Business Models for the operation of Mobility-as-a-service solutions

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Abstract
Digitalization is reshaping the conventional transportation industry boundaries and it is important to understand which disruptive opportunities emerge. In this study, it is explained an alternative service than the current mobility offer, a concept named as Mobility-as-a-Service (MaaS). It consists on transportation from A to B through a subscription plan in which the user plans, books, manages and pays in one single platform, that integrates diverse mobility partners.

The empirical purpose of this research is to understand the distinct business models to implement MaaS based on common characteristics of current MaaS projects, implemented in different cities. To address the research problem, the following questions are asked: What are different business models already on the market to operate MaaS? Is it possible to identify different types? Which factors seems to influence the choice of a certain type?

In order to answer these research questions, I use a multiple case study methodology. First by analyzing various scientific articles and MaaS projects presentations, specific to each city. Secondly, by collecting empirical data through semi-structured interviews from Mobility-as-a-Service Industry experts. My research determines that MaaS implementation is tailored to the city and a combination of challenges influences its operation. It concludes that the most influential factor for operating MaaS is the level of government support. This thesis finalizes providing a checklist for MaaS implementation.

Abstrato
A digitalização está a reformular os limites do setor do transporte convencional e é importante entender quais as oportunidades disruptivas que surgem com ela. Nesta dissertação, é introduzida uma alternativa ao atual serviço de mobilidade, conceito denominado como *Mobility-as-a-Service* (MaaS). Consiste na mobilidade de A para B, através de um plano de subscrição no qual o usuário planeia, reserva, gere e paga numa única plataforma, que integra diversos parceiros de mobilidade.

O objetivo empírico desta pesquisa é entender os diferentes modelos de negócios para implementar MaaS, com base em características comuns dos projetos atuais, implementados em diferentes cidades. Para responder às questões de investigação, são colocadas as seguintes perguntas: Quais são os diferentes modelos de negócios já existentes no mercado para operar MaaS? É possível identificar diferentes tipos? Quais os fatores que parecem influenciar a escolha e aptidão de um determinado tipo?

Para responder às questões anteriormente mencionadas, utilizei uma metodologia adequada para estudar múltiplos casos. Primeiro, analisando vários artigos científicos e apresentações de projetos relativos a MaaS, específicos para cada cidade. Em segundo lugar, recolhendo dados por meio de entrevistas semiestruturadas, feitas a especialistas do setor de *Mobility-as-a-Service.* Através da minha pesquisa, determina-se que não só a implementação de MaaS é personalizada a cada cidade, mas há também diversos desafios que influenciam a sua implementação. Conclui-se que o nível de apoio do governo é o fator mais influente para a operação e implementação de MaaS numa cidade. Esta tese finaliza ao proporcionar uma *checklist* para implementação de MaaS.

Keywords: Business models, platform business models, multi-sided business models, Mobility as a Service, MaaS, mobility partners, MaaS operator, stakeholders, patterns, traits.
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Key Abbreviations

MaaS – Mobility as a Service

BM – Business Model

PT – Public Transport

PTA – Public Transport Authorities

Key Definitions

Mobility-as-a-Service (MaaS): With no clear definition, several authors have agreed MaaS as:

(i) Operates through a single platform, a mobile app, connecting several stakeholders such as users; mobility partners (bus, taxi, carsharing, carpooling, rental car, bike sharing, e-scooters, among others); parking companies; insurance companies; among others.

(ii) A platform for users to plan the most optimal route to go from location A to B. User can personalize given its need. This app also allows to manage, book and pay one or several travels. It is seen as "one-stop-shop" for mobility.

(iii) Mobility partners (Public transport, taxi, car rental, and many others) assign the direct contact with customers to the MaaS operator.

(iv) A service with a monthly subscription revenue stream, although it can also provide "Pay-as-you-Go" option.

Mobility partners: Provides the service of mobility. Responsible for a form of transport. E.g. Public Transportation Authority, car rental company or Taxi.

Carpooling*:* Consists in sharing a private vehicle for a common ride between several passengers that can be unknown to each other. The common goal is to reduce traffic congestion, pollution and share expenses, apposite to generate profit. It is usually connected via a smartphone app. E.g. BlaBlaCar.

Ridesharing: Consists in using a private vehicle to drive one or more passengers to a destination, for profit. It is connected via a smartphone app or website, managed by a third party to connect riders and drivers. E.g. Uber.

Ride hailing: Consists in employed drivers providing transport to passengers. By "hailing" or even hire a personal driver to get to a specific destination. E.g. Taxi.

MaaS operator: It is responsible for managing all forms of transport modes, such as public transport, ride hailing, ride sharing, carpooling, e-scooters, bike sharing, among others, through a platform while presented via a single interface (e.g. smartphone app).

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1. Introduction

Modern cities usually generate a substantial amount of pollution, congestion and are also overcrowded. Yet, the number of habitants in those cities keeps rising. In many cities, the current transportation infrastructure cannot answer to the increasing demand (Comtrade Digital Services, 2017).

As a result of a population increase, the need of Mobility-as-a-Service (MaaS) thrives especially in metropolitan areas, growing mobility necessities, traffic congestions, and pollutant emissions (Schikofsky et al., 2020). Urban areas have 55% of the world's population, with a forecast to increase up to 68% by 2050 (United Nations, 2018). Smart mobility services, which hold long-term potential to reduce the private ownership of cars, can affect the above mentioned challenges (Fioreze et al., 2019). Consequently, it would allow to moderate the quantity of vehicles, which spend more than 90% of their lives parked on the streets, besides giving the vehicles to have a more sustainable purpose (Zhang, Spieser, Frazzoli & Pavone, 2015).

An alternative to owning a private car, is the hassle-free that integrated mobility solutions, such as MaaS provides. Planning a route, finding a parking place and maintenance of a car are no longer a concern (Ruohomaa & Salminen, 2019). But, so far, the use of private vehicles is strongly present in urban cities where the complexity of using alternative transportation offered by different enterprises – each with different subscriptions and ways of payment – discourages individuals from exercising them. When offered a digital integration that incorporates several transport options and unifying users subscriptions with bundling prices, could increase the willingness for travelers to use alternatives to private cars (Fioreze et al., 2019).

Mobility-as-a-Service (MaaS), the concept studied in this research, intends to provide individuals an alternative to the current conventional transportation system. This service has potential to disrupt the industry, while merging with other technologies and causing a positive impact on sustainability, mainly in urban areas (Bouton et al., 2015). Being a relative recent concept, there is not yet a universal definition of MaaS. It can be explained as the collaboration and connection between different mobility partners, managed by an operator and through a digital platform to plan, manage, book and pay multimodal mobility options, such as car renting, car sharing, public transport, carpooling, among others (Hensher & Mulley, 2020). The

rapid evolution and interest of MaaS led to many projects implementing the service in different cities all around the world.

The problem statement of this thesis consists in the following research questions:

1. What are different business ways in which cities already operate MaaS?

1.1. Are there different types?

2. Which factors seems to influence the choice of a certain type?

Based on extensive desk research and interviews with MaaS industry experts in various cities, this thesis will analyse differences and commonalities in the way of operating MaaS and cluster cities along common traits. Moreover, it will try to uncover the reasons for operating MaaS in distinct ways. This research aims to provide a practical approach for MaaS implementation, finalizing with a scheme of possible types of Business Models, combined with recommendations to be alert for. Additionally, it will be delivered a checklist for MaaS implementation, taking into account not only the findings but also key insights from industry experts. The existing literature focuses mainly on city-specific case studies or the general business model to operate MaaS, while this thesis aims to add a practical comparison of different procedures to implement MaaS.

2. Literature Review

2.1.The need for new mobility services

There has been a shift of people from rural to urban areas, regardless of being polluted, over-crowded and slow moving. The current transportation network is not providing a service that can answer to the demand. The need of owning and using a private car opposite to the use of public transport is still a common reality as a feasible solution have not been provided. The mobility services are currently going through a change, adapting to the Digital Era by providing services such as carpooling and ride sharing (Comtrade Digital Services, 2017).

The Advancing Public Transport (2015) studied 39 countries in which 27 are European and reported the current state of public transportation use. As shown in figure 1, bus is the dominant mode of transport in the average modal distribution in 2015. In that year, there was a 18% increase of public transport journeys when compared to 2000.

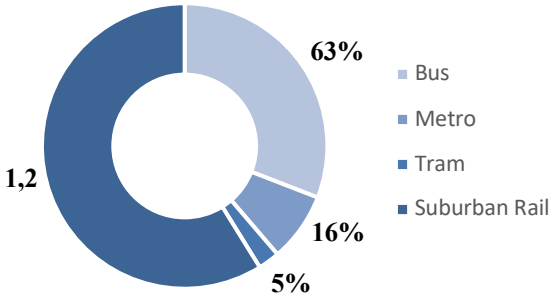


Figure 1 - Average modal distribution of all public transport journeys
Source: Urban Public Transport in the 21st century, 2015

Moreover, ownership and use of passenger cars and commercial vehicles worldwide have increase 40% and 35% respectively, as shown in Figure 2**.**

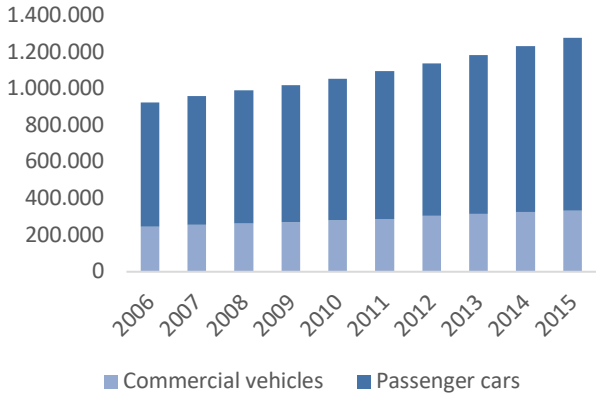


Figure 2 – N. of passenger cars and commercial vehicles in use, worldwide, 2006-2015 (1,000 units)
Source: Statistca, 2018

As a result of demographic tendency together with concerns with technology development and climate change, the need for an adjustment in mobility become inevitable. Equally important, traffic congestion, commuting time and demand for sustainable alternatives are strong arguments seeking for an alternative mobility. The current state of conventional mobility is costly, representing a big share of every household's income. (Bouton et al., 2015).

Mobility services can fulfil the significant gap between private and public transportation, in spite of challenges as "first mile/last mile". New mobility transportation such as Uber and Lyft have, so far, demonstrated a positive review, with constant growth popularity, boosted by digital platforms. Nevertheless, the current state of mobility it is not yet well integrated into the ecosystem, causing a great hassle to users, however with great potential if used digital tools to offer new experience to customers (Comtrade Digital Services, 2017).

2.2. Mobility-as-a-Service (MaaS)

The term "Mobility-as-a-Service", born in Finland (Ruohomaa & Salminen, 2019), describes the access of numerous transport modes and services, including public transport, taxi or car rentals while integrating some key components such as booking, ticketing and multimodal traveler information services (König et al., 2016). In analogy to the term Software-as-a-Service[1], which describes the provision of software applications online in highly customizable subscription models, instead of one-time purchases (Dubey & Wagle, 2007), the term "Mobility-as-a-Service" is used to highlight the options of self-configuration and customization when booking transportation.

