



## Make Mobility-as-a-Service (MaaS) work

An artificial intelligence-grounded blueprint

# Executive summary

The last decade has witnessed how Mobility-as-a-Service (MaaS) has become more important when talking about urban mobility. The premise of streamlining diverse services into a cohesive solution with significant societal and environmental implications has attracted lots of attention from players all over the world. But despite the potential that MaaS presents, substantial challenges hinder its broad implementation and the successful establishment of profitable ecosystems. The following point of view was developed with the goal of developing a better understanding on MaaS ecosystems and their journey toward profitability and is split into two main chapters.

The first part presents an AI-grounded analysis of MaaS ecosystems, which was conducted via an iterative process using a customized Natural Language Processing (NLP) approach to analyze key constructs and variables of ecosystem-building activities within the MaaS sector. Natural language inference was applied to 26,288 selected text snippets between 2015 and 2022. Then, certain ecosystems could be analyzed and trends in the industry identified to better understand what MaaS orchestrators have achieved to date, how the establishment of ecosystems has evolved, and how successful practices differentiate themselves from the rest. Key takeaways include the use of asset collaboration to expand offerings and improve customer experience without heavy capital investments, and the implementation of integrated customer solutions, acting as a one-stop-shop, to boost user engagement and retention.

In the second chapter, we focused on detailing a rough blueprint for the operating model of such an ecosystem based on the results of chapter one. Therefore, we defined four key modules of interactions between players within a mobility ecosystem: demand, platform, assets, and public-private collaboration. Optimizing these four modules independently and adding a pragmatic governance structure on how to regulate the joint efforts of all players may encourage the transition toward an ecosystem that creates value for all stakeholders. The economic model considered shows ways to address the growing global MaaS market in a profitable way. Despite setbacks in recent years, and thanks to technological advancements, growing urban populations, and rising sustainability concerns, industry recovery and rapid expansion are anticipated.

# Introduction

## Navigating the future of urban mobility

Having been simmering for nearly a decade, Mobility-as-a-Service (MaaS) is quietly revolutionizing the way society approaches mobility. The concept brings a diverse range of mobility services together through a streamlined interface, presenting great possibilities in terms of mobility behavior and environmental benefits. The concept has been around almost ten years now and has attracted significant attention especially for urban areas, as it provides a one-stop access to mobility services for consumers.

Despite numerous social and environmental benefits, there continue to be major challenges associated with establishing a functioning MaaS system. And the COVID-19 pandemic has proven to be an important set back. Still, urban populations—not only the younger generations—appear to demand more MaaS solutions for their mobility needs. Therefore, the market and profit pools in this sector should continuously increase in the next years, which could draw the attention of capital markets.

When more than two players create a value proposition for the customer by linking their offerings (e.g., mobility services) via an exchange platform, with which they jointly create value, this provider structure can also be referred to as an ecosystem (Adner, 2017). However, we see only a few highly integrated MaaS ecosystems in operation globally, and lots of pilots that almost never reach the implementation stage (Karlsson et al., 2020). But building up a profitable MaaS ecosystem is not an easy task as it requires a public-private collaboration between cities/regulators, (public) transport companies, private transport providers and asset owners. Nevertheless, the components with which to build a transaction ecosystem exist and include:

- Potential private customers
- Potential corporate customers (companies), that are looking for “smart” corporate mobility options for their employees as an element to attract talent (e.g., by offering mobility budgets).
- Regulatory environment (e.g., the EU Green Deal)
- Digital technical platforms, like the many different apps as well as backend systems
- Green investment capital from the capital markets
- An automotive industry in transition looking for new business models
- New mobility providers

The question is how to make MaaS work. What is needed to overcome some of the existing barriers—decision processes in cities, lack of integration, and inconvenient routing? What is needed to finance the development of these solutions to accelerate for the sake of e.g., the decarbonization of mobility? What actions and governance should companies who are involved in MaaS ecosystems pursue?

Deloitte does not see MaaS as the only future way of (urban) transport. But it appears to meet the criteria set out by target populations, including more mobility, flexibility, and environmentally friendly operations. And therefore, it is likely that a multimodal model could be the most optimal solution in the future: owning/leasing/subscribing to a private vehicle will not likely go away completely in the short term but could be complemented by other forms of mobility with regional differences around the globe.

This point of view is organized as follows: the first chapter gives an overview of existing MaaS solutions globally. For this first section a thorough AI-based analysis was conducted with a natural language processing (NLP) methodology to identify MaaS patterns along the key constructs of MaaS ecosystems. These key constructs are not only the overarching value proposition, operating model of actors and their relationships, and a technical platform as the necessary components, but also value drivers and governance mechanisms to enable a joint value creation of which the individual stakeholders can capture and share (Jaspers et al., 2023; Kraus et al., 2023). Then secondly, a blueprint showing the operating model of the actors and their relationships as well as the necessary governance are examined in more detail, and an estimate is made of what a profitable solution could look like for the future. The text ends with a conclusion and an outlook.

This effort was led Deloitte Germany and Deloitte Portugal professionals who are active in the Public and the Automotive sectors, developing digital mobility solutions and working with Automotive industry organizations as well as their financing/mobility departments. The team was supported by researchers from the chair of International Automotive Management at the University of Duisburg-Essen (UDE), focusing on ecosystems, vehicle manufacturers, and suppliers. LocosLab GmbH in Bonn, Germany, provided the NLP expertise to make this analysis a reality.

# 1. The status of MaaS activities globally

## An NLP-based examination

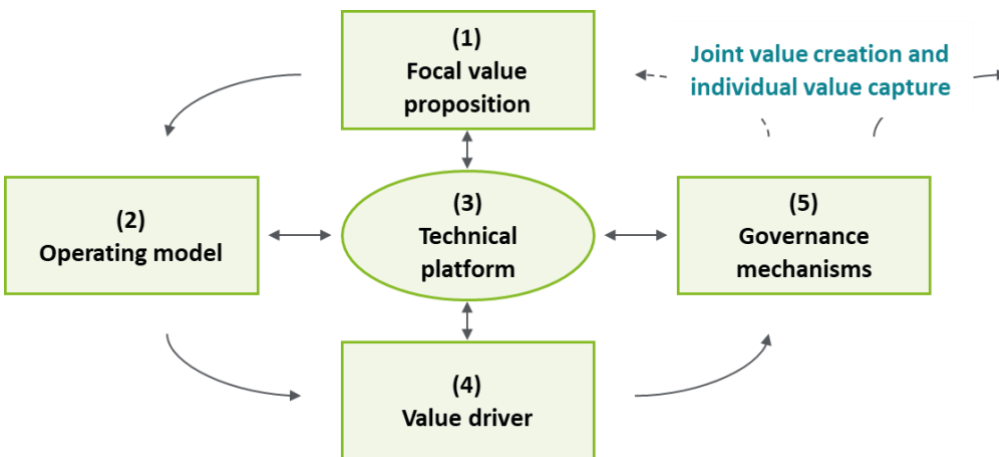
Due to the organizational structure of MaaS, detailed reporting is often not a requirement, resulting in scarce information about providers, ecosystems, and their maturity levels. Therefore, an analysis of the status quo was conducted by employing an AI-based methodology with additional data sourced from existing annual reports of MaaS players and analyst reports covering the industry. This provided a broad picture of which providers are more active than others, which cities appear to have the most advanced ecosystems, and most importantly, what the likely differentiators are when it comes to successful ecosystems. This analysis serves as the basis for the key takeaways outlined here as recommendations for companies to follow.

### 1.1 Methodology

The approach was designed and implemented between February and October 2023 within a collaboration project involving Deloitte Germany, Deloitte Portugal, the University of Duisburg-Essen (UDE), chair of International Automotive Management and LocosLab GmbH. Five key constructs (see Figure 1a) were employed with a total of 23 variables to capture ecosystem-building activities, derived from existing literature on how to establish ecosystems (Jaspers et al., 2023; Kraus et al., 2023). Then, the Factiva database was scanned for relevant datapoints. Out of its 672 million articles we conducted several filtering steps and selected the fitting mentions in 26.288 text snippets (see Figure 1b). From this selection we reviewed the usage of the selected key constructs and variables for ecosystems and considered the period from 2015 to 2022. This period was selected, as the concept of MaaS was only articulated in 2014 by the executive director of the Intelligent Transportation Society of Finland, ITS (Hietanen, 2014) and 2022 was the last available full data year. We focused on English and German sources, as these were the only languages we could validate, knowing this may lead to a certain bias in the results.

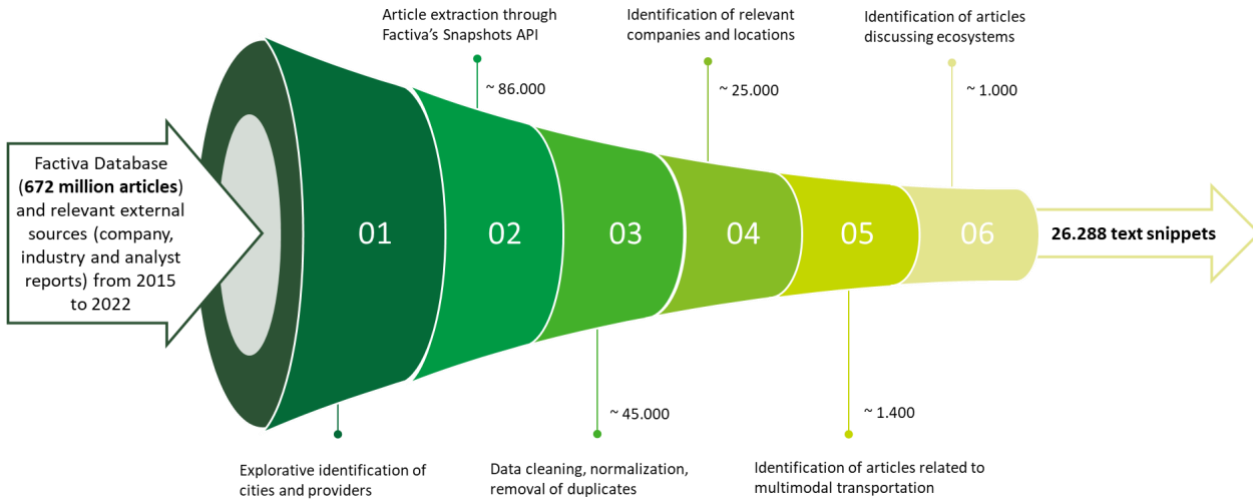
Figure 1: Conceptual model and used data base

