



**UNIVERSITY
OF TURKU**

Turku School of
Economics

Unravelling the complexity of Mobility as a Service (MaaS): A Systems Thinking Approach

Information Systems Science

Master's thesis

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03.06.2025

Turku

The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin Originality Check service.

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Subject: Information Systems Science

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Number of pages: 47 pages + appendices 17 pages

Date: 03.06.2025

Abstract

Mobility-as-a-Service (MaaS) is a rapidly evolving and user-friendly transport service concept designed to offer an alternative to private car ownership by integrating various modes of transport into a single mobile application. Its development has been driven by digitalization and the growing need for more sustainable mobility solutions in the face of population growth and increasing environmental challenges.

This thesis explores whether MaaS can serve as a solution for reducing private car use and promoting sustainable development. It also examines the future prospects of the MaaS concept in Finland, with a particular focus on the city of Turku. The research was conducted within a systems thinking framework, analyzing what a MaaS system entails and how it functions as a whole.

Empirical data was collected through an online survey targeting two key stakeholder groups within the MaaS ecosystem: consumers and service providers. For consumers, the study examined car usage habits, experiences, and existing knowledge of MaaS services. For service providers, the focus was on business models, future outlooks, and perceived challenges.

The results revealed recurring challenges in both the literature and survey responses: low consumer awareness of MaaS, concerns about security, general lack of interest, and insufficient engagement from service providers. Key development actions identified include user-centered design, extensive awareness-raising, the launch of pilot projects (once market viability improves), transparent data security policies, and stronger political and public support. Increasing consumer knowledge in particular emerged as a potential key enabler for the successful development of MaaS services in Finland.

Overall, it appears that MaaS requires the support of something larger and more systematic to enable its future growth and development. Based on the research findings, it is suggested that the MaaS ecosystem needs the support of external ecosystems to establish a unified foundation for stable growth and customer base development. Examples of such supporting ecosystems include data, AI, and infrastructure ecosystems. In practice, these ecosystems can lend credibility and visibility through their already established customer bases, which in turn strengthens the position of MaaS in future markets – especially from the perspective of both organizations and consumers.

Key words: Mobility as a Service, MaaS, survey research, ecosystem, business models, concept, mobility, sustainability.

Pro gradu -tutkielma

Oppiaine: Tietojärjestelmätiede

Tekijä: Lotte Mäkinen

Otsikko: Liikkumispalvelusovellusten (MaaS) monimutkaisuuden hahmottaminen systeemiajattelun avulla

Ohjaaja: Ph.Lic., Antti Tuomisto

Sivumäärä: 47 sivua + liitteet 17 sivua

Päivämäärä: 03.06.2025

Tiivistelmä

Mobility-as-a-Service (MaaS) on nopeasti kehittyvä ja käyttäjäystävälliseksi suunniteltu liikkumispalvelukonsepti, jonka tavoitteena on tarjota vaihtoehto yksityisautoilulle kokoamalla eri liikennemuodot yhteen mobiilisovellukseen. Kehitystä ovat vauhdittaneet digitalisaatio ja tarve kestävimille liikkumiskäytännöille kasvavan väestön ja ympäristöhaasteiden keskellä.

Tässä tutkielmassa selvitetään, voiko MaaS toimia ratkaisuna yksityisautoilun vähentämiseksi ja kestävä kehityksen edistämiseksi. Lisäksi tarkastellaan MaaS-konseptin tulevaisuudennäkymiä Suomessa, erityisesti Turun kaupungissa. Tutkimus toteutettiin systeemiajattelun viitekehyksessä, jossa analysoitiin, mitä MaaS-järjestelmä ylipäänsä pitää sisällään ja miten se toimii kokonaisuutena.

Empiirinen aineisto kerättiin verkkokyselyllä kahdelta kohderyhmältä: kuluttajilta ja palveluntarjoajilta. Kuluttajien osalta selvitettiin yksityisautoiluttumuksia ja kokemuksia sekä aiempaa tietämystä MaaS-palveluista, kun taas palveluntarjoajilta kartoitettiin mm. liiketoimintamalleja, tulevaisuudennäkymiä sekä koettuja haasteita.

Tulokset osoittivat, että sekä kirjallisuudessa että kyselyn vastauksissa nousi esiin samankaltaisia haasteita: kuluttajien heikko tietoisuus palveluista, turvallisuushuolet, yleinen kiinnostuksen puute sekä palveluntarjoajien vähäinen osallistuminen. Keskeisiksi kehitystoimiksi esitettiin käyttäjälähtöistä suunnittelua, tietoisuuden runsasta lisäämistä, pilottihankkeita (kun markkinarako on saatu tarpeeksi kannattavaksi), läpinäkyviä tietoturvakäytäntöjä sekä vahvempaa poliittista ja julkista tukea. Erityisesti kuluttajien tietämyksen lisääminen nähtiin yhdeksi mahdolliseksi avaintekijäksi MaaS-palveluiden menestykselle kehitykselle Suomessa.

Kokonaisuudessaan näyttää siltä, että MaaS tarvitsee tuekseen jotain isompaa ja systemaattisempaa, jotta kasvu ja kehittyminen olisivat mahdollisia tulevaisuudessa. Tutkimuksen perusteella esitetään, että MaaS-ekosysteemi vaatii ulkopuolisten ekosysteemien tukea yhtenäisen perustan luomiseksi vakaata kasvua ja asiakaskunnan kehittämistä ajatellen. Tällaisia tukevia ekosysteemejä voivat olla esimerkiksi data-, tekoäly ja infrastruktuuriekosysteemit. Käytännössä ne tuovat uskottavuutta ja näkyvyyttä ekosysteemeistä, joilla on jo vakiintunut asiakaspohja ja tämä puolestaan parhaimmillaan voi vahvistaa MaaS:n asemaa tulevaisuuden markkinoilla etenkin organisaatioiden ja kuluttajien näkökulmasta.

Avainsanat: Mobility as a Service, MaaS, kyselytutkimus, ekosysteemi, liiketoimintamallit, konsepti, mobiliteetti, kestävyys.

TABLE OF CONTENTS

1	Introduction	8
1.1	Background of the research	9
1.2	Introduction of the research question	9
1.3	Scope of the research area	10
1.4	Structure of the research	10
2	Literature review	12
2.1	What is MaaS?	12
2.1.1	Challenges and barriers related to MaaS development	13
2.2	The Mobility as a Service ecosystem	14
2.3	Sustainable MaaS	17
3	Stakeholder analysis	19
3.1	Stakeholder analysis (SA) as a process	19
3.2	Stakeholder analysis in this study	20
4	Methodology	21
4.1	Survey design	21
4.1.1	Testing	22
4.2	Consumer survey	22
4.2.1	Background information	23
4.2.2	Mobility habits	23
4.2.3	Knowledge and experience with MaaS services	23
4.2.4	Expectations from MaaS services	24
4.2.5	Open-ended questions	24
4.3	Service providers	24
4.3.1	Business models and operations	25
4.3.2	Ecosystem and partnership	25
4.3.3	Challenges and opportunities	25
4.3.4	Future directions	26
4.3.5	Open-ended questions	26
5	Data analysis	27
5.1	Consumers	27
5.1.1	Demographics	28

5.1.2	Mobility habits	28
5.1.3	Knowledge and experience with MaaS services	28
5.1.4	Expectations from MaaS-services	29
5.1.5	Innovation and development ideas	31
5.2	Service providers	32
6	Discussion	34
6.1	Reflections on consumer observations	34
6.2	Service providers' perspectives	35
6.3	Integration and significance of findings	35
7	Conclusions	37
7.1	Research summary	37
7.2	Solving the Chicken-or-Egg dilemma with systemic thinking	39
7.3	Practical measures based on the findings	42
7.4	Limitations of the study	43
7.5	Suggestions for future research	44
	References	45
	Appendices	48
	Appendix 1: Customer survey layout	48
	Appendix 2: Service providers survey layout	57
	Appendix 3: Usage of AI	65

LIST OF FIGURES

Figure 1: An edited version of MaaS ecosystem by Kamargianni and Matyas (2017, p. 7) **15**

LIST OF TABLES

Table 1: Systemic thinking matrix **40**

1 Introduction

Nowadays, technology enables nearly all services to be accessible to people around the clock.

Whether it concerns banking, entertainment services, health concerns, or even travel, all of these can almost without exception be managed anywhere and anytime with a smartphone or another portable device.

When it comes to mobility and travel, developments in recent years and decades have been significant and rapid. There is no longer a need to visit a travel agency in person to book vacations or to own a personal car to move freely without schedule constraints. The excessive growth of the global population in relation to the planet's capacity has also brought sustainability and increasing environmental strain to the forefront. One of the major global issues is related to private car use, from cities' limited traffic infrastructure to the pollution caused by internal combustion engine vehicles. Although car manufacturers have been increasing the production of more environmentally friendly electric vehicles, the road to a carbon-neutral planet remains long and challenging.

In Finland, public transportation is highly seamless and operates via waterways, railways, and roadways. Despite the growing popularity of public transport among citizens, private car use remains a fundamental part of many people's daily lives. The freedom and convenience of independent travel continue to attract people to private cars.

This study delves into whether Mobility as a Service (MaaS) can serve as a solution for reducing private car usage and thereby improving sustainability. It also examines the future of the MaaS concept in Finland, with a particular focus on the city of Turku. Over the past decade, MaaS has taken on a more significant role globally, particularly in urban areas, but its flexibility and adaptability have also made it relevant in less densely populated regions. The concept is fundamentally designed as a user-friendly alternative to private car ownership, where all services are available through a single mobile package, such as an application. Jittrapirom, P. et al. (2017) compare such a service to a monthly mobile subscription plan.

MaaS has been under scrutiny for over a decade, and extensive trials have been conducted worldwide—some of which are still actively in operation, while others have been discontinued. Developing a system like MaaS is complex due to its intricate structure and the large number of stakeholders involved. There are numerous variables to consider, such as how to make a system which is easy to use for customers.

The research problem of this thesis is approached from a system perspective—examining what exactly constitutes a "MaaS system", what it includes, and how it functions as a whole. Without delving too deeply into the technical aspects, our understanding of the subject is built through stakeholder analysis, a literature review, and empirical research conducted via surveys targeted at key stakeholders. The goal is to gain insight into the role of stakeholders within the MaaS ecosystem and, conversely, how the role of MaaS manifests within these stakeholders' internal ecosystems.