Beyond this common denominator, the concept of Mobility-as-a-Service (MaaS) lacks a clear definition. As revealed by some cities, MaaS includes mostly traditional public transport modes such as busses and trains, in other cities it also includes emerging transport options such as bike and car sharing, ride hailing, or carpooling. Generally, MaaS can be described as *"a system, in which a comprehensive range of mobility services are provided to customers by mobility*

[1] Software as a service (SaaS) is defined as a service delivered by a company that designs and develops a software application, selling a service to a big number of clients with a sharing architecture, to get great benefit from the economy of scale. As an alternative of buying a software service for an application and installing it in individual machines, SaaS allows to access the software online by subscribing to a service The key take-away lands in the subscription business model, that requires a strategy of a self-configuration and customization software by clients without making any changes into the source code of the software, for any particular customer (Sun, Zhang, Jie Guo, Sun & Su, 2008).

operators" (Heikkilä, 2014, p.8). MaaS originates in the idea that transportation is seen as a service in which time and location of the desired departure, the duration of the trip and the arrival at the target destination are more relevant than the specific mode of transportation (Ruohomaa & Salminen, 2019). The key element of MaaS is the integration of multiple modes of transportation into a single platform, mostly given its ability to personalize services given individual mobility needs, enable payments integrated in the platform, and plan the desired journey (Urban Transport Group, 2019).

Figure 3: A visualization of MaaS
Source: Urban Transport Group (2019)

Value proposition of Mobility-as-a-Service (MaaS)

MaaS intention is to better accomplish traveler needs than conventional public transport (Hensher, 2017). In fact, many mobility services, such as bus or train companies, car sharing providers, or ride hailing services, already provide digital access to journey planning and booking trips via their websites or apps. Yet, the complexity of having to choose from a number of alternative transportation services, each offered by different enterprises, with different communication channels, subscriptions and payment methods, can be overwhelming. With an increase in mobility services, such as car sharing or ride-hailing, offers become even wider with more players to choose from (Gilibert & Ribas, 2019). There are already several platforms that deliver smart route planning options to get from location A to B, such as Waze and Google Maps, which offer distinctive services than MaaS. Waze integrates community feedback while Google Maps is a standard navigation app (Coomes and Widman, 2019). The key take-away is that route planning apps and MaaS have very different purposes, although with some similarities. Their main disparity comes from their revenue model. MaaS revenue scheme is driven from subscription plans that bundles many transportation options for a monthly price, attractive to customers, especially given that the user does not have costs with the private car maintenance. Pangbourne et al (2020) referred to MaaS as the "Netflix of Transportation". The user benefits a tailored service to meet mobility needs, the ease and convenience of transaction and payment for a ride ticket, management and access to planned journeys and useful information for a better journey decision making regarding cost, speed, and health benefit (Urban Transport Group, 2019).

Mobility-as-a-Service Ecosystem

Operating a MaaS ecosystem requires a vast number of participants that benefit from collaborating with each other. As illustrated in Figure 4, the supply side is constructed by Mobility Service Providers, defined as any public or private organization providing transport capacity or mobility services, such as train tickets or parking services. The main suppliers of transport are public transport, taxi, bike and car sharing, carpooling, e-scooter and on-demand services. MaaS does not aim to provide alternative mobility options, but to integrate the existing ones (Kamargianni et al., 2018).

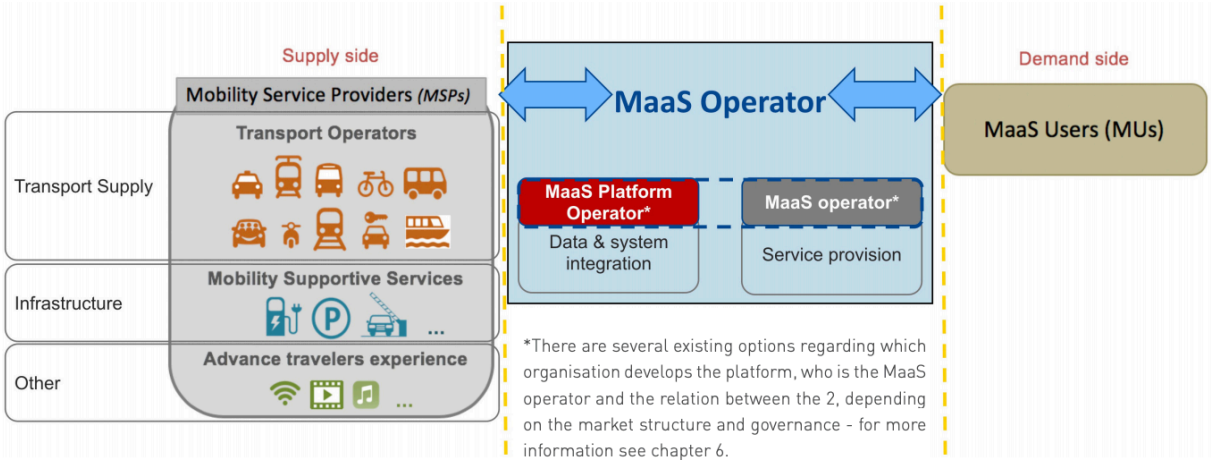


Figure 4 - Overview of MaaS ecosystem

Source: Mobility-as-a-Service and Sustainable Urban Mobility Planning, UCL-MaaSLab. P.8, 2019

In order to integrate the above mobility services, features such as data management, journey planning, journey optimization, ticketing, payment and communication are required from MaaS platform. Users can expect this service to plan multimodal journeys, to support guidance and re-booking suggestions when disruptions occur while paying in a unified manner. With data shared by mobility partners, the app can inform public transport stations, routing and timetable information (Signor et al., 2019).

However, there is a distinction between Maas Platform Provider and Maas Operator. The term "MaaS Platform Provider" refers to the organization responsible for the platform (e.g. a city), which can be done by the MaaS Operator or can be outsourced. The second one, "MaaS Operator", refers to the responsible for the smartphone app and by compiling multimodal mobility services. A Platform provider and operator do not necessarily have to be part of the same organization. For instance, a city can operate the app herself, but it can also decide to outsource the operation to a service provider. When it comes to MaaS revenue scheme, this can

be by subscription, usually monthly, or pay-as-you-go. In a mature business, a stage of complete growth (Oxford University Press 2004), MaaS Operator can plan and optimize the journey by knowing the real time mobility options and users' preferences. In the right side of Figure 4, it represents the demand side of this ecosystem – MaaS users – which are individuals, groups, households or companies. Personalized mobility services are critical to answer users' individual need for MaaS success (Signor et al., 2019).

As a business model, MaaS can be described as a digital platform or, more specifically, a multi-sided digital platform as its mobile application brings together travelers, mobility partners (public transport services, Uber, e-scooter companies, city bikes, among many others), insurance companies, government, parking companies, (…). Such business models are well known from other domains, as the hotel and tourism industry, where, for instance, operators such as Booking.com have demonstrated that business can thrive from being the bridge between multiple service providers and users (Finger et al., 2015).

2.3.Digital Platform Business Models

Crucial to the present research is the literature regarding business models. There is a good conceptual understanding of the concept. Teece (2010) defines it as *"the manner by which the enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit"* (p.282). In other words, it is the design of the value creation, delivery, and capture mechanisms a firm employ (Teece, 2018). A firm's business model can be a key to achieving competitive advantage (Casadesus-Masanell & Ricart, 2010). Considering this, the author that stands-out in the study of Business Model is Alexander Osterwalder, which in 2005 created the Business Model Canvas as a strategic tool to design that consists in nine blocks, defined below.

- **Value proposition:** Any product and/or service delivered to customers segments to deliver the company's value;
- **Customer segments:** People and/or organization that belong to different groups to be reached and served by the company;
- **Customer relationships:** Adapted relationships given a company customer segment;
- **Channels:** Reaching customers using any kind of connection to explain their value proposition;
- **Key activities:** Fundamental actions required for the company's business model to operate;

- **Key resources:** Fundamental resources required for the business operation;
- **Key partnerships:** An arrangement of partners required for the company's business model to operate;
- **Revenue streams:** Money generated from creating value to company customer segments;
- **Cost structure:** Expenses from the operating the business model.

Digital business models have transformed profoundly the structure of a firm. It creates additional value not only to customers, but also to the firm itself and the involved stakeholders (Verhoef et al., 2019). Digital business models consist in managing multiple sides of the market through an online platform, using the internet as a bridge to interact towards a group of users, usually between buyer and seller, to generate value for no less than one group. A digital platform brings together consumers and producers through an infrastructure that rules the marketplace (Parker & Choudary, 2016), enables innovation and sustainable growth (Kim & Min, 2019). Examples of this business models are Uber, a ride-hailing company, or Zalando, a fashion customer-centric platform.

The concept mentioned above, digital platforms, can connect two sides, sellers and buyers, but it can also connect multiple sides. In such a case, the literature speaks of a *multi-sided platform* or *multi-sided platform business model* (Evans & Schmalensee, 2020). Multi-sided platforms (MSP) bring together multiple independent customers (Eisenmann et al., 2007) and can involve different other actors (producers, customers, suppliers, …) of complementary products and services. Moreover, the user often does not pay to use the platform, the revenue stream comes from partners participation and advertisements, hereby the platform has two customers to satisfy: users and companies (Evans & Schmalensee, 2020).

MSP business model must generate value to each participant while also creating economic benefits as a whole (Abdelkafi et al., 2019). As an example, Deliveroo, a courier service that purchases, picks up, and delivers products ordered through a platform, has a three-sided platform model. It serves three customers: Riders to deliver the food; restaurants to provide the food and users that order it. Advertisers can be added as an additional customer to many MPS, including Deliveroo.

2.4. The challenge of operating MaaS

It is high priority for MaaS to attain multiple sides "on board" (Rochet & Tirole, 2006, p. 645). Since MaaS must come from a partnership between many actors, both private and public, the lack of alignment between private firms and government markets can be an obstacle to achieve success (Mahoney, McGahan, & Pitelis, 2009). A MaaS service can only be successfully when achieved a robust, transparently organized, and well managed cooperation between the involved stakeholders (Meurs et al., 2020). Reaching such cooperation and finding a sustainable business model, one that generates value for all parties, might be challenging.

Regulatory challenges

In most countries, the regulations for transport sector are heavy, mainly as a safety for public values. On the other hand, it might be a barrier for innovation. For MaaS to develop, legislation must support this sharing service. For that, it is fundamental to regulate in such a way where public interest is served and private actors are attracted to create new opportunities (Karlsson et al., 2020). Without regulatory support, public authorities might not encourage mobility partners to be onboard for such projects. Some arguments for this standpoint are the fear of a power decrease and their customers shifting to MaaS. Furthermore, besides legislation, also the mobility partners, can face regulatory and legal barriers to allow a third party, besides the operator, to sell tickets for its bundled services.

Digitalization challenges

The implementation of a MaaS scheme requires an infrastructure capable of providing a certain level of digitalization. Considering MaaS must connect a vast number of partners, it is expected to have different technological resources between partners. When some of those partners don't have real time travelling data or Application Programming Interface (API) to allow external programmers to access and change the current software, it creates a barrier. It is fundamental that partners are technological evolved in such a way electronic tickets are viable (Holmberg et al., 2016). Moreover, it can also become a challenge for this companies to have the necessary financial resources to keep up with technological evolution (Polydoropoulou et al., 2020).