a) Conceptual model to build up an ecosystem



Source: Own design based on Kraus et al., 2023

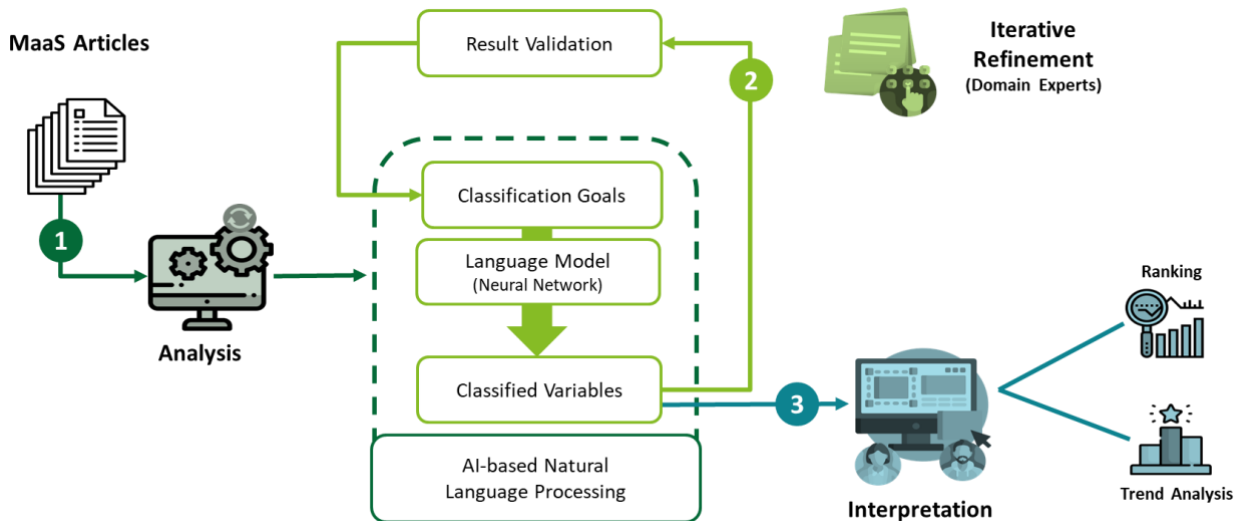
b) Used data base



Source: Own design based on Jaspers et al., 2023; Kraus et al., 2023, Locoslab GmbH

To extract the key constructs and variables from the articles, we applied an iterative process using a customized NLP pipeline leveraging state-of-the-art AI models. Starting with a credible large language model (LLM), we defined a series of entailments and applied natural language inference (NLI) at the sentence and paragraph level to classify the article contents and to identify the occurrences of the variables that allow us to infer the presence of key constructs. To achieve precision and recall, the pipeline was defined and repeatedly optimized by LocosLab GmbH in collaboration with the domain specialists from Deloitte and UDE. During the iterative refinement process, the domain specialists manually validated more than 250 documents and identified a broad spectrum of positive and negative instances from all variables. These variables were then used to fine-tune the NLI parameters, and the underlying Artificial Neural Networks until the NLP pipeline delivered the required performance. Figure 2 shows the methodological steps in the analysis of the selected MaaS articles.

Figure 2: AI methodology to identify patterns



Source: Deloitte's Mobility-as-a-Service Model, 2023

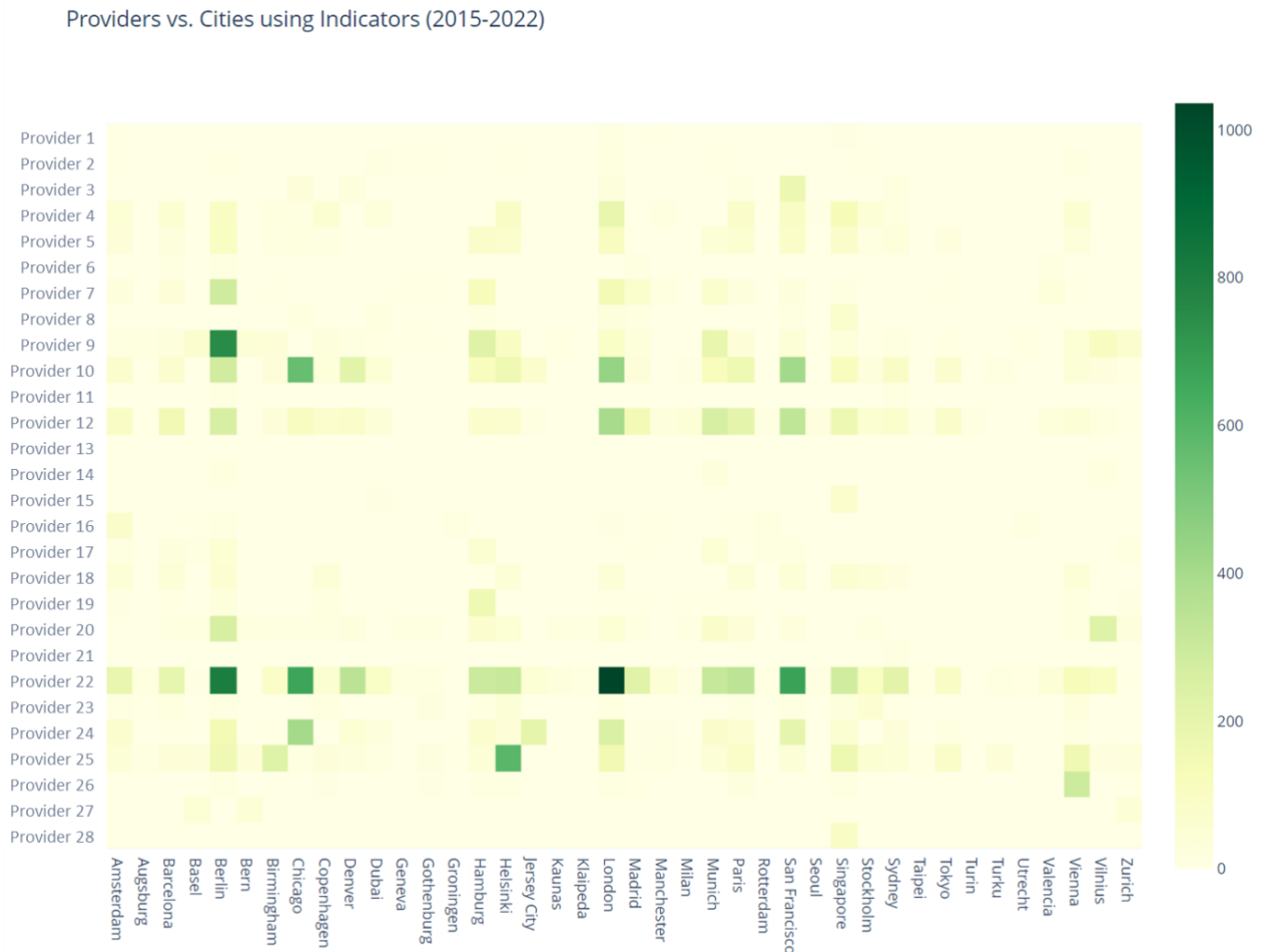
The mentions could then be allocated to MaaS activities in the marketplace, identified as a combination of a MaaS orchestrator—which integrates different transport modes in a seamless MaaS solution—and the city mentioned in the respective datapoint. This allowed the analysis of the high-impact practices of certain combinations and the identification of trends in the MaaS sector. As expected, due to the complex topic of MaaS, even in a combined AI and business researcher approach, six of the 23 considered variables failed to meet the required F1 Score, a metric balancing precision and recall (Allwright, 2022), and therefore were not included in the result interpretation. The F1 score serves as a reliability indicator, and variables falling short of the threshold set for this use case (see table 1 in the appendix) would raise concerns about their significance and the quality of insights they can offer. Consequently, these variables were deemed unfit for driving robust conclusions about MaaS ecosystems. Nevertheless, they were included in the visualizations to demonstrate the possible range of variables of the five key constructs considered in the first place.

## 1.2 Overall results /

Figure 3 shows the matrix with combinations of providers (ecosystem orchestrators) and cities considered followed by a summary of the results. The previously mentioned bias, due to the language barrier, can be observed as the top 15 combinations by mentions and contain cities in Europe or North America (nine in Europe, six in North America), where English and German are widely spoken languages. London and Berlin are the most active cities with three different ecosystem orchestrators /and therefore ecosystems in the top 15 each. Both cities have a long history of innovation and a pioneering role in the mobility sector. Also, Paris and Munich appear in the top rankings as urban agglomerations with complex mobility needs. Helsinki, as the birthplace of the MaaS concept, also made it to the top spots. In total, the top 15 MaaS orchestrator-city combinations allocated 30% of all identified mentions.

For the following analysis, all identified mentions were used, not only those of the most frequently mentioned city-orchestrator combinations. Different analyses help reveal certain patterns of activity in the sector and of successful MaaS offerings. They also serve partially as a basis for the development of a blueprint for an operating model for a MaaS ecosystem and its governance in the next chapter.

Figure 3: Overview of the selected provider-city combinations considered in our analysis



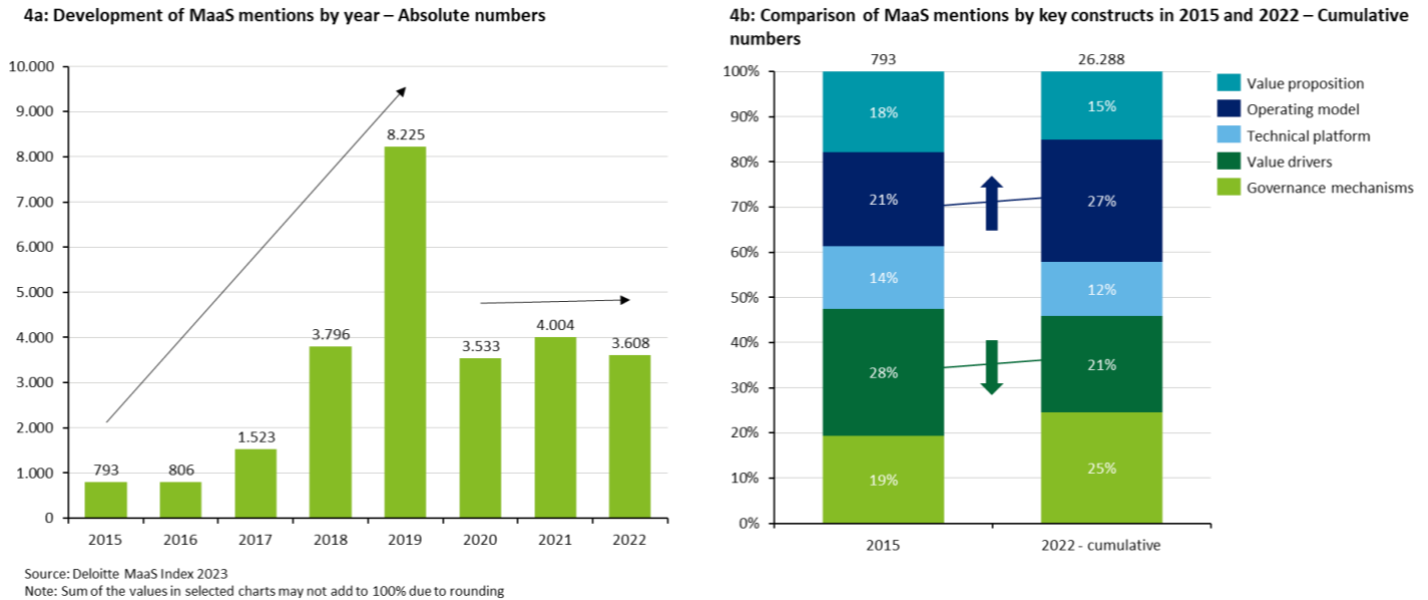
Source: Deloitte MaaS Index 2023

A sharp increase in activity is observed from 2015 to 2019 (Figure 4a). The total number of mentions in the selected providers and cities increased by a factor of 10 while MaaS evolved and gained traction. Despite momentum, COVID-19 brought about a decline to almost half of the mentions from the previous year. As the pandemic affected the way people travel and commute, discussions about MaaS seemed to become temporarily irrelevant. Since then, mentions have not returned to their pre-COVID levels, which may be influenced by geopolitical challenges and the economic climate overall. But we expect the activity to pick up again in future.

Looking at the different key constructs from the analysis (Figure 4b), we notice a relative decline in mentions for the value drivers in favor of the operating model. A shift from focusing on individual value drivers to the overall operating model could be due to the slow implementation. As the market evolves, stakeholders may be more concerned with how benefits can be delivered in a sustainably and efficient way, hence the operating model gaining in importance. Governance issues also seem to have grown in importance, but should be analyzed with caution, as most variables in that construct did not achieve the required significance, as explained in the previous paragraph.



Figure 4: Development of MaaS mentions overall and by key construct between 2015 and 2022



### 1.3 Key constructs and variables

Further analysis of trends in each MaaS key construct, based on absolute mention shares 2015, 2019 and 2022, offers deeper insights into the industry's direction (see Figure 5). Observations of the analyzed variables of each key construct include:

#### Value proposition

The shift toward integrated customer solutions and individualization reflects evolving consumer expectations for more comprehensive and personalized services with a visible decline in the integration of presumably shared mobility solutions due to COVID-19. As MaaS matures, customers increasingly look for a holistic experience that serves multiple (basic) mobility needs seamlessly. The core value proposition now takes precedence, as it helps encapsulate these varied customer desires into a single, compelling solutions with the opportunity to choose from different mobility services. Possible additional benefits of a MaaS offering, such as information about the weather or important events in a region, seemed to have been put on the back burner at first. As for interactivity, its significance dipped between 2015 and 2019, but by 2022 rebounded to 2015 levels (see Figure 5a).

#### Operating model

The shift in the importance of data flows over the years likely stems from the normalization of data-sharing capabilities, thanks to technological advancements. Increased focus on financial flows highlights the growing importance of sustainable revenue models, including subsidies and payment processes as key components for a functioning MaaS ecosystem. While the importance of asset collaboration saw a brief rise between 2015 and 2019, it eventually reverted to its 2015 levels by 2022, and asset investments have also declined slightly in importance over the years. This suggests that persistent challenges remain regarding who should invest in, and own, MaaS fleets and other assets. This points to the unsettled landscape and suggests that the final configuration of successful MaaS ecosystems regarding assets remains to be determined (see Figure 5b).

## Platform

The shift toward platform technology could be attributed to the increasing importance of robust, scalable, and interoperable tech infrastructure. As a mobility ecosystem matures, having a reliable technology stack becomes crucial for seamless integration of services, data analytics, and user experience. Innovations in application programming interfaces (APIs), backend systems, and data provision may also have driven this shift, offering more competitive advantages than incremental improvements in functionality alone (see Figure 5c).

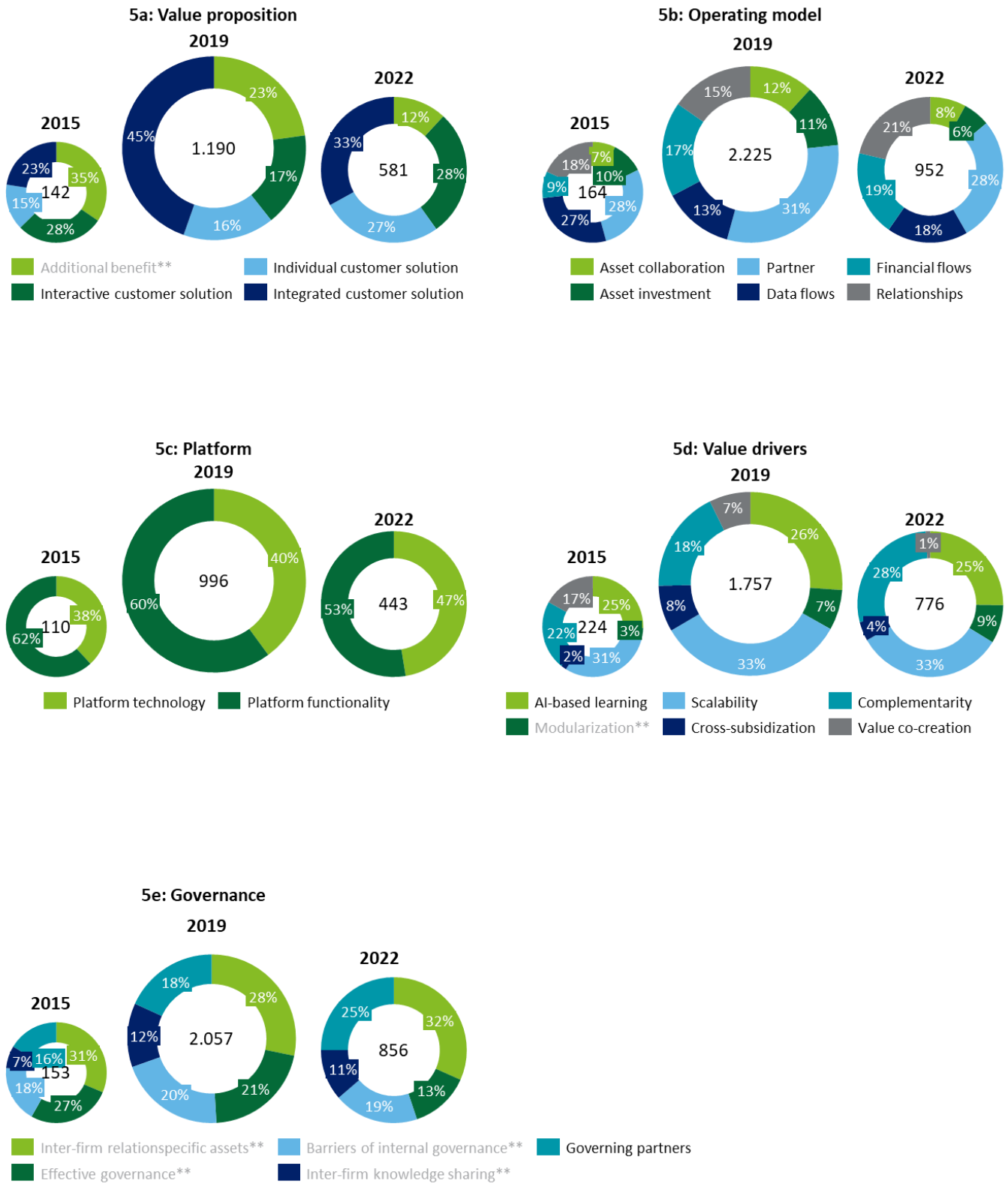
## Value drivers

The shift toward scalability, cross-subsidization and complementarity highlights the evolving maturity of the MaaS market. As an ecosystem expands, efficient scalability becomes increasingly important for accommodating larger customer bases and introducing new services. Complementarity underscores the growing need for mobility services that mutually enhance one another, potentially adding another layer of complexity to developing sustainable and scalable solutions. Cross-subsidization was also growing in importance, as companies aimed for financial sustainability by leveraging profitable segments to subsidize essential, but less lucrative, services. This was especially true until 2019, but since then, there appears to have been a lack of money for this. Meanwhile, the decline in newsworthiness on value cocreation with customers suggests that initial customer input may have been sufficiently integrated and that there is a shift toward prioritizing scalable and financially sustainable solutions over additional customer engagement (see Figure 5d).

## Governance

As MaaS ecosystems mature, the importance of governance and governance-oriented relationships grows but is overall less emphasized at present compared to 2019. In the last three years, rules, and regulations (effective governance) appear to have lost importance, especially when compared to factors such as trust. Governance mechanisms are key to maintaining strategic alignment and coordinating diverse stakeholders and services. The growing relative importance of governing relationships suggests that successful MaaS operations now rely more on strong governance and which stakeholders are collaborating in the ecosystem than on individual organizational assets or capabilities (see Figure 5e).

Figure 5: Development of MaaS variables for each key construct—absolute numbers



Source: Deloitte MaaS Index 2023

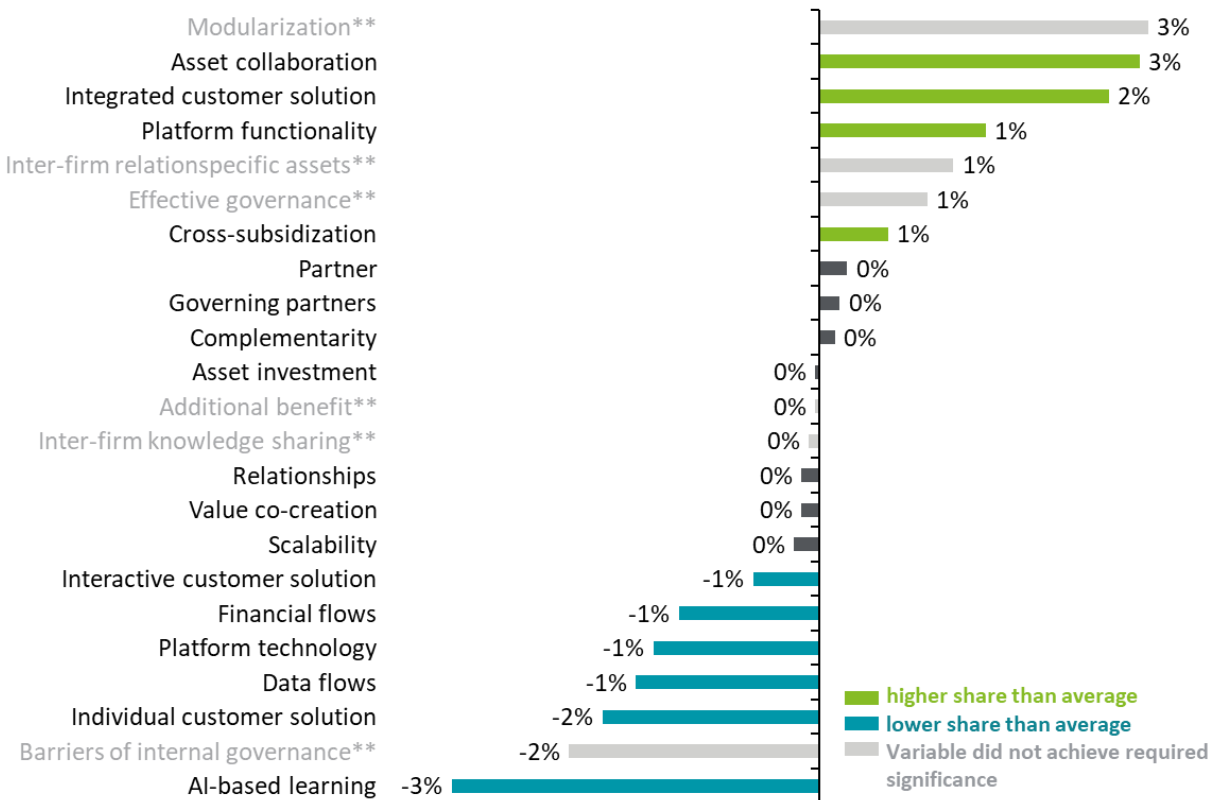
Notes: 1. \*\* Variable did not achieve the required accuracy and was left out for further deep dive analysis.  
 2. Sum of the values in selected charts may not add to 100% due to rounding.  
 3. Chart sizes indicate relative differences in total numbers but are not scaled to actual values.

### 1.4 High-impact practices

Also examined were combinations of providers and cities that are successfully growing their ecosystems. To identify the top MaaS ecosystems, one challenge appeared prominent: comparable data on user numbers, revenue, downloads, etc., across specific provider-city combinations was not widely available. Therefore, the top providers were selected based on a qualitative assessment of strategies, innovations, or business models that make certain companies stand out, irrespective of location. These providers were then paired with cities where they exhibited the highest number of cumulative mentions (see Figure 3). This way, we were able to combine strong performance indicators with high visibility, offering a comprehensive view of successful MaaS operations.

The differences between the highest-impact and average-impact practices are relatively small overall which can be explained with a broad set of indicators needed, but also with the cumulative figures used. The absolute numbers for the year 2022 show a similar distribution but higher differences between high-impact and average.

Figure 6: Difference in mentions in 2015-2022 from the selected ecosystems (provider-city combinations) compared to the overall numbers (cumulative)



Source: Deloitte MaaS Index 2023

Notes:

- \*\* Variable did not achieve the required accuracy and was left out for further deep dive analysis.
- Only Factiva sources were considered for this visual. Our methodology did not allow for additional sources (company, city and industry reports) to be paired to a specific city-provider combination.

This analysis provides valuable insights into the strategies and operational tactics that the standout ecosystems employ, setting them apart and contributing to their market successes. The following key takeaways were derived from our examination:

- + Asset collaboration allows successful MaaS ecosystems to offer richer and more comprehensive services without heavy capital investments. By collaborating with asset owners/operators, these MaaS ecosystems can quickly expand their offerings, increasing their market reach and improving customer experience. This approach is particularly advantageous for navigating the competitive landscape and responding to user demands more efficiently, setting successful providers apart.
- + An integrated customer solution serves as a one-stop-shop for users, streamlining multiple services into a single, streamlined platform. This boosts user engagement and retention by offering convenience and ease of use. Providing such a solution—against the overall trend of a decline in integrated customer solutions (see Figure 5a) presumably due to less integration/use of shared transport-successful ecosystems—creates a better customer experience, one that attracts and retains a loyal customer base, giving them a competitive edge over other providers, whose offerings are more fragmented.
- Higher shares on AI-based learning among overall players suggest that successful ecosystems were already engaging AI well before the current hype. Figure 5d shows that this variable already enjoyed a relatively high share of activity before 2020, suggesting it should not necessarily be a news-worthy element for successful digital platforms in 2022.
- Top MaaS ecosystems have likely already integrated personalized services into their offerings, enabling them to now focus on other pressing challenges and opportunities. In this context, individualization is likely a baseline expectation for leading platforms nowadays.

## 2. Blueprint for a viable MaaS operating model and its governance

### What is needed to succeed

As analyzed in the previous chapter, the basic value proposition of a MaaS ecosystem nowadays is clear. The digital platforms and technical requirements pose certain challenges; payment processes and data sharing among stakeholders can be difficult. Yet, these platforms exist today and do not pose prominent challenges.

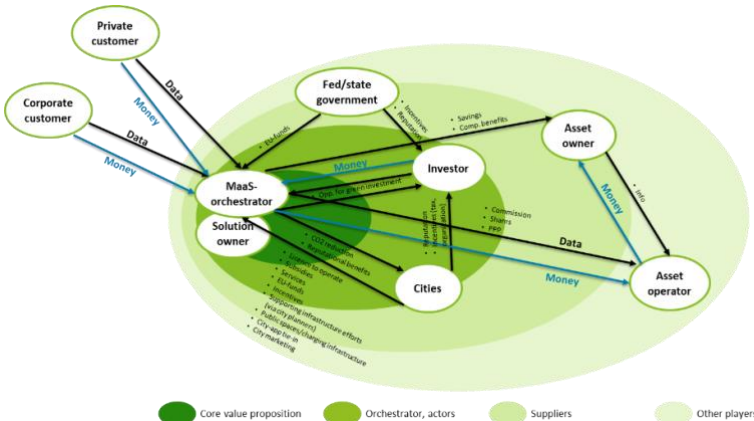
Currently, the main challenges preventing the success of MaaS ecosystems seem to be the interactions between actors in the operating model and the governance of these interactions (see Figure 4). Since the mentions of value drivers and thus the preoccupation with them is currently declining (see Figure 5), they will not be considered separately here, but in a more detailed analysis in future. The initial relationship arrangements as well as the data and finance flows between them are prerequisites for an initial assessment of the financial viability and steering approach, foundational for trustful cooperation. Therefore, we developed a rough blueprint with an operating model of the actors and their relationships (2.1) as well as the necessary governance (2.2) to detail a blueprint of a viable MaaS operating model that have the potential to yield profitability soon (2.3) and assess what a profitable solution (2.4) could look like.

### 2.1 Understanding the operating model

A rough blueprint of a MaaS ecosystem (Figure 7) was defined in a series of workshops. As a starting point we took the St. Gallen templates for ecosystem design (Lewrick, 2022) and used it as the basis to form the features of this use case. In addition, we considered the insights generated by our AI-based approach from the previous chapter—especially with reference to the high-impact practices.

Figure 7 shows that at the core of the ecosystem lies the core value proposition, driven by the MaaS orchestrator, which encourages voluntary, value cocreating inputs to coordinate hierarchically independent actors in an operating model. The orchestrator interacts with suppliers and other players. Main data and financial flows from and to the orchestrator, main actors, suppliers, and other players less involved in the set up and management of an ecosystem, are indicated as well. This means that a rather complex operating model may be one root cause for the limited implementation of many MaaS pilots.

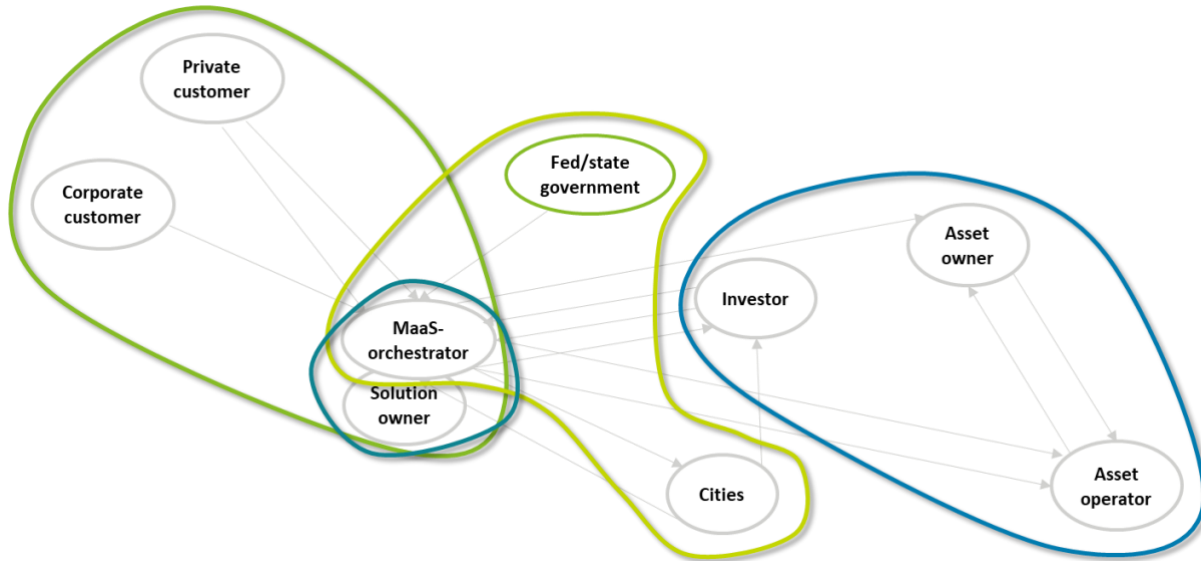
Figure 7: Rough blueprint of a MaaS operating model



Source: Deloitte’s Mobility-as-a-Service Model, 2023. Based on Lewrick (2022)

As prerequisites of a successful implementation of a MaaS operating model we could distinguish, based on our work, four main modules of a MaaS operating model with different constellations of relationships between the parties involved (Figure 8). These should be individually optimized in order to cope with the complexity of a MaaS ecosystem. As the orchestrators interacts with different actors in terms of demand, asset management, platform technology and public-private collaboration, these are: a demand module, a (technical) platform module, an asset module, and a public-private module.

Figure 8: Modules of a MaaS operating model

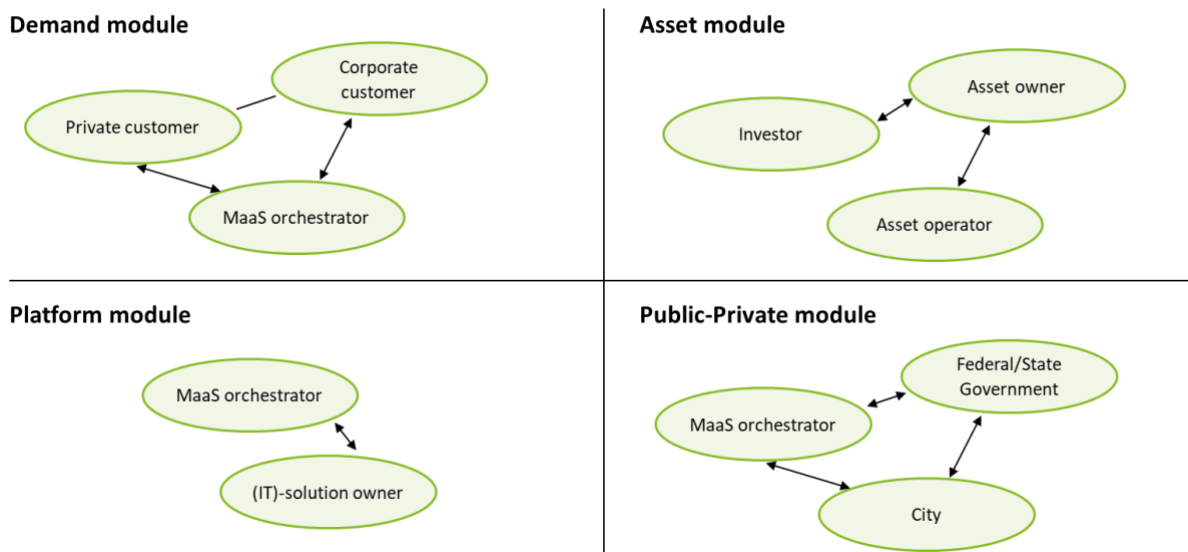


Source: Deloitte’s Mobility-as-a-Service Model, 2023

Figure 9 shows the interactions in the individual modules:

1. The demand interactions of the MaaS orchestrator with the private and corporate customers
2. The platform interactions of the MaaS orchestrator with a potential third-party platform provider or (IT) solution owner, mainly on data (governance and AI)
3. The asset interactions of the MaaS orchestrator with the asset owners, asset managers and investors
4. The public-private interaction of the MaaS orchestrator with the cities, regulators, or state governments

Figure 9: Interactions with actors in terms of demand, assets, the platform, and public-private collaboration



Source: Deloitte’s Mobility-as-a-Service Model, 2023

These four modules of a MaaS operating model with different constellations of interactions between the parties are now considered more in detail (Sections 2.1.1-2.1.4).

### 2.1.1 Demand Mobile (interaction with customers)

Understanding and addressing demand is foundational to a successful MaaS ecosystem, shaping the types of services offered and informs the asset types needed. Our analysis from the previous chapter showed that successful providers focus on the integration of services, emphasizing the need to understand the role and demands of customers. Our work with mobility providers shows that customers nowadays seem to be more conscious of their options and more frequently opt for “green mobility” solutions. Also, generations after Gen Z appear to be less willing to drive as much as other generations before them. In their demand for alternative mobility options, MaaS could play an important role similar to what digital streaming services did to the cinema and music industries in the past years. Therefore, understanding user behavior, needs, and pain points can help tailor services for long-term success.

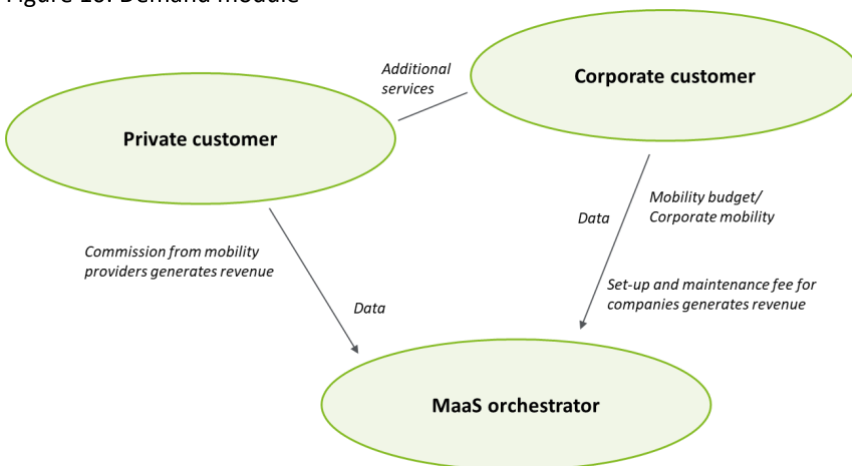
Demand management has different implications for private and corporate customers (Figure 10). To initiate a self-reinforcing effect of increased traffic on a platform, the focus should be on both individual and corporate users. Collaboration with corporations on smart mobility solutions to onboard their employees can lead to an accelerated platform growth. Corporations are now becoming conscious of how impactful onboarding can be, and they are beginning to implement new sustainability strategies to reduce the impact of their operations on the environment in line with their employees’ “green” consciousnesses. The corporate MaaS will likely result in delivering alternatives to cars and give employees more options in terms of mobility. In addition, these companies can also benefit in certain areas from tax advantages that may arise in some countries from the purchase of electric vehicles or monthly commuting passes for their employees. In the context of increasing sustainability efforts, mobility budgets can encourage people to switch from using private cars to other mobility modes. Even a CO<sub>2</sub> budget with a benefit program could be a way to reinforce the use of public transport and micromobility, expanding the market for MaaS solutions.



Furthermore, the range of services offered plays a significant role in attracting users. Beyond mobility, the inclusion of catering, leisure, and other optional services have the potential to generate additional revenue streams and makes the system more appealing, and therefore profitable. However, as indicated in Figure 5a, the achievement of the integrated mobility solution garners greater focus than additional services. Nevertheless, a vast amount of valuable data is produced in the ecosystem, which can help better understand the different customer segments and forecast their development in the future. But for these services to be effectively used, the platform should prioritize convenience, easy and secure payment options—including optional payroll deductions for corporate customers—and comprehensive geographical coverage.

The MaaS orchestrator commonly receives commissions from the mobility providers for additional private and corporate customers, where corporate customers typically pay a set-up and maintenance fees.

Figure 10: Demand module



Source: Deloitte’s Mobility-as-a-Service Model, 2023

### 2.1.2 Platform module (interaction with IT solution owner)

The (technical) platform is the digital interface where demand meets supply. A well-designed platform should seamlessly integrate various assets and services while offering a user-friendly experience. It serves as the operational hub, crucial for data analysis, payment processing, and overall system management. Therefore, in successful ecosystems (Figure 6), platform functionality is of above average importance – unlike platform technology, which is basically already in place.

Platform interactions may exist between the orchestrator and an IT solution owner. However, the orchestrator of a MaaS ecosystem can also be the owner of the used data platform itself (Figure 11a). That depends on the level of frontend and backend solutions needed and the level of complexity the MaaS orchestrator is willing to manage. To better understand this, Figure 11b diagrams the (technical) platform structure with a user-friendly frontend layer, an orchestrator layer, and a backend layer.

A MaaS ecosystem demands a robust, highly efficient, and securely integrated platform that can connect the set of components required to provide a sustainable journey when combining the mobility modes. Individuals expect seamless experiences, as with most day-to-day consumption habits, providing, for example, real-time information to optimize routes and enable easy, reliable use of sustainable modes of transport.

The last generation of MaaS platform should position users at the center of the ecosystem, providing a mobility account across all operators-account-based ticketing—with personal/corporate information and integrated digital fare products. The account-based ticketing concept allows travelers to combine in the same account the payments and tokens used to access different mobility services: transit, parking, tolls, bike sharing, EV charging stations and others.

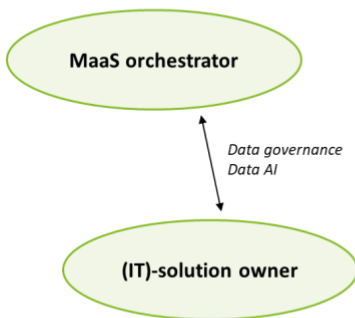
A user-friendly web portal for riders to purchase fares, check travel, history, receipts, and view their carbon footprint is also recommended, as access to multimodal transportation encourages people to choose more efficient options.

Taking advantage of current cloud-based architectures, where real-time information, high volume of data-with clear data governance-, and data privacy and data clustering are not negotiable drivers, the MaaS platform also comprises backend systems. A backend system should have the capacity to collect and make use of real-time data, include a robust and flexible price engine, which, integrated with contract management, can enable dynamic pricing based on modern consumption-based revenue models. People also expect easy-to-use and secure payment gateways that should be fully integrated in the MaaS ecosystem, helping to ensure accurate collection and manage the consequent revenue sharing between the MaaS players.

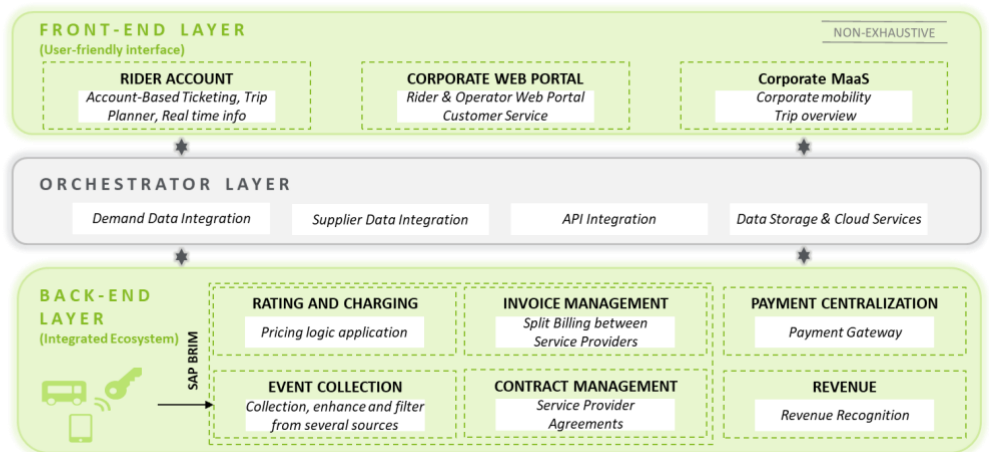
One of our basic assumptions is that a successful MaaS operator is not only a broker of existing offerings but a true system integrator to speed up processes. Therefore, the MaaS operator should not be necessarily the platform owner if it opts to reduce its complexity, but it should have the full data control to run AI-based optimization algorithms or the data governance.

Figure 11: Platform module with interactions based on front and backend complexity

11a: Platform module interactions



11b: Platform complexity layers



Source: Deloitte’s Mobility-as-a-Service Model, 2023

### 2.1.3 Asset module (interaction with investors)

Assets form the backbone of MaaS operations. Our previous analysis underscored the importance of the asset collaboration variable, revealing that top performing MaaS ecosystems enrich their offerings through relationships with asset operators or owners (Figure 6). This can allow for a more diversified and efficient use of resources, from vehicles to parking spaces, contributing to the ecosystem's success and resilience. But also, the importance of asset management and refinancing is becoming increasingly pronounced. Deloitte's 2023 study on the future of automotive mobility ([LINK](#)) indicates that by 2035, just within the EU4 (France, Germany, Italy and Spain), there could be an up to 57% increase in demand for asset refinancing. This corresponds to a surge in refinancing volume of €161 billion from 2023 to 2035.

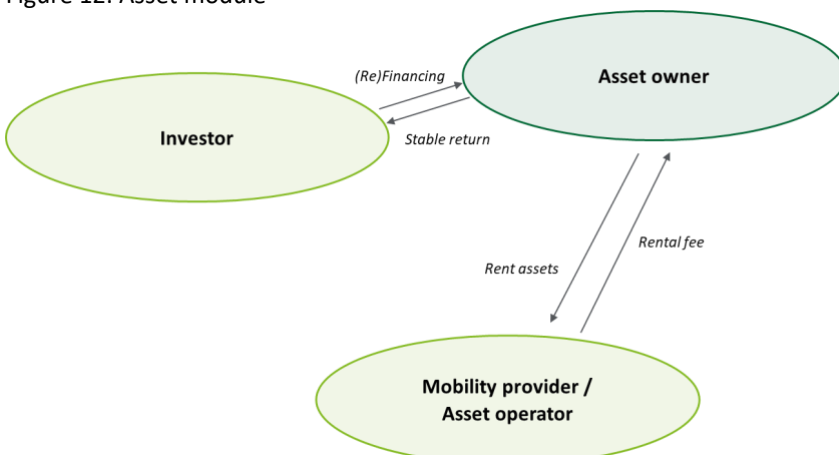
Yet, traditional methods like asset-backed securities are nearing their limits, accelerating the need for innovative financing models. MaaS orchestrators, including cities, are encouraged to explore new collaboration strategies and concepts for the refinancing of future mobility assets. It is likely unrealistic to believe that the cities have enough capital to quickly invest in missing transportation modes and routes. In addition, it is questionable whether they can bear and manage the residual value risks of the assets. In this context, a separate (private) investor could be useful, converting existing funds into investment vehicles. Stable returns, rental fees and asset rent agreements would need to be managed.

Lastly, effective asset management extends beyond ownership and brings into focus three essential aspects:

- **Asset life-cycle management:** Managing an asset from acquisition, through usage to disposal, optimizing its value and performance throughout its lifespan.
- **Asset utilization:** Real-time tracking (e.g., with telematics) and performance metrics enable more precise valuation and refinancing strategies.
- **Market collaboration:** Forming alliances with asset owners/operators can not only facilitate effective utilization but can also broaden refinancing options.

Thus, the intersection of innovative asset collaboration, detailed asset management, and adaptive refinancing models are likely to set the stage for the leading MaaS providers of the future. The goal is to optimize the use of capital, meet regulatory requirements, and adapt to technological and market changes, all while aiming for sustainable growth.

Figure 12: Asset module



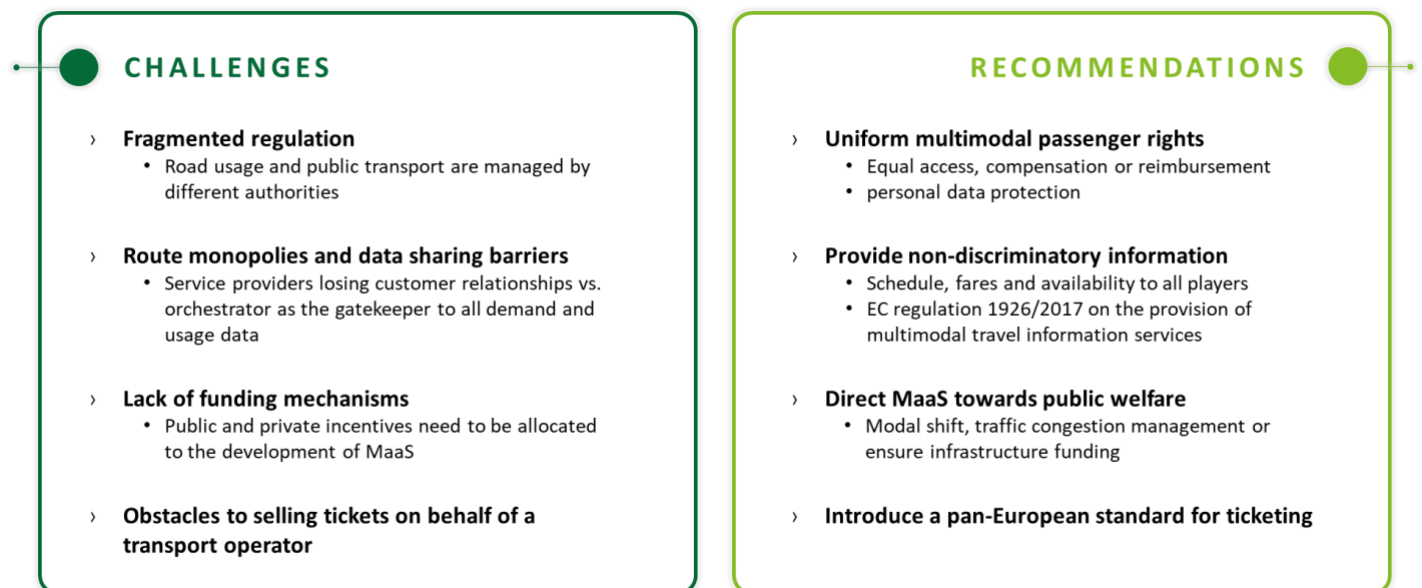
Source: Deloitte's Mobility-as-a-Service Model, 2023

## 2.1.4 Public-private module (interaction with cities and government)

Our analysis (Figure 5b) found an overall increased emphasis on relationships over the considered timeframe. Public-private collaboration is vital to navigating complex regulatory landscapes and the implementation of large-scale projects that have the potential to benefit the public. Collaboration helps ensure that involved parties leverage their strengths to build MaaS ecosystems that are profitable and serve the public interest.

Public-private collaborations are the cornerstone of any MaaS ecosystem. There's no MaaS solution without the participation of public entities, and at the same time public entities are likely to encounter great challenges without the support and investments that private enterprises can deliver. Hence, cooperation between public and private enterprises is key for the success of the MaaS model in line with Figure 9's public-private module. Some experiences of Deloitte's work in that area are presented in Figure 13.

Figure 13: MaaS-public-private challenges and recommendations



Source: Deloitte's Mobility-as-a-Service Model, 2023

Transportation is heavily regulated to reduce risks to users. Many transport operators have licensing agreements in place that determine how their tickets can be sold. And organizations need to allocate resources for complying with these agreements. So, it is important to create consistent multimodal standards, and Switzerland is a good example of a jurisdiction that has done just that. MaaS thrives on the seamless integration of various transportation modes, and cities like Zurich ([Source](#)) have embraced intermodal ticketing, allowing passengers to use a single ticket for multiple modes of transportation. This integrated approach simplifies the user experience and encourages cooperation between public and private entities, thereby accelerating MaaS adoption.

The European Union also played a crucial role in enabling and promoting MaaS solutions across the EU. Regulations like the Directive 2010/40/EU established a framework for Intelligent Transport Systems (ITS) in the field of road transport, as well as their integration with other modes of transportation. A key aspect of this initiative is the standardization of data exchange formats. This involves defining common data structures and protocols for sharing transportation-related information. When data is consistently formatted it becomes much easier for MaaS service providers to access and use this data effectively. The emphasis on common standards and data formats fosters interoperability between different transportation systems and services. This interoperability is a fundamental requirement for the successful implementation of MaaS solutions. When data is open and accessible in a consistent way, it becomes easier for MaaS providers to create integrated services that combine various modes of transportation.

However, there's still a lack of funding mechanisms in place to speed up MaaS adoption. Incentives are crucial for accelerating a societal shift from using cars to alternative modes. To encourage the transition, governments and relevant stakeholders can introduce various incentives. Tax incentives can play a pivotal role in promoting electric and shared mobility. These incentives might include tax breaks or subsidies for electric vehicles, carpooling services, or other benefits for companies that provide MaaS solutions. In addition, low emission zones and limited traffic zones could restrict or penalize the entry of high-emission or nonessential vehicles in specific urban areas. Policies like these can help reduce pollution and congestion, making it more appealing for people to choose cleaner and more efficient transportation modes, accelerating the MaaS model adoption. Aligning these incentives with long-term climate goals, such as the EU's climate-neutral 2050 strategy, is essential. These strategies could help policymakers work toward the development of more sustainable and climate-friendly transportation systems and accelerate MaaS adoption by public and private entities.

## 2.2 Defining the right governance structures

The four modules of an initial MaaS operating model blueprint should be optimized individually to avoid overcomplexity; rather start with minimal viable solutions. However, to help secure the viability of the total construct, and not only a part of it, there is a need for a governance structure for the whole MaaS ecosystem. Therefore, in figure 14 the main matters to be governed in an ecosystem are summarized.

Figure 14: Governance issues in (MaaS) ecosystems

General approach	Coupling of activities	Partner management
<p><b>Develop a governance approach with buy-in of all MaaS stakeholders</b></p> <ul style="list-style-type: none"> <li>• E.g., like a collaboration model of a professional service firm combining individual performance orientation with collective development for a joint (own) company</li> <li>• Focus on predictable standards, de-risking of activities and collective identification of options</li> </ul>	<p><b>Define a right balance between</b></p> <ul style="list-style-type: none"> <li>• Tight coupling (focus in asset specificity or lock-in effects)</li> <li>• Loose coupling (thin interfaces, new solutions in all network areas)</li> <li>• Effective governance through rules</li> <li>• Investment in relation-specific assets</li> <li>• Interfirm knowledge sharing</li> </ul>	<p><b>Combine</b></p> <ul style="list-style-type: none"> <li>• Variety                             <ul style="list-style-type: none"> <li>– Use of modular approaches for variants (e.g., via libraries)</li> <li>– Financing schemes</li> <li>– Sales and marketing support</li> </ul> </li> <li>• Focus                             <ul style="list-style-type: none"> <li>– Certification processes for all (new) stakeholders</li> <li>– Third-party verification</li> <li>– Training centers</li> </ul> </li> </ul>

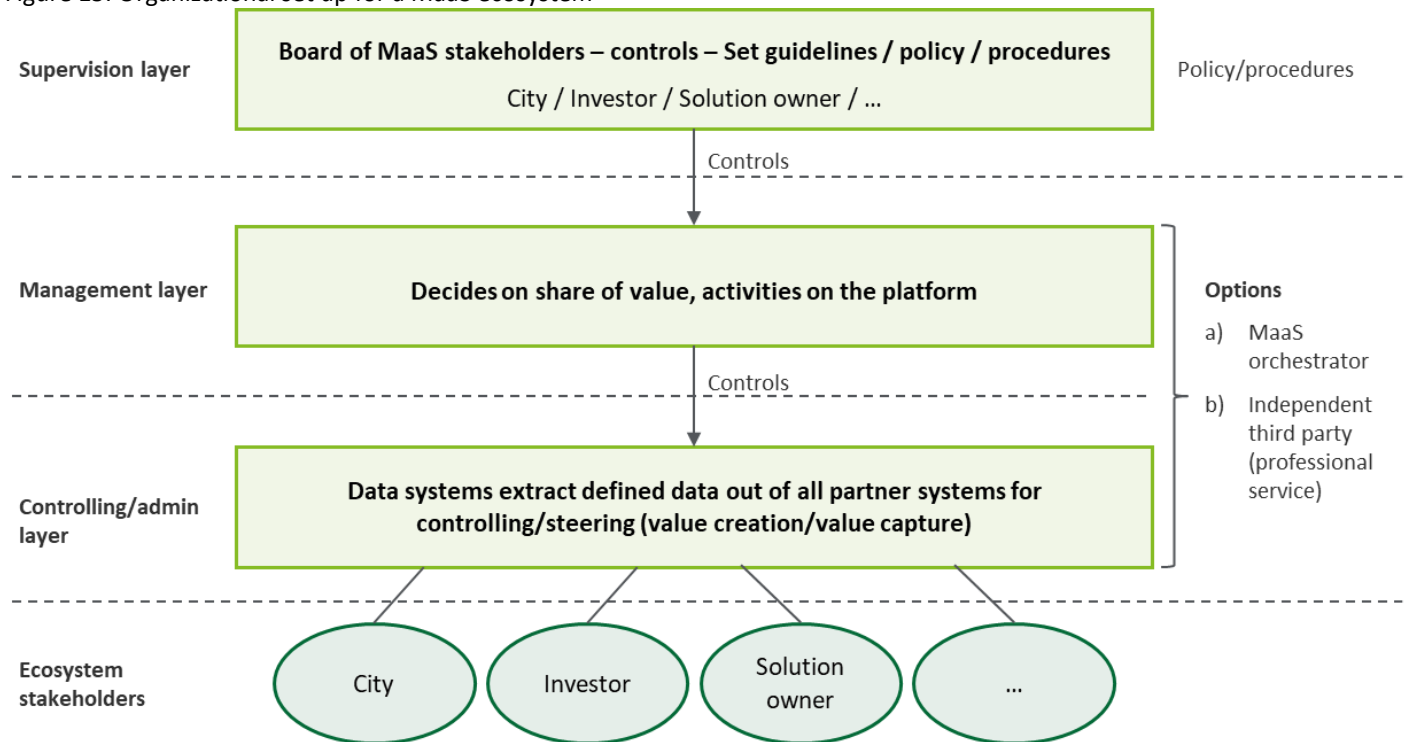
Source: Deloitte's Mobility-as-a-Service Model, 2023

The governance task can be divided into three main areas. The general governance of a relationship model with high-level collaboration and joint risk mitigation efforts should be defined. Based on this foundation the coupling of the joint activities via rules, interfaces or knowledge sharing is important. The difficult question of how to handle the tradeoff between variety and focus on the party management is the third main governance challenge.

Figure 15 shows how the tasks shown in Figure 14 can be arranged in an organizational structure. Platform-based ecosystems may have an advantage—if done correctly from the beginning—data for steering, reviews and evaluations and governance can be made available. Of course, the willingness to share that data by the ecosystem stakeholder is sometimes limited, as mentioned above. However, without it, trust can be difficult to generate and without trust, most ecosystems will likely encounter challenges. The outline of a MaaS governance in Figure 15 is rooted in workable examples of multilateral joint ventures. The ecosystem stakeholders work together with an administration/controlling layer that - based on the data flows out of Figures 7-9 – extracts transparency and information for steering and controlling done by the management layer. This layer makes decisions about the share of value for the individual ecosystem stakeholders or new activities on the platform. Both layers can be done by the MaaS-orchestrator or an independent third party (e.g., a professional service organization) that could engender trust by providing assurance services. The management layer will be controlled by the supervision layer where ecosystem stakeholders are represented. Here, the guidelines, policies, and procedures of the MaaS ecosystem developed by the MaaS orchestrator would be discussed and reviewed.

This organizational arrangement should be differentiated to reflect individual situations but can serve as a starting point for establishing ecosystem governance structures.

Figure 15: Organizational set up for a MaaS ecosystem

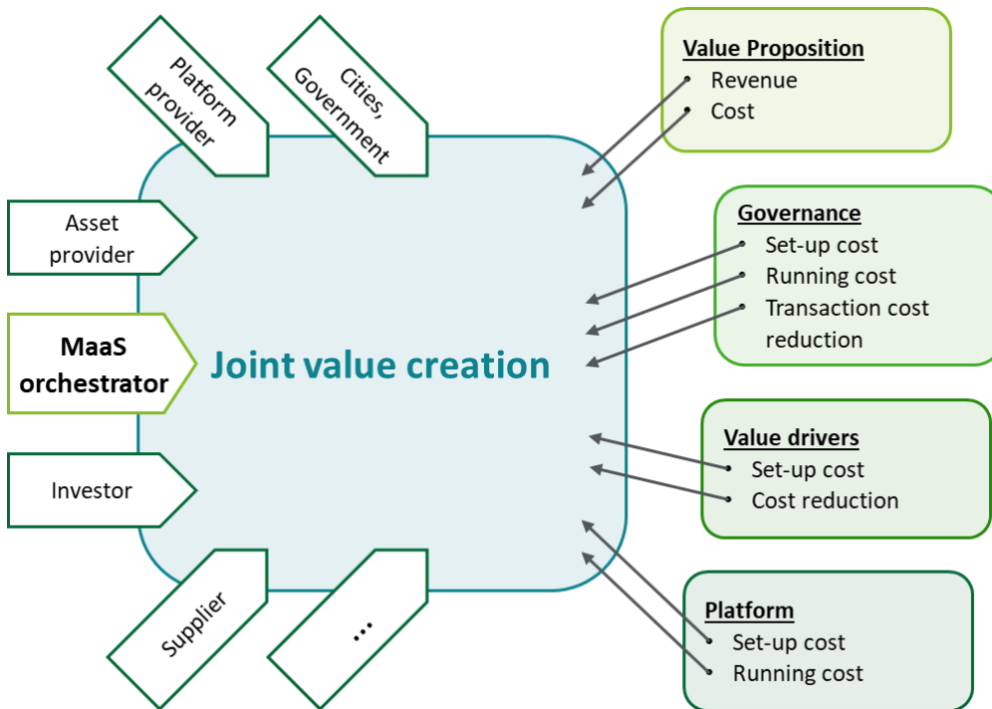


Source: Deloitte’s Mobility-as-a-Service Model, 2023.