1.1 Background of the research

The background of this research stems from a desire and interest in understanding the complexity of the MaaS system through systems thinking, as well as identifying the various components that make up such a system. Understanding the ecosystem helps to visualize where we currently stand, why and in which direction we could or should be heading in terms of MaaS.

Another point of interest is why MaaS, which has been proven to work in Finland, has not gained a foothold in citizens' daily lives and why previously tested concepts have failed. After all, MaaS has been recognized as a part of the future of mobility. But what does this future actually entail? What is the role of humans and local and global societies within this system from daily mobility behaviour to temporal and ad hoc needs?

1.2 Introduction of the research question

The research problem is approached by addressing the following main question and its related sub-questions:

Research Question:

What does the Mobility as a Service (MaaS) ecosystem look like from the perspective of local stakeholders, and how does this ecosystem reflect the current state and future development directions of MaaS services?

Sub-question 1:

Who are the key stakeholders in the MaaS ecosystem, and how do they collaborate?

Sub-question 2:

What challenges or opportunities do stakeholders perceive in the development of MaaS?

This study aims to provide a comprehensive overview of how MaaS companies operate today and what their future outlooks are. MaaS serves as the framework for this research, which ultimately delves into the ecosystem structure through stakeholders, revealing details about the current state and future of MaaS.

In addition to examining other central variables, the study seeks to explore the role of information technology, mobile solutions, and potential artificial intelligence applications within the MaaS ecosystem. It aims to understand how MaaS systems are built and what key components they consist of. It is evident that the MaaS concept is driven by the necessity of human mobility, environmental concerns, costs, risks, and business models. This research strives to understand all these components and variables both as an integrated whole and as individual elements.

1.3 Scope of the research area

The research focuses on examining the situation in Finland, specifically in the city of Turku. The findings of this study may not necessarily apply to the current situation elsewhere in Finland or globally.

The stakeholders are limited to those specifically defined in the stakeholder analysis, and the results and analyses do not extend to other entities or industries beyond the mentioned stakeholders.

1.4 Structure of the research

The research consists of chapters divided into an introduction, theory and literature review, research, and conclusions. Below, the structure of the report is described in detail by chapter.

Chapter 1 is the introduction, which presents the background of the study, outlines the research question, and defines any possible limitations related to the research.

Chapter 2 consists of the literature review and theoretical framework. The purpose of this chapter is to provide the reader with a deeper understanding of what MaaS is in general.

Chapter 3 focuses on the stakeholder analysis, detailing and presenting the stakeholders involved in the empirical part of the study. This chapter also discusses the role of stakeholders within the MaaS ecosystem.

Chapter 4 is dedicated to the qualitative research itself. It presents the research methods used and goes through the different stages of the study step by step.

Chapter 5 contains the analysis of the collected data and responses.

Chapter 6 consists of discussions and reflections on the topic.

Chapter 7 is the final chapter, presenting the overall conclusions drawn from the research findings.

2 Literature review

2.1 What is MaaS?

Mobility-as-a-Service (MaaS) is an innovative concept for urban mobility services that has rapidly evolved in recent years. The concept is designed as a user-friendly alternative to private car ownership, where all services are accessible within a single mobile package, such as an application. Jittrapirom et al. (2017) compare such a service to a monthly mobile subscription package. According to Ceccato et al. (2023), the (MaaS) system does not provide access to individual transport products or services but delivers mobility where it is needed.

Implementing a functional MaaS concept is challenging. According to an article by Polydoropoulou et al. (2020), it requires a comprehensive understanding of how to develop a system that supports service providers' business models while also meeting the needs of cities and end-users. Such a complex system consists of multiple building blocks or components. Nemtanu, Schlingensiepen, Buretea, and Iordache (2016) consider information technology and information systems as the foundation and main component of the entire MaaS infrastructure, upon which other elements are built. ICT solutions play a crucial role in integrating and connecting information between users, services, and service providers.

So, how is a traditional MaaS ecosystem structured? Jittrapirom et al. (2020) describe the ecosystem as being based on the interaction of various stakeholders through a digital platform. In practice, this primarily involves mobility service users, (transport) service providers, and platform owners. Other stakeholders may also be involved to facilitate service operations, depending on the context, such as local authorities, payment companies, and telecommunication or IT firms.

Mobility service users in this context refer to end-users, who can range from private individuals to corporate clients, including local residents and tourists. For this group, system usability is particularly important to ensure that anyone can seamlessly access the desired services. Service providers, on the other hand, refer specifically to transport service providers. These can include local public transportation, taxi services, car rental companies, shared electric scooters/bicycles, or even car-sharing services. The available services vary greatly depending on the specific MaaS system in question. Most MaaS systems are local, covering a specific area such as a city or country, like WienMobil in Vienna, Austria (wienmobil.at). In such cases, the service offerings within that

area determine what is available within the system. A study by Jittrapirom et al. (2020) comparing multiple MaaS systems demonstrated that public transport is almost always included as one of the mobility options. Other commonly available services include taxis and bicycle rental services.

Platform owners, in turn, are the entities that own or develop the digital MaaS system. This typically involves a mobile application that operates on smartphones or similar devices, making it portable and accessible whenever needed. These owners are often third-party companies specializing in mobile applications.

Without delving too deeply into the technical side, it is worth mentioning that MaaS systems require various technologies to function effectively. These include devices such as mobile devices (including smart devices), mobile networks, GPS, electronic ticketing and payment systems, database management systems, information security systems and an integrated technology infrastructure (e.g., IoT) (Jittrapirom et al., 2020).

2.1.1 Challenges and barriers related to MaaS development

The large number of stakeholders involved in the development of a MaaS system can present various obstacles and challenges. According to Carbonara et al. (2024), a MaaS system requires seamless data sharing and compatibility with other systems. This has led to a situation where, particularly for companies, the biggest barriers are related to reluctance to share data for system use. Polydoropoulou, Pagoni & Tsirimpa (2020) wrote in their article that this unwillingness to share information with third parties is almost without exception one of the strongest technical barriers to participating in the MaaS concept.

One organizational challenge identified is collaboration among the various stakeholders, as their goals may conflict with each other, preventing seamless cooperation (Carbonara et al., 2024). The reluctance of companies to share data is also one of the main reasons why some MaaS systems are discontinued after the prototype versions.

For consumers, data security concerns emerge regarding location data required by mobile applications, as well as the sharing of personal and payment information with such applications. A multidimensional mobility service application like MaaS inherently requires detailed user information to function correctly and as intended (Polydoropoulou, Pagoni & Tsirimpa, 2020).

Despite these challenges, stakeholders play a key role in the implementation of the MaaS concept. In particular, the number of service providers can be significant, as the offerings typically range

from public transport to taxis and rental cars. Additionally, it is essential to consider consumer preferences regarding the features they value in such a system.

In addition, according to an article by Karlsson et al. (2020), MaaS is situated at the intersection of several policy sectors (sustainability, transport, innovation), which may lead to the responsibility for its promotion being distributed across multiple actors. This, in turn, can create ambiguities regarding political responsibilities and thus hinder the development of MaaS.

2.2 The Mobility as a Service ecosystem

The MaaS ecosystem is built upon actors from both the public and private sectors. In this section, we take a closer look at the ecosystem structure, focusing on specific layers and parties in more detail.

Carbonara et al. (2024) conducted research aimed at examining how MaaS impacts organizations operating within the MaaS ecosystem and how it has affected their strategies and operations. The study revealed that service providers prioritize improving operations through data, user convenience, safety, and the overall travel experience. Changes were also observed in revenue generation models because of the adoption of new pricing strategies, subscription models, and customer programs.

MaaS has also contributed to changes in how new value is delivered to users. In particular, data sharing has become a central element, highlighting the importance of collaboration and interconnectedness within the MaaS ecosystem (Carbonara et al., 2024).

Kamargianni & Matyas (2017) propose that the MaaS ecosystem is constructed from several layers, which are named as core business, extended enterprise, and business ecosystem levels. This study focuses on the core business layer, particularly transport/service operators and customers, while briefly touching on the two outer layers. Next, we will take a closer look at what these layers entail and their purpose in the ecosystem structure. Below is an (edited) illustrative diagram of this structure originally by Kamargianni and Matyas (2017).

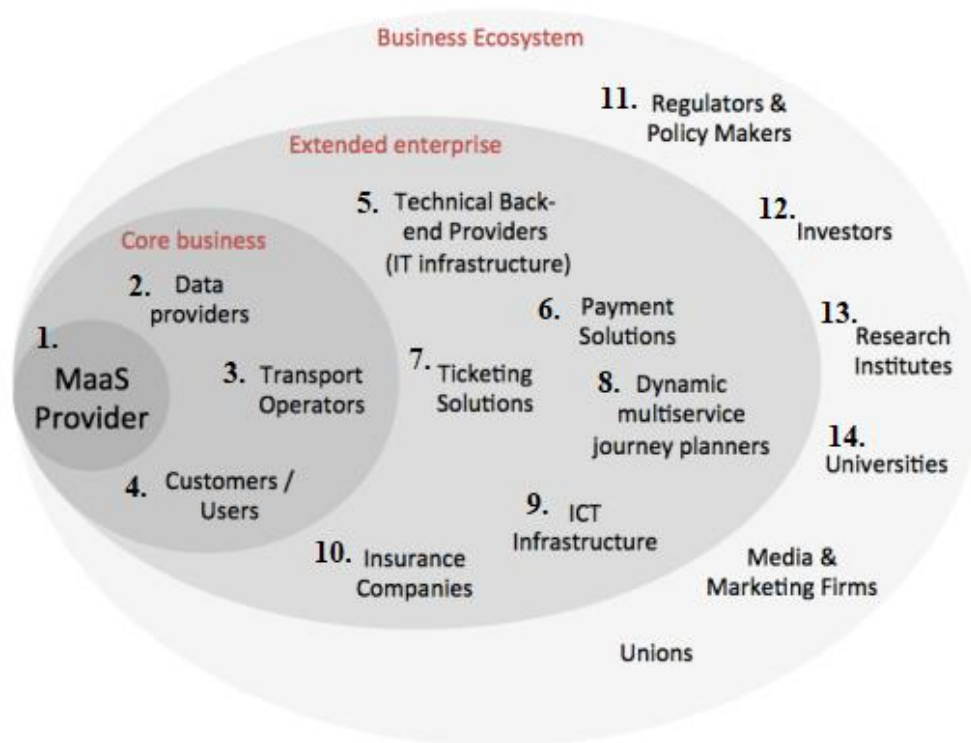


Figure 1: An edited version of MaaS ecosystem by Kamargianni and Matyas (2017, p. 7)

Core business

The Core Business level thus includes the three most prominent stakeholder groups: data providers, transport operators/service operators, and customers. This layer consists of MaaS providers and other key actors who form the core of the business.

Explanation of terms in practice:

A MaaS provider (1.) refers to the actual Mobility-as-a-Service provider itself, such as Whim in Finland or NL in the Netherlands.

A Data provider (2.), on the other hand, is any entity that supplies necessary data. In the MaaS context, this typically includes companies that offer mobility services, as they provide customer data as well as other information related to movement. Other data providers can include for example parking service providers, map and navigation service providers, and weather service providers. Each of these contributes their share of essential data to the MaaS ecosystem.

Transport operators (3.) are specifically those companies that offer mobility services—such as public transportation, taxi services, car rental companies, or electric scooter rental services.

Customers / Users (4.) are the end-users of the MaaS system. They can be people of any age from children to the elderly (Kamargianni & Matyas, 2017).

Extended enterprises

The Extended Enterprises layer broadens the perspective of the companies' supply chain. In the MaaS ecosystem, this includes technical background service providers (IT infrastructure), companies providing ticketing and payment solutions, ICT infrastructure, and insurance companies.

Technical Back-end Providers and IT Infrastructure (5.) are a critical part of the functioning of MaaS models and include, for example, the availability of big data and cloud computing. These form the layer upon which the entire system is built.

Payment Solutions (6.) are solutions that offer various payment options within the service, for example through bank cards or even smartphones. The same applies to Ticketing Solutions (7.), which enable the storage of tickets, for example, via a digital wallet.

Dynamic Multiservice Journey Planner Providers (8.) refer to travel planning using real-time information and multiple transportation options. This type of service is almost essential in a system like MaaS, where the aim is to provide a time-saving and convenient alternative for mobility.

ICT Infrastructure (9.), in turn, is critical for all MaaS operators, as users must be able to access the service in real time via a mobile device or website. The MaaS operator must therefore be able to transfer customer data in real time, which requires a fast and stable internet connection.

Insurance Companies (10.) are responsible for keeping both the customer and the service provider safe in problem situations, thus helping to avoid issues that would require legal assistance (Kamargianni & Matyas, 2017).

Business ecosystem

The outermost layer, the Business Ecosystem layer, adds regulators, labor unions, universities and other research institutions, as well as investors to the ecosystem. These actors can have a significant impact on the success of the MaaS model, even though they may not be directly involved in the business operations.

Regulators and Policy Makers (11.) are a vital key actors in the MaaS ecosystem, even though they are positioned on the outermost layer. Their role is to create policies and regulations that must be followed in order to be in the markets. Examples include data protection regulations such as the GDPR.

Investors (12.) enable the development of MaaS. These investors can include both private investors and public funders who participate in the operations.

Universities (14.) and **Research Institutes (13.)**, in turn, carry out continuous work to develop MaaS and create new technological innovations. Since MaaS is still a relatively new concept, all research contributes to its future development (Kamargianni & Matyas, 2017).

2.3 Sustainable MaaS

The goal of the Mobility as a Service (MaaS) concept is to offer a seamless alternative to private car ownership in situations where transportation is required. We are living in a time when it is crucial to reflect on the strain we are placing on the planet and to consider what kind of future we may face if we continue along the current path. Climate change is a real and pressing issue, and every effort—particularly those that reduce the reliance on private cars—can be seen as a step in the right direction. In Finland, the national Climate Act mandates that the country must become carbon neutral by 2035 (Ministry of the Environment, ym.fi). Additionally, Finland is bound by the European Union's climate and energy legislation and related political decisions (Ministry of the Environment, ym.fi).

How does MaaS take sustainability into account, and how can these issues be integrated into its development?

According to Future Mobility Finland, a leading company working on MaaS in Finland, emissions from transport and mobility must be reduced to mitigate climate change. Sustainable development and carbon neutrality should be foundational principles of today's mobility and logistics solutions from the outset. Cruz and Sarmiento (2020) argue that MaaS services are characterized by greater flexibility due to their reliance on the sharing economy, while simultaneously offering lower greenhouse gas emissions. This, in itself, signals a transformation in the traditional transport system. MaaS is seen as an ecosystem that can offer (for example through incentive-based regulations) a way forward for governments and other parties to achieve a wide range of sustainability objectives (Hensher, 2024).

Research by Ceccato et al. (2023) shows that the sustainability potential of MaaS systems strongly depends on their design: offering diverse, door-to-door mobility solutions and integrating public transportation into service packages promotes sustainable usage. At the same time, it is crucial to avoid shifts from more sustainable modes of transport—such as cycling and walking—to less eco-friendly alternatives. In this way, MaaS can genuinely support environmental goals and sustainable urban mobility in the future.

For example, as an alternative to driving alone, MaaS is expected to have positive impacts such as reducing car ownership, lowering the number of kilometers driven and the need for parking space, and improving accessibility and equity (Ceccato et al., 2023).

Artificial intelligence (AI), in turn, can either strengthen or weaken sustainability goals, depending on how and by whom it is ultimately governed, according to Servou, Behrendt, and Horst (2023). Achieving sustainable mobility requires decision-making based on collaboration between humans and AI, transparency, the definition of common goals, and democratic accountability (Servou, Behrendt, and Horst, 2023).

In what ways could AI strengthen more sustainable mobility?

AI is a key driver in data-driven Mobility-as-a-Service (MaaS) systems, assisting, for example, in demand prediction, service integration, and the optimization of transport systems. These functions can promote more sustainable mobility by reducing emissions and improving accessibility.

However, as with all uses of AI, the use of AI in the context of MaaS also carries risks, such as a lack of transparency and accountability, as well as threats related to "algocracy," meaning governance driven by algorithms. (Servou, Behrendt, and Horst, 2023).

Algocracy refers to a situation where key decisions are guided and made by algorithms instead of humans. In the worst case, this can lead to inequality and unfair decision-making.

3 Stakeholder analysis

3.1 Stakeholder analysis (SA) as a process

Reed et al. (2009) present stakeholder analysis (SA) as a process aimed at identifying and assessing the influence and interests of key individuals, groups, or organizations that may be affected by a project/phenomenon or that may influence the project/phenomenon or decision-making. The analysis helps to understand stakeholders' needs, expectations, and potential impacts on the success of various aspects.

The key benefits of stakeholder analysis include:

- **Improved communication and collaboration among stakeholders.** A carefully conducted stakeholder analysis facilitates working with stakeholders, leading to more efficient project management.
- **Conflict resolution and risk management.** By identifying and understanding stakeholders' interests and needs, unexpected conflicts and contradictions can be avoided.
- **Enhanced decision-making capabilities.** Understanding and incorporating different stakeholders' perspectives into decision-making generally leads to more informed and balanced decisions.

Hench and Secchi (2009) outline the traditional initial steps in conducting a stakeholder analysis as follows:

1. **Identifying and mapping stakeholders.** The first step is to recognize key individuals, groups, and organizations that may influence or be influenced by the project/issue.
2. **Determining the weight of stakeholders.** This step assesses how each stakeholder impacts the project/phenomenon.
3. **Categorizing stakeholders.** Reed et al. (2009) emphasize that stakeholders should be categorized to facilitate analysis and decision-making.

In summary, stakeholder analysis is a powerful and flexible tool widely used across various disciplines to identify and assess the influence of key individuals or groups on projects and organizations.

3.2 Stakeholder analysis in this study

The purpose of this study is to examine and analyze the business models and operational practices of various MaaS operators in Turku, Finland and its surrounding areas. Stakeholder analysis is used to identify the key actors that directly influence the studied subject as well as other indirect but significant stakeholders.

In the previous section (Section 2: The MaaS Ecosystem), we outlined the structure of the MaaS ecosystem and potential stakeholders, emphasizing our focus on core operations stakeholders, namely service providers and consumers. By concentrating on these groups, we establish a framework for the research and narrow the scope within this broad subject.

The role of service providers in such a complex system is substantial, as they largely determine the extent of service availability. The selection of service providers was approached with the aim of gathering diverse opinions and perspectives from different types of operators. Given that the geographical scope is limited to a single city and region in Finland, the identification of relevant actors was carried out with this constraint in mind.

The identified groups within the category of mobility service providers include:

- public transportation
- car rental companies
- taxi services
- shared electric scooters/bicycles
- car-sharing services

Consumers, who are equally as important stakeholders, represent the second key group analysed in this study. Consumers are not further categorized but are instead considered as a single collective group.

4 Methodology

The research method chosen for this study is a qualitative online survey. This approach was deemed the most suitable due to the multidimensional nature of the topic and the presence of multiple stakeholder groups, each requiring separate investigations due to significant differences among them. The adaptability of the survey method and the flexibility of its implementation without strict time constraints made it the most appropriate choice.

The objective is not to collect a large quantity of data but rather to explore a specific phenomenon and concept from multiple perspectives by utilizing the experiences and responses of stakeholders.

Efforts have been made to gather responses from two respondent groups: consumers and service providers (see section 3: Stakeholder Analysis).

4.1 Survey design

Before constructing the survey, the research framework and research questions were formulated to ensure that the survey would provide relevant answers. The survey process began with the development of a questionnaire targeted at consumers. The aim of this questionnaire was to examine the private car usage habits of adult Finnish residents with a valid driver's license, as well as their experiences with MaaS services. Some of the questions in the consumer survey were initially modelled on and compared with P. Luukkainen's 2020 study.

For the service provider survey, the consumer questionnaire served as a foundation and was then modified to suit the needs of this respondent group. In addition to exploring similar themes, the service provider survey also examined how MaaS is integrated into their business operations.

The questions were designed to be as simple and easy to understand as possible to prevent confusion or difficulty in answering (Lietz, 2010). Complex, multi-part questions were avoided; if such questions arose during the design process, they were broken down into smaller, standalone questions.

The survey was divided into five sections, with each section focusing on a specific topic. The themes progressed in a structured manner, and the final section collected basic demographic information, such as age, gender, and region of residence.

Most response options included an alternative choice of "Other" to allow respondents to provide answers beyond the predefined options. Additionally, respondents were sometimes given the option to select "I don't know" or "I prefer not to answer," which helped identify questions that participants found unclear or were unwilling to answer.

The surveys were conducted in Finnish, but the responses were translated into English during the analysis phase due to the language requirements of the report.

4.1.1 Testing

Before the surveys were published, they were tested with a test group of nine people. The group consisted of individuals from diverse backgrounds, allowing them to evaluate the survey and its content from different perspectives. Based on the feedback from the testing phase, a few adjustments were made, such as correcting the numbering of questions, to ensure a smoother user experience.

4.2 Consumer survey

The publicly shared online survey for consumers consisted of five sections. The first section focused on the respondent's mobility habits and private car usage. The second section inquired about the respondent's prior knowledge and experiences with MaaS services. The third section explored the respondent's expectations and preferences regarding MaaS service providers, while the fourth section included two open-ended questions about suggestions and recommendations. Finally, the last section collected basic demographic information, such as age, gender, and region of residence. The question structure will be discussed in more detail in the following section.

As previously mentioned, the purpose of the consumer survey was to assess consumers' knowledge and experiences of MaaS services and to examine their private car usage habits. These responses help build data, particularly for supporting sub-questions 1 and 2. The survey questions were as follows:

Sub-question 1: What are the key stakeholders in the MaaS ecosystem, and how do they interact?

Sub-question 2: What challenges or opportunities do stakeholders perceive in the development of MaaS?

The full list of research questions is included as screenshots in the appendix section at the end of this report.

4.2.1 Background information

The background information section, placed at the end of the survey, collected basic details about the respondents, such as age, gender, and region of residence. The survey was conducted anonymously, adhering to GDPR regulations. To ensure privacy, each question regarding personal information included the option "I prefer not to answer." This data was gathered to create a respondent profile map for the report.

4.2.2 Mobility habits

The first section of the survey aimed to assess respondents' mobility habits and private car usage. Responses were particularly expected on the following topics:

- Use of a private car for daily errands
- Main reasons/factors for choosing private car use over public transportation
- Monthly budget allocated for private car use

These responses are expected to help form a comprehensive understanding of how much consumers are willing to pay or currently spend on private car usage compared to MaaS services.

4.2.3 Knowledge and experience with MaaS services

The second section inquired about the respondents' prior knowledge and experience with MaaS services. The term MaaS may be relatively unknown to many, so the introductory part of the survey aimed to clarify the term to ensure that responses would not be too unclear.

The questions were designed to gather answers on the following topics:

- Familiarity with MaaS platforms
- Whether respondents have used MaaS services
- What services respondents have used
- Opinions on the use of these services

- Challenges faced in using these services
- Reasons why some respondents may not have used MaaS services before

For consumers, it is important to understand why they have used or not used MaaS services. Understanding both perspectives and reasons helps move closer to more effective and consumer-friendly MaaS solutions. Especially the challenges faced by consumers (without specifying which service users they are) provide valuable information for future development.

4.2.4 Expectations from MaaS services

The third section explores consumers' possible desires and expectations from MaaS services and service providers. The aim is to understand, at a basic level, what factors would make the apps more attractive to consumers.

The questions seek answers, particularly on the following topics:

- Importance of different functions
- Monthly budget allocated for services
- Whether it would be possible to give up owning a personal car if functional mobility services were available

In particular, the question related to the budget seeks to provide a comparison with the budget question about private car use in the second section (Section 4.2.2 Mobility Habits).

4.2.5 Open-ended questions

The fourth section contained open-ended questions related to development suggestions and free comments. The open-ended questions were optional to answer, so it is not expected that every respondent will contribute to this section. Overall, the aim was to gather insights into consumers' opinions on mobility services in their own city, as well as possibly receive innovation suggestions for MaaS service providers from the consumer's perspective.

4.3 Service providers

The survey aimed at service providers was sent to the designated contact persons at pre-identified companies, who ensured that the responses were received on time. The purpose of this survey was to gather insights from MaaS service providers regarding their operations, ecosystem, business,

challenges, and future opportunities. These insights will help create a better understanding of the overall picture and identify potential areas for development in the future.

The survey consisted of five sections, which are described in more detail in the following paragraphs.

4.3.1 Business models and operations

The first section of the survey focused on the company's business models and operations. The aim of this section was to gather a comprehensive understanding of the following areas:

- The company's service offerings and operational area
- Revenue generation
- Integration with external service providers
- The significance of MaaS in relation to the company's other business development efforts

4.3.2 Ecosystem and partnership

The second section delved into the company's ecosystem and partnerships with a few questions. The aim was to map out which types of partnerships are most critical for the company, as well as the most common challenges or barriers related to partnerships.

4.3.3 Challenges and opportunities

Section three focuses on the challenges and opportunities within the MaaS industry. The questions are designed to address the following topics:

- The biggest operational challenges currently faced
- Barriers to the adoption of sustainable solutions
- New technologies/innovations

The aim is to outline the current challenges within the industry and gain insights into potential innovations that companies may have considered for the future.

4.3.4 Future directions

The second-to-last section aimed to gather, through a single question, the companies' opinions on what will drive the development of MaaS in the next 5-10 years. The question seeks to understand whether companies view technological development, environmental issues, or something in between as the biggest driver of change.

4.3.5 Open-ended questions

In the final, fifth section of the survey, two open-ended questions were presented, which were as follows:

- What are the most significant shortcomings in the mobility services sector that need to be addressed in order to scale effectively for future changes?
- What actions would you like to see from policymakers or urban planners to better support MaaS providers?

Responding to these questions was voluntary, but respondents were encouraged to provide ideas, suggestions, or thoughts on the topic in a few sentences, as the role of service providers in the development of MaaS services will continue to be crucial in the future.

5 Data analysis

This section reviews the results obtained from the surveys and the responses to the questions and themes presented in the previous section. First, the results from consumers are discussed, followed by the results from service providers. The next section will focus more on whether the results answer the research questions and what can be interpreted from the findings in terms of the study overall.

5.1 Consumers

The consumer-targeted survey was shared across several social media platforms (LinkedIn, Facebook, university email distribution lists) with reasonably good visibility, yet the number of responses remained relatively modest. The survey was open for a total of three weeks and ultimately received 52 responses. Unfortunately, the response rate was rather low this time — but why?

There may be several reasons for the low number of responses, but the most prominent ones are likely the complexity of the topic and a general lack of awareness. Although the survey introduction aimed to briefly explain what MaaS (Mobility as a Service) means, the term is still unfamiliar and foreign to most people. This likely raises the threshold to participate in the survey, especially if the initial reaction is, “I probably don’t know how to answer these questions.” A lack of personal connection or experience with the topic might also explain why some felt it wasn’t important to participate — why give your opinion on something that doesn’t feel relevant to you?

Other possible reasons could include the survey being too long or the questions being too difficult to interpret. This was something we tried to avoid by testing the usability of the survey before its release, but it’s true that, in today’s busy world, people rarely have time to spend tens of minutes filling out surveys.

Nevertheless, we did collect data — and as the saying goes, quality often outweighs quantity. All responses passed background checks, and it was evident that the topic had sparked discussion, which was great to see.

5.1.1 Demographics

A total of 52 people responded to the survey. The gender distribution was as follows: 56% of respondents identified as female, 42% as male, and 2% chose not to answer to the question. The age of respondents ranged from 20 to 70 years, with an average age of just over 36 years.

As expected, the regional distribution of respondents showed that the majority were located in the region of Southwest Finland (Varsinais-Suomi), accounting for 73% of responses. The second largest group of respondents was from Uusimaa (19%). Other regions mentioned in the responses included Pirkanmaa (4%), Central Finland (2%), and Northern Ostrobothnia (2%).

5.1.2 Mobility habits

When it comes to private car use, the responses were fairly unanimous: over half of the respondents (56%) reported using their own car for everyday errands. Additionally, 23% said they use a car belonging to a family member or someone close to them, and 6% reported using another option, such as a company or a friend's car. Meanwhile, 31% of respondents said they do not use a car at all for everyday errands. The majority, 64%, said they use a car daily, 28% use it weekly, and a few reported using a car monthly or less than once a month.

So, what are the main reasons for private car use according to the respondents? Convenience and flexibility in travel clearly stood out as the biggest reasons, cited by nearly 90% of respondents. Other common reasons included the lack of public transport, affordability compared to alternatives, and safety. Additional reasons mentioned were time savings, physical limitations, and the necessity of having a vehicle for work.

Regarding the perceived monthly costs associated with private car use, the majority (33%) considered them fairly neutral. However, the second largest group (30%) felt that the costs were relatively high in comparison to their overall expenses. A smaller portion of respondents found the costs either expensive or affordable.

5.1.3 Knowledge and experience with MaaS services

Respondents' knowledge of MaaS services was quite evenly distributed: 58% said they were in some way already familiar with MaaS services, while 42% stated they were not familiar with them. To the question "Have you used MaaS services before?", the answers were also quite balanced,

though the majority (58%) responded “Yes”, and 42% said “No”. Those who had used MaaS services previously were presented with additional questions related to the topic.

The most commonly used MaaS services among respondents were, by far, public transport-related services (such as route planners and ticket purchasing) — used by 93% of those familiar with MaaS. The second most used services were ride-hailing options like Uber or Bolt (73%), followed closely by shared bicycles and/or rentable electric scooters (70%). Other mentioned services included integrated MaaS applications like Whim (which formerly operated in Finland) (3%), car-sharing services (3%), and traditional car rental platforms.

Respondents rated the services they had used just with the options "excellent", "good", or "neutral", even though there were also options for bad ratings available. The overall reception was very positive — notably, 70% rated the services they had used as "good".

So, what exactly did users find good about these services?

The most appreciated feature was good availability, cited by 60% of respondents. Other commonly mentioned benefits included time savings (60%), reasonable pricing (50%), real-time functionality (50%), and ease of use of the app (50%).

What challenges did respondents face while using the MaaS services mentioned earlier?

An interesting finding was that 33% of respondents identified safety concerns as one of the main issues. Another 23% selected the open-ended "Other" option, mentioning, for example, issues with vehicle functionality and challenges related to returning scooters. Additionally, 27% experienced problems with application usability, 30% with high pricing, 30% with limited-service availability in specific areas, and 17% with a lack of real-time updates.

Lastly, the survey asked why nearly half of the respondents had never used MaaS services. A significant 91% said they were simply unaware of the existence of such services. 9% stated that they had not needed them or had never come across them in a format that interested them. A small portion also cited limited local availability as a barrier.

5.1.4 Expectations from MaaS-services

The survey included a section where respondents were asked to rank a list of predefined features in order of importance (1 = most important feature). Affordability stood out clearly as the most important attribute, chosen by 48% of respondents as their top priority. Following that, reliability

and real-time information were selected as the second most important features by 27%. For the third place, opinions varied more, but availability narrowly took the spot with 25%. In fourth place, flexible subscription options (e.g., pay-per-use, monthly subscriptions, etc.) were selected quite consistently, with 38% identifying them as fourth important feature out of seven options. The fifth most important feature had wide variation in responses, but ultimately, having a wide range of mobility services under one application (19%) proved to be the most fitting option.

The sixth most important feature was integration with existing transport services (42%), and the seventh and least important feature, according to respondents, was environmental friendliness (39%). This means that 42% voted “existing transport services” as the sixth most important feature and 39% voted “environmental friendliness” as the seventh and the least important feature of them all.

Respondents were also asked how much they would be willing to pay for a monthly MaaS subscription.

- 67% said they would be willing to pay less than €50,
- 25% would be willing to pay between €50–€100,
- 6% would pay €100–€200, and
- 2% said they could spend over €200 per month on MaaS services.

So, what about when we asked whether respondents would be willing to give up their private car if MaaS services fully met their mobility needs?

- 33% responded that they would not give up their car under any circumstances.
- 36% said they might, depending on the situation.
- 31% said they would be willing to give up their car immediately.

The open-ended responses related to this question mostly emphasized the freedom and flexibility that owning a private car offers — something that is difficult to replicate with other services. Some respondents also expressed doubts about the coverage of MaaS offerings, particularly for longer journeys (over 50 km). The desire to have one’s own means of transport also came through, which is understandable given the relatively long history of individual control and freedom that ownership provides.

For example, with traditional car rental services, respondents pointed out issues like the location of rental offices and the inconvenience of having to pick up and return the vehicle yourself. It's worth noting that many respondents did not own a car, which helped balance the overall responses to this question.

5.1.5 Innovation and development ideas

Among consumers, the development ideas and suggestions largely focused on improving the efficiency of public transportation, payment solutions, and delivery services for car rental platforms. Especially regarding delivery services, there is already some recognition that this service model could become more common in the future, especially if technologies develop to the point where vehicles can reliably drive themselves from point A to point B.

In terms of payment, an interesting and encouraging idea was the introduction of a gift card or a free ride reward when a certain usage threshold is reached within a specific timeframe. A feature like this could certainly encourage more users to join — and it's entirely possible that such a system already exists somewhere.

Other comments regarding local mobility services mostly touched on the lack of demand-based fleet management, which contributes to environmental strain. For example, large buses often run nearly empty outside rush hours, while during peak times, the available fleet is too limited and spaced out. One new idea that emerged was a continuous loop bus — a nonstop service that would circle a fixed route, allowing passengers to hop on and off at will, like how tourist buses operate in cities.

There was also discussion around shared commuting solutions. In practice, this could mean shuttle services organized by large business parks in suburban areas, enabling residents of single-family neighbourhoods to commute without needing a private car — effectively reducing at least one vehicle's worth of monthly expenses.

A lot of discussion also revolved around the traditional MaaS concept itself — the idea of consolidating various transport services into one unified app. Currently, there is no such fully integrated MaaS service available in Finland, even though there clearly seems to be a demand and a strong desire for one. Especially in the city of Turku, having city bikes available in the same application as public transportation would already be a significant step forward, as currently the bikes are in a separate application. People also wish for more general information about MaaS, so

that the services would become more familiar to a wider audience. Availability should also be significantly improved in the future.

5.2 Service providers

The focus of the study shifted slightly as the project progressed, and the primary emphasis ultimately centered on consumers. According to the original plan, responses were to be obtained from four different service providers, each with their own service concepts. The companies were contacted several times via email as well as through social media channels. A phone interview was also offered as one way to conduct the survey. In the end, only one company responded to the inquiries, so in this section we will briefly go over the results in preparation for the discussion in the following section. Due to the limited number of responses, this section has not been divided into smaller subsections.

Business models and operations

The main service offering of the company that responded to the survey was related to rental services, which in this context included both traditional rental services and car-sharing services. Operations are located in the Turku city area, suburban areas, and rural regions. Revenue is generated through usage-based pricing.

The importance of MaaS (Mobility as a Service) in relation to other business development activities was rated as 2 on a scale where 10 represents extremely important.

Among partnerships, customers were considered the most important, followed by municipalities and governments, while technology developers were deemed the least important. Analysing this question is challenging, as there are no other respondents to provide a basis for comparison.

Challenges and opportunities

The challenges mentioned in the responses include high customer acquisition costs and a lack of user awareness or difficulty in adopting information. Both challenges are likely to affect the majority of similar companies, especially within the MaaS sector. Other potential and probable challenges include, for example, scaling to new markets and integration with legacy systems.

The best features of the MaaS concept according to respondents are especially:

- User-friendliness

- Cost-efficiency
- Utilization of data

Future directions

When it comes to improving services, new technologies or innovations of interest include AI solutions, such as predictive analytics and route optimization. According to the responses, the development of MaaS over the next 5 to 10 years will be driven particularly by political support and government incentives, urbanization, increased attention to environmental sustainability, and the advancement of technology and application ecosystems. A valuable comment was also that, in reality, the success of a MaaS system requires an already existing core service and customer base. A good example is Whim, which was an excellent and fully functional prototype, but failed to gain enough traction in the market and with customers to make continuation viable.

In the open-ended questions, a summarized comment on shortcomings in the mobility service industry highlighted that the incentives must be in place and the service must offer more than just ecological benefits. People usually vote with their wallets, so it's true that a functional and customer-centered solution must first and foremost be affordable for the consumer. The support hoped for from decision-makers or urban planners relates to simple actions, such as making parking for shared vehicles easier.

6 Discussion

This chapter interprets the observations presented in the previous analysis section in relation to the research questions and the broader objectives of the study. The discussion considers the perspectives and experiences of both consumers (customers) and service providers in order to assess current awareness, adoption, and expectations regarding Mobility as a Service (MaaS). Although the sample size was limited, the findings reveal significant insights into the challenges and opportunities related to the adoption of MaaS in Southwest Finland. The next chapter presents the conclusions drawn from these findings, along with recommended actions for the future development of the MaaS sector.

6.1 Reflections on consumer observations

One of the most prominent challenges emerging from consumer responses is the general lack of awareness about the MaaS concept. Although the survey included a brief introduction to the topic, a large portion of respondents had never heard of MaaS, and over 90% of those who had never used the service cited lack of knowledge as the main reason. This highlights a critical barrier to broader adoption and suggests that marketing, communication, and public education about MaaS need to be significantly strengthened if this type of concept is to gain traction in the future.

Despite this knowledge gap, users who had tried the service mostly reported positive experiences. Public transportation applications were the most commonly used and were praised especially for their usability, availability, and time-saving aspects. However, concerns were raised about app-related usability issues, safety concerns, and pricing—challenges that must be addressed in future design and policy development.

Although MaaS is often marketed as a tool for sustainable development and a key to a more environmentally friendly future, this was not a top priority for consumers. Instead, they valued affordability, reliability, and real-time information the most. This may suggest that consumers adopt new services primarily based on practical needs rather than ideological benefits.

Willingness to give up private car ownership was somewhat divided: one-third were willing, one-third were uncertain, and one-third were strongly opposed. The freedom, convenience, and flexibility offered by private cars remain strong values that MaaS must match if it aims to provide a viable alternative to private vehicle use.

Consumer suggestions for improvement—such as mobile gift cards, circulating buses, and applications that integrate all services—reflect a need for better usability, incentives, and service integration. These ideas also demonstrate consumers’ readiness for new innovations that stem from genuine needs.

6.2 Service providers’ perspectives

Although the number of responses from service providers was limited, the one respondent operating in the car rental and/or shared mobility sector highlighted several key issues: high customer acquisition costs, lack of user awareness, and difficulties in scaling and integrating legacy systems.

The service provider assessed the relevance of MaaS within their business strategy as relatively low, which may partly indicate that the current market situation does not yet offer sufficient incentives to prioritize MaaS. This also reflects the experiences of earlier MaaS initiatives, such as Whim, where technically functional solutions ultimately failed to secure a lasting foothold in the market.

While potential is recognized—particularly in terms of cost efficiency and data-driven optimization—MaaS requires strong infrastructural and political support to succeed. For instance, urban planning that enables parking for shared vehicles and political commitment that reduces investment risks are ultimately crucial factors.

6.3 Integration and significance of findings

The study highlights a clear disconnect between consumer expectations and service provider readiness. Consumers are, in principle, open to MaaS, but practical concerns—particularly cost, usability, and trust—pose significant barriers. Service providers, on the other hand, are hesitant to invest without concrete signs of demand and institutional support.

This creates a classic "chicken or the egg" dilemma: consumers are unlikely to adopt services without reliable and affordable options, but services won’t be developed without sufficient demand and practical evidence. Bridging this gap requires coordinated collaboration among various stakeholders, such as municipalities, businesses, and potentially other national actors.

From a broader perspective, MaaS has the potential to reduce urban congestion, improve transportation equity, and support both national and international sustainability goals. However, realizing these benefits depends on presenting MaaS primarily as a competitive, practical, and

trustworthy mobility solution for citizens—not just as an eco-efficient alternative. That said, a shift in mindset toward a more sustainable future could also help position MaaS as a viable option—at least eventually.

7 Conclusions

This chapter presents findings and observations from the reviewed literature and the conducted survey. At the end, the limitations related to the study and potential ideas for future research are discussed. The research question addressed in this study was: “What does the Mobility as a Service (MaaS) ecosystem look like from the perspective of local stakeholders, and how does this ecosystem reflect the current state and future development directions of MaaS services?”

7.1 Research summary

The research began with a general overview of the literature regarding what Mobility as a Service is and how it appears within today’s mobility infrastructure. From the literature, an effort was made to build a solid framework and foundation for the study, which focused locally on MaaS services through various stakeholders. Particularly with the help of the article by Kamargianni & Matyas (2017), we gained a comprehensive view of the traditional and commonly referenced model of the MaaS ecosystem. The framework was expanded by incorporating more sustainable perspectives in the section 2.3 Sustainable MaaS.

The first notable observation relates particularly to the consumer values highlighted in the survey, which leaned much more towards service diversity and affordability rather than sustainability and environmental values. As noted by Servou, Behrendt, and Horst (2023), achieving sustainable goals requires decision-making based on collaboration between humans and artificial intelligence.

Although this primarily refers to the relationship between decision-makers and AI, ultimately it is the end-users who decide what kind of product they wish to use—without users, there is no product.

The stakeholder analysis identified the stakeholders present within the MaaS ecosystem in general and within the scope of this study. The aim was to identify key players from whom to obtain a comprehensive picture of the current state of MaaS in the city of Turku. Although the final sample size was smaller than initially intended, the original groups are still analyzed in section 3 of this report.

The research eventually focused more on the consumer perspective and consumer perceptions of MaaS. It is interesting to observe the current level of consumer awareness about MaaS and the kinds of thoughts it provokes, particularly regarding the potential abandonment of private car ownership.

Safety was one of the issues highlighted both in the literature and in the survey. 33% of respondents who had used MaaS services expressed concerns regarding the safety of these services. A multidimensional application like MaaS requires detailed user information to function properly, such as payment and location data (Polydoropoulou, Pagoni & Tsirimpa, 2020). The literature revealed that data security issues are among the primary concerns for consumers. However, given that 50% of respondents were unaware of MaaS services altogether, it is reasonable to assume that current security concerns stem almost exclusively from a general unfamiliarity and lack of awareness about the topic.

Reflecting on the research question (*“What does the Mobility as a Service (MaaS) ecosystem look like from the perspective of local stakeholders, and how does this ecosystem reflect the current state and future development directions of MaaS services?”*) has not been a straightforward task. In this study, the first part of the research question could not be answered as broadly based on the empirical data as initially hoped. However, key findings that did emerge from the responses emphasized user-centricity—again, without users, there is no product. Still, a clear structural overview of the MaaS concept in Turku could not be obtained due to limitations in participant numbers.

For the second part of the research question (*“And how does this ecosystem reflect the current state and future development directions of MaaS services?”*), it was easier to draw observations and conclusions. The low response rates from both consumers and service providers already indicate:

- A) unfamiliarity with the topic,
- B) the perceived irrelevance of the topic, and
- C) the general lack of interest in the topic.

These factors together effectively summarize the current state of MaaS in Finland, especially in Turku, as practically non-existent. However, the future path looks considerably brighter, given the many ideas and thoughts people shared regarding MaaS. According to the responses, various incentives from companies to consumers, and from governments to companies, could help MaaS gain a foothold in urban mobility ecosystems. Moreover, the literature highlighted companies' reluctance toward cooperation and data sharing, which also contributed to the demise of the MaaS application "Whim" in Finland. In other words, the market was not yet mature for such services in Finland. People are still content with purchasing their transport tickets via different apps rather than through a unified platform. Thus, a mindset shift is needed both among consumers and companies.

Elsewhere in the world, MaaS has already proven successful (e.g., NS App in the Netherlands, www.ns.nl and WienMobil in Vienna, wienmobil.at), suggesting that it could also eventually succeed in Finland.

In summary, although the concept is seen as a potential solution for sustainable, user-centered mobility, its practical implementation does not yet fully live up to its theoretical promise, particularly in Finland. Besides the low consumer awareness, service providers also approach MaaS cautiously, deterred by high risks and unclear benefits.

For consumers, the most important criteria are affordability compared to competitors, reliability, and ease of use—not ecological considerations, which are often emphasized in political discussions. On the service provider side, survey responses highlighted customer acquisition costs, technological integration challenges, and a lack of public and political support as key barriers.

Additionally, the previously mentioned "chicken or egg" problem surfaced: consumers will not adopt MaaS without functioning services, and service providers have little incentive to develop services without existing demand. Security concerns, such as data privacy, must also not be overlooked, as they can significantly hinder the building of user trust.

7.2 Solving the Chicken-or-Egg dilemma with systemic thinking

It is also crucial to understand how an ecosystem like this "lives" and which elements define its behavioral patterns (Battistella et al., 2013). At the heart of Mobility as a Service (MaaS) lies human-centered design, which means that the issues surrounding MaaS are not merely technical but rather complex socio-technical problems.

In this context, we approach MaaS-related challenges using the so-called 3x3 systemic thinking model, based on Battistella et al. (2013) article. This model helps to understand the interacting parts of complex systems and the outcomes of their cooperation. As a point of comparison, we selected a globally widespread **AI-powered** mapping service—Google Maps—which already has over one billion monthly users (loopexdigital.com, google.com). The model categorizes the system through three levels (individual, organizational, and ecosystem) and three dimensions (activities, structures, and mental models).

System level	Activities (Doing)	Structures (Organizing)	Mental models (Thinking)
Individual	<p>MaaS: Requires behavioural change and active commitment from users.</p> <p>Google Maps: Is passively used and embedded into daily routines</p>	<p>MaaS: Low user awareness; Usage not habitual.</p> <p>Google Maps: Highly familiar; integrated into smartphone and other personal device.</p>	<p>MaaS: Abstract and unfamiliar.</p> <p>Google Maps: Perceived as a practical and reliable everyday tool</p>
Organizational	<p>MaaS: High customer acquisition costs; low interoperability.</p> <p>Google Maps: API-based scalability and seamless integration into services.</p>	<p>MaaS: Legacy systems hinder integration and innovation.</p> <p>Google Maps: Standardized infrastructure supports fast deployment and global scalability.</p>	<p>MaaS: Adoption often driven by idealism or policy rather than clear business value.</p> <p>Google Maps: Seen as value-driven solutions; easily justifiable for integration from a business perspective.</p>
Ecosystem	<p>MaaS: Fragmented actors; requires strong public-private collaboration and policy support.</p> <p>Google Maps: Global data ecosystems and existing digital infrastructure.</p>	<p>MaaS: Dependent on national/local transport policies and funding.</p> <p>Google Maps: Operates on shared standards; can be localized but globally connected.</p>	<p>MaaS: Requires cultural and structural shifts toward shared mobility and sustainability.</p> <p>Google Maps: Built on a mindset of global service adaptability, innovation and user-centric improvement.</p>

Table 2: Systemic thinking matrix

As shown in this study, traditional MaaS struggles particularly with user-centricity, customer awareness, and service integration. On the individual level, using MaaS requires behavioral change and active commitment from users. In contrast, an application like Google Maps is often seamlessly embedded into users' daily routines.

On the organizational level, the MaaS ecosystem suffers from high customer acquisition costs and outdated legacy systems that hinder system integration. In contrast, AI-based platforms offer APIs that allow service providers to scale effortlessly as part of a global infrastructure.

At the level of mental models, MaaS is often framed as an idealistic solution to sustainability goals, whereas an AI-based mapping service is positioned as a practical tool for daily life, with environmental impact perhaps seen as a secondary benefit. This distinction may influence the adoption and scalability of MaaS-type systems in the market.

At the ecosystem level, the differences are significant: MaaS requires collaboration between numerous stakeholders and strong political support and guidance. Meanwhile, the AI-based models utilize existing infrastructure and data ecosystems, enabling a locally and globally adaptive and interoperable system. In the case of MaaS, it has been observed that development remains fragmented without a unified platform and the support of other ecosystems.

The key difference between an integrated MaaS service and a solution like Google Maps is that the latter's ecosystem is built upon globally shared data and technology, leveraging already existing ecosystems. This establishes a foundation where organizations can join based on clear value propositions—not merely ideological motivation. The pressing question then becomes: how can MaaS reach the "critical mass" point that would finally resolve the age-old chicken-or-egg problem?

Critical mass theory seeks to explain how the success of innovations (such as MaaS) often depends on reaching a threshold of users or participants before the service becomes self-sustaining and begins to grow independently. In the context of MaaS, this practically means that until the "critical mass" is achieved, both consumers and service providers (and other ecosystem actors) may hesitate to commit. Consumers might be discouraged due to the limited availability of services, while providers may be held back by low demand. This mutual reluctance creates a systemic barrier to adoption (Oliver, Marwell & Teixeira, 1985).

There is no clear-cut answer as to which group (consumers or providers) should commit to the system first. However, with the support and adaptation of other ecosystems, both scenarios become possible. Service providers can commit more easily when MaaS is embedded within other ecosystems, and consumers may commit more readily when they see MaaS in use beyond the traditional integrated MaaS framework.

In summary, MaaS is in urgent need of support from other ecosystems—such as data, AI, and infrastructure ecosystems—to build a unified platform from which to develop a viable customer interface. Once a functioning platform is achieved through the help of external ecosystems and integrated systems, both organizations and consumers will find it easier to incorporate MaaS into their routines—without the sense of taking a significant risk.

7.3 Practical measures based on the findings

Concrete suggestions for the future based on this study are presented in the following section. These are merely proposals and thoughts—not rules or regulations.

Improving Consumer Awareness

One of the biggest—if not the biggest—obstacles identified in this study was the lack of awareness among consumers (and perhaps to some extent service providers), which led to lower-than-expected survey response rates. More efforts are needed to communicate and gradually build a market through customer awareness. Communication could help increase consumer understanding of:

- What MaaS is and what it means
- How it works
- What practical benefits it offers for ordinary citizens

Once a niche market has been carved out to the extent that a new pilot is possible, these pilots should offer free or very low-cost trials. This would lower the threshold for people to try the service and, ideally, through practical experience, realize how MaaS could support their own lifestyles.

Ecosystem Collaboration to Support the Growth of MaaS

The MaaS ecosystem requires the support of external ecosystems to establish a unified foundation for stable growth and customer base development. Examples of such supporting ecosystems include data, AI, and infrastructure ecosystems. In practice, these ecosystems can lend credibility and visibility through their already established customer bases, which in turn strengthens the position of MaaS in future markets.

User-Centric Approach in the Design Phase

For a service so dependent on its users, it is crucial to incorporate a user-centric approach right from the design phase. Ideally, users could even be involved in service design, for example, through idea

competitions. This would bring the topic closer to users and make them feel that their opinions matter. Continuous usability testing and customer experience evaluations would also be essential.

Additionally, ideas raised by users during the research, such as loyalty programs and gift cards, could be utilized. For instance, offering a free trip after a certain number of trips could encourage more frequent use.

Security and Data Protection

Transparency regarding data security policies is absolutely essential. Terms and conditions must be clearly communicated, along with explanations of why and by whom user data is used. Also, giving users easy control over their own data could reduce related anxieties.

Political and Public Support

The research findings suggest that governmental or municipal support for companies involved in building MaaS concepts could significantly boost motivation to participate. Background factors, such as Finland's goal of becoming carbon neutral by 2035, could drive this support. Cities are also encouraged to incorporate MaaS-supportive infrastructure into urban planning, such as parking spaces for shared cars and scooters.

In conclusion, at this stage in Finland's MaaS development, it is particularly important to recognize the critical role of users in the entire concept. The game is not lost yet, but it will require strong support, cooperation across various actors, openness to experimentation, and attitude shifts for consumers, service providers and policy-makers.

7.4 Limitations of the study

While the study provides valuable insights, its limitations must be acknowledged. The sample sizes for both target groups were small, and the geographical representation was concentrated in Southwest Finland. Perspectives from service providers were obtained from only one operator, which significantly limits the generalizability of the findings. Further research with broader coverage and especially deeper involvement from the private sector is necessary to gain a more comprehensive understanding of the current impacts and future prospects of MaaS.

7.5 Suggestions for future research

A similar study could be conducted in a larger city (for example, Helsinki) on a broader scale for both consumers and service providers, assuming selected companies and target groups would participate. A more detailed investigation into failed MaaS concepts in Finland and the root causes behind these failures would also be a valuable continuation of this research, which aimed to provide a general overview of the MaaS ecosystem and the current and future state of Mobility as Service concept in the city of Turku.

Another potential research topic could be a comparative study of consumer behaviour between two cities, for example, Turku and Helsinki. How do consumers' mobility habits and their requirements for mobility services differ between these cities?

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Appendices


The main heading of the appendices is not numbered. The same styles are used in the appendices as in the text chapters. The appendices are not included in the number of pages on the Abstract page.

Appendix 1: Customer survey layout



**TURUN
YLIOPISTO**

Mobility as a service -palvelut kuluttajanäkökulmasta

 Pakolliset kysymykset merkitty tähdellä (*)

Millä ja miten liikut omassa arjessasi? Oletko koskaan miettinyt, miksi toimit kuten toimit liikkumisen osalta? Liikkumiseen liittyy monia seikkoja, kuten tarpeet, toiveet ja kustannukset, jotka vaikuttavat sekä meidän omiin että palveluntarjoajien päätöksiin. Kerro mielipiteesi ja ajatuksiasi arkiseen liikkumiseen ja sen sujuvoittamiseen.

Tässä kyselyssä käsitellään MaaS-konseptia (Mobility as a Service), joka tarkoittaa eri liikkumismuotojen yhdistämistä yhdeksi saumattomaksi palveluksi. MaaS-palvelut toimivat digitaalisilla alustoilla, kuten älypuhelinsovelluksissa, ja voivat sisältää esimerkiksi julkisen liikenteen lippujen ostamisen, reittisuunnittelun sekä kyytipalveluiden, kuten Uberin, käytön. Tavoitteena on helpottaa liikkumista tarjoamalla käyttäjille joustavia ja monipuolisia matkustusvaihtoehtoja yhdestä palvelusta.

Kysely on osa Pro Gradu -tutkielmaani, joka keskittyy ymmärtämään kokonaisvaltaisesti MaaS-ilmiötä Turun kaupungissa (myös muualta Suomea tulevat vastaukset ovat toivottuja). Tutkimusosa koostuu eri sidosryhmille jaettavista kyselyistä, joista yksi osa on tämä kuluttajille suunnattu kysely. Tarkoituksena on saada käsitys kuluttajien yksityisautoilutottumuksista sekä kartoittaa aiempaa tietämystä ja kokemuksia MaaS-palveluista.

Kysely on anonyymi eikä vastauksia pystytä yksilöimään. Perustiedoissa kerätään kuitenkin ikä-, sukupuoli- ja maakuntatiedot datan analysointia varten. Vastauksia ei käytetä muuhun kuin ylempänä mainittuun pro gradu -tutkielmaan. Kyselyn tiedot tallentuvat väliaikaisesti Turun Yliopiston Webropol-tilille. Pakolliset kysymykset ovat merkitty *-merkillä.

Osa 1: Liikkumistottumukset

Käytätkö omaa tai jonkun toisen omistamaa yksityisautoa päivittäiseen asiointiin? (Valitse kaikki vaihtoehdot jotka pitävät paikkaansa, vastaukset 1-5 avaavat lisää kysymyksiä) *

- Oma
- Läheisen/perheenjäsenen
- Lainaan autoa esimerkiksi naapurilta
- Käytän yhteiskäyttöautoa
- Muu, mikä?
- En käytä/ei ole käytössä

Kuinka usein käytät yksityisautoa päivittäiseen liikkumiseen? *

- Päivittäin
- Viikoittain
- Kuukausittain
- Harvemmin kuin kerran kuukaudessa
- En koskaan

Mitkä ovat suurimmat syyt yksityisautoilullesi? (valitse kaikki vaihtoehdot jotka pitävät paikkaansa) *

- Mukavuus
- Julkisen liikenteen puute
- Kohtuuhintaisuus vaihtoehtoihin verrattuna
- Joustavuus
- Turvallisuus
- Muu

Jos omistat auton, miten koet sen kustannukset kuukausitasolla kaikki kulut mukaanlukien (polttoaine/sähkö, huollot, vakuutukset, rahoitus ym.) oman taloutenne näkökulmasta? *

- Edullinen
- Melko edullinen
- Neutraali
- Melko kallis
- Kallis
- Muu, mikä?

Osa 2: Tietämys ja kokemukset MaaS-palveluista

Ovatko Mobility as a Service (MaaS) alustat sinulle tuttuja entuudestaan? *

Kyllä

Ei

Oletko käyttänyt MaaS-palveluja aikaisemmin? Vastauksesta riippuen alle avautuu lisää kysymyksiä. *

Kyllä

En

Seuraava

Jos vastasit aiempaan kyllä, mitä kaikkia MaaS-palveluja olet käyttänyt? (Valitse kaikki vaihtoehdot jotka pitävät paikkaansa) *

- Kyytipalveluita (esim. Uber, Bolt)
- Yhteiskäyttöautopalveluita (esim. Omago,
- Julkinen liikenne (esim. Föli)
- Polkupyörä- tai sähköpotkulautavuokraus (Esim. Voi, Tier)
- Integroitu MaaS-sovellus (Tuup, Whim)
- Muu, mikä?

Miten arvostelisit kokemuksesi kyseisistä palveluista? *

- Erinomainen
- Hyvä
- Neutraali
- Huono
- Erittäin huono

Mitä haasteita olet kohdannut käyttäessäsi MaaS-palveluita? (Valitse kaikki vaihtoehdot jotka pitävät paikkansa) *

- Korkea hinta
- Rajoitettu saatavuus alueellani
- Reaaliaikaisten päivitysten puute
- Sovelluksen hankala käytettävyys
- Turvallisuushuolet
- Muu, mikä?

Mistä olet pitänyt/mikä on ollut hyvää käyttämässäsi palvelussa? (Valitse kaikki vaihtoehdot jotka pitävät paikkansa) *

- Sopiva hinta
- Hyvä saatavuus
- Reaaliaikaisuus
- Sovelluksen helppo käytettävyys
- Ajansäästö
- Muu, mikä?

Seuraava

Mistä syystä et ole käyttänyt MaaS-palveluita? (Valitse kaikki jotka pitävät paikkaansa) *

En ole ollut tietoinen kyseisten palvelujen olemassaolosta

Korkea hinta

Rajoitettu saatavuus alueellani

Sovelluksen hankala käytettävyys

Turvallisuushuolet

Muu, mikä?



Mobility as a service -palvelut kuluttajanäkökulmasta

i Pakolliset kysymykset merkitty tähdellä (*)

Osa 3: Odotukset MaaS-palveluntarjoajilta

Mitkä toiminnot tekisivät MaaS-palveluista houkuttelevampia sinulle? (Laita seuraavat vaihtoehdot tärkeysjärjestykseen 1-7, 1 = tärkein, 7 = vähiten tärkeä) HUOM! Vertaa vaihtoehtoja keskenään. *

Kohtuuhintaisuus	Valitse ▾
Luotettavuus ja reaaliaikaiset päivitykset	Valitse ▾
Laaja tarjonta liikkumispalveluissa saman sovelluksen alla (esim. julkinen liikenne, vuokra-autot, pyörät/sähköpotkulaudat jne.)	Valitse ▾
Joustavat tilausvaihtoehdot (esim. kertamaksut, kuukaustilaukset, käytön mukaan)	Valitse ▾
Saatavuus	Valitse ▾
Integraatio olemassaolevien liikkumispalveluiden kanssa	Valitse ▾
Ympäristöystävällisyys	Valitse ▾

Kuinka paljon olisit valmis maksamaan kuukausittaisesta MaaS-tilauksesta, joka tarjoaa integroidun pääsyn useisiin eri liikkumismuotoihin? *

- Alle 50€
 50€ - 100€
 100€ - 200€
 Enemmän kuin 200€

Voisitko harkita luopuvasi omasta autostasi jos MaaS-palvelut vastaisivat omia liikkumistarpeitasi? *

- Kyllä
 Ei
 Ehkä

Perustele tähän lyhyesti edellinen vastauksesi (Kyllä/Ei/Ehkä) *

Osa 4: Avoimet kysymykset

Minkälaista kehitystä tai innovaatioita toivoisit näkeväsi MaaS-tarjoajilta tehdäkseen liikkumisen helpommaksi ja kätevämmäksi juuri sinulle?

Onko sinulla mielessä muita kommentteja tai ehdotuksia liikkumispalveluiden parantamiseksi omassa kotikaupungissasi?

Osa 5: Perustiedot**Anna ikäsi vuosina *****Sukupuoli ***

- Nainen
- Mies
- Muu
- En halua vastata

Maakunta *

- Ahvenanmaa
- Etelä-Karjala
- Etelä-Pohjanmaa
- Etelä-Savo
- Kainuu
- Kanta-Häme
- Keski-Pohjanmaa
- Keski-Suomi
- Kymenlaakso
- Lappi
- Pirkanmaa
- Pohjanmaa
- Pohjois-Karjala
- Pohjois-Pohjanmaa
- Pohjois-Savo
- Päijät-Häme
- Satakunta
- Uusimaa
- Varsinais-Suomi
- Suomen ulkopuolella

Onko sinulla tullut mieleen jotain muuta, joka liittyy aiheeseen, mutta jota ei ole kysytty? Se voi liittyä suoraan tai välillisesti MaaS-palveluihin, liikkumiseen, yksityisautoiluun tms. Tai onko sinulla ajatus, toive, ratkaisu tai visio siitä, miten sinun oma liikkumisesi järjestyy nyt ja lähitulevaisuudessa.

Appendix 2: Service providers survey layout



**TURUN
YLIOPISTO**

Mobility as a Service -palveluntarjoajien näkökulmasta

i Pakolliset kysymykset merkitty tähdellä (*)

Miltä liikkumispalvelujen tulevaisuus näyttää keskellä nopeasti muuttuvaa maailmaa?

Kysely on osa Pro Gradu -tutkielmaani, joka keskittyy ymmärtämään kokonaisvaltaisesti MaaS-ilmiötä Turun kaupungissa. Tutkimusosa koostuu eri sidosryhmille jaettavista kyselyistä, joista yksi osa on tämä palveluntarjoajille suunnattu kysely. Tarkoituksena on saada karkeasti käsitys siitä, miten liikkumispalveluja tarjoavan yrityksen liiketoimintamallit rakentuvat sekä missä ylipäänsä mennään tällä hetkellä kehityksen kanssa ja mitä on mahdollisesti luvassa tulevaisuudessa.

Lyhyesti termistöä: Mobility as a Service (MaaS) tarkoittaa lyhykäisyydessään ja yksinkertaisuudessaan liikkumispalvelua, jossa erityyppiset liikennemuodot – kuten esim. joukkoliikenne, sähköpotkulaudat, taksit, autonvuokraus, yhteiskäyttöautot (yms.) – yhdistetään yhdeksi digitaaliseksi palveluksi. Tavoitteena on tarjota käyttäjille saumaton, helppokäyttöinen ja kestävä kehityksen mukainen vaihtoehto liikkumiselle, joka myös mahdollistaa matkasuunnittelun sekä lippujen ostamisen ja maksamisen yhden sovelluksen avulla. Tähän tutkimukseen termin merkitystä on laajennettu osaltaan koskemaan myös ihan yksittäisiä "MaaS-toimijoita", eli palveluntarjoajia jotka tarjoavat liikkumispalveluja.

Kysely on anonymi. Vastauksia käytetään vain tässä pro gradu -tutkielmassa loppuanalyysin rakentamiseen sekä tutkimuskysymyksiin vastaamiseen. Tiedot tallentuvat väliaikaisesti Turun Yliopiston Webropol-tilille. Tähdellä merkityt kysymykset ovat pakollisia vastata.

Osa 1: Liiketoimintamallit ja yrityksen toiminta

1. Mikä on yrityksenne pääasiallinen palvelutarjonta? (Valitse kaikki vaihtoehdot jotka täsmäävät) *

- Kyyti-/taksipalvelut
- Vuokrauspalvelut (perinteinen vuokraus, yhteiskäyttöautot)
- Mikromobilitteettipalvelut (pyörät, sähköpotkulaadat)
- Joukkoliikenne
- Muu, mikä?

2. Mikä on toimialueenne? (Valitse kaikki vaihtoehdot jotka täsmäävät) *

- Vain kaupunkialueet
- Esikaupunkialueet
- Maaseutualueet
- Kansallisesti, kansainvälisesti tai useissa kaupungeissa
- Muu, mikä?

3. Mistä yrityksen tulot muodostuvat? (Valitse kaikki vaihtoehdot jotka täsmäävät) *

- Maksa käytön mukaan- hinnoittelulla / muu käyttöhinnoittelu
- Tilaussuunnitelmilla (kuukausitilaukset jne.)
- Kumppanuudet kuljetusalan yritysten kanssa
- Tietojen kaupallistamisella
- Muu, mikä?

4. Millä tavoin integroitte tietoja ulkoisten kuljetuspalveluntarjoajien kanssa? (Valitse kaikki vaihtoehdot jotka täsmäävät) *

- API:t reaaliaikaiseen tiedonjakoon
- Jaetut kanta-asiakasohjelmat
- Yhteisbrändätyt palvelut
- Muu, mikä?

5. Kuinka korkealle arvostelisit Maa S:in merkityksen suhteessa muihin liiketoimintanne kehittämistoimiin? (0 = Ei yhtään tärkeää, 10 = erittäin tärkeää) *



Osa 2: Ekosysteemi ja kumppanuudet

6. Minkä tyyppiset kumppanuudet ovat kriittisimpiä yrityksenne Maa S-ekosysteemille? (Laita vaihtoehdot tärkeysjärjestykseen toisiinsa verrattuna, 1 = mielestäsi tärkein, 7 = vähiten tärkeä) *

Julkisen liikenteen tarjoajat	Valitse ▼
Mikromobiliiteettitarjoajat (pyörät, sähköpotkulaudat)	Valitse ▼
Autovuokraamot tai autojen yhteiskäyttöyritykset	Valitse ▼
Maksupalveluntarjoajat	Valitse ▼
Kunnat ja hallitukset	Valitse ▼
Teknologiakumppanit (sovelluskehittäjät)	Valitse ▼
Muu	Valitse ▼

7. Jos vastasit edelliseen "Muu", niin kerro tähän mitä tarkoittit.

8. Mitkä ovat yleisimpiä haasteita/esteitä kumppanuuksia muodostaessa? (Valitse kaikki vaihtoehdot jotka täsmäävät) *

- Teknisten integraatioiden puute (API:t, tiedon jakaminen)
- Lainsäädännölliset tai oikeudelliset esteet
- Tulojen jakamiseen liittyvät erimielisyydet
- Alan sisäinen kilpailu
- Rajoittunut luottamus tai yhteistyö sidosryhmien välillä
- Muu, mikä?

9. Näkemyksiä kuluttajien tarpeista / asiakasymmärryksestä. Mitä olette tehneet tai mitä teette tällä hetkellä kartoittaaksenne kuluttajien tarpeita? *


10. Ja aiempaan lisäten: Entä mitä koette, että tulevaisuudessa tulisi mahdollisesti tehdä toisin/lisää kuluttajien tarpeiden kartoittamiseksi? *

Seuraava



TURUN YLIOPISTO

Mobility as a Service -palveluntarjoajien näkökulmasta

 Pakolliset kysymykset merkitty tähdellä (*)

Osa 3: Haasteet ja mahdollisuudet

11. Mitkä ovat (MaaS-näkökulmasta) yrityksenne suurimmat toiminnalliset haasteet tällä hetkellä? (Valitse kaikki vaihtoehdot jotka täsmäävät) *

- Skaalautuminen uusilla markkinoilla
- Korkeat asiakashankintakustannukset
- Käyttäjien tietoisuuden puute tai omaksuminen
- Integrointi vanhoihin järjestelmiin
- Säädösten noudattaminen
- Muu, mikä?

12. Mitkä ovat mielestänne MaaS-konseptin parhaita ominaisuuksia nyt ja tulevaisuudessa? (Valitse kaikki vaihtoehdot jotka täsmäävät) *

- Uudet liiketoimintamahdollisuudet
- Käyttäjäystävällisyys
- Kustannustehokkuus
- Joustavuus
- Datan hyödyntäminen
- Parempi saavutettavuus
- Kestävä ja vastuullinen brändikuva
- Teknologian kehityksen hyödyntäminen
- Muu, mikä?

13. Mitkä ovat suurimmat esteet kestävien MaaS-ratkaisujen käyttöönotolle? (Valitse kaikki vaihtoehdot jotka täsmäävät) *

- Korkeat infrastruktuurikustannukset
- Rajallisuus vihreiden liikennevaihtoehtojen kysynnässä
- Hallituksen tai kaupunkisuunnittelijoiden tuen puute
- Vaikeus yhdenmukaistaa toiminta SDG (Sustainable Development Goals) viitekehysten kanssa
- Muu, mikä?
- Ei esteitä

14. Mitkä uudet teknologiat tai innovaatiot kiinnostavat/ovat kiinnostaneet yritystänne palveluiden parantamista ajatellen? (Valitse kaikki vaihtoehdot jotka täsmäävät) *

- Tekoäly (esim. ennustavaa analytiikkaa ja reitin optimointia varten)
- Autonomisten ajoneuvojen integraatio
- Sähköautot (pienemmän hiilijalanjäljen takia)
- Muu, mikä?
- En osaa sanoa

Osa 4: Tulevaisuuden kehityssuunnat

15. Mikä mielestäsi ohjaa MaaS:n kehitystä seuraavien 5-10 vuoden aikana? (Laita vaihtoehdot tärkeysjärjestykseen toisiinsa verrattuna, 1 = mielestäsi tärkein, 7 = vähiten tärkeä) *

Teknologian ja sovellusekosysteemien kehitys	Valitse ▾
Paremmat integraatiomahdollisuudet julkisen liikenteen kanssa	Valitse ▾
Kilpailukykyinen hinnoittelu ja kustannusten alentaminen	Valitse ▾
Ympäristön kestävyys suurempi huomioiminen	Valitse ▾
Kaupungistuminen ja multimodaalisten vaihtoehtojen kysyntä	Valitse ▾
Poliittinen tuki ja hallituksen kannustimet	Valitse ▾
Muu	Valitse ▾

16. Jos vastasit aiempaan "Muu", vastaa tähän mitä tarkoittit.

Osa 5: Avoimet kysymykset

17. Mitkä ovat liikkumispalvelualan merkittävimmät puutteet, jotka on korjattava, jotta skaalautuminen tulevaisuuden muutoksiin onnistuisi? *

18. Mitä toimia haluaisit nähdä päättäjiltä tai kaupunkisuunnittelijoilta tukeakseen MaaS-palveluntarjoajia paremmin? *

19. Onko sinulla lisänäkemyksiä tai suosituksia MaaS-ekosysteemin parantamiseksi?

Appendix 3: Usage of AI

Artificial intelligence was primarily used in this report for translations from Finnish to English and for grammatical corrections to ensure the text is as readable and clear as possible. The tool used was the generative AI tool ChatGPT. The tool was also used, for example, to summarize (self-written) text with prompts such as “Summarize the following text in a shorter form,” to improve sentence structures for better readability, and to assist in refining and formulating research questions as well as in initially shaping the title.

ChatGPT was used alongside literature materials to help explain concepts. When approaching a new topic, I often started by simply asking the AI: “What does concept X mean?” before delving more deeply into the literature. In addition to explanations, the tool was used for translating and summarizing literature when necessary, using prompts like “Translate the following sentence into Finnish” or “Summarize the following text with bullet points.”

ChatGPT assisted in the creation of the survey by rephrasing questions to be suitable for a formal survey (e.g., “Modify this question to match the style of a formal survey question”) and by suggesting what types of questions should be considered when conducting a survey on this specific topic (MaaS).

ChatGPT was used as a help to draw connections between observations from the literature and findings from the research, and to create summaries of these connections. These were mainly used as creative tools to inspire ideas, but also as concrete observations in the Discussion and Conclusions sections. AI were also used as a help to create the table 1 in chapter 7.2 based on the findings from research and articles.