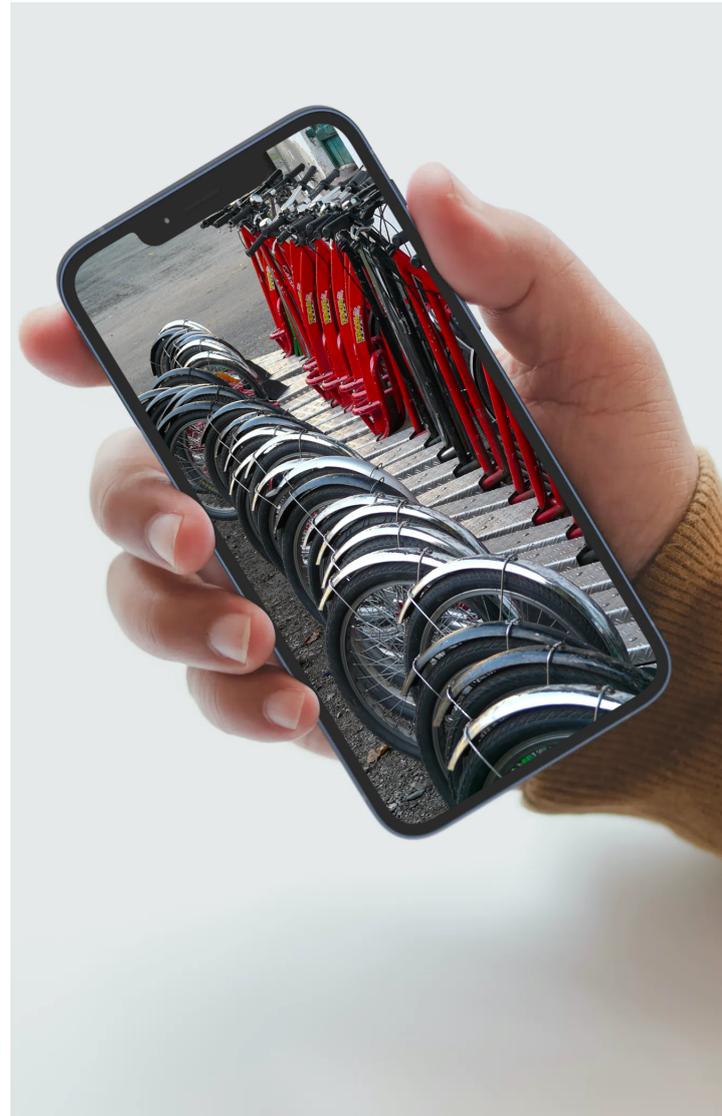
Outside of the transport supply and MaaS levels but inside the enabling level we find the third party technology and service providers. These actors provide necessary technology to enable MaaS, such as payment, ticketing, routing, security, etc. Yet, they do not necessarily always form part of the ecosystem, as in some cases MaaS service providers are able to offer such services without external intervention.

The pilot in Nijmegen (p. 5) offers valuable insights into the preconditions which help to form alliances and to design the MaaS governance structure.

*MaaS level of integration		Main technical enablers	Main policy enablers
No integration	Single separate services	• High-quality transport infrastructure • Multimodal Services	Access to new mobility market
1 Integration of information	Multimodal journey planner with price information	• Static & dynamic data • Open APIs for data sharing • Common data formats	Common data formats and open APIs
2 Integration of payment	Single trip route planner, booking and payment	• Digital payment and validation methods • Open APIs for planning, booking and payment	• Access to ticket resale • Multimodal passenger rights • Incentives for data exchange, interoperability framework
3 Contractual integration	Bundling of services, subscription packages, contracts	Data feedback loop to service providers	• Access to ticket resale, all types of tickets • Flexibility in terms of pricing when reselling services • Comprehensive passenger rights/consumer rights and privacy schemes • Creation of non-discriminatory and competitive market
4 Policy integration	Integration of societal goals, public-private coordination	Data feedback loop to public authorities	• Incentives for the sustainable modes • Aligned policies across the sectors and administrative borders (subsidies, taxation, etc.) • Comprehensive mobility budget approach • Framework for impact assessment and compliance

Table 1 MaaS levels of integation

Content source: Making the most of MaaS during and after COVID-19, Intelligent Transport, 2021.

3. MaaS business models

The way and the variety of services MaaS providers offer depends on the supply side and the intelligence of each operator, as well as the existing regulatory framework. MaaS providers can offer services in at least three ways:

- Business-to-business (B2B). In B2B models the MaaS solution is targeted at organizations, such as companies or universities (like in the case of Nijmegen, p. 5, and Ghent, p. 19), covering the employees' commuting and business trips.
- Business-to-customers (B2C). In B2C models the solution is targeted directly at individuals, including locals and tourists (e.g. Madrid, p. 9, Budapest, p. 11, Gothenburg, p. 14).

- Business-to-Government (B2G). In B2G models the MaaS solution is targeted at public governmental entities.

Generally, there are two types of MaaS service providers that can co-exist and operate in the same territory:

- Private firms: commercial organisations that are backed by venture capital, e.g. MaaS Global in Helsinki. It can be a firm that is established with the sole purpose of operating MaaS or an extension of an existing firm that is expanding their services.
- Public authorities: An extension of the local public transport authority is set to operate MaaS, such as Upstream in Vienna, or EMT Madrid (p. 9).

Nijmegen use case

Location	**Nijmegen**
Leader	**Radboud University**
Duration of pilot	Research for pilot implementation started in 2016 Pilot launched in September 2018 and planned to run until 2020 (free for users) Currently ongoing in altered version (no longer free)
Target audience	**B2B: university and university hospital employees, looking to further expand for students, hospital visitors and conference/symposium participants.**
Types of transport integrated	• Public transport: train (Dutch Railways - NS), regional train (Arriva) bus (Connexxion), Flex Bus • Shared bikes & e-bikes (GoAbout) • Shared cars (GoAbout)
MaaS level	**Level 2 (planning, booking and paying inside the app)**
Brief description	The MaaS pilot SliM Nijmegen was developed in the urban district of Heyendaal, aiming to offer the university's employees comfortable and carbon neutral commuting options. To stimulate participation, the service was free for users during the pilot, and costs were covered by mobility provider and the university. The stakeholders were involved throughout the entire innovation process to uncover their needs, expectations and conditions for forming an alliance. To facilitate the ecosystem formation and speed up the implementation, transport providers were granted monopoly through contracts for exclusive provision of public transport services (concessions). In addition, the platform provider (GoAbout) also provided shared mobility services. However, this initial structure is not ideal and would require renegotiation in going from an exploration to an exploitation phase (Meurs et al., 2020).
Insights	• **Stakeholders are willing to participate and invest in a pilot project for experimentation and learning purposes.** • **MaaS alliances require: (1) shared goals - initially for exploration, to generate know-how, and in later stages for exploitation, to generate revenue, (2) limited risks for the partners involved, (3) trust and commitment among stakeholders, (4) stimulating public actions & supportive role of public agencies.**

Part 2 – Insights for MOBI-MIX partners

1. Different interests for different stakeholders. The role of public authorities

The MaaS ecosystem is truly diverse and depending on the provision of local public transport, and on social, cultural and demographic characteristics, the role city authorities play in implementing MaaS may vary. Public authorities have different attitudes towards MaaS, as some see it as a complementary service to their public transport offer, while others consider MaaS to be solely a commercial service.

Yet, MaaS is not only valuable as a service product and customer tool, but it can also be a great force for organising and managing mobility across all transport modes at regional and local level. Public authorities have a crucial role to play coordinating all those involved in this mobility system. They can ensure the best possible service, while preserving society's interest to achieve sustainable, accessible and equity policy goals. As Madrid's case shows (p. 8), transport authorities can enable and facilitate MaaS formation, since mobility operators are less likely to consider them as competitors. However, fragmented regulatory frameworks, both geographically and sector-wise, as well as operational interoperability issues, hinder the scalability of services and integration. To overcome these barriers, rules should be implemented to foster market access and competition while ensuring fairness and a balance market development.

UITP, POLIS and EMTA published a statement with recommendations that can help policy makers steer the development of MaaS.[1]

Some relevant recommendations to ensure a fair marketplace for all stakeholders are:

- All operators of transport services within a certain jurisdiction must be allowed, and encouraged, to join the area's mobility digital ecosystem.
- The authorities or transport operators that bear the production risk for the services they provide, must be able to condition access to the ticketing system on data sharing. It must allow any type of integrated mobility service to emerge, not restricting MaaS provision to a commercial business case, and ensure all vendors are subject to the same rules and regulations (e.g. passenger rights, accessibility information).
- Local and regional (transport) authorities should describe the conditions for resale of publicly-produced and funded transport and infrastructure services and define non-discriminatory contracts for interested resellers.

Given the specific characteristics of each city, region, and/or country, it is unlikely that a single MaaS configuration would be universally applicable. Cities and regions involved in the development of MaaS need to develop clear strategic vision, connecting MaaS with other foreseen projects. This perspective can be used to guide MaaS systems and to enhance collaborative relationships with transport operators and other private stakeholders, ensuring that the MaaS system supports a city's broader objectives.[2]

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1 POLIS, UITP, EMTA, 2021, Joint Opinion on EU-wide integrated ticketing.
2 Kamargianni, M., and M. Matyas 2017. The Business Ecosystem of Mobility as a Service. 96th Transportation Research Board (TRB) Annual Meeting, Washington DC, 8–12 January 2017.

The city of Helsinki has accumulated significant experience in MaaS, being the concept's birthplace. Sami Sahala, who has been involved from the beginning, summarised some of the most important lessons:

- The role the public authorities is one of enablers and facilitators, not necessarily leaders.
- Cities looking to enable MaaS should learn from existing use cases, such as Helsinki, to avoid making the same mistakes.
- All different stakeholders should be involved from the beginning, to reduce resistance and the need for legally coercive actions. Still, certain legislative frameworks (e.g. open data) should be set up to support MaaS.
- As public transport is the backbone of MaaS, public transport operators need to see the value in joining this ecosystem.
- Although data is an important part, ensuring that transport providers allow third parties to resell tickets and products is crucial.

2. Ensuring affordability, sustainability and resilience

Many practitioners argue that MaaS comprises a user-centric approach, suggesting that creating user value is the main aim. However, MaaS can and should aim higher than this by contributing to the development of a more sustainable transport system.

MaaS promises the promotion of sustainable travel by reducing private car use and ownership. However, there is a risk that the opposite may happen, that there is a shift from public transport to individual modes (taxis, car-sharing...) and from active modes (walking and cycling) to motorised modes. Integrators see little revenue potential from sustainable and active modes, notably walking, cycling, public transport, as they are either free or low-margin, subsidised modes, while there is much higher revenue potential coming from car-based modes, whether rental/shared or taxis/ride-hailing. [3]

Ultimately, the user modal choice will depend on how the MaaS system is designed and how services and prices are promoted. Because of this, platforms should be obliged to offer all relevant available services (including active modes), and not only those with the highest revenue potential.

MaaS may or may not be cheaper than owning a personal vehicle. For most people, MaaS is expected to be more affordable than owning a private vehicle, but for people that make multiple trips per day and go to numerous locations each day, the cost can add up quickly. To ensure affordability, an uninterrupted, streamlined method of payment/ticketing is necessary and subscription plans need to be made available so that riders can afford these transit services.

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3 POLIS, 2017, MaaS: Implications for urban and regional transport.

In cities and large urban areas, innovative mobility solutions such as ride-sharing, car-sharing, electrical mobility, real-time travel information, intermodal mobility chains, are enjoying increased public attention. These concepts are less used outside cities due to lower user rates in sparsely populated regions, lack of institutional cooperation or fewer financial resources. MaaS should not focus on urban centres only as this would have a very limited impact on mobility and mostly target a well-off but small user-base. In fact, MaaS has a higher potential to reduce car usage in peripheral areas where sustainable mobility patterns are often more difficult to develop. Public authorities should encourage and facilitate the implementation of shared mobility services where they complement and feed, rather than replace, high-capacity public transport systems. Considering their experience in planning and organising these services, local authorities and public transport operators can greatly contribute to the development and implementation of such services. [4]

To ensure public transport remains the backbone of mobility and MaaS systems, public authorities must plan efficient public transport that connects peripheral areas between each other as well as to city centres. Additionally, local authorities must strengthen public transport offerings and develop dedicated prioritised infrastructure for both public transport and shared mobility. The digital infrastructure, particularly regarding ticketing integration and data sharing, will also need to evolve and adapt to enable the implementation of MaaS. However, given the uncertainties about the uptake of MaaS and its contribution to sustainable mobility goals, transport authorities should not bear all the cost and the principle of cost-sharing should be established amongst those who will benefit from it. [5]

In MOBI-MIX, the city of Antwerp is working with three different MaaS operators to implement B2B MaaS pilots. The MaaS operators are mainly targeting companies which offer their employees mobility budgets and company cars, although other companies can join, too. The overall aim is to reduce car use, through different approaches and incentives: (1) bonus for action (rewards for not using parking spots or for choosing carpooling), (2) gamification (integrated games and rewarding elements), and (3) trial offers for using alternative services to private cars.

The public authority is playing an important role as an enabler, having integrated the MaaS pilots in the city's multimodal route planner, *Smart Ways to Antwerp.* Through it, the city facilitates the communication and connection with local private businesses. Besides, Antwerp has also hosted a webinar during which the MaaS operators promoted their products to different companies.

The pilots last for 18 months and each operator must report a series of KPIs to ensure milestones are reached. In addition, the city aims to conduct surveys, to better understand mobility behaviour and how to continue influencing the reduction of private car use.

4 CERRE, 2019, Shared Mobility, MaaS and the Regulatory Challenges of Urban Mobility.
5 POLIS, UITP, EMTA, 2021, Joint Opinion on EU-wide integrated ticketing.

Madrid use case

Location	Madrid
Leader	EMT Madrid
Duration of pilot	Pilot started with aggregating data from mobility providers in 2018. New app integrates route planner, ticketing, and payment since 2020, ongoing
Target audience	B2C: initial analysis focused on students and employees as potential early adopters, yet service is open to all users
Types of transport integrated	• Public transport (urban buses, cable car, Metro, Metro Ligero, Cercanías trains, intercity buses) • Shared e-bikes (BiciMAD) • Shared e-scooters • Shared cars and motorcycles (including free floating) • Public parking facilities
MaaS level	Level 3 (for bus, public e-bikesharing and parking, payment not integrated in app for private mobility providers)
Brief description	EMT is a not-for-profit public company owned by the City Council of Madrid, charged with the management of the bus service, public e-bikesharing service (BiciMAD), cable car, and underground parking facilities. The aim of MaaS is to provide sustainable mobility solutions and a reliable alternative to private cars. Given the large number of services and operators present in Madrid, MaaS facilitates the users' experience, raising awareness regarding the wide choice (Arias-Molinares & García-Palomares, 2020). The app, Madrid Mobility 360, is innovative because it offers information on free floating services (including battery level for e-vehicles), as well as user information on bus occupancy levels.
Insights	• **Private partners collaborate with EMT Madrid more willingly, as the public company is not perceived as a competitor.** • **Status of bus occupancy is a new function added due to the COVID-19 pandemic, highly appreciated by users.**

3. Data governance and data sharing

In the digital economy, data constitutes a key asset and a competitive advantage. With the popularity of new urban mobility services, there is a new stream of mobility data and cities are working to understand how to use it. High-quality data, supported by interoperability between different systems, glues the entire MaaS system together. However, data sharing and data access are a recurring issue for MaaS, as data is commonly found in silos or lacks a common structure or format. Privacy and security, low quality and availability, poor data management and fragmentation of data also pose unresolved issues, together with a lack of well-defined standards. [6]

The EU-wide Multimodal Travel Information Services (MMTIS) regulation calls for the standardization of formats for all (public and private) traffic and travel data. In addition, it suggests the creation of a National Access Point in all EU-member countries, to create a catalogue of open data. Covering all transport modes and actors, this is a basis for multimodal travel information services which could enable the delivery of MaaS. An update on the regulation is expected in 2021/2022.

Local authorities collect mobility data to achieve different purposes and objectives: monitoring, enforcement, policy making and planning. Although there is no unique roadmap of best practices for cities to follow, different organizations such as NUMO and NACTO have developed tools and frameworks to help cities manage and use data to serve policy goals. However, there is still a lack of mapping data needs and use-cases, hindering public authorities' capacity to manage and use data.

The lack of resources (financial and human) in data management affects public authorities and public transport operators more than their private counterparts.

Public authorities need to build capacity in data management and governance. Cities should understand what data is needed for which purpose, and ask for the suitable level of detail necessary to accomplish a specific goal. For instance, aggregated data may be sufficient to address policy making, but real-time data is necessary for monitoring and enforcement purposes. Trusted third-party data aggregators can be a practical solution to bridge the capacity gap between public authorities and private operators, as they can facilitate data management when public authorities lack sufficient capacity or expertise.

Finally, public authorities should facilitate access and availability of high-quality data to make MaaS happen, while also establishing a framework which guarantees their access to data from various (public and private) sources. Ideally, sound agreements should be in place between Mobility Service Providers (MSP) and MaaS operators for data sharing. MaaS operators reselling transport services of MSP should provide data back to the MSP to improve the service offered and to avoid market asymmetry (data-poor transport operators and authorities, and data-rich platforms).

MOBI-MIX partner cities have exchanged best practices on data licensing, leading to a better understanding of the type of information local authorities could request from mobility providers. This is not only helping them set up a collaboration framework with other stakeholders, but also facilitates data collection and cross-city impact analysis.

Budapest (p. 10) offers insights regarding some stakeholders' potential reluctance to share data. Generally, the temporary nature of pilots can help overcome this issue, while the successful pilot implementation can demonstrate the mutual gains of data sharing.