### 2.3 Generate value for all ecosystem partners

Most existing MaaS initiatives have shown limited profitability so far. What is needed is a stronger focus towards the creation of a solution that allows for a positive joint value creation. The data and financial flows outlined in the above presented sections are essential for achieving this goal, but it's not automatic; managing an ecosystem is a complex task. Effective translation of these data flows and governance mechanisms can lower internal transaction costs, although it will incur some administrative expenses for setting up and operating the structure illustrated in Figure 15. This transition is broadly depicted in Figure 16. The goal isn't just to make existing processes more efficient, but to strategically transform the ecosystem in a way that long-term, mutually beneficial profitability becomes a reality

Figure 16: Transition toward an MaaS ecosystem that creates value for all partners



Source: Deloitte's Mobility-as-a-Service Model, 2023

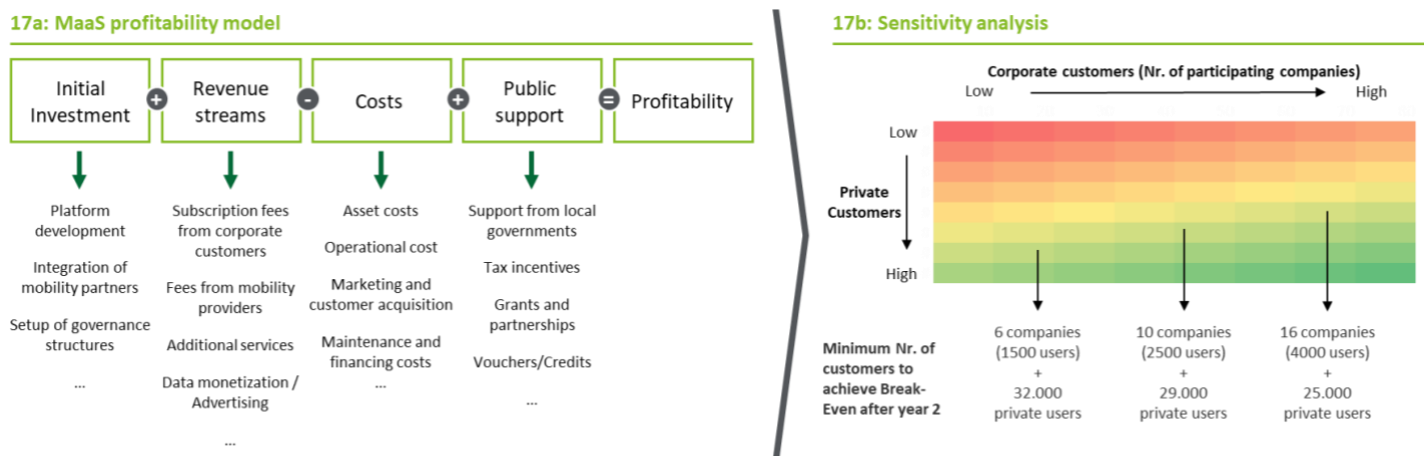
## 2.4 Profitability of a MaaS ecosystem

The integration of the four key modules—demand, assets, platform, and public-private collaboration and their governance—are crucial for the successful rollout of a MaaS solution. Based on the analysis presented above we have developed a high-level financial framework designed for assessing its economic viability. At the core, we can examine several revenue streams and cost variables following an initial investment (Figure 17a). Revenue is derived not only from the transactions by private and corporate users on the platform but also from additional avenues, as outlined in the demand chapter. These can vary from value-added services to potential subsidies from government bodies. Alternatively, the cost components encompass both operational and capital expenditures required to operate and maintain the MaaS platform. An initial estimate of economic viability can be generated (see Figure 17a), enabling stakeholders to make informed adjustments to strategies for long-term profitability and sustainability.

Once the initial framework is in place, sensitivity analyses can be conducted to understand the combined traffic requirements from both private and corporate customers to achieve break-even (see Figure 17b). Adjusting cost and revenue models, as well as the evaluation timeframe, allows for insights into the necessary user base for a minimum viable solution. It also helps in identifying which additional services and revenue streams—or subsidies—can enhance profitability. This flexibility enables the framework to adapt to various business models and platform participants.

For instance, based on our current assumptions and revenue models, a sensitivity analysis shows that acquiring one corporate customer can achieve approximately the same profitability as acquiring two to three times as many private customers. Therefore, MaaS systems currently focused on financial flows (Figures 5b,d) should prioritize corporate customers to optimize their returns. Furthermore, it endorses the premise that orchestrators need to find new concepts to finance and manage fleets and other assets, as depreciation and other asset-related costs can greatly affect their financial model. Thus, this analysis can be used and expanded in the future for initial scoping activities to optimize the probability and get to an economically viable MaaS operating models and, with them, ecosystems.

Figure 17: High-level profitability model for a MaaS ecosystem



Source: Deloitte's Mobility-as-a-Service Model, 2023  
 Note: Numbers on figure 17b not exhaustive and rounded for visualization purposes



### 3. Conclusion and outlook

“If a trend becomes obvious you are too late.” This famous statement by Steve Jobs is also valid for the potential US\$500 billion market for new smart mobility in the year 2030 (cf. Deloitte, 2021). The findings from this report indicate that the MaaS sector is maturing and is marked by greater emphasis on comprehensive operating models, scaling and governance. Although the sector has yet to fully recover from the pandemic's impact, with geopolitical factors slowing its rebound, there is optimism for rapid expansion. Technological advancements, growing urban populations, and escalating sustainability concerns are driving this positive outlook.

Top-performing MaaS ecosystems appear to have addressed fundamental challenges like data flows, interactivity, and financial logics. This allows them to concentrate on scaling and complex operational issues.

It is now time to define one's strategy to avoid missing out. Both the MaaS-NLP data set and the presented blueprint of a MaaS operating model and its governance serve as resources for understanding the current MaaS landscape and its future trajectory. They offer a foundational steppingstone for further inquiries and discussions in this fast-paced, ever-changing field, while also acting as a roadmap for years to come.

# Introduction



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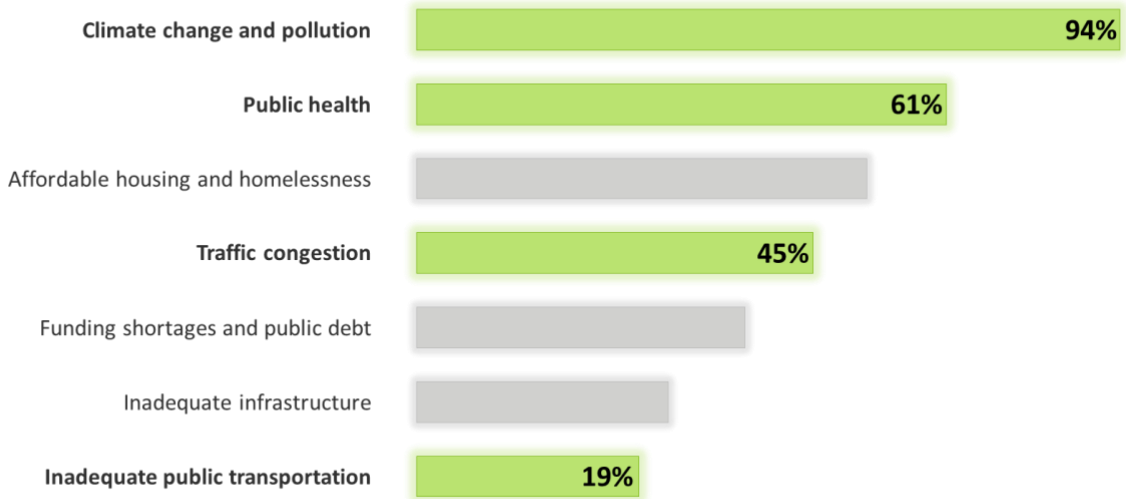
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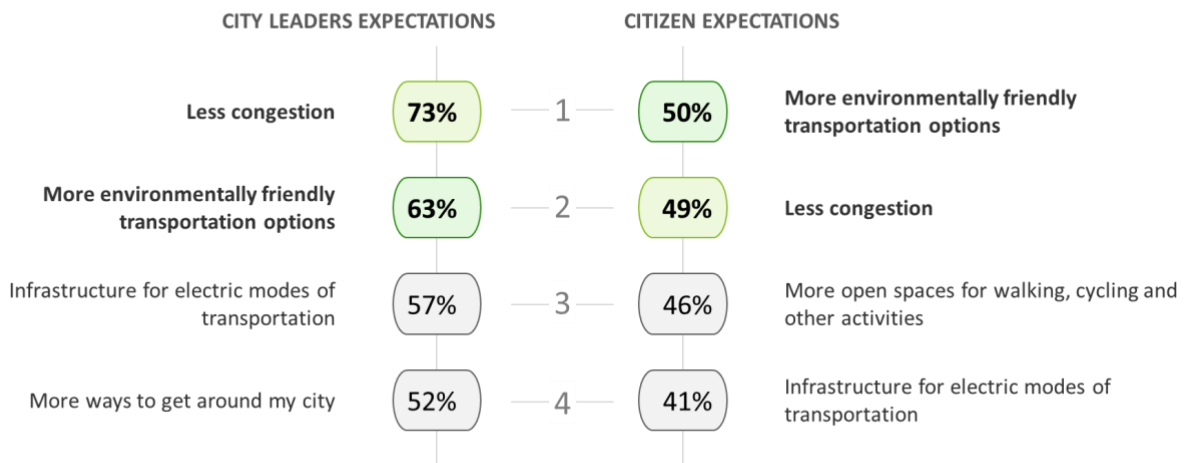
# Appendix

OVER 2000 CITIZENS AND CITY LEADERS IDENTIFIED THE FOLLOWING CHALLENGES:



Source: Deloitte-ThoughtLab Global City Survey (2022)

THEIR EXPECTATIONS DIFFERED IN TERMS OF NEXT STEPS FOR MOBILITY:



Source: Deloitte-ThoughtLab Global City Survey (2022)

Table 1: MaaS ecosystems selected for the analysis of high-impact practices (figure 6)

<b>Provider</b>	<b>Unique selling proposition</b>	<b>City pairing with most mentions from matrix</b>
<b>Provider 1</b>	User, asset, and station growth, stemming from public transport company, scalability, and synergies due to strong collaboration with public administration	Berlin
<b>Provider 2</b>	Pioneering role, years in operation, scaling of active users and geographical expansion, high level of integration (based on integration level model by Sochor et al. (2018))	Helsinki
<b>Provider 3</b>	White label solution capable of deploying in different geographies, highly scaled user basis, role of mobility data provider	London
<b>Provider 4</b>	Global player integrating modes of transport into its own mobility service	London
<b>Provider 5</b>	Integrated modes of transport successfully into solution, significant growth in micromobility, emphasizing potential social welfare provided by MaaS solutions	Chicago

Table 2: Overview of F1 score thresholds and their usability in our analysis

<b>F1 score</b>	<b>Interpretation</b>	<b>Considered for the analysis</b>
<b>&gt; 0.9</b>	Very good	Yes
<b>0.8 - 0.9</b>	Good	Yes
<b>0.5 - 0.8</b>	OK	Yes
<b>&lt; 0.5</b>	Not good	No

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