Report

Public Mobility: The Next Evolution of MaaS

The Roles of Government

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Public Mobility – the Next Evolution of MaaS

Mobility as a Service (MaaS) has been actively discussed and debated over the last decade with various pilots in place throughout the globe. The technology-driven, innovation pushing and app-centric MaaS 1.0 (1996-2020) is not necessarily a doomed concept, just a relatively new one. To make it work, it requires a different way of organizing the ecosystem around it, setting up business and value cases that actually work, and a shift in ownership and roles within the MaaS-landscape. This is MaaS 2.0 (2020 – present) or Public Mobility, the term used in this study, where the focus has moved beyond a narrow focus on technological aspects or grandiose visions of potential profits and instead focusses on the need to develop a healthy ecosystem where the public and private sector are working together, the economic realities and challenges of the shared transportation sector are addressed, and societal benefits are a primary driver.

Public Mobility (MaaS 2.0) can be a relevant and promising technology and concept that could solve issues in cities regarding congestion, increase transit ridership, organize new mobility offerings, and realize a modal shift from cars to different modes of transportation. In fact, it has become clear that for people to sell their car or refrain from buying one in the first place, travellers need a portfolio of travel options.

Public Mobility can fill this need, but to do that it must overcome the current perception of MaaS, as “merely an app”. While the term MaaS has gained a more negative connotation, we want to clearly distinguish this technology-driven MaaS 1.0 from Public Mobility, a more evolved version of MaaS. The biggest issues for Public Mobility are not concerning technology, but instead relate to norms, barriers, contracts and ecosystems.

Shaping Public Mobility towards societal benefits

Public Mobility, with its potential societal benefits and current barriers to deployment, is the central concept that is studied in this research project. It is *a* solution pathway towards a futureproof mobility system, not *the* solution. However it is important to stress the fact that without some sort of digital integration, collaboration - and steering mechanism (whether you call it Public Mobility, MaaS, or something different), you end up with ‘just’ infrastructure, and ‘just’ wheels-on-the-ground, which not necessarily leads to the much needed societal benefits such as mode-shifts, increased quality of life and smarter ways of using and organising our mobility system. Assuming Public Mobility is a critical component of our future mobility, this research asks how can local governments and public transport agencies help create a viable and effective Public Mobility Ecosystem, contribute to societal goals, how can they help optimize technology benefits, and how do they overcome barriers to deployment?

Public Mobility Ecosystems

A Public Mobility ecosystem, in the definition used for this study, consists of transportation services, a digital interface, physical infrastructure, and regulations, standards and agreements (such as data sharing and data standard agreements, price, cost setting and money flow agreements, and customer service agreements). For cities there could be multiple reasons to be interested in pursuing Public Mobility, which includes: i) achieving societal outcome goals; ii) organizing new mobility offerings and an orderly public realm; iii) maintaining control of the ecosystem; iv) increasing transit ridership, and; v) achieving direct profitability. However, whereas the reasons to engage with Public Mobility might be similar across different countries and contexts, the models in which they organize the ecosystem and offer the services vary.

Based on desk research and the discussions in interviews, we found a wide range of Public Mobility models, ecosystems, and operational characteristics with variations often based on the local, contextual variables. This punctuated the notion that there is not a single, universal right or wrong form of deployment, and that understanding potential contextual differences is critical in selecting the best model for that location. There are five main contextual variables for Public Mobility ecosystems: a sense of urgency, the presence of transportation service providers, the characteristics and scale of the market, the profitability of transportation service providers, and subsidies by local authorities.

Needs, Barriers and Roles of Government for Public Mobility Ecosystems

To succeed, Public Mobility requires a full ecosystem to exist. In addition to the actual wheels on the ground and apps, a functioning Public Mobility ecosystem requires pricing schemes, customer service, supportive physical infrastructure, technical functionality, inter-organizational structure, trust, as well as viable business models. While various actors need to act to fulfill these different needs, there is a specific role for local authorities in this, as they can help remove potential barriers towards Public Mobility deployment. Areas local authorities can assist in this include:

Operational needs – Developing clear guidelines on responsibilities, pricing mechanisms, and support;

Infrastructural needs – Constructing physical infrastructure (incl. hubs), and designing standards for mobility hubs, parking, and branding;

Technical functionality – Financially assisting platform development, development of standards, and smaller companies, and minimize data sharing;

Organizational leadership – Aligning motivations through a unified Public Mobility vision, and acting as a broker between different parties through standardized contract terms and focus on 'increasing the pie;'

Business models – Focusing on the non-financial benefits of Public Mobility, together with standardization of regulations, services, platforms, etc., while being the broker between other actors and providing subsidies as needed and as appropriate;

Increased ridership – Unified Public Mobility branding, along with Travel Demand Management, and facilitating ease of use and geographical equity;

Evaluation and steering – Creating standards for Key Performance Indicators and data (sharing), while continuously analyzing and learning from the Public Mobility ecosystem.

Regional Competitiveness for Successful Public Mobility Ecosystems

Two key components of the Public Mobility Ecosystem are the Transportation Service Providers (TSPs) and Mobility Service Providers (MSPs) that provide services to a local area. In the world of shared mobility, these are often large, multinational companies that weigh deployment and investments throughout the globe. While municipalities and regions may do substantial work in setting up a Public Mobility Ecosystem, they also need to understand their competitive attractiveness for these companies within the broader international context. Not being able to attract TSPs and MSPs might be a challenge in setting up a successful, functioning Public Mobility ecosystem, since having these services available – under the right preconditions – is key. There are several ways in which municipalities and regions can increase their competitiveness. These include:

- Provide direct subsidies;
- Limit competition between TSPs;
- Increase the level of Public Mobility preparedness, coordination, and collaboration;
- Make use of established MSP systems and standards;
- Enable market replicability;
- Coordinate branding to recruit new riders.

Future Research and Next Steps

Public Mobility deployment and the optimal role of the public sector and transit in this deployment continues to be an area for further research. As regions deploy more Public Mobility pilots, additional research into the models of deployment, roles of public entities, and impacts on societal goals can help pave the way for future deployments that have stronger chances of success and are efficient in the use of public sector resources. We see a strong need for deep-dive case study in one city or a network of cities on these topics. This research should focus on potential differences between contexts in the roles governments have and should have within a Public Mobility ecosystem.

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List of Abbreviations

KPI	Key Performance Indicator
MaaS	Mobility-as-a-Service
MSP	Mobility Service Provider
PT	Public Transport
TDM	Travel Demand Management
TSP	Transportation Service Provider

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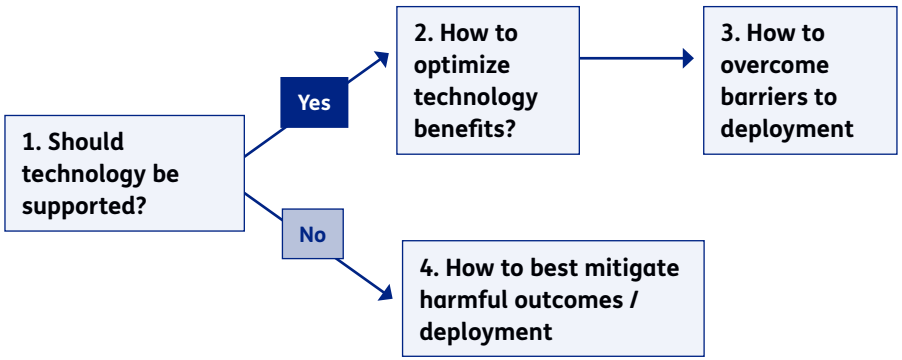
1. Introduction

1.1 – Public Mobility: The Next Evolution of MaaS

Mobility as a Service (MaaS) has been actively discussed and debated over the last decade with various pilots in place throughout the globe. While originally touted primarily as a technological solution it has become clear that the delivery of MaaS requires the development of a full ecosystem – including the municipalities, national governments, community stakeholders, integrators, public transit operators, and transportation service providers (TSPs) – to name a few key players. This research is focused on understanding the role of the public sector and transit agencies in helping develop and maintain this ecosystem.

This research arose from earlier research and explorative work done in the KIP New Mobility Concepts in 2022 which resulted in a list of key knowledge questions regarding the uptake and steering of (new) technologies for mobility solutions. These were: 1) Should technology be supported? If the answer to this question is 'Yes', question 2 and 3 follow: 2) How to optimize technology benefits? 3) What are barriers to deployment? If the answer to question 1 is 'No', question 4 follows: 4) How to best mitigate harmful outcomes/deployment?



These questions – with corresponding sub-questions to further specify technology impact, benefits, barriers, mitigation and deployment strategies – are not just a guiding principle for executing research of new technologies, but it also highlights an important point: not all technologies have to be supported, and if they are supported, we should think about creating an ecosystem and context that allows the benefits to work for our society.

The topic of MaaS – Mobility as a Service – is hardly a 'new' topic anymore, however MaaS has been a hype, a buzz, a solution that could revolutionize the way we organize and exploit our mobility system. However it is important to distinguish MaaS in different phases. What we consider to be MaaS 1.0 (1996-2020) was primarily a technologically driven innovation push, where promises of profit and dominant players on the private side were omnipresent. Government and transit agencies were advised to step aside and let the private sector figure out a way to make this work, and translate this idea into a profit. The assumption was that MaaS would be everywhere, it would solve a lot of issues and it would be successful (both in terms of impact as well as business models). However, MaaS 1.0 struggled with issues regarding interoperability, with technology and profitability. In short, it did not live up to its promise, and the buzz around Mobility as a Service quieted down over the years.

Coming back to the knowledge questions of 2022 – MaaS 1.0 had serious flaws and should potentially not have been supported. However, the concept of MaaS in itself is not necessarily a doomed concept, just a relatively new one, that requires a different way of organizing the ecosystem around it, setting up business and value cases that actually work, and with a shift in ownership and roles within the MaaS-landscape. This is Public Mobility or MaaS 2.0 (2020 – present), where the focus has moved beyond a narrow focus on the technological aspects of MaaS or on grandiose visions of potential profits and instead now includes the need to develop a healthy ecosystem where the public and private sector are working together, the economic realities and challenges of the shared transportation sector are addressed, and societal benefits are a primary driver. Public Mobility could still be a relevant and promising technology and concept that could solve issues in cities regarding congestion, increase transit ridership, organize new mobility offerings, and realize a modal shift from cars to different

modes of transportation. In fact, it has become clear that for people to sell their car or refrain from buying one in the first place, travellers need a portfolio of travel options. Particularly in urban areas l the backbone of public transportation has great societal benefits. MaaS can be seen as concept that complements this vision by providing options in addition to public transport for particularly the most challenging trips (to the countryside, outside office hours etc.). Public Mobility and MaaS 2.0 can fill this need, but to do that it must overcome the current perception of MaaS, as “merely an app”. The biggest issues for MaaS 2.0 are not concerning technology, but instead relate to norms, barriers, contracts and ecosystems. While the term MaaS has an understandably negative connotation , we want to clearly distinguish this technology-driven MaaS 1.0 from MaaS 2.0 or Public Mobility, a more evolved version of MaaS.

Public Mobility, with its potential societal benefits and current barriers to deployment, is the central concept that will be studied in this research project. Assuming Public Mobility is a critical component of our future mobility, this research asks how can local governments and public transport agencies help create a viable and effective Public Mobility Ecosystem, how can they help optimize technology benefits, and how do they overcome barriers to deployment?

1.2 – Research questions and methodology

Research questions

Following the shift from MaaS 1.0 to Public Mobility, and acknowledging that successfully and meaningfully implementing Public Mobility relies mostly on the development of a healthy ecosystem. The main research question is:

What should cities do to encourage/create a Public Mobility Ecosystem that will best support societal goals?

This research question includes the following sub-questions:

- What are the key components of a Public Mobility ecosystem?
- What are different models for developing/supporting a Public Mobility ecosystem?
- What are governmental roles in developing these Public Mobility ecosystems?
  - In deployment, uptake and shaping the Public Mobility ecosystem.
- What are benefits and challenges of each model?
  - In terms of success of deploying Public Mobility.
  - In terms of shaping deployment towards community goals.

Methodology and research plan

To answer the research questions, we first conducted a literature review considering Public Mobility models, government roles in Public Mobility, criteria for shaping deployment, goals of Public Mobility and in evaluating longer-term success in helping support community or societal goals. This literature review also helped to identify case studies with successful ecosystems that led to interviews with key actors in those case studies.

This round of interviews included parties leading Public Mobility deployments, with insight in governmental roles in Public Mobility ecosystem development and the benefits, pitfalls, challenges and contribution to societal goals of each approach or Public Mobility model used. Below, in table 1, is a list of the interviewed organisations and the interview date.

Organisation	Date of interview
Nederlandse Spoorwegen	24-07-2023
Capital District Transport Authority	08-08-2023
Translink	08-08-2023
Moovit	11-08-2023
Rivier	21-08-2023
Los Angeles Department of Transport	31-08-2023
Jelbi	20-09-2023
Lime	05-10-2023

Table 1. Overview of Interviews for the Public Mobility ecosystem study

The literature review and interviews, were the basis of our analysis on Public Mobility Ecosystems and the answers to our research questions.

1.3 – Reading guide

This report begins with a description of the Public Mobility Ecosystem, as defined in current literature. Chapter two describes the definition of Public Mobility we've adopted in this study, goes into the Public Mobility elements and stakeholders, and sets out three typical Public Mobility deployment models. In chapter three we discuss Motivations for Public Mobility and Contextual variables that differentiate Public Mobility Ecosystems and deployments. Based on literature as well as interviews, we describe the five main motivations for Public Mobility (profitability, achieving societal outcome goals, increasing transit ridership, organizing new mobility offerings and an orderly public realm, and finally maintaining control of Public Mobility offerings) and how key contexts such as existing senses of urgency, the presence of subsidies, market size and condition, and TSP engagement impact the Public Mobility Ecosystem.

Chapter four goes into the needs, barriers and roles of government for (building and sustaining a Public Mobility ecosystem. Then chapter five combines findings from chapter three and four, by shedding light on the municipal and regional competitiveness – combining the needs, barriers and government roles of chapter four with the contextual variables and motivations for Public Mobility in chapter five. Finally, chapter six concludes the report highlighting the most important findings and learnings, and suggests next steps.

2. Understanding the Public Mobility Ecosystem

Resulting both from the literature review and the interviews, the following chapter gives an overview of the current state-of-the-art of Public Mobility. Starting off with providing a definition of Public Mobility, and shortcomings to current definitions, this is followed by a list of Public Mobility elements and related stakeholders. Then, different Public Mobility models are explained, in particular their relation to the Public Mobility elements and stakeholders.

2.1 – Definition of Public Mobility

Various studies have offered definitions of the MaaS (Public Mobility) concept. Key components in almost every definition include:

i) the transportation service provided,
ii) the digital interface, and
iii) the end user.

Many Public Mobility definitions go beyond components to include the goals of Public Mobility. While the key components remain largely the same, definitions are sometimes extended with various other components. Type of model (e.g. business model (Wong & Hensher, 2021)) or needs for Public Mobility (e.g. regulatory and pricing mechanisms (Wong et al., 2020)) are some examples of additional components mentioned by other studies.

Kamargianni & Goulding (2018) offer a strong, general description of MaaS that we have adopted for this study as it steers clear of goals and focuses squarely on components. They define MaaS (i.e. Public Mobility) as **"a user-centric, multimodal, sustainable and intelligent mobility management and distribution system, in which a MaaS Provider brings together offerings of multiple mobility services providers (public and private) and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility"**.

König et al.'s (2016) definition also captures the different components of MaaS (Public Mobility) but also extends it to include stakeholders. Although we think that the definition of Kamargianni & Goulding and the model of König et al. capture the basic components of Public Mobility fairly well, both still miss some elements that we believe are important to a Public Mobility ecosystem such as the physical infrastructure, regulations, standards and agreements. The next section builds on these definitions/ models to include a broader set of elements and stakeholders in a Public Mobility Ecosystem.

2.2 – Public Mobility Elements and Stakeholders

This section provides a holistic overview of the different elements existing within a Public Mobility ecosystem. It also explains which stakeholders are related to, or act on, various Public Mobility elements.

Transportation services

The physical transportation services provided (wheels on the ground) are one of the most essential elements for Public Mobility. Without these services Public Mobility could not exist. Modes range from traditional public transport services (both scheduled and on-demand bus, tram, and train services) to more recently growing shared transport services (bikeshare, e-scootershare, carshare, rideshare, and micro-transit). Transportation service providers (public transport operators and private sector vehicle sharing and renting companies) are responsible for most of these services. It is important to note that not all modes will be part of the Public Mobility ecosystem in any given location. This will vary based on contextual circumstances and will be further discussed in section 3.2.

Geographic coverage is an important factor influencing the Public Mobility utilization and the optimal amount of transportation services existing in an area. The potential uptake of services often increases when the area that is served increases. Each mode can be served by one or multiple operators in a specific area. If this geographic coverage cannot be provided by a single operator, it might result in having multiple transportation service providers in one area for a single mode.

Digital interface

Solely providing a whole range of different transportation services does not create a well-functioning Public Mobility ecosystem on its own. It is also essential to have a digital interface that integrates all transportation services, allowing the ability to identify routes/modes, book them, and eventually pay for the trip.

A digital interface on the one hand acts as a digital 'marketplace' where all available services are listed, but it also can help enable seamless usage of the transportation services. Being able to provide real-time travel information, and integrating mobile payment and mobile routing are two steps towards facilitating shared transportation use. Both aspects should be included in a digital interface that supports the role-out of a Public Mobility ecosystem. While some municipal governments and/or public transport providers have (attempted to) build these digital systems on their own, private sector technology and/or platform providers are often better suited at this task and can offer national and multinational TSPs consistent interfaces in various markets.

This consistent interface and standardization of data transfer protocols are a key term in the development of the digital interface. Standardization enhances the wider uptake of Public Mobility, especially in smaller cities or regions. When a digital interface is developed in such a way that it becomes interoperable in different areas, there is no need for cities or regions to develop their own new interface. This saves time and money for cities or regions that want to start the roll-out of Public Mobility in their area. It also reduces costs for TSPs, facilitating their desire to integrate into a Public Mobility Ecosystem – particularly in secondary and tertiary markets.

While the technology and platform providers are the predominant actors working on the development of the digital interface, there is also the need for actors who integrate different transportation services within the digital interface – namely structuring data standards, establishing data sharing protocols between actors, creating bundles or subscription services, defining processes, and defining terms and agreements. In addition, some integrators also manage relationships and mediate between stakeholders – taking on a broker/aggregator role (Wong & Hensher, 2021). The interpretation of this integrator role can vary widely and depends on the Public Mobility model (see section 2.3 Public Mobility Models) that is in place.

Physical infrastructure

The transportation services described in section 2.2.1 cannot function without using physical infrastructure. Not only do the transportation services need the physical infrastructure such as roads to drive upon, they also require hubs and parking lots where they can be (temporarily) parked. These parking lots can be either physically demarcated (i.e. parking lots in the classical way) or virtually demarcated (e.g. by means of geofencing).

Public Mobility can utilize physical infrastructure on both private and public property. This applies particularly to hubs and parking, as roads are usually provided by local or national authorities. Although both private and public actors could take a role in the allocation of physical infrastructure, a public authority is often seen as the preferred actor in this, as they often control larger areas, serve societal interests, and are not limited by the need to produce profits.

Regulations, standards and agreements

Setting up a successful Public Mobility ecosystem is not only about providing the needed transportation services and digital interface, it also includes establishing a robust regulatory framework from local authorities. This includes not only regulations that support the deployment/rollout of Public Mobility as well as the promotion of Public Mobility, but also requires a complementary set of regulations that decrease the relative ease of car usage when reduction of car use and/or a modal shift from car to other modes is one of the policy goals. This includes decreasing the number and cost of parking lots, implementing road charging, etc.. The regulatory framework should include both enabling and steering mechanisms.

Within the Public Mobility ecosystem a large range of actors is present, which all have to adhere to the regulatory framework. Since this large range of actors come with a large variety of goals and desired outcomes, it is also critical to have a clearly defined set of standards and agreements, fitting within the regulatory framework set by the (local) authorities. Data sharing agreements, and related data standards, along with money flow, cost and price agreements, as well as customer service agreements are all essential elements. The following paragraphs will explain these three elements, as they should not be overlooked, and need thorough understanding.

Data sharing and data standard agreements - These are needed to ensure the availability of necessary data in easily usable formats to support proper functioning of a digital interface. Having an open transportation data hub is one of the challenges for Public Mobility (Chang et al., 2019). In order to overcome difficulties and privacy issues regarding data sharing, what data should be commonly available must be clearly stated and thought through, along with a clear understanding of data that should be limited to specific actors. These data sharing agreements should also ensure that public authorities themselves obtain the necessary data from the transportation service providers. In this way the public authorities can have needed insight into the way people move around (Audouin, 2019), potentially enhancing trip planning for the last-mile of a journey.

Data sharing goes hand in hand with data standards More clarity in data standards is needed (Bandeira et al., 2022), and should go both ways between transportation services providers and public authorities. For example, clarity could be provided whether real-time travel information should be up to date every 10, 30 or 60 seconds. This is a balancing act between precision of data and costs of providing that level of data – all weighed against the most efficient means of attaining local community goals.

Price, cost setting, and money flow agreements - These are crucial as the development of Public Mobility is often faced with issues of financial sustainability (Chang et al., 2019). Key to financial sustainability is the role that the (local) authorities are willing to take. A key point is whether these authorities are willing to contribute subsidies to ensure that a Public Mobility ecosystem becomes financially sustainable, so that it can – on the short and long term – serve societal goals? If the public authorities are unwilling to subsidize services, the Public Mobility ecosystem needs to have a self-supporting business model for all involved – something that has proven difficult in examples of MaaS 1.0 deployments.

Related to issues of financial sustainability it is also important to determine how money flows are organized. Is the customer payment flowing directly to the transportation service provider, or does it go via the integrator to the different transportation service providers, potentially with a fee taken by the integrator. Uniformity in the pricing mechanisms is a key pillar in agreements about the money flow, as this provides certainty to the customer. Uniformity in the payment system similarly provides certainty for the customer, as it eases payment. Here the trade-off is to be made whether a different price can be set by different service providers for a similar service, or whether one price is set for a certain service, independent of the provider.

Customer service agreements - These agreements are critical as different parties (TSPs, Public Mobility platform providers, mobility hub managers, etc) will hold responsibility for solving different customer issues. That said, from the customer side, the experience needs to feel seamless and as if they are working with a single entity, not being passed on from one person to another. Our interviews revealed that customer service works best when these agreements include i) who is responsible for the handling of which problem, and ii) who is the first point of contact for the customer. This should also be clearly communicated to the end user so that they know for example to contact the responsible transportation service provider, and not the integrator, when having an issue with a certain transportation service.

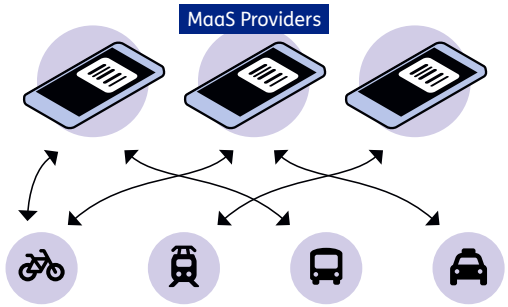
2.3 – Public Mobility Models

There are a range of configurations of setting up a Public Mobility ecosystem and various studies (Aapaoja et al., 2017; König et al., 2016; UITP, 2019; Van den Berg et al., 2022) have tried to distinguish these by defining different basic models of Public Mobility. The three types of Public Mobility models as defined by UITP (2019) provide the best overview of potential configurations of a Public Mobility ecosystem and are elaborated upon below.

Commercial integrator

The commercial integrator model reflects the situation where different Public Mobility providers have set up contracts with several transportation service providers. It could occur that a certain TSP is represented by multiple Public Mobility providers. Still it is an unregulated/uncoordinated market where agreements are made directly between the TSPs and Public Mobility providers, ensuring that data and money flows directly between both parties. Unfortunately, data in this model of Public Mobility is typically not shared with the public authorities, which limits their ability adjust public transport and related policies to steer the impacts and benefits of the Public Mobility ecosystem.

Figure 1. – Commercial Integrator - UITP, 2019

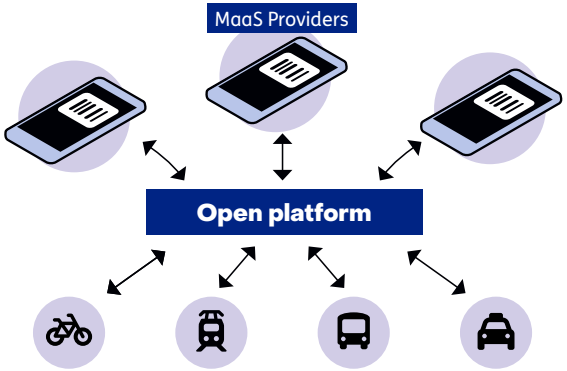


In this model, TSPs are setting prices, based on what they think is fair, and afterwards they are selling their service to the Public Mobility providers. This could be a disadvantage to the Public Mobility ecosystem, since it drives up prices. With the need to pay high prices, there is hardly any profit to be made for the Public Mobility providers (Van den Berg et al., 2022), leading to the possibility of financial unsustainability.

Open back-end platform

The open back-end platform model is comparable to the commercial integrator model, as several Public Mobility providers still provide packages of transport services. The difference is that an open platform is included where a public authority functions as the integrator. Data from all TSPs is integrated into one platform, with a single data standard and data sharing protocol, which can be used by different rider-facing Public Mobility providers. Advantages of this model are that the public authority can set up rules and regulations, which adhere to wider environmental and societal goals. However, disadvantages are that costs for developing and maintaining this platform can be high, there is still the need to negotiate and manage contracts with various Public Mobility Providers, and services can be diluted along many different Public Mobility Providers.

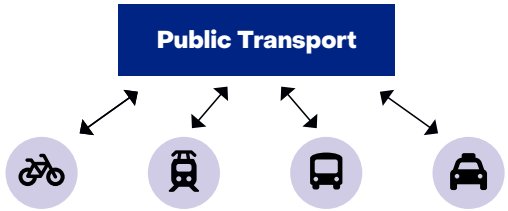
Figure 2. – Open Back-end platform - UITP, 2019



Transport as the integrator

The transport as the integrator model is on its face fairly similar to the open back-end platform model, except for having only one Public Mobility provider instead of multiple ones. It is the public transport operator that is both setting up the platform, and using this same platform as a Public Mobility provider. All included transport services fall under the umbrella of the public transport operator, creating a direct flow of data and money between the PT (Public Transport) operator and the TSPs. Similar to the open back-end platform model, the significant cost of developing and maintaining the platform is carried by the public transport company, but this also allows them to set the rules for the ecosystem. This again means that the development of a Public Mobility ecosystem can best serve and align with the environmental and societal goals of the public (transport) authorities.

Figure 3. – Transport as the integrator - UITP, 2019



2.4 – Concluding

This chapter has set out the state-of-the-art regarding Public Mobility, specifically defining Public Mobility, describing Public Mobility elements and stakeholders and different Public Mobility models. The definition of Public Mobility adopted in this study is aligned with the definition of MaaS by Kamargianni & Goulding (2018), which is as follows:

Public Mobility is: a user-centric, multimodal, sustainable and intelligent mobility management and distribution system, in which a MaaS Provider brings together offerings of multiple mobility services providers (public and private) and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility.

Four core elements of Public Mobility

Following this definition, and results from literature and interviews, the four core elements of Public Mobility are:

1. Transportation services
This ranges from traditional public transport services to newer, shared transport services.

2. Digital interface
To integrate all transportation services, to enable steering on the use of these services, offering a digital marketplace, providing real-time information, integrating mobile payment and routing and enable seamless usage.

3. Physical infrastructure
Including roads to drive upon but also hubs and parking lots.

4. Regulation, standards and agreements
Stimulating and steering Public Mobility, by addressing both enabling regulation and regulations that limit the dominance of the automobile. Need for clearly defined standards, agreements, regulatory frameworks on data sharing, money flow, cost and price.

Three Public Mobility Models

For configuring and setting up these Public Mobility ecosystems, there are three Public Mobility models identified in literature:

1. Commercial integrator
A free, unregulated market with direct contracts and agreements between different Public Mobility providers and transportation service providers.

2. Open back-end platform
A platform set-up by a public sector actor setting the rules, technical standards, and agreements to serve societal interests. Multiple Public Mobility providers and TSP's connect with this open platform, conforming to its rules.

3. Transport as the integrator
Similar to the Open back-end platform, but with a public transportation agency as the integrator and sole operator of the public facing In this model, all rules are set by public transport provider, connecting other (selected) mobility services.

3. Motivations for Public Mobility and Contextual Variables

Motivations for Public Mobility and the contextual variables around deployment vary greatly depending on the political, economic, and geographic context. Public Mobility deployments do not occur in isolation in a single market. Rather, deployments should be understood as existing in a regional or global competitive context where national and multinational TSPs and Public Mobility platforms are selectively deploying in the most favourable markets. Motivations for Public Mobility are elaborated upon below, followed by an explanation of contextual variables of a Public Mobility ecosystem, which also reciprocally influence the motivations for Public Mobility.

3.1 – Motivations for Public Mobility

There are a range of reasons cities and/or transit agencies have been interested in pursuing Public Mobility. We have compiled leading reasons found in our desk research and interviews below. This includes direct profitability, achieving societal goals, increasing transit ridership, helping organize new mobility offerings and the public realm, and maintaining control of Public Mobility. Each of these motivations is described in more detail below.

Profitability

Early discussions surrounding motivations for Public Mobility included the possibility of Public Mobility providers directly turning a profit – often envisioned as revenue generated by small added fees per trip. Because of this vision of Public Mobility, many governments and transit agencies positioned themselves to assist in removing barriers to Public Mobility, but presumed that private entities would individually invest and the market would eventually deliver working, sustainable, and profitable Public Mobility models. This, however, has largely been difficult to achieve. Transportation is a low-margin endeavour and the added costs associated with developing and managing Public Mobility platforms, coupled with the price sensitivity of riders – and an associated resistance from TSPs to increase costs to riders – has led to a lack of profitability for Public Mobility operators, with many first generation Public Mobility entities folding.

This lack of profitability is not necessarily a death knell for Public Mobility, but instead points to the importance of motivations that are outside of profit (as is detailed in the other motivations described in the following sub-paragraphs). This suggests that if Public Mobility is to succeed, it will most probably do so through the support of the public sector, specifically because it is fulfilling societal needs, not primarily because it is generating a profit.

Achieving Societal Outcome Goals

One of the primary motivations cited by proponents for pursuing and supporting Public Mobility is to help achieve societal goals such as reducing car ownership and congestion, as well as increasing access, equity, and sustainability. As Public Mobility expands rider transportation options, the hope is that it will lead to a reduction in car ownership and, relatedly, a reduction in car use and congestion. Because Public Mobility deployments are still limited and in early stages, proof of beneficial outcomes are still more marginal and suggestive than concrete. Reducing car use requires not only a feasible transportation alternative but also for actively reducing the attractiveness of car use.

That said, early studies suggest that Public Mobility can help reduce congestion by providing users with alternative modes of transportation that are more efficient and less polluting. It can also increase access to transportation for people who may not have access to traditional transit options. Additionally, Public Mobility can increase equity by providing affordable transportation options for low-income individuals and those living in underserved areas.

Increasing Transit Ridership

Another motivation for Public Mobility is its purported ability to increase transit ridership. If Public Mobility improves first/last mile connections, it could directly feed the transit system, expanding its catchment area and make transit use easier and seamless for riders. Additionally, Public Mobility could fill transportation needs not met by transit due to limits in transit's coverage and frequency, or due to use cases that are not conducive to transit trips (for instance, trips that require the movement of goods). If

Public Mobility is able to fill gaps in the current transit system, allowing seamless first/last mile connections, it could increase the attractiveness and accessibility of public transportation options, thereby reducing car dependency and eventually contribute to a reduced car ownership.

Organizing New Mobility Offerings and an Orderly Public Realm

The proliferation of shared mobility services has often created chaotic transportation environments with many mode options and offerings per mode. This requires multiple rider accounts (one for each company), apps, and knowledge of different operating procedures, pricing, and payment options. In the public realm, this translates to numerous shared mobility vehicles taking up space and cluttering sidewalks. All of this creates inefficiencies, confusion, and an unpleasant public realm. Municipalities, transit agencies, shared mobility providers, and riders all have an interest in supporting a Public Mobility ecosystem that creates a more rationalized approach where offerings are organized, standards are set and enforced, and the public realm is well ordered.

Maintaining Control of Public Mobility Offerings

While Public Mobility is still in development and remains largely unproven, some governments see it as progressing and potentially inevitable. With this, governments and transit agencies fear that if they are not helping shape, or even drive, Public Mobility projects, they will be sidelined and will cede control of the Public Mobility ecosystem to private entities such as Google or Uber. This could dampen the potential societal benefits of Public Mobility as profit-motives might lead to servicing only wealthy areas of cities or potentially with polluting modes that create congestion. By being active in creating the Public Mobility ecosystem, governments and transit agencies can ensure that they retain control, that Public Mobility is developed in a way that aligns with societal goals, meets the needs of their communities, and that it is accessible to everyone.

3.2 – Contextual Variables of a Public Mobility Ecosystem

Based on desk research and the discussions in interviews, we found a wide range of Public Mobility models, ecosystems, and operational characteristics with variations often based on the local, contextual variables. This punctuated the notion that there is not a single, universal right or wrong form of Public Mobility deployment, and that understanding potential contextual differences is critical in selecting the best model for that location.. Therefore, the following section describes five contextual variables for Public Mobility ecosystems: a sense of urgency, the presence of transportation service providers, the characteristics and scale of the market, the profitability of transportation service providers, and subsidies by local authorities.

Sense of Urgency

The level of attention and effort public sector actors give to the development of a Public Mobility ecosystem often depends on the local authority's sense of urgency that private sector actors will be developing Public Mobility on their own. Local governments often sense that the development of a Public Mobility ecosystem by a private actor is not likely to be driven by societal goals and could limit future abilities to steer the transportation sector towards those goals. For this reason, seeing the private sector move ahead with Public Mobility or seeming to be planning it, can motivate the public sector to organize, align political will, and put energy and funding into the development of a Public Mobility ecosystem.

Presence of Transportation Service Providers

TSPs, particularly shared mobility providers, often act in a national or multinational competitive context. They weigh opportunities across multiple markets to decide where best to place effort and deploy. Some areas have multiple TSPs present (sometimes many per mode) and therefore Public Mobility development is a question of engaging and organizing existing offerings and actors. Other areas – particularly smaller markets – may have limited TSPs present, may only have one or two per mode, or may not

have TSPs present at all. This creates a much more difficult situation for Public Mobility development where local authorities wanting to develop a Public Mobility ecosystem need to attract TSPs to the area (often a challenging task).

Characteristics and Scale of the Market

All markets are not equal when it comes to Public Mobility. Some key differences lie in the size of the market (in terms of potential riders and in terms of geographic area), the demographics of potential riders (age, wealth, existing use of public transit, tech savviness, car ownership), density of origins and destinations, the extent and frequency of public transit, the unity or fractured nature of the region (multiple jurisdictions, multiple transit providers, having a respected existing local champion for Public Mobility, etc), the areas visibility on the national and/or world stage, and the presence of Public Mobility supportive policies (such as parking policies, road pricing, etc.). These differences will impact the complexity of developing Public Mobility, the ease of attracting riders, and TSPs interest in having a presence in the region as well as having an interest in investing in and engaging in a Public Mobility deployment.

Profitability of Transportation Service Providers

The willingness of TSPs to become part of a Public Mobility ecosystem depends in large part on their financial situation. TSP profitability varies greatly by market, by mode, and by the nuances of a TSPs business strategy and operations. TSP engagement in Public Mobility is a long-term investment and a risk. TSPs will need to spend time and money on Public Mobility integration and interoperability, on working with local public and private sector partners on deployments, and on a host of contractual agreements. While the hope is that this leads to increased visibility, uptake and, eventually, profitability, there is the risk that the Public Mobility system will not ultimately thrive or that the benefits will not outweigh the investments. TSPs will weigh these potential benefits and risks in relation to their current and near-term projected profitability. Financial security from the TSP will lead to a larger willingness to invest to become part of an emerging Public Mobility Ecosystem.

Subsidies by Local Authorities

Setting up and maintaining a well-functioning Public Mobility ecosystem is a costly enterprise. Having local authorities subsidize this ecosystem is often critical to the overall success of a Public Mobility deployment. Not only does it strengthen the financial sustainability of an ecosystem, but it also ensures the connection of Public Mobility deployments to achieving societal goals. Subsidies also send a signal to TSPs, to markets, and to TSP investors that cities see value in Public Mobility, that it is worthwhile to engage, and that local authorities will be willing partners in the development of a healthy Public Mobility ecosystem.

3.3 Concluding

As mentioned before, Public Mobility does not occur in isolation. Rather, its deployment should be positioned in a wider context. But which contextual variables should be considered when deploying Public Mobility? And what are potential motivations for deploying Public Mobility? It is the point where both are coming together that one should thoroughly consider when setting up a Public Mobility ecosystem.

This chapter has shown that cities and/or transit agencies could have several motivations for pursuing Public Mobility:

- **Achieving direct profitability:** Public Mobility ecosystems are complicated, have narrow margins, and often will not lead to profits for TSPs or Public Mobility providers. While profitability was a motivation for MaaS 1.0, it has proven elusive. In order for Public Mobility to become financially sustainable the public sector could assist in this if Public Mobility is seen as contributing to societal needs.
- **Achieving societal outcome goals:** Public Mobility is not only a means to provide more mobility options. It can also help achieve societal goals such as reducing congestion, or increasing access, equity and sustainability.
- **Increasing transit ridership:** Public Mobility could increase the transit ridership by improving transit's first and last mile connections.
- **Organizing new mobility offerings and an orderly public realm:** Many jurisdictions have a large variety of shared mobility offerings, creating a confusing transportation landscape and often creating a cluttered public realm. The public sector can help organize shared mobility offerings, and also help help created a well-ordered public realm.
- **Maintaining control of a Public Mobility ecosystem:** The fear of Public Mobility being controlled by private parties, that often have a profitability objective, is a concern for the public sector and can motivate them to lead the organization of a Public Mobility Ecosystem. This gives these public actors the ability to steer Public Mobility and connect it with societal goals.

To ensure that cities and/or transit agencies adapt to the local context, while pursuing Public Mobility, this chapter provided an overview of several contextual variables that should be considered during the deployment:

- **Sense of urgency:** This described the level of concern local authorities have regarding the public sector developing Public Mobility on their own – and the level they feel this will threaten their ability to achieve societal goals via Public Mobility.
- **Presence of transportation service providers:** The amount of TSPs present differs per region based on local characteristics. The degree of existing TSP presence will determine the initial needs of Public Mobility Ecosystem development.
- **Characteristics and scale of market:** A local areas size, demographics, and political context will greatly impact Public Mobility strategies.
- **Profitability of transportation service providers:** TSPs existing level of profitability in a market will impacts their interest in becoming part of a Public Mobility ecosystem.
- **Subsidies by local authorities:** Subsidizing by the public sector not only strengthens the financial sustainability of a Public Mobility ecosystem, but it also stresses the importance of connecting Public Mobility to societal goals.

4. Needs, Barriers and Roles of Government for (building and sustaining) Public Mobility Ecosystems

To succeed, Public Mobility requires a full ecosystem to exist. The existence of TSPs that provide the actual wheels on the ground and the existence of auser facing Public Mobility apps that act as an interface between providers and riders are not alone sufficient. The Public Mobility ecosystem also requires pricing schemes, customer service, supportive physical infrastructure, technical functionality, inter-organizational structure (i.e. regulations and agreements) and trust, as well as viable business models, means to increase ridership, and structures for evaluation and steering.

Each of these areas can be complicated to develop, can be assisted by governments and transit agencies, and often do not materialize on their own through private sector action. The tables below, drawn from the literature review and interviews, organize various Public Mobility elements and needs, describe typical barriers, and potential roles governments and transit agencies can take to assist with the development of the greater Public Mobility ecosystem. Individual government and transit agencies will need to decide which aspects of the Public Mobility ecosystem are most in need of assistance and most critical to their area's ecosystem functionality.

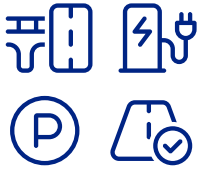
4.1 – Operational needs

Operational needs are the basic functional building block of Public Mobility. Having TSPs providing services is an absolute necessity, however adding these services into a Public Mobility ecosystem faces some challenges such as market size, demographics, transit use and ridership, and government support. Next to services existing, there needs to be agreement on pricing which can vary largely within a single ecosystem and between different providers of mobility offerings. Lastly, there is a need for customer service, or at least customer oriented service provision. This requires clear division of responsibilities and incentives for complying with certain standards of operation and service quality.

Elements/needs	Barriers	Government Role
TSPs providing services	Varying interest from TSPs – largely dependent on market size, demographics, transit use, area prominence, government support, etc.	**Promotion of regions benefits for TSP use/growth (area prominence, market size/demographics, replicable model, etc.).**
		Prominent positioning of government as supportive of TSPs (willing partner, organizing of services, funding of Public Mobility – directly or indirectly).
		Acting as a trusted broker and partner for Public Mobility deployment (Smith et al., 2018)**.**
		Marketing of TSP/Public Mobility services (Vij & Dühr, 2022)**.**
		Organizing TSP and MSP (Mobility Service Provider) services (both digitally and physically).
Pricing	Large range in prices (even for same mode).	**Create standard pricing or at least standard means of describing pricing.**
Customer Service	Fragmented TSP and MSP (this includes problems of finger pointing (as to responsibility) and conversely, concerns about damage to TSP brands).	**Help create clear roadmap and assignment of responsibilities.**
		Create incentives/penalties to eliminate non-compliance or poor services.

4.2 – Infrastructural needs

Public Mobility functionality is substantially dependent on the quality of existing infrastructure. In addition to simply having travel lanes for micromobility (protected bike lanes and safe intersections, for instance), Public Mobility will also require parking and storage space as well as charging infrastructure for shared vehicles. Developing this can be a substantial lift for any single TSP, so having government entities facilitate it beforehand and allow TSPs to plug in to existing systems can be a substantial benefit. Additionally, governments, TSPs, MSPs, and the general public all have an interest in creating a coherent and organized public realm that is clutter free. This increases safety for riders and pedestrians and creates a more attractive public realm.



Elements/needs	Barriers	Government role
Parking/Storage Space	Limited availability of space in public realm.	**Allocating space on street or on municipally or transit-owned property** (Smith et al., 2018; Wong et al., 2020).
		Design/construction of mobility hubs (Smith et al., 2018).
	Limited coherence of parking areas.	**Create standards for mobility hubs (size, location, organization, branding, user interface).**
	Lack of clarity of who should manage hubs.	**Provide or contract services to physically manage hubs.**
Charging	Lack of accessible electric service available near parking.	**Broker agreements between utilities and hubs/TSPs.**
	Lack of charging stations (physical plugin station).	
	Unclear means of metering/ billing for charging.	
Riding Infrastructure (Travel Lanes)	Limited, discontinuous, or dangerous travel lanes for non-auto modes.	**Construction of protected lanes and complete streets** (Smith et al., 2018).
Coherent/Organized Public Realm	Perception of 'Cluttered' environments (Hammond, 2023).	**Setting of standards (and penalties) of vehicle parking to ensure it is orderly and safe** (Wong et al., 2020).
		Unified branding of mobility hubs.

4.3 – Technical Functionality

A fundamental aspect of a Public Mobility system is the digital platform that combines and coordinates offerings. Making this work requires interoperability (the ability of different systems, services, and modes of transportation to work together seamlessly) and data sharing standards and norms. It also requires development of the Public Mobility platform itself, preferably a white-label platform (an unbranded generic platform that allows any TSP and/or MSP to offer their services) that builds from existing systems and deployments in other regions, to allow interoperability and stimulate transparency and data sharing.

Elements/needs	Barriers	Government role
Public Mobility Platform Development	Costs of developing system.	**Directly subsidize or fund platform development** (Smith et al., 2018).
		Help create buy-in/consensus around the use of an existing white-label system. (Internally creating proprietary Public Mobility app has not proven helpful in previous case studies).
Interoperability	Agreement on system specifics.	**Require use of existing and tested platforms (from other locations).**
	Costs of developing system and standards.	**Assist in/fund development of standards** (Smith et al., 2020).
	No desire (by TSPs) to use a single system.	**Help create buy-in/consensus around standards.**
		Require or incentivize use of standards.
Data Sharing	Privacy, concern about sharing business secrets and limiting competitiveness (Chang et al., 2019).	**Act as (or contract) a neutral third party to be the Public Mobility Integrator** (Smith et al., 2018)
		Limit data sharing to only essential information. Limit or eliminate transfer of personally identifiable information.
	Concerns about cost of continually collecting and sharing data (Bandeira et al., 2022).	**Minimize frequency of data transfer (30 sec., 1 min., 5 min….).**
		Subsidize setup for smaller companies.

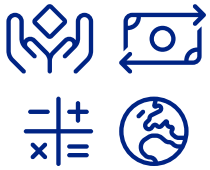
4.4 – Organizational Leadership

Public Mobility requires a substantial amount of coordination across various public sector, private sector, and community stakeholders. This includes high level coordination on motivations and goals, concrete development of contracts for all involved, and the more ephemeral, but absolutely critical development of trust between stakeholders. This all requires leadership that can inspire, drive, and create momentum and commitment around Public Mobility.

Elements/Needs	Barriers	Government role
Catalyst/Instigator/ Leader	Lack of vision and leadership.	**Create unified Public Mobility vision and roadmap for implementation.**
		Bring attention to Public Mobility (as a topic), be a booster (Smith et al., 2018).
Aligned Motivations	Individually/internally focused interests by TSPs and transit.	**Consistent messaging and discussion to bring stakeholders to aligned motivations around topics such as reduced congestion and societal goals.**
		Focusing on 'increasing the pie' (getting riders out of cars) and not a zero-sum gain.
Momentum	Comfort with status quo (from all stakeholders).	**Help create political will, necessity, and urgency.**
	Risk avoidance (of any new model) (Karlsson et al., 2016).	**Analyze impacts of Public Mobility on congestion, equity, emissions, etc. (to build support for services).**
Contracts Between Parties	Cumbersome and tedious process to create contracts with all parties.	**Create standard contract terms** (Smith et al., 2020).
		Act as a connector/ broker between stakeholders (Smith et al., 2018; 2020).
		Mediate between stakeholders (Smith et al., 2018).
Stakeholder Trust	PT operators reluctant to work with external actors (Audouin, 2019).	**Public sector can act as a neutral/supportive trust broker** (Smith et al., 2018) **(for instance, to collectively determine the rules of the game).**
	TSPs feel competition between themselves (particular within same mode offerings).	**Public sector can remove unnecessary barriers by changing policies to facilitate desirable private sector operations.**
	Untested long-term relationships between actors.	

4.5 – Business Models

For Public Mobility to survive long-term, it must have a viable financial model. This does not have to mean that there is a highly profitable business model for Public Mobility overall, but it does point to a need to balance costs with societal or financial benefits. This goes beyond organising finances but is also about the way markets are structured in terms of competition and market (geographical) scale.



Elements/Needs	Barriers	Government role
Financial Feasibility	Low profit margins in Public Mobility platform (Chang et al., 2019; Surakka et al., 2018).	**Focus on societal benefits, not on financial gain** (Sarasini et al., 2017; Wong et al., 2020).
		Focus on increasing transit ridership.
	High cost of setting up Public Mobility (Smith et al., 2020).	**Direct funding of Public Mobility platform development** (Karlsson et al., 2016).
		Use of existing platform that TSPs have already integrated into.
Alleviate Competition Fears	Competition within and between modes (Van den Berg, 2022).	**Focus on shared goal of expanding pie (less people in cars, more in shared mobility).**
		Avoid zero sum gain mentality.
Scaling	Increased partners, jurisdictions, need for negotiation, and competition (Surakka et al., 2018).	**Broker relationships and trust between expanding parties.**
		Create (or be) a forum for dialog between TSPs and between TSPs, governments, and transit agencies (Surakka et al., 2018).
		Assist with roadmap for orderly expansion across larger region.
	Patchwork of regulations.	**Standardize rules/ regulations across areas** (Surakka et al., 2018).
	Patchwork of services (across countries or between metro areas).	**Standardize services, platforms, data sharing, price, etc** (Smith et al., 2020; Vij & Dühr, 2022).

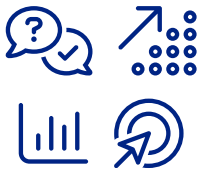
4.6 – Increased Ridership

A Public Mobility ecosystem needs people to be using offered mobility services for it to be successful. Stimulating ridership is a means to achieve this goal. For user uptake it is important to overcome barriers such as the allure of the private car, and to ensure ease of use, affordability of use and availability of services. This can be strengthened through branding and marketing to familiarize users with Public Mobility and its mobility offering.

Elements/Needs	Barriers	Government role
User Uptake	Allure of private car (Alonso-Gonzalez et al., 2020).	**Travel Demand Management (TDM) (fees, parking costs, etc.) to create a push toward non-auto modes** (Audouin, 2019; UITP, 2019).
		Limit incentives that contradict Public Mobility (e.g. free parking or subsidized car use) (UITP, 2019).
	Ease of use.	**Facilitate single Public Mobility app with ability to find/book/pay.**
		Facilitate payment options.
		Create standard price structures/agreements (as Jelbi did).
	Affordability of use.	**Subsidize use (particularly for economically disadvantaged).**
		Facilitate validation of participation in low-income programs.
	Availability of service (geographically).	**Require or incentivize fleet distribution (to underserviced regions) and rebalancing.**
Branding/Marketing	Brand Noise (too many options/looks).	**Create a single Public Mobility overarching brand.**
	Users unfamiliar with Public Mobility options.	**Coordinated and pervasive marketing/branding (focusing on shift to Public Mobility, not only a particular TSP).**

4.7 – Evaluation and Steering

Finally, in order to ensure the functioning of the Public Mobility ecosystem and its services, evaluation and steering are important elements that need to be in place, both to improve and to maintain the ecosystem. Evaluation is necessary to determine where in the processes, operations or outcomes of the Public Mobility ecosystem improvements can be made. The next step is to act upon these insights by steering towards desired (societal) outcomes.



Elements/Needs	Barriers	Government role
Evaluation of Process, Operations and Outcomes	Lack of shared KPIs (Key Performance Indicators).	**Create standard KPIs for Public Mobility.**
	Lack of data.	**Establish data standards and data sharing behaviour to evaluate KPIs.**
Steering towards desired societal outcomes	Lack of understanding best path towards desired societal outcomes.	**Support research on Public Mobility impact/outcomes and on the impacts of public sector action in achieving societal goals.**
	Lack of understanding of levers to steer towards desired outcomes.	**Create unified mobility vision including the role of Public Mobility / public transport in the mobility system.**

5. Municipal and Regional Competitiveness

Two key components of the Public Mobility Ecosystem are the TSPs and MSPs that provide services to a local area. In the world of shared mobility, these are often large, multinational companies that weigh deployment and investments throughout the globe. While municipalities and regions may do substantial work in setting up a Public Mobility Ecosystem, they also need to understand their competitive attractiveness for these companies within the broader international context.

All areas are not equal, as was also described in chapter 3.2, detailing some of the contextual variables of a Public Mobility ecosystem. Market size and characteristics, global visibility, existing transit utilization, built environment, and infrastructure will affect an area's level of attraction of TSPs and MSPs. Large cities such as Berlin and Amsterdam will more easily attract companies who are willing to invest substantial amounts of time and money to be successful in the market and who will be more willing to work with governmental requests and constraints. Smaller markets with less visibility and more challenging built environments and transit use may have difficulty attracting any TSPs or MSPs and may have much more difficulty in imposing regulatory requirements on them. Not being able to attract TSPs and MSPs might be a challenge in setting up a successful, functioning Public Mobility ecosystem, since having these services available – under the right preconditions – is key.

There are several ways in which municipalities and regions can increase their competitiveness. These include:

- Direct subsidies
- Limited competition
- Level of Public Mobility preparedness, coordination, and collaboration
- Use of established MSP systems and standards
- Market replicability
- Rider recruitment and coordinated branding

The following section will elaborate on each of these.

Direct Subsidies

Public and shared transportation are low-margin businesses with the secondary benefits (e.g. economic development, equity, environmental) often being the primary drivers of their public sector development and support. This is clear in many public transportation systems throughout the world, where government subsidies support operations and system expansion. Public Mobility is a similar endeavour where direct profitability is difficult in many if not most markets. Direct subsidies for Public Mobility development can not only help create a viable and robust ecosystem, but they can also be instrumental in attracting TSPs and MSPs. They show committed public sector support for Public Mobility and can cover funding gaps in transportation delivery. Creating and maintaining this support, however, requires Public Mobility organizers to evaluate and document how Public Mobility deployment is assisting with larger governmental/societal goals, essentially making the case for why public funds are being used for these purposes.

Limited Competition

Smaller markets may have difficulty attracting TSPs and MSPs if they remain on open/competitive marketplace. If market size creates substantial risk from competing companies of similar modes, TSPs may decide not to deploy at all. Limiting permits to one or two scooter companies, for instance, creates a more favorable business environment and eliminates the 'rush to the bottom' where competing providers cut corners and skirt regulatory limits to survive. Limiting competition within modes (or geographically) can also help create a coalition of TSPs that see the success of a Public Mobility ecosystem as directly beneficial to them, encouraging their participation in developing the ecosystem, data sharing, and investment.

Level of Public Mobility Preparedness, Coordination, and Collaboration

Establishing Public Mobility is a complicated endeavour that requires substantial coordination of various stakeholders including local government(s), transit agencies, business organizations, and community groups. Having a central organization that has aligned ecosystem goals, needs, roles, and standards makes entry into the region by a TSP and/or MSP much easier, providing a central contact point and a welcoming and organized environment. This organization can save TSPs and MSPs time and money and also creates a more predictable and secure operating environment.

Use of Established MSP Systems and Standards

In a push to avoid any one company owning the Public Mobility marketplace, some municipalities and regions have attempted to develop their own Public Mobility apps and data systems. While the intention is understandable, the creation of new and unfamiliar systems and apps creates a barrier to entry for TSPs, requiring substantial investment and time for integration. Large and attractive markets will often have trouble attracting TSPs and MSPs if they are developing and piloting their own systems. Medium or small markets will have even more trouble and this may be an insurmountable barrier for launching a Public Mobility ecosystem. Using established and tested white-label systems reduces potential disruptions and provides strong incentives for TSPs and MSPs to invest in integration if they have not already done so in other markets.

Market Replicability

Smaller markets simply may not have the customer volume that will alone be attractive to TSPs and MSPs. One strategy to overcome this can be to find approaches to Public Mobility ecosystem development and market deployment that offers easily replicable lessons or models for deployment in other similar markets.

Rider Recruitment and Coordinated Branding

A large challenge in building any new Public Mobility system is attracting new riders and increasing public awareness of the program. Coordinated and centralized branding and marketing around a Public Mobility system benefits all TSPs and MSPs and reduces their own marketing and outreach burden. Additionally, areas that have established and popular transit systems are attractive to TSPs and MSPs who see easy opportunities to expand their customer base by providing additional services to these existing riders.

TSP and MSP participation in a new Public Mobility ecosystem is by no means guaranteed and regions need to understand their relative national and international competitiveness in attracting these private sector actors. This will vary by market size and context, but the strategies listed above can help markets improve their position and attract the needed partners.

6. Conclusion

Knowing that there has been a shift from MaaS 1.0 – which was largely technology focused and assumed the potential of large profits – to Public Mobility – which understands a range of motivations beyond profit and is more focused on issues relating norms, barriers, contracts and ecosystems, this research explored what cities should do to encourage or create a Public Mobility ecosystem that will best support community goals.

For cities there could be multiple reasons to be interested in pursuing Public Mobility, which includes: i) achieving societal outcome goals; ii) organizing new mobility offerings and an orderly public realm; iii) increasing transit ridership; iv) maintaining control of a Public Mobility ecosystem; v) achieving direct profitability.

Pursuing Public Mobility does not occur in isolation. Rather it should be understood as existing within a wider context that can necessitate different approaches to Public Mobility – particularly to the role of the public sector and transit agencies in developing Public Mobility. Contextual variables could include: i) sense of urgency; ii) presence of transportation service providers; iii) characteristics and scale of market; iv) profitability of transportation service providers; v) subsidies by local authorities.

In addition to the actual wheels on the ground and the Public Mobility apps, a functioning Public Mobility ecosystem requires pricing schemes, customer service, supportive physical infrastructure, technical functionality, inter-organizational structure, trust, as well as viable business models. While various actors need to act to fulfill these different needs, there is a specific role for local authorities in this, as they can help remove potential barriers towards Public Mobility deployment. Areas local authorities can assist in this include the following list of Needs, Barriers and Roles of Government for Public Mobility Ecosystems.

Needs, Barriers and Roles of Government for Public Mobility Ecosystems

Operational needs – Developing clear guidelines on responsibilities, pricing mechanisms, and support;

Infrastructural needs – Constructing physical infrastructure (incl. hubs), and designing standards for mobility hubs, parking, and branding;

Technical functionality – Financially assisting platform development, development of standards, and smaller companies, and minimize data sharing;

Organizational leadership – Aligning motivations through a unified Public Mobility vision, and acting as a broker between different parties through standardized contract terms and focus on ‘increasing the pie;’

Business models – Focusing on the non-financial benefits of Public Mobility, together with standardization of regulations, services, platforms, etc., while being the broker between other actors and providing subsidies as needed and as appropriate;

Increased ridership – Unified Public Mobility branding, along with Travel Demand Management, and facilitating ease of use and geographical equity;

Evaluation and steering – Creating standards for KPIs and data (sharing), while continuously analyzing and learning from the Public Mobility ecosystem.

Regional Competitiveness for Successful Public Mobility Ecosystems

Setting up a successful Public Mobility ecosystem is largely context-dependent and requires an area to be attractive to TSPs and MSPs. This research found six ways in which an area can increase their level of attraction for these critical partners:

1. **Provide direct subsidies;**
2. **Limit competition between TSPs;**
3. **Increase the level of Public Mobility preparedness, coordination, and collaboration;**
4. **Make use of established MSP systems and standards;**
5. **Enable market replicability;**
6. **Coordinate branding to recruit new riders.**

Public Mobility deployment and the optimal role of the public sector and transit in this deployment continues to be an area for further research.

As regions deploy more Public Mobility pilots, additional research into the models of deployment, roles of public entities, and impacts on societal goals can help pave the way for future deployments that have stronger chances of success and are efficient in the use of public sector resources.

We see a strong need for deep-dive case study in one city or a network of cities on these topics. This research should focus on potential differences between contexts in the roles governments have and should have within a Public Mobility ecosystem.

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