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6 MaaS Alliance, 2019, Main challenges associated with MaaS & Approaches for overcoming them. Study of MaaS Alliance Governance & Business Models Working Group. Available at: https://maasalliance.eu/library/

Budapest use case

Location	Budapest
Leader	BKK Centre for Budapest Transport (public transport authority)
Duration of pilot	Travel behaviour data collection (locals & tourists) in May 2018 Pilot rollout in February 2020 (1 month) & August 2020 (2 months)
Target audience	B2C
Types of transport integrated	• Public transport: metro, bus, tram, ferry (BKK); rail - intercity, cross-border (MAV) • Public shared bikes • Carpooling/ridesharing • Carsharing and car-rental • Taxi
MaaS level	Level 1 (booking and journey planning)
Brief description	Budapest was one of the living labs in the MaaS4EU H2020 project, along with Manchester and Luxembourg. MaaS4EU aimed to explore and address challenges for MaaS at four levels: business, end-users, technology, and policy. In Budapest, the MaaS operator was a private company, National Toll Payment Services. Services included in the pilot covered urban trips inside the city, as well intercity and cross-border trips that started or ended in Budapest. The app was downloaded by more than 1000 people during the first phase, as it was widely promoted through BKK and other partners' online channels. One of the main challenges in the pilot was the fact that the ticketing system of the public transport authority did not accept mobile-based ticketing solutions. Although not ideal, as an alternative solution, the app indicated the location for the nearest ticketing machine where users could get tickets from.
Insights	• **The public transport authority (BKK) was instrumental in facilitating the collaboration between the MaaS operator and the mobility service providers.** • **Main issues arose in terms of agreements and data sharing, but they were solved through extensive discussions. Operators agreed to share data primarily because of the pilot nature of the project, which allowed all partners to gather knowledge.**

Part 3 – Ways forward

1. SUMP principles in the context of MaaS [7]

Plan for sustainable mobility in the functional city

MaaS has the potential to reduce car usage and ownership not only in denser, city centres, but in wider functional areas, too. A functional area is generally defined by travel-to-work patterns from a city's surroundings, where it can be difficult to maintain a continuous sustainable multimodal mobility offer. In this regard, it is important to pay special attention to incentives and data management, as well as to the integrated planning of transport services to support equitable and effective spatial, time and quality coverage of services. Public authorities need to plan the mobility for the functional area recognizing that not all commercial modes are suitable for every part of the city or region, and adjusting to maintain an appropriate accessibility level. At the same time, local authorities should prevent further sprawling induced by better transport connections, for instance, through planning mechanisms (e.g., zoning provisions, densification of existing built-up areas, building permit limits, etc.).

Define a long-term vision and a clear implementation plan

MaaS gives cities the opportunity to move more citizens more efficiently by enabling multimodality. To make this a reality, cities need a clear, strategic long-term vision combined with a flexible, sustainable and holistic approach to urban planning.

Local authorities need to focus on developing smart and sustainable infrastructure, efficient and affordable solutions, and a greater collaboration with private mobility providers.

To define such a long-term strategy, cities need to study the impacts and implications within MaaS implementation. Scenario planning can help when tackling the uncertainty that currently surrounds MaaS, and this planning method can help cities understand the possible paths of developments and plan accordingly.

Cooperate across institutional boundaries

MaaS has the ability to go beyond single urban areas, into national territory and even beyond national boundaries, and so it is important to foster collaboration with other institutional organizations at different levels. Collaboration with other bodies, at regional, national and European level, is important to define and establish a technical interoperability network, as one of the main barriers to sustainable MaaS implementation is the lack of a clear framework. Although regulators and policymakers are positioned in the outer layer of the MaaS ecosystem, they hold the key that could enable the MaaS market, since they have the power to regulate open standards and interoperable data formats. Furthermore, they can provide policy frameworks and recommendations on fair competition, financing, passenger rights, privacy and

7 ERTICO, 2019, MaaS and SUMP Practicioner's Briefing.

security, service quality standards, social inclusion and safety. Ideally, this framework should be defined at the national level, with the cooperation of local and regional authorities, to avoid different open standards that will hinder interoperability.

Develop all transport modes in an integrated manner

A variety of transport modes and the integration of all transport services is at the core of any MaaS system. Local and regional authorities could develop a more integrated, efficient urban planning by using data collected through MaaS systems. This would

allow a better overview of the transport network, service usage and performance. For instance, demand and usage information derived from MaaS platforms can shed light on existing mobility gaps in the system, showing patterns that would otherwise go unnoticed.