In addition, also the Mobility-as-a-Service app design architecture must be user-friendly, efficient, trustworthy and flawless, apt for a daily use, to be successful.

Trust challenges

Trust plays a compelling role for MaaS success, notwithstanding leads also many challenges. MaaS is the connector between different parties that are usually competitors, not allies. Mobility services companies may be hesitant to support MaaS platform and unwilling to share their sensitive booking, ticketing and pricing data with competitors (Polydoropoulou et al., 2020). Furthermore, by booking trips and payment via the MaaS platform, mobility partners fear of losing the direct contact with the customer, as the communication channel is no longer through their own platform, and this can be a barrier to partnerships. Furthermore, public transportation authorities might be afraid to sacrifice their control and power towards MaaS operators, in case it is not them.

Economic challenges

Although different MaaS projects can have different revenue streams, the mobility partner often pays a commission to the MaaS Operator. For the user, revenue thrives from paying a subscription plan. In this case, the traveler pays a monthly fee to enjoy an offer of bundled services available (car rental, bus, train, city bike, among others and depending of the subscription), generating a fix revenue flow from traveler to the partner, with MaaS as an intermediate commission. On the other hand, MaaS can also offer "Pay as you Go" option to users, meaning no extra cost for the traveler to enjoy the service. In this case, it would be more beneficial to the mobility partner to have the journey through their own platform, as through MaaS there is no profit. The challenge is to convince partners that travelers will mostly subscribe to the plans, and not only "Pay as You Go". In addition, it is vital to convince them that MaaS will not shift their existing customers but instead attract new customers adding more revenues. Nevertheless, it might require stakeholders to have more than economic interest to join and believe in the higher cause of innovating urban transport and making it more sustainable.

Social challenges

MaaS implementation is likely to be different in every city, as it depends on local situations; cultural behavior; political reality; quality of transports; rate of public transport usage; city willingness to cooperate; among many others. Social barriers can be an obstacle, as an example, a study in Greater Manchester found that rail, tram, metro, private and public bus operator are

key actors in MaaS scheme, while in Budapest, the local government and public transport authority are the most important actors (Polydoropoulou et al., 2020).

For all the reasons named above, finding a way to operate MaaS can be challenging. Against this background, in this thesis I set out to answer:

1. What are different business ways in which cities already operate MaaS?

1.1. Are there different types?

2. Which factors seems to influence the choice of a certain type?

I aim to compare different scenarios that enable a city to run MaaS. Firstly, different MaaS projects will be studied and common traits between these cases will be revealed. With the information collected, cities are clustered as a result of common traits, generating types of MaaS operation. Moreover, for a practical application of this thesis, it will be provided a checklist based on findings and recommendations from industry experts with steps to follow.

3. Methodology

3.1. Research design: Building theory from cases.

Building theory over an analysis on multiple cases has a crucial role in research on strategy, entrepreneurship and other relevant fields. It consists in a research strategy which combines "*a grounded theory-building process with case study research design and analytic logic"* (Mir & Jain, 2018, p.79). Interviews, observations and survey data are a few options to conduct the case study research. Moreover, multiple cases consist between two and twelve, as the likelihood of accuracy increases when studying multiple-cases, instead of a single-case. It is indispensable to use theoretical sampling as the core for theory building from multiple cases (Eisenhardt, 1989). Theoretical sampling implicates selecting cases grounded on their knowledge about the topic of study, which enables the researcher to compare across cases, taking advantage of new and anticipated insights (Glaser & Strauss, 2017, p.45).

As previously mentioned, the objective of the study is to analyse current ways to operate Mobility-as-a-Service in different cities. Therefore, my research was organized into six sequential phases that acknowledges the final outcome (Figure 5): Creation of list with cities that have MaaS; Filtering long list along MaaS definition; Comparison of MaaS projects;

Selection of experts in key cities that use MaaS; Interviews with industry experts; Identification of extreme cases and clustering.

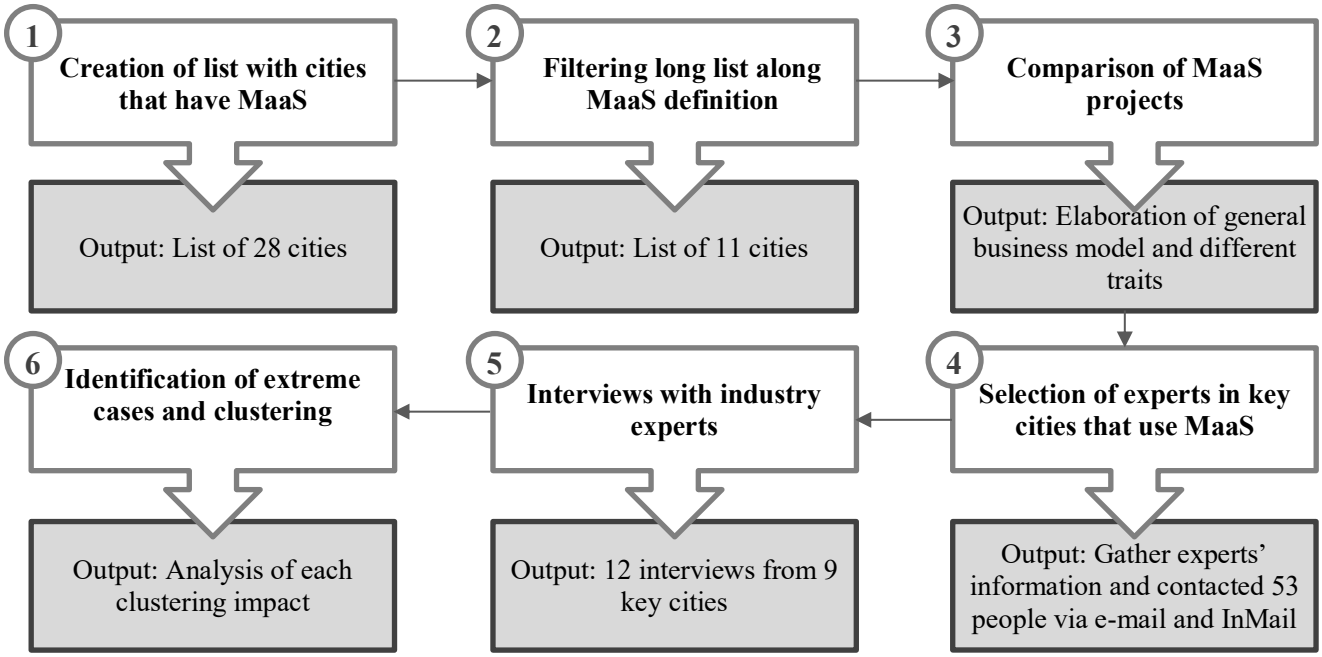


Figure 5 - Data collection and analysis process

3.2. Data Collection and Analysis

For the purpose of this, I collected qualitative, primary and secondary data. The data collection was split in 4 steps:

Step (i) Creation of long list of cities that use MaaS and respective smartphone apps

The beginning of this study started with a deep research on which cities worldwide use MaaS using secondary data. The first stage of my research, corresponding to roughly 25% of the workload, was by reading scientific articles found essentially at databases, such as EBSCO, E-learning B-ON, Google Scholar, among others. It resulted in 97 articles saved on Mendeley (a reference manager and academic social network). Although every article saved was reviewed to better understand the topic of MaaS, this dissertation uses in-text reference to 48 out of those 97 articles. Key words used for this search were: Business models, platform business models, multi-sided business models, Mobility as a Service, MaaS, mobility partners, MaaS operator, stakeholders, patterns, traits.

In addition, corresponded to 15% of workload, I reviewed presentations and reports available online specific to a certain city using MaaS or a MaaS smartphone mobility app which provided a more practical knowledge of the topic.
With the information collected, an overview of MaaS smartphone app per city was constructed (**Figure A.11**, appendix), to better interpretate their functionality, which corresponded to 10% of my research workload.
The remaining 50% of workload was attained by finding industry experts in key cities, contacting them, interviewing them and structure the information and will be explained further in the below steps.

Step (ii) Define MaaS and their level of integration to filter the long list

The MaaS definition is not yet clear, it is a very broad concept. Most studies agree that core elements are: Mobility service offered via a single platform; connects several stakeholders; information in real-time; multimodal transportation; it has a direct contact with customer and to access to this one-stop-shop to plan, book and pay is via usually a monthly subscription plan (Arias-Molinares & García-Palomares, 2020). Heikkilä (2014) defined MaaS as a mobility service structure offered by mobility operators towards customers. Moreover, for some it can simply mean any transport mode besides a private car (Sakai, 2019). Therefore, it was decisive to review what the cities included in the research understand as MaaS. For narrowing down the definition of MaaS, I found the level of integration (see table 1) to be useful.

Table 1 explains levels from zero (0) to four (4) describing the different topology of MaaS.
For the purpose of this study the focus lands on MaaS projects that operate using a smartphone app and its level of integration is 2 (Integration of booking & payment), 3 (Integration of the service offer) and 4 (Integration of societal goals), being 0 the less integrated MaaS and 4 the maximum level of integration. This is in line with (Hietanen, 2014) who shared that MaaS is provided via one single interface and offers possibilities of customization. Yet, it should be noted that a higher level of integration does not mean higher quality of service. Moreover, the levels do not depend on each other, which implies that some platforms can be level 3 but lack functionalities from previous levels (Sochor et al., 2017).

Integration level	Integration depth	Description	Example
0	No integration	- Single and separate services	
1	Integration of information	- Added value: Supporting the best trip to go from A to B - Has users instead of customers by focusing on single trips - End users don't usually pay for this service; revenue can come from ads. - MaaS Operator is not responsible for quality of the service, however users turn away in the information cannot be trusted	 
2	Integration of booking & payment	- Oriented to single trips and is a natural extension of travel planner - User can search, book and pay, seen as a one-stop-shop - Small mobility services gain advantage when joining MaaS to win market share - MaaS Operator is responsible for ticket validation, booking accuracy and the purchase, but not for the traveling	
3	Integration of the service offer	- It offers mobility in a bundled plan, subscription-based. Requires at least a monthly commitment from the user. - It focuses in the need of the household instead of single trips from A to B. It answers the need of everyday trip, from morning to evening and full year. - MaaS Operator is responsible for the service provided to both suppliers and customers.	
4	Integration of societal goals	- Added value: Decrease of private car ownership, - Incentives are implemented in the MaaS - Influence on societal and ecological impacts on mobility services by the city public authorities. - Two important stakeholders: Cities that dictate the use of infrastructure and public space and public transport authorities considered the 'backbone' of mobility.	N/A

Table 1 - Level of Mobility-as-a-Service Integration

Source: A topological approach to Mobility as a Service: A proposed tool for understanding requirements and effects, and for aiding the integration of societal goals, p.93, 2017

Step (iii) Comparing MaaS business models

Crossing the information of which cities use MaaS and their level of integration, a list combining this two information was designed (**Table A.3**, appendix). The outcome if this research sustained MaaS key cities selection, as both research and studies constantly referred to them. At that point, it was already feasible to find common traits and extreme opposites between the cities, although not enough to complete the findings of this study.