The physical integration of transport can be achieved through the implementation of mobility hubs. Mobility hubs enable safe and convenient switches between modes of transport, although their potential surpasses that of an interchange. Mobility hubs can close supply gaps, enhance traveler experience and the quality of life in their areas.

When seeking a more comprehensive multimodal approach, the attention should be brought to the operational, regulatory and technical preconditions of:

- The integration of high-quality data, static and dynamic on networks and services (e.g., routes, schedules, availability of fleet, road works, traffic situation, disruptions etc.).
- The integration and interoperability of information, booking, payment and ticketing systems.
- The market access of new mobility services.

Involve citizens and stakeholders

To fully understand the picture, cities need to take a more holistic approach to mobility planning. Public authorities should involve early on not only the usual experts on infrastructure and mobility planning, but also specialists in data science, cybersecurity, environment, and socioeconomic issues, representatives of the civil society and the user communities, and relevant stakeholders from the private sector.

By doing so cities will:
- Ensure the implementation of a system that works for everyone.
- Be able to develop more flexible and integrated governance structures and partnership models.
- Produce key performance indicators that

allow them to assess whether the system is meeting objectives and user needs, and further improve the offer.

Cities and regions should seek to bring together different stakeholders to build a common vision with the right incentives, and risk and profit-sharing amongst those involved. As MaaS usually integrates public and private stakeholders, cities and regions should create an institutional framework that allows continuous cooperation with all stakeholders. Nonetheless, the case of Gothenburg (p. 13) shows that MaaS can sometimes emerge even if all partners are public, albeit as a more limited version.

Gothenburg use case

Location	Gothenburg
Leader	**Göteborgs Stads Parkering**
Duration of pilot	App released in 2017 Discussions with the Public Transport Authority began in 2018 Technical solution in place early 2019, currently ongoing (affected by COVID-19)
Target audience	**B2C**
Types of transport integrated	• Public transport • Public shared bikes • Public parking
MaaS level	**Level 3 (bundle parking and PT)**
Brief description	Göteborgs Stads Parkering is a parking company owned by Gothenburg city. MaaS was one of the solutions to achieve a more efficient transport system and reduce the space allocated to cars, as fleet electrification was no longer enough for the city's ambitions. As Swedish regulations do not allow integration of private operators in the app due to competition policies, only public services were included. The initial pilot started with a small group of 50 people whose main commute was by done by car. Participants received a daily invitation to switch to public transport, and if they accepted, they received a free ticket for the trip. The pilot showed that when offered a viable alternative, people are willing to change their behaviour.
Insights	• **Good collaboration since all stakeholders were public actors, sharing a common goal.** • **Focusing on one type of client, instead of expanding and adding more services, seemed to have a bigger impact.**

Arrange for monitoring and evaluation

To cover the monitoring and evaluation needs in relation to MaaS, the organization and management of mobility data requires an integration with various data sources and platforms (e.g., traffic management, urban planning and city management platforms), with adequate resources and competences.

To monitor progress and adaption, cities should engage continuously with citizens and stakeholders and learn from the experience. From an early stage, public authorities should set appropriate indicators (based on their policy objectives) and monitor them to assess MaaS progress and how it contributes to the achievement of the defined goals, both low (e.g., improve accessibility to a specific area) and high level (e.g., reduce car-usage).

One of the main objectives of the MOBI-MIX project is to develop a method for evaluating and monitoring the impact of MaaS using synthetic indicators. Although assessing the sustainability of MaaS currently remains difficult, the MOBI-MIX project attempts to provide a clearer answer. Besides assessing the impact of MaaS pilots in Antwerp, MOBI-MIX is also engaging with experts and leading cities in the field, in order to learn from best practices.

Assess current and future performance

With the appropriate capacities, resources and institutional set-ups, MaaS can also serve as a tool to assess both the current and future performance of urban and regional transport systems. This is particularly useful to evaluate capabilities and systems for the collection and management of data. Public authorities can create insights relevant for the evaluation framework on the impact of MaaS on aspects such as travel behaviour.

Assure quality

Building trust and creating awareness are the two key enablers of a high-quality MaaS development and implementation. Regulation is a tool for building trust, and institutions and policymakers are already working on strengthening trust within the ecosystem. Policies such as the General Data Protection Regulation (GDPR) work as a trust-building mechanism geared towards users. To facilitate the development of the sector, policy makers need to set similar trust-building mechanisms for business-to-government, government-to-business, and business-to-business interfaces. Trust is particularly important since the MaaS ecosystem bundles actors from the public and private side as partners and, in some cases, as competitors.[8]

For MaaS to fulfill its potential and influence travel behaviour in favour of multimodal sustainable options, relevant stakeholders and institutional partners need to collaborate to create awareness amongst the user community. Involving the different actors at an early stage is crucial but local authorities can also increase awareness through campaigns, action days, educational activities, individualized social marketing measures, mobility information centres and more. In addition, initial incentives for both stakeholders and users can encourage uptake, like in the case of Ghent (p. 18).

Finally, for a successful development of MaaS, public authorities should embrace a pilot-based learning-by-doing approach. MaaS implementation can be seen as a continuous project that can be developed and improved by fostering knowledge- and experience-exchange with other public authorities and among different stakeholders.

8 MaaS alliance, 2020, MaaS Market Playbook

2. Dimensions of a city's readiness to implement MaaS [9]

Certainly, public transport services form the backbone of MaaS, but for assessing a city's readiness to develop and implement MaaS, there are other critical elements to be considered before the new transportation culture can flourish. CIVITAS ECCENTRIC has prepared a list of readiness indicators aimed as a starting point for local authorities to assess their city's preparedness to implement MaaS. These indicators give a cross-sectoral view on how prepared each local authority is for the change and how their decisions regarding transport support the implementation of MaaS. They can be a starting tool to speed up the process among local authorities.

These indicators consist of eight different components, packaged into 4 groups:

1) Strategic readiness

a. The **strategic focus** indicator measures to what level the local authority has invested in MaaS development.

1   No measures taken to enable MaaS

5   The MaaS development is included in the city's strategy and resources have been allocated to ensure its deployment

b. The **parking policy** indicator measures to what level the local authority has implemented parking management policies to promote sustainable mobility.

1   No parking policies in place

5   The local authority has implemented parking policies supporting shared mobility

2) Internal use

a. The **internal travelling** indicator measures to what degree the local authority is promoting sustainable mobility through their internal mobility plans.

1   No internal mobility plans promoting sustainable mobility

5   Mobility plans prioritize sustainable mobility, travel patterns are being monitored, and the use of private cars is following a declining trend

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9 Aaltonen S, CIVITAS ECCENTRIC, 2020, MaaS Readiness Level Indicators for Local authorities.

b. The **internal use of shared mobility** indicator measures to what degree local authorities are encouraging shared mobility within the local administration.

1 The local authority is not offering shared mobility services itself

5 The local authority is using several shared mobility services, including outside working hours

3) Shared use

a. The **shared economy** indicator measures how advanced the availability and market penetration of shared and combined travel options is.

1 No shared mobility offer within the local authority's geographical jurisdiction

5 Several service providers (mobility related and others, such as grocery stores, culture & leisure providers, etc.) work together with MaaS operators and offer package deals to users

b. The **public transport** indicator measures to what level public transport is integrated with other services.

1 Users can only buy public transport tickets via the public transport service provider own channels

5 Public transport is integrated with other services, and users can access packages combining transport and other amenities

4) Shared understanding

a. The **integration platform** indicator measures to what level there is open data and how much interoperability there is between operators.

1 Public authorities do not share open data

5 Third parties work with public and private operators to sell their MaaS services in the same platform
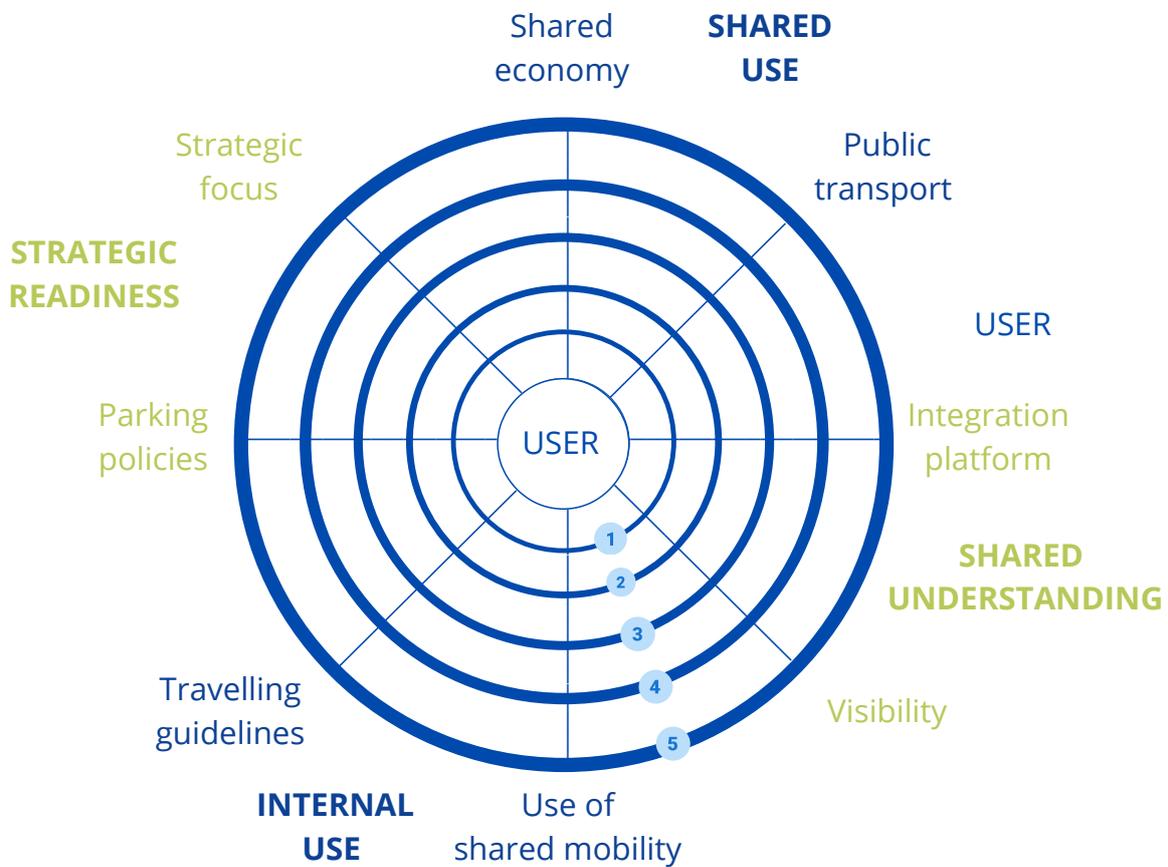
b. The **visibility** indicator measures how straightforward and easy it is for citizens/users to access shared mobility offers.

1 Users can find multimodal traveller information

5 Users have found MaaS services and their usage has increased within the last year

MaaS Readiness Level Indicators for local authorities

Figure 2 MaaS readiness Indicators
Content source: MaaS Readiness Level Indicators for local authorities, CIVITAS ECCENTRIC, 2017.

To perform the assessment, local authorities must choose which level represents their situation best for each component. As a result, cities will get a clear view on which areas their readiness level is satisfactory and on which areas there is still work to be done.

The CIVITAS ECCENTRIC readiness indicator is a useful tool to asses a city's preparedness for MaaS, and there are other elements that public authorities should not overlook in their assessment: spatial coverage, quality of the transport network and ICT infrastructure.

The spatial coverage and quality of the transport network is very important to the success of MaaS -especially for level 4- and should be analysed in any MaaS readiness assessment. Public authorities need to make sure that there is accessible transport not only in the dense urban centres but also in the peripheral areas. With regards to the ICT infrastructure, public authorities need to asses all the enabling technologies for MaaS, not only in terms of smart and integrated ticketing, but also the degree of internet access of the population (e.g., smartphone penetration).

Ghent use case

Location	Ghent
Leader	**Touring Club Belgium (private company) in collaboration with Ghent University**
Duration of pilot	April – June 2017
Target audience	**B2B: 100 car-owning Ghent University employees**
Types of transport integrated	• Public transport: bus & tram (De Lijn), railway network (NMBS) not integrated in app, but cost reimbursed separately • Shared & rental bikes • Public & private shared cars, rental cars • Taxis
MaaS level	**Level 0 (no route planner, car sharing and train tickets only bookable and payable outside of app)** **Level 2 (other services bookable and payable through app)**
Brief description	Touring Club Belgium commissioned the pilot and developed the prototype MaaS app, while Ghent University designed and led the research. The pilot explored the extent to which people are willing to reduce car use in return for a monthly mobility budget that could be spent on MaaS services. Participants were pre-selected based on their residence, car ownership, smartphone & data plan access, and commitment to the research process. The study offered two types of incentives: a mobility budget (150-350€) and five prizes for the most active users (Storme et al., 2020). The app had certain inconveniences, since it did not include a multimodal route planner or direct reimbursement for train trips.
Insights	• **The frequency of private car use diminished significantly for commute trips, and to a smaller extent, for leisure trips.** • **MaaS might not entirely substitute car use, but it can be a complementary part of the mobility mix.**

Acknowledgements