Step (iv) Creation of a list of experts to contact on key cities that use MaaS

Qualitive data is the key piece for this research, as insights about this topic could only be provided by those who experienced the set up and implementation of MaaS. Mostly of the input used in this thesis it would not be accessible from only studying MaaS apps or reading articles about the projects. With this in mind, at least one expert per key city that was involved in MaaS was needed. The information regarding who those experts were and their relevant role, was taken not only from secondary data and presentations available at Google engine search, but also through LinkedIn search. Fifty-three people were contacted by personalized e-mails and LinkedIn inMail (**Table A.5**, appendix), in addition to attaching a presentation with an overview of the research goal, the researcher (myself), research approach, next steps and contacts information. Experts e-mails were publicly available in presentation or at the platform app while LinkedIn inMail was available once the experts accept my invite for connection. In total, I conducted 12 interviews for the purpose of this research between April 23rd and May 19th.

The experts whom agreed to proceed with the interview provided me crucial information, becoming the core of the research. It was sent in advanced 4 questions that were discussed during the interviews (**Table A.8**, appendix).

Step (v) Interview with experts on key cities that use MaaS

For this study, I collected primary data through semi-structured interviews with previsouly prepared questions, sent in advance (**Table A.8**, appendix). The 12 experts interviewed are currently working in 9 different countries (**Table A.5**, appendix), 2 key cities did not answer the meeting request (Stockholm and Madrid), therefore the collected information was only through secondary data. The respondents are currently working with Mobility-as-a-Service, including (i) specialists, (ii) managers, (iii) head of division, (iv) directors and (v) Chief Executive Officer (CEO). Having interviewees with diversity in their origin and roles, especially within the same industry, enables the reader to feel secure regarding the accuracy of the findings (Lorenc et al., 2016). The split of interviews platform was the following: 33% of the interviews were executed by Skype, 50% by Microsoft Teams and 16% answered via e-mail. The average length of the interview was 45 min, maximum length was 90 min and a minimum of 30 min.

The interviews were not recorded, but instead I was taking notes during the conversation. After the video call, the key information was summarized (**Table A.10**, appendix). Moreover, it was created a table with top answers from the experts (**Table A.9**, appendix)

The data collected from the interviews is the core source of information used throughout the entire research. This information is crucial to find traits and cluster the cities. Yet, the analysis of the scientific articles and presentations were crucial for the purpose of understanding and analyzing the Mobility-as-a-Service industry and entering interviews.

Step (vi) Comparison of business models to operate MaaS and identification of extreme cases

With the information gathered from the interviews, the below table 2 was elaborated to analyse the characteristics of each key city and its main Smartphone app. The following characteristics were identifies as the most important to differentiate MaaS services: *Operator (if a private company or government); level of government support (low, medium, high); current geographical scope (city, regional, super-regional, national, international); Mobility partners operating for MaaS; Private ride sharing (Yes or No).* Concerning this last characteristic, when MaaS operator is own by the government or has a high level of support from this entity, it can lead to an obligation of share data.

At this point, given the information collected so far, it was now feasible to detect clusters (Figure 6). It appeared as if the core distinction between the MaaS approach to the market is the level of government support for this service and the regional scope a MaaS solution seems to cover. To validate my cluster proposal, one of the four questions asked during the interview was "*What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like city name?"* and *"Do you think any city can implement MaaS?"*, which allowed me to identify common challenges that different cities face.

Table 2 - Key cities and respective MaaS smartphone Apps analysis

Smartphone App	Area	Operator	Government support[2]	Current geographical scope	Partners on board	Open Market[3]	Private ride sharing[4]	Regulatory barriers[5]	Data sharing from Mobility partners[6]
Whim	West Midlands, UK	Private company	Medium	International	Public transport, car rental and taxi	Yes	No	Medium	Low
UMAJI	Taipei, Taiwan	Government	High	Regional	Train, MRT, Bus, Taxi, light rail, Ferry, Ride Sharing, E-Bike, Bicycle	No	Yes	Low	High
Whim	Helsinki, Finland	Private company	Medium	International	Bicycle sharing, car sharing, car rental, taxi, urban PT, regional PT	No	No	Low	Medium
Arevo	Melbourne, Australia	Private company	Medium	City	Trains, trams and bus, bike share and car share, Uber and off-street parking	Yes	Yes	Medium	Low
WienMobil	Vienna, Austria	Government	High	City	Bicycle sharing, car sharing, taxi, urban PT, parking	Yes	Yes	Medium	Medium
Whim	Antwerp, Belgium	Private company	High	International	Train, bus, taxis, car rental, shared bikes	Yes	No	Low	High
FluidTime	Aarhus, Denmark	Government	High	Regional	Public transport, carpooling, taxi, car sharing	No	Yes	Low	High
Jelbi	Berlin, Germany	Government	High	City	Bike share, scooters, ride share, car sharing, taxis and public transport	No	Yes	Low	High
MaaS Madrid	Madrid, Spain	Government	High	City	e-bike sharing, electric car sharing, electric moto sharing, e-scooter sharing and Public Transport	No	Yes	Medium	High
UbiGo	Gothenburg & Stockholm, Sweden	Private company	Medium	City	Bicycle sharing, car sharing, car rental, taxi, urban PT	Yes	Yes	Medium	Medium
Turnn	Many cities, Netherlands	Private company	Medium	National	Public transport, car rental, car shared, bicycle, ferry and taxi	Yes	Yes	Medium	Medium

[2]**Governement support** - E.g. Public endorsement, advertising by the city, provision of funds, arrangement of industry agreements; clear and validated data license models; provided license model framework; APIs support; data exchange platform; among others.
[3] **Open Market –** Market with other Mobility-as-a-Service platforms operating (competitors).
[4]**Private ride sharing –** An agreement in which a passenger travels in a private vehicle driven by its owner, for free or a fee, usually as arranged through a website or app
[5]**Regulatory barriers –** *Low* if the city facilitates and is willing to adapt regulation for MaaS implementation. E.g. Policy in order to be more beneficial for companies to provide a MaaS subscription than a company vehicle; *Medium* if the city is willing to assist with bureaucracy and facilitate regulation for MaaS implementation. E.g. Amsterdam has a limited number of passengers for ride sharing and the Innovation department from City of Amsterdam are trying to change regulation; *High* when the public authorities will not facilitate MaaS implementation neither give support.
[6] **Data sharing from Mobility partners** – *Low* when mobility partners fear losing control and direct contact with customer, therefore MaaS Operator needs to negotiate e.g. MaaS app Whim in Birmingham, Public Transport Authority agreed on sharing data, if as a counterpart, Whim shared the result and is transparent. *Medium* when MaaS Operator faces some challenges on getting mobility partners on board and sharing data, but eventually is agreed; *High* when the government defines sharing data mandatory from mobility partner to join MaaS

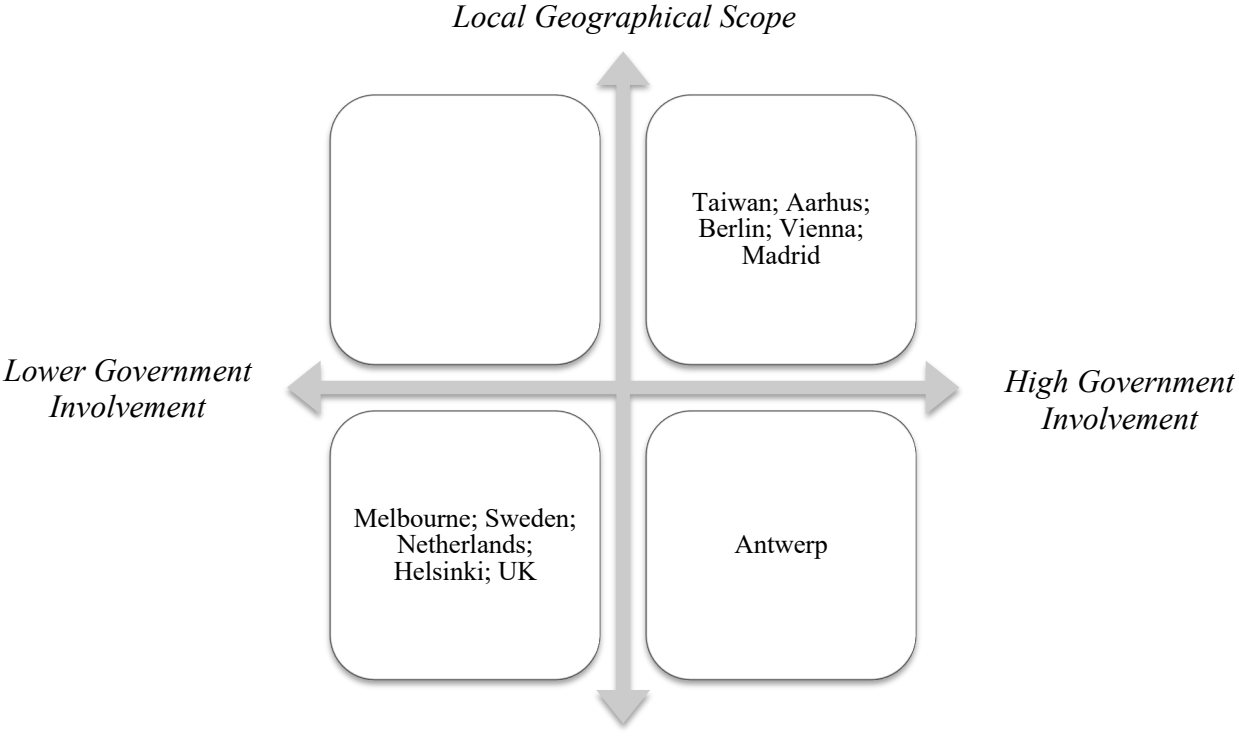
4. Different business models to operate Mobility as a service

In line with my two research question, this section will be divided in two parts. The first one, concerning the question how cities already operate MaaS, will consist in a description of the different clusters found. The second part will give an explanation of the reasons for the different MaaS implementations in each city. In particular, three patterns will be explained in detail, together with the challenges that come along. Furthermore, it will be provided the actual impact on the Business Model Canvas by Alexander Osterwalder, followed by a *checklist* as a practical tool for those interested in implementing MaaS in their cities.

By comparing and contrasting how MaaS operation works in different cities, I identified 3 clusters. As seen in figure 6, the clusters are grouped taking into account government support level with MaaS in each city, while also managing geographical scope of MaaS platforms mentioned in Table 2. There is a clear overview of three distinctive clusters:

1. Cluster 1: Hyperlocal (Taiwan, Aarhus, Berlin, Vienna, Madrid)
2. Cluster 2: City tailored, but international scope desired (Melbourne, Sweden, Netherlands, Helsinki, UK)
3. Cluster 3: Data sharing is caring (Antwerp)

Figure 6 - Cluster of cities based on common characteristics



4.1. Types of business models used to operate MaaS

It is explained, in the literature review, the purpose of the nine blocks of the Business Model Canvas, created by Alexander Osterwalder (2005). Moreover, for business model innovation it is often used business model patterns as a powerful instrument. A prototypical pattern refers to a general set-up of business model while a solution pattern refers to the components of the business model (Remane et al., 2017). Hence, when combining several patterns, it is being built a complete business model (Osterwalder & Pigneur, 2010).

Based on this, I describe a prototypical pattern for Mobility-as-a-Service implementation, adding underlined (e.g. underline) when the MaaS operator is managed by the government:

Value Proposition: Integration of public/private transport & infrastructure under a single platform to cover mobility needs; single booking, ticketing and payment; services provided (increased convenience, improved accessibility; flexible mobility; sustainable mobility; cost beneficial mobility options; personalization; market share increment; social benefits according to the government measures)

Customer segments: Individual/private users (Commuters; Locals; Tourists; Families; Young; Elderly; Students); corporate users; authorities; policy makers.

Customer Relationship: Personal assistance; automated services; communities; loyalty programs.

Channels: Website; Smartphone app; Internet; Promoting and advertising via (tour operators, hotels, rental cars, airline companies); social media; third party retailers; local community groups; social media; public spaces; public transportation authority's website.

Key activities: Service development and provision (booking, journey planning, ticketing; payment); customer service; gather customer feedback; marketing; processing demand data; providing data to authorities.

Key resources: Human resources; physical and technological resources; government mobility fund; government support (digitalization, API's; license frameworks, partnership with mobility services to help them reach goals e.g. use city logo and network contacts)
Key partnerships: Mobility service providers (Bus, Taxi, Train/Tram, Car-sharing, e-scooter, bike sharing, car rental, carpooling); Public Transport Authority; Regional Authorities; users; parking companies; car manufacturers; research organizations; infrastructure providers; insurance companies; financial transaction enabler/credit card companies; event and entertainment services; city government.

Cost structure: Operational costs (amortization of the investment cost; marketing and advertisement; maintenance of the website, app and information system, legal costs); investments costs (platform and app design and development; brand creation; service provision cost; customer service and support; personal cost; insurance cost; data security and privacy related costs)

Revenue streams: Commission on ticket sales (subscription packages and pay-as-you-go); advertisements; public subsidization; commission from non-mobility providers, advertisement)

As previously mentioned, three clusters have been grouped based on the information taken from primary and secondary data.
In the next pages, it will be explained in greater depth the reason behind these distinctions between the cities with practical examples quoted from industry experts' interviews. For every cluster, I use a simple city illustration.

4.2.Mobility-as-a-Service characteristics

4.2.1. Cluster 1: Hyperlocal

Defining characteristics

This pattern is characterized by the following characteristics (see Table 2): MaaS is implemented aiming to fix a specific social issue, relevant to the region in which the government rules. Therefore, the transport modes included in MaaS are based on their capability of support to fix the specific social issue. Usually, given that government is the MaaS

operator, MaaS operates exclusively in a certain city, thus it has a low desire of international expansion, followed by a lower probability of an open market (government has MaaS monopoly). Moreover, due to government power, there is a higher chance of adjusting regulation to MaaS implementation and having mobility partners sharing their data.
The pattern we can observe in the following cities: Aarhus (Denmark), Austria (Vienna); Berlin (Germany); Madrid (Spain) and Taipei (Taiwan),

Sample city: Aarhus, Denmark. A good example for this pattern is Aarhus. In this city, the MaaS platform "FluidTime" was initiated in year of 2018 by the government. It covers the geographic range of Aarhus and 12 municipalities around. The government implemented MaaS to solve an issue of *"high traffic of congestion and lack of mobility from rural areas to the city"* (Informant K, Smart and Green Mobility Expert, Aarhus). The government has the best interest of the city in mind, putting aside any desire of international expansion. The interviewee clarified that MaaS aims to have the 12 municipalities move without increasing congestion. The solution seems to be, for the interviewee, carpooling. An increase on the number of people per car would fix the issue previously mentioned. Therefore, of the emergence of e-scooters, although included in the city MaaS app, it will not contribute for the resolution of the issue. Moreover, the industry expert shared feeling a disparity in mobility focus and business models between public and private operators.

Discussion of relations within the pattern:
Industry experts from cities, which have the Government as MaaS Operator, revealed that the special characteristic of operating MaaS this way is the high level of public support, which helps to get all stakeholders on the table. Most of the interviewees considers public as the backbone of MaaS. The interviewee F, Head of Business Division Europe at Upstream from Vienna said, *"the backbone in any city is public transport, without it MaaS won't be successful"*, it has also shared that a critical factor is MaaS government structure in a city. This level of commitment from the government led the entity to cover all the digital challenges, hiring a company to be responsible for the city digitalization, even if it still has *"a long journey ahead"*, as illustrated by the challenged faced with ticketing, not due to *"technical challenges but organizational instead"*. Although is easy to get mobility partners sharing data, ticketing is difficult to implement, since each of mobility partners want to have the direct contact with customer. Evidently, having a high level of government support does not stand for a smooth MaaS implementation, as each city stakeholders react differently.

As revealed by the government of Taiwan, MaaS implementation was aspired to increase the low rate of public transportation use. For that, the entity developed information and communication technology for MaaS, to increase awareness. Consequently, it determined gradually the implementation of MaaS by *"encouraging the transportation systems to change their relationship from competition to cooperation so that shared mobility can be able to fill the gap of the public transportation's first-mile and last-mile services"* (Informant C, Director of Institute of Transportation, Taiwan). The high level of government support is also a key factor to change regulation in favor of MaaS. This is the reason why in cities such as Berlin, payment and ticketing is mostly possible. The project is initiated are tightly controlled by the local government. Because of this, MaaS services of this type are also usually targeted at the local level. The government is interested about high integration in this specific city, but not so much about the expansion of the service beyond the region.

4.2.2. Cluster 2: City-tailored, international expansion desired

Defining characteristics

This pattern is characterized by the following characteristics (see Table 2): Both the city and government are seen as important stakeholders. In this cluster, MaaS was created as an innovative and disruptive profitable business, not to fix a specific social issue in a city, but instead implemented to decrease the use of private vehicle regardless of where its operating. With private companies owning MaaS operator, together with the above characteristics, not only it creates a more attractive environment for an open market, but also motivates for expansion. Nevertheless, this cluster has less power to request mobility partners to share their data and more challenges with regulation for MaaS implementation. Moreover, it aims to provide the highest number of transport modes into a MaaS subscription as a way to increase its value.

The pattern we can observe in the following cities: Amsterdam and other cities (The Netherlands), Gothenburg (Sweden), Helsinki (Finland), Melbourne (Australia), Stockholm (Sweden) and West Midlands and other cities (UK).

Sample city: Helsinki, Finland. A good example for this pattern is Helsinki, where "Whim", MaaS platform operator, was born and initiated in year of 2015 by a private company (Whim)

and is seen as the founder of Mobility-as-a-Service. This app is now available in 5 cities with a desire of *"being in all over Europe" (*Informant D, Founder at MaaS Global, Finland). As a consequence of being in the market for a longer time, it has developed a relationship with mobility partners and other stakeholders. Nonetheless, the city still faces considerable challenges with public transport: *"Changing public transport mentality is a challenge. Public transportation authorities believe MaaS will become a car centric solution and therefore create a negative impact in the pubic mobility. However, by not cooperating it is indeed leading MaaS to be a car solution".* Moreover, for Helsinki industry expert D, competition is a right of consumers, it is not fair to provide only one option. When *"public transport is owned by the government, and if they do not want to cooperate, it is a big challenge and the reason behind this action is too much power over citizens money".*

Discussion of relations within the pattern:

Industry experts from cities, which have private companies as MaaS Operator, revealed that the special characteristic of operating MaaS this way enables a higher chance of an open market. The reason behind this sits on MaaS being a possible profitable new business which is not monopolized by the government, given this entity medium level of support. Melbourne industry expert E believes the *"core message in MaaS is based on a sharing mobility services, and for a healthy MaaS, it must be an open market delivered through competition. It can't be exclusive to one operator, such as the government, to serve the consumer".* In this cluster, MaaS was not generated to fix a specific social issue but instead to provide a disruptive alternative to society.

Nonetheless, a consequence from receiving medium level of support from the government, it can cause to this service not to be seen as a priority. Industry expert A, Innovation Manager at Highways England which worked previously at Public Transport of Greater Manchester (TfGM), shared the challenge of having work colleagues not very supportive of the idea (MaaS), *"as the innovation department is not considered a priority by her colleagues which focus on day-to-day challenges"*. Thus, there are lower chances of facing this challenge once the government is highly supportive of MaaS. Moreover, although it depends on each city relationship between stakeholders, it is seen as more challenging to have mobility partners sharing their data with MaaS operator in this pattern. The reason is led by the fear of losing control *"Whim, mobility partners are no longer talking directly to the customer therefore having less customer knowledge and less revenues"* (Informant B, Managing Director at

Intelligent Mobility Solutions, UK). There isn't any policy that makes mandatory to share data, as it happens in cities with high intervention from the government, such as Antwerp.
Interviewees revealed that cities with this pattern have higher chances of following an international expansion. Illustrated by industry expert A, Innovation Manager at Highways England from Manchester, which believes MaaS should be implemented as an European solution. Moreover, Whim aspires to become that European leader. This company mission would not be feasible in cities such as Aarhus in which government has the best interest of the city only.

UK operates under a deregulated market and industry expert B, Managing Director at Intelligent Mobility Solutions from this region, shared that *"MaaS in UK seems more feasible"* as *"comparing to Berlin, Public Transport Authority owns the MaaS solution therefore regulating MaaS app. Every mobility option must go through this app, owned by public government".* Still, facing regulation challenges is one characteristic from this cluster. *"having government support can speed up the development of MaaS quite a lot" (*Informant D, Founder at MaaS Global, Finland) as *"public transport entity is afraid of having MaaS playing a role similar to Booking.com and pay commission to 3rd parties, paying MaaS to get customers"* (Informant G, Specialist Consultant at Future Mobility, Melbourne). It is a challenge to have mobility partners on board. Another example shared by Industry expert D, Founder at MaaS Global from Finland, concerns of having 30% of emission due to cars in 2030 and regulation is not helping to accelerate the process, giving an example of being more financial beneficial for companies to provide a car to their employees than a MaaS subscription. The interviewee also shared concerns regarding transportation industry being the only one which hasn't improved since 90's. *"We don't want people to use their car but do not give them a good alternative".* Amsterdam is another example of the regulation impact in MaaS as it has *"a maximum number of passengers allowed for carsharing, a different policy and regulation than other cities in The Netherlands"* (L, Program Manager Smart Mobility at Gemeente, Amsterdam). In cities such as Antwerp, the change in regulation is faster and with less bureaucracy.

4.2.3. Cluster 3: Data sharing is caring

Defining characteristics

This pattern is characterized by the following characteristics (see Table 2): The government plays as a mediator for MaaS, in particular to change mobility partners relationship from "competition" to "cooperation". This cluster is in between the two mentioned above, as MaaS operator is owned by private companies but highly intervened by the government. This ecosystem benefits MaaS projects, as government not only funds them but also forces mobility partners to share their data and supports the digitalization of mobility partners to enable API's access to third parties. In Antwerp, there are several MaaS platforms and supportive of an open market.

The pattern we can observe in the following cities: Antwerp (Belgium).

Sample city: Antwerp, Belgium. A good example for this pattern is Antwerp. In this city, there are several of MaaS solutions, being Whim, founded in Helsinki, one of the main MaaS operators. Whim in Antwerp was initiated in 2018 by MaaS Global. MaaS in Antwerp is clustered alone, as their operational model is an extreme. In this city, private companies are launching MaaS combined with extremely high support from the government. *"The local government plays a crucial role in pushing stakeholders in the same direction. It was built a strong brand for communication on everything related to mobility"*. (Informant H, Mobility-as-a-Service Specialist at Stad Antwerpen, Antwerp). The city started "Smart Ways to Antwerp", a website to create awareness for everything related to mobility, as they believe communication is the key for mobility. With 99% brand awareness in Antwerp and 20% in the country, this website contains relevant information's to citizens, such as work constructions, Mobility-as-a-Service, improving bike infrastructure, among others. Antwerp, opposite to Germany owning MaaS app Jelbi, does not aim to manage a city MaaS app, since there is a higher number of people to influence their behavior outside of the city (tourists). It supports "*all the service providers in developing MaaS product offering while not making them dependent of government financing*". In Antwerp the market plays freely, opposite to Berlin Public Transport authority which bought Trafi to integrate all mobility services. Moreover, the city provides funding for MaaS implementation, managed in such a way that companies won't be financially dependent from this subsidize.

The regulation to operate MaaS is very city specific and each of them faces different barriers. In Antwerp, the city hasn't let the market arrange everything – the government has changed the regulation accordingly: arranged industry agreements; clear and validated data license models; intermodal route planner; clear and neutral communication; self-sovereign identity for mobility; quality framework; license model framework; APIs; subscription models; market research; data exchange platform; among many other generic things that most MaaS and mobility providers require, costing a lot of money.

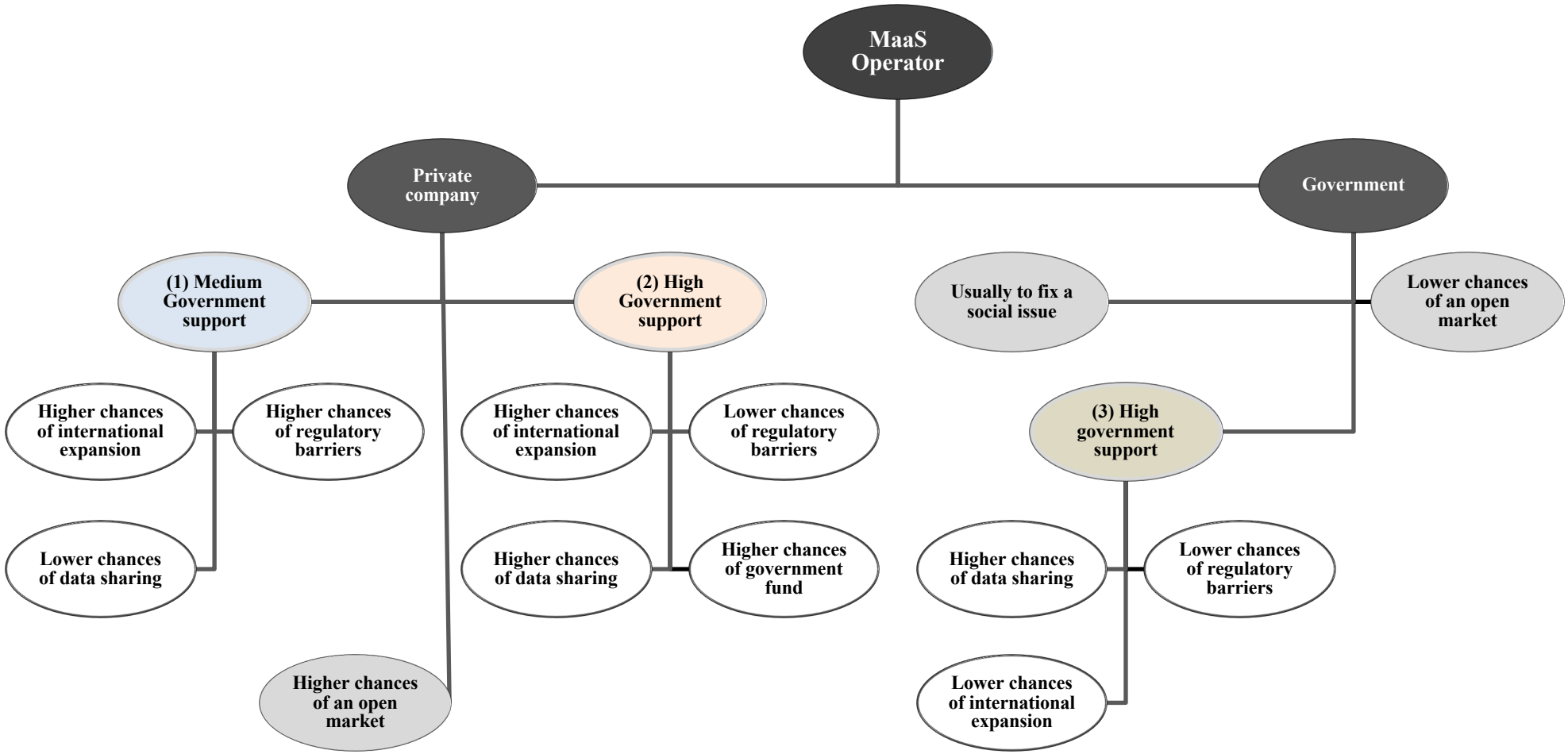
The government in Antwerp forces the players to work together and find solutions for challenges, such as insurance of shared cars and privacy legislation. It helps to build trust and co-ownership of the network. Antwerp strongly believes that *"is important to let the market play but not to let the market roam freely".*

On the whole, the government of Antwerp believes that cities and local governments must make sure to support the backbone of an open MaaS Ecosystem. This means enabling roaming (between cities, regions, countries), have a clear communication channel to the people to show them what their possible alternatives are, also related to validated driver licenses and make detailed information available. Moreover, it supports users and providers to find each other and build trust. Government must reinforce a strong and unifying brand.

Below, in Figure 6, I summarize the most important cause-effect relations identified. It is my understand, after the analysis of research and interviews with industry experts, that the entity managing the MaaS operator is the main factor which can change the direction of Mobility-as-a-Service. After this decision – if owned by the government as a project to build a more sustainable city or to fix a specific social issue; if owned by a private company as a business which follows the same strategy as recent and successful companies (Uber, as a digital platform and Deliveroo, as a multi-sided platform). However, it is clear that regardless of MaaS operator, there are still different levels of government support and regulatory barriers. These three factors together will lead to distinctive consequences and business journeys.

Under the scheme, each text box has practical advices to "watch for" when implementing each of the three clusters.

Figure 6 - Scheme containing the different approaches for Mobility-as-a-Service implementation



1

1. Challenge to change current mobility behaviour;
2. Different digitalization levels between mobility partners;
3. Ticketing integration between mobility partners is difficult as each wants direct contact with customer.
4. Individuals working with MaaS pilot at public companies, feel MaaS it in not seen as a priority by colleagues when compared to daily challenges.

Cluster 2

2

1. Challenge to change current mobility behaviour;
2. MaaS private operators highly dependent on government support (financial, technical and social)
3. Low motivation from MaaS operators for expansion, as other cities won't give the same support level as Antwerp did.

Cluster 3

3

1. Challenge to change current mobility behaviour;
2. Less ambition for a profitable business, more motivation to fix a specific social problem for the city;
3. Different goals between public and private mobility

Cluster 1

Irrespective of the cluster, however, the interviews also revealed that the biggest challenge, in fact, for every MaaS-offer (whether it is one platform supported/played by a local government or a privately-owned company trying to into the local market) is the same everywhere: there is no money to be earned in reselling tickets for commission. It is difficult to earn back the investments made from 5 to 10% on a 1€ trip. There are only very few mobility players who operate at a large enough scale where the number of transactions might become interesting for such low profits per transaction. The main challenge is to find where there is a real business model for MaaS (Informant H, Mobility-as-a-Service Specialist at Stad Antwerpen, Antwerp).

5. Checklist for MaaS implementation

Creating a company can be stressful and human errors can happen. The checklist is an important tool in error management, which leads to an increase of productivity. It can be a direction for an user to guarantee its verification, even without a conclusion (Hales & Pronovost, 2006).

Figure 7, in Appendix, contains a checklist with steps to follow based on all the findings and gathered information, together with MaaS industry experts' insights. These are divided into 4 categories: MaaS market, stakeholders, customers and business model as key topics mentioned during the interviews.

Overall the checklist is designed to serve any individual interested to implement MaaS in any city, especially taking into consideration that the cities analyzed in this thesis are very diverse, reaching cultures from Europe, Asia and Oceania. Moreover, it combines inputs from both private and public sector at all types of positions within an organization.

By checking a task once it is completed, it will help MaaS operation and increase its likelihood of success, as most challenges are common across every city.

6. Discussion

The concept of Mobility-as-a-Service is recent, in such a way that no clear definition has been agreed on. Nevertheless, society is in need of a change from the current mobility system, and it will be in favor of it over owning and using a private car, once available an alternative to aggregate efficiently different mobility options into one well connected mobile app (Comtrade Digital Services, 2017).

The aim of this research has been to provide an overview of the business models for operating Mobility-as-a-Service, underlining the implications of key decisions experienced by industry experts. There is a theoretical implication for this dissertation, but more importantly, also a practical one. By showcasing the current business models for Mobility-as-a-Service, the contribution of this thesis was to map out the landscape of MaaS systems already operating. As a result, a MaaS implementation checklist is presented, based on this thesis findings and industry experts' insights.

This can be useful for both further research as well as practitioners. By highlighting the unique characteristics and challenges of different ways to operate MaaS, the findings can help to improve transparency about a new format of operating mobility. Moreover, they provide interesting discoveries for understanding the collaborative set up of digital platform business models. The reader will benefit from this research to foresee future challenges and key insights from individuals who have experienced it beforehand. After identifying common characteristics between cities, the clusters were created. Increased transparency about the different ways to operate MaaS are also of use to practitioners and policy makers, for instance follower cities or cities looking for ideas how to implement MaaS.

Lastly, the findings have shown there is a prototypical business model for operating MaaS but also many solution models that configure MaaS platforms in a certain way, driven by the conditions that surround them.

6.1.Limitations

The findings of this thesis have to be seen in light of some limitations.

The first one concerning the interviews, as out of eleven key cities, there were two that did not have a primary data analyse, instead a secondary one was used. Increasing the number of interviews and geographical heterogeneity of MaaS industry experts, might have been added relevant information, impacting the final results. The reason for this outcome is due to absence of answer and unavailability of industry experts in Madrid (Spain) and Gothenburg & Stockholm (Sweden). Future analysis should add the insights of relevant players from these regions to confirm the results. Moreover, if given more time, all the cities implementing MaaS with level two or more, can be analyzed for a more rigorous outcome.

In addition, although interviewees generally spoke very freely and I could establish a good level of communication with them, it has to be considered that, when questioning the challenges of implementing MaaS in their city and the main differences with MaaS of other cities, industry experts answers might have been biased to provide a brighter reality, knowing this dissertation will be published.

Finally, this industry requires a high level of technological use and digitalization in order to integrate all mobility options (need of API's), manage data to provide real time route options, ticketing management of multimoded transportation and returns of those. At the moment, this section plays a crucial role for this dissertation, however, given the rapid evolution of technology, the same might not apply in some years from now.

7. Conclusion

In this thesis, business models for operating Mobility-as-a-Service has been studied.

In the first research question, the current and past MaaS projects have been analysed based on the following steps: research of the key MaaS cities and understanding how each have implemented this service, followed by a comparison between them to identify common traits to cluster the cities. With key cities analyse, as a result on the research of each MaaS platform (**Figure A.11**, appendix), it was clear the different mobility transports available per city; the possible revenue streams for this service (subscription plan as the dominant revenue & pay as you go); how user friendly and integrated each platforms is and which stakeholders are involved in MaaS implementation (stands out the role of the government and its impact in the operation). Overall, with the information gathered, the existence of different methods to operate MaaS was confirmed.

In the second research question, the factors and reasons for the choice of the business model was estimated based on interviews with industry experts in key cities. Considering the understanding of twelve experts, factors such as the desire of international expansion linked to an existence of competitors in the market, in addition to understanding which challenges are faced, such as ticketing integration into the platform or getting mobility partners to share their data. Moreover, it was crucial to understand the project mission and regulatory barriers to implement MaaS. All these factors led to a distinction between types of MaaS operation and implementation. With the information gathered, the cities were clusters.

As a result, three clusters were identified: (i) Cluster 1: Hyperlocal, containing the regions of Taiwan, Aarhus, Berlin, Vienna and Madrid. (ii) Cluster 2: City tailored, international expansion desired, containing the regions of Melbourne, Sweden, Netherlands, Helsinki and UK. (iii) Cluster 3: Data sharing is caring, containing the region of Antwerp.

To conclude, the contribution of this research is to provide a practical overview of the different MaaS implementations, together with challenges and implication of common decisions. The insights from the industry experts are extremely valuable, used to provide a strategy tool, as a scheme containing the different approaches for Mobility-as-a-Service implementation (Figure 6). Moreover, this thesis finalizes with a “MaaS implementation Checklist”, with includes practical tips from industry experts personal experience with Mobility-as-a-Service.

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9. Appendix

Table A.3 - Long list of cities that use MaaS and their characteristics

	Area implemented	App	Modes of Transport	Level of Integration
1	Hamburg and Stuttgart, Germany	Moovel	Car sharing, taxi, urban PT[7], regional PT	2
2	Italy	myCiero	Urban PT, regional PT, international PT, parking, access to urban congestion charging zones	2
3	Dundee and North East Fife regions, Scotland, UK	NaviGoGo	Car sharing, taxi, urban PT, regional PT	2
4	France	iDPASS	Car rental, taxi, valet parking	2
5	Turku region, Finland	Tuup	Car sharing, bicycle sharing, taxi, urban PT, DRT	2
6	Hannover, Germany	Hannovermobil	Car sharing, taxi, urban PT, regional PT	2
7	Montpellier, France	EMMA	Bicycle sharing, car sharing, urban PT, parking	2
8	Netherlands	NS Business Card, MobilityMixx, Radiuz Total Mobility	(Car sharing, parking, fuel costs, e-car charging, taxi, car rental), bicycle sharing, urban PT, regional PT	2
9	Vienna, Austria	Smile	Bicycle sharing, car sharing, taxi, urban PT, regional PT, parking	2
10	Vienna, Austria	WienMobil Lab	Bicycle sharing, car sharing, taxi, urban PT, parking	2
11	Vienna, Austria	Whim	Public Transport, city airport train, E-scooters, taxi, rental cars	2
12	Las Vegas, US	SHIFT	Bicycle sharing, car sharing, taxi, DRT, valet parking	3
13	Gothenburg, Sweden	UbiGo	Bicycle sharing, car sharing, car rental, taxi, urban PT	3
14	Helsinki, Finland	Whim	Bicycle sharing (car sharing u.d.**), car rental, taxi, urban PT, regional PT	3
15	West Midlands, UK	Whim	Public transport, taxi rides and Car hire	3
16	Antwerp, Belgium	Skipr	Public transport, carsharing, carpooling, e-boikes, carsharing	2
17	Antwerp, Belgium	Whim	Tain, bus, taxis, car rental, shared bikes	3

18	Antwerp, Belgium	Mobiflow	Taxi, bikeshare, charging station, bus & tram, train	2
19	USA	Migo	Ride share, Taxi, carshare, bike share and public transport	2
20	Berlin, Germany	Jelbi	bike share, scooters, ride share, car sharing, taxis and all public transport modes	3
21	Berlin, Germany	Urbi	Taxi, bike sharing, e-scooter sharing	2
22	Madrid, Spain	MaaS Madrid	City e-bike sharing, electric car sharing, electric moto sharing, e-scooter sharing and Public Transport	3
23	Greater Manchester, UK	MaaS Evolution	Public transport, car share, car hire, bike share and Taxi	2
24	Aarhus, Denrmark	FluidTime	Public transport operators, carpooling services, taxi companies, car sharing,	2
25	Taipei-Yilan , Taiwan	Umaki	Train, MRT, Bus, Taxi, light rail, bus, Ferry, Ride Sharing, E-Bike, Bicycle	2
26	Kaohsiung, Taiwan	MenGo	Bus, taxi, chartered vehicle, highway bus, train, local bus, Taiwan tour bus, rental car, car sharing	2
27	Netherlands	Turnn	Public transport, to (shared) car, (shared) bicycle, ferry and taxi	2
28	Melbourne, Australia	Arevo	Melbourne's trains, trams and bus systems, bike share and car share options, as well as Uber and off-street parking	2

[7]**PT** – Public Transport

[8]**Level of integration** – Can be found in detail in Table 1. Level of integration ranges from zero (0) to four (4) describing the different topology of MaaS. This study focus on MaaS projects that operate using a smartphone app and its level of integration is 2 (Integration of booking & payment), 3 (Integration of the service offer) and 4 (Integration of societal goals), being 0 the less integrated MaaS and 4 the maximum level of integration.

Table A.4 - Illustration of list created to contact industry experts

Name	Status	E-mail	Relevant information	LinkedIn	Article found
A	Answered	Example@gmail.com	Founder of company X in city Y	LinkedIn link	Article where I found person A

Table A.5 - Industry Experts: Profile and Companies

	Data on Informant				Data on Interview		
#	Name	Job Title	Company	Location	Length	Date	Documentation
1	A	Innovation Manager	Highways England	Manchester, UK	45 min	April 23rd	Taken notes
2	B	Managing Director	Intelligent Mobility Solutions Limited	UK	30 min	April 24th	Taken notes
3	C	Director	Institute of Transportation, MOTC	Taiwan	-	April 28th	By e-mail
4	D	Founder and CEO	MaaS Global Ltd	Helsinki, Finland	45 min	April 28th	Taken notes
5	E	Managing Director	MaaS Australia	Melbourne, Australia	40 min	April 29th	Taken notes
6	F	Head of Business Division Europe	Upstream - next level mobility GmbH	Austria, Vienna	45 min	April 29th	Taken notes
7	G	Specialist Consultant	Future Mobility and ITS	Melbourne, Australia	30 min	April 30th	Taken notes
8	H	Mobility-as-a-Service Specialist	Stad Antwerpen	Antwerp, Belgium	120 min	May 11th	Taken notes
10	J	Policy and Research Advisor	Urban Transport Group	UK	-	May 4th	By e-mail
11	K	Smart and Green Mobility Expert	Aarhus Kommune	Aarhus, Denmark	45 min	May 6th	Taken notes

12	L	Program Manager Smart Mobility	Gemeente Amsterdam	Amsterdam, The Netherlands	35 min	May 19th	(N) Taken notes

Table A.6 - Meeting requests sent to industry experts via e-mail

E-mail sent to Industry Experts
Dear p*erson name,* I hope this email finds you well. My name is Sofia Lacerda, I am currently writing my master dissertation on the topic *"Business Models for operating Mobility-as-a-Service"* at Católica Lisbon School of Business & Economics. I am contacting you because I came across your active role in MaaS a report *name of report* **I am currently conducting expert interviews. I would kindly like to ask you whether you would have the time to schedule a 30min. call about Mobility-as-a-Service in *expert's city*? If so, please just let me know when this would suit you.** **ABOUT MY THESIS** Talking to you would help me significantly, because in my thesis I set out to compare different options to operate Mobility-as-a-Service in a city. Having your perspective on the choices that drove the implementation of MaaS in (city X) would be extremely valuable. All insights you share would be treated confidentially. Attached please also find a short presentation that describes my thesis project in greater depth. <u>Some questions I would like to ask, are:</u> 1. Who are the key stakeholders/partners for the success of a MaaS pilot? 2. What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like *expert city*? 3. What are the main differences between MaaS in *expert city* compared to other cities? 4. Do you believe any city can implement MaaS? What are the necessary factors to consider? Of course, also feel free to answer them in writing. **ABOUT ME**

I am from Porto, Portugal but currently live in Amsterdam. I work as an intern for the Nike European Headquarters while finishing my master's in International Management Strategy specialized in Strategy & Consulting. The interest in smart cities was born after having classes with my professor and thesis supervisor, René Bohnsack. I chose to focus on a topic related to sustainability and smart cities also due my personal experiences of living already in Porto, Lisbon, Budapest, Barcelona and now in Amsterdam. I am very excited to understand if there are really patterns between cities that already operate Mobility-as-a-Service and I hope you are willing to support my research. Thank you very much for your time and consideration, Sofia

Table A.7 - Meeting request sent to industry experts via LinkedIn inMail

LinkedIn inMail sent to Industry Experts (limitation to 300 characters)
Hi *person name*, I hope you are great. I am writing my dissertation on "Business Models for operating Mobility-as-a-Service". I am contacting you because I came across your active role in MaaS. Would you accept my invite so I can contact you regarding the topic in greater depth? Thank you, Sofia

Table A.8 - Industry Experts Interview Guide

Introduction	
Q1	Who are the key stakeholders/partners for the success of a MaaS pilot?
Q2	What do you see as the main challenges or critical decisions when deciding how to implement MaaS in city X?
Q3	What are the main differences between MaaS in city X and other cities?
Q4	Do you believe any city can implement MaaS? What are the necessary factors to consider?

Question	Top Answers across all interviews
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	Public Transport Authorities; Mobility operators (Taxis, bike sharing, carpooling, among others); Government; Users.
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in city X?	Having mobility partners on board, especially Public Transport Authorities as they are afraid to lose control with MaaS; Ticketing integration into MaaS Ecosystem; Change consumer mentality regarding private car ownership and using MaaS as an alternative; Data sharing from partners, unwillingness to have a third party company speaking directly with customers and getting their data.
Q3: What are the main differences between MaaS in city X and other cities?	The key difference between cities is policy making and city regulation to allow a smooth MaaS implementation, in particular having government and city support; Deregulated bus market and privatized railways Demanding a certain level of data sharing and digitalization from mobility partners
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	Yes, however institutional and economic issues of developing a mass market MaaS package are significant, it is not clear that every city can implement such a package. Cities with barriers to their public transport should avoid MaaS implementation, as the challenge is too big.

	Yes, if cities have the supply (good public transport), as well as many offers of taxi, car sharing schemes, car club access, city bike scheme or scooters. Combining a suitable demographic (young educated people) for MaaS and government control. In cities with a big supply of mobility partners, it is not suitable to have a fully integrated MaaS as having every partner on board is almost impossible.

Table A.9 - Industry Experts Top Answers

Table A.10 - Industry Experts summarized answers

Name	A
Role and company	Innovation Manager at Highways England
Area	Manchester UK
Relevant information	Her previous job was working at "Transport Greater Manchester". Melissa was the Owner of MaaS in Greater Manchester report, she has knowledge of MaaS pilots in TfGM
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	- Internal stakeholders supporting the idea, as the innovation department is not considered a priority by her colleagues which focus on day-to-day challenges. - External stakeholders, such as Bus companies, car sharing companies, etc. In UK, except London, bus services are provided by many different private companies. In a big city as Manchester, to move forward with MaaS, it is needed to have all bus companies on board. Tram service is public, therefore having its support is easier.
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Greater Manchester?	- Different companies have different level of digitalization and technology. For instance, tram public authority has API, therefore any developer can access online and get the information of real time travel. However, not every bus companies have API or even online information which becomes a challenge for MaaS success. - Companies might not be willing to share personal data. - Ticketing becomes a challenge as the same service (bus transportation) provided by different companies have different pricing.
Q3: What are the main differences between MaaS in Greater Manchester compared to other cities?	The main different is privatization of the public transportations. For instance, in Milan, all public transports are run by the same public authority, becoming easier to manage ticketing.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	MaaS should be implemented everywhere, as an European solution. Millennials that travel around Europe often, use different mobility transportations. Having MaaS implemented in Europe as one, would be a successful concept and cause a reduction of car ownership.

Name	B
Role and company	Managing Director at Intelligent Mobility Solutions Limited
Area	UK
Relevant information	Independent consultant and recognized leader in the fields of Mobility-as-a-Service (MaaS) and Smart and Integrated Ticketing. Currently working with KMPG to support the Integrated Smart Ticketing Programme at Transport for the North. Worked for MaaS Global (UK), Leading the relationship with existing and new partners and stakeholders, helping to grow MaaS Global's award-winning "Whim" solution across the UK
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	Public transport authorities, transport users, taxis service, ride hailing and city bikes For instance, in Birmingham, one bus companies run 90% of all companies becoming a key partner to approach and have onboard.
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Greater Manchester?	The biggest challenge are the commercial deals, not the technical part. Even if the app works perfectly, if the bus won't approve, the project won't come forward. What prevents transportation companies from being onboard with MaaS project, is the fear of losing control. As an example, Uber has no 3rd company in between the company and the customer, taking advantage of all customer data and revenue. When introducing a MaaS app, Whim, Uber is no longer talking directly to the customer therefore having less customer knowledge and less revenues. The argument used to convince companies to make a deal with MaaS project, is that actually it will increase customers and therefore more revenues. In addition, revenues generated by MaaS come from subscriptions with prices that provide access to several mobility transportations providing fix extra revenues to the partner companies. Partners must have faith that MaaS users will be happy to use "Unlimited package" that replaces the need and cost of owning a private car.

Q3: What are the main differences between MaaS in Greater Manchester compared to other cities?	The main difference comes from delivery models, in UK things are more deregulated than many other countries. When deregulated, MaaS approach becomes more feasible. Comparing to Berlin, Public Transport Authority owns the MaaS solution therefore regulating MaaS app. Every mobility option must go thru this app, owned by public government. In UK there is a very private mentality, believing that private sector can innovate faster, in which public sector is seen as being slower. The problem of private sector is that you do lose control. For instance, in Birmingham, there was a concern that Transport Authority wouldn't have power as soon as MaaS gets introduced. Nevertheless, being UK so deregulated, MaaS projects do not have to take into consideration Public Authority concerns and initiate the project anyway. What happened in this specific situation in Birmingham, is that Public Transport Authority agreed on supporting MaaS projects, if as a counterpart it would result on sharing results and being transparent.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	The first step to understand chances of MaaS success, is to do an analysis which cities have the supply (good public transport), as well as many offer of taxi, car share scheme, car club access, city bike scheme or scoters. Also, it is important to know how the population looks like - MaaS works well with educated young people. For a MaaS project success, the city must be onboard, therefore look at key target cities and which ones are willing to speak to you. However, any city can enable MaaS to happen, is about how much control you have. In case of weaker economies, let's say India, the government controls the country so it might be possible to implement MaaS. Santiago in Chile, there are thousands of companies providing transportation - in that situation is quite hard to get everyone on board.

Name	**C**
Role and company	Director of Institute of Transportation, MOTC, R.O.C. (Taiwan)
Area	Taiwan
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	The stakeholders in the MaaS project include the government, transport operators, operating teams, and users. The government 's policy needs to be correct. the transportation services have to be reliable. The operating teams must be high in efficiency. The users should be willing to use this service. Therefore, the balance of the four stakeholders is the key to success
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Greater Manchester?	The utilization rate of public transportation in Taiwan is quite low. So, how to suppress the high use rate of private vehicles is the main challenge. Taiwan 's information and communication technology is now developed. Thus, through this service model, the change of people 's commuting habits and the reduction of the traffic impact, including congestions, pollutions, accidents and casualties, among the city can be expected. To well develop the MaaS service, the public transportation needs of local people and the target group should be met while promoting.
Q3: What are the main differences between MaaS in Greater Manchester compared to other cities?	Like most of the countries, the current phase of MaaS service in Taiwan is at the stage of vehicle integration. To conduct the service plan that meets users' demand, the big data analysis and mobile payment have been introduced gradually to keep track of the users' characteristics. The difference between other countries and Taiwan is the government's domination and determination to gradually put the service in practice. In addition, we encourage the transportation systems to change their relationship from "competition" to "cooperation" so that shared mobility can be able to fill the gap of the public transportation's first-mile and last-mile services as well as offering services during off-peak time or midnight.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	MaaS is not an antidote in solving urban transportation problems. It is only a means to change the travel mode of people. Therefore, it is necessary to check the current transportation problems among the cities that are trying to promote the service. Furthermore, to establish the transportation services that are in line with the cities, the government should check the transportation services available in that areas and reach a consensus with the relevant transportation industry.

Name	D
Role and company	Founder and CEO at MaaS Global Ltd
Area	Finland
Relevant information	The CEO of MaaS Global the world's first mobility provider. The first person to introduce the concept “Mobility as a Service”, a paradigm changing transport offering.
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	- All available public transportation, Taxi, access to cars, bikes, among others. Without them there is no MaaS, all relevant partners must be on board. - It has to work for the society, important stakeholders are city and government, and they are and should be the dictators of how we go into the market. - Companies that give benefits for end users, such as companies supporting their employees to travel. Instead of providing a car, MaaS is the alternative.
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Helsinki?	- To have stakeholders such as companies that offer transportation benefit to employees, legislation and tax benefit are a challenge as it becomes more beneficial for a company to offer a car than to have a MaaS subscription. With today’s sustainability concerns, this should change to avoid promoting individual car ownership, especially when there is an alternative. - The most crucial decision and challenge is to analyse if the market is ready to evolve in a MaaS direction. This direction should be led by the city and government to make policies accordingly. - Public transport cooperation with MaaS is a challenge as the management must allow this partnership and 99% of Public entities have the power but are not willing to change. It is a shame for Europe to have the best public transport in the world and is becoming more car centric. - The challenge is also changing public transport mentality. They believe MaaS will become a car centric solution and therefore have a negative impact in the pubic mobility, however by not cooperating it is indeed leading MaaS to be a car solution. - Convincing Finish people not to use the car. Our studies show that 38% of population is waiting for an alternative to car ownership but is still difficult.
Q3: What are the main differences between MaaS in Helsinki compared to other cities?	Helsinki, being the first city to implement MaaS has, naturally, more data available. Comparing to other cities, we have been developing a relationship with partners and government for a long time. However, when compared to Antwerp, with less time in the market, the city has probably the most developed regulation for its operation. This is due to Antwerp government is more willing to cooperate.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	There are cities where MaaS implementation will definitely be easier, such as cities as Tokyo, New York, Singapore, London, where owning a private car is not useful and it is expensive. Also, the mentioned cities have many offers in the public and private sector as mobility alternatives, which play a big role.

Name	E
Role and company	Managing Director of Mobility as a Service Australia at MaaS Australia
Area	Melbourne, Australia
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	Regardless of the city, there is not only one winner. It is a shared mobility ride, so all players play an almost equal role. MaaS Operator is the one that faces the customer but behind there is model which it wouldn’t exist if not for mobility services. Government and policy makers are key to put everything together.
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Melbourne?	- From government perspective the key question is the role of government in the market. The core of MaaS is public transportation, it is not a threat, but people see it like that. Government role provides reliable public transportation and enable MaaS. - Ticketing integration and technology are important, a challenge is to establish a flexible regulation that allows data sharing. - Government needs to develop regulation to allow the implementation of MaaS. - To change a city culture of replacing their private car. The solution comes from gamification and loyal programs, imagine an example where if you use public transport every day, there is a free coffee in the weekend. It’s a very powerful tool that can lead to the shift in the culture.

Q3: What are the main differences between MaaS in Melbourne compared to other cities?	The key difference between cities as Helsinki and Melbourne is demographic. The density in Australia compared to Europe is considered low and that is a challenge when implementing a service, especially when commercializing a private service. Active transportation in Melbourne is still low (between 5% and 6%), meanwhile Netherlands and Northern countries have 30%. Melbourne uses their own vehicles; however, Governments is working hard to increase frequency of public transport, especially the train. MaaS has the right recipe to put everything together.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	You must analyse what problem are you trying to fix? The biggest challenge is the car ownership. That is the core vision and to get that you need to offer other solutions. Maas is tailored to the customer (city) based on the culture. Regardless of where it goes, the backbone is public transportation. Within each city you might end up having different models for urban or rural cities. The beauty of MaaS is customizations. To have a healthy MaaS implemented in a city it requires an open market, with competition. It can't be exclusive to one operator, such as government.

Name	**F**
Role and company	Head of Business Division Europe at Upstream - next level mobility GmbH
Area	Vienna
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	The backbone in any city is public transport, without it MaaS won't be successful. All the other mobility operators are also important stakeholders, such as bike sharing companies, taxi, uber among others. In addition, a forgotten but important stakeholder is the people who live in the cities
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Vienna?	- Critical factor is MaaS government structure in a city. Most cities do not have clear MaaS ecosystem governance, Vienna can be a small exception although not in the ideal situation yet. - Vienna is an exception as we have started investigating MaaS far earlier, about 10 years ago, where we collected experience of this ecosystem in the city. We came into the conclusion that Maas is far more digital than physical, so government must cover all digital challenges. Vienna was first city stating the need to have digital infrastructure, therefore found a company to take care of digitalization of the city. - Public transport is a challenge that needs to me well integrated in the ecosystem - ticketing - There are four level of MaaS integration: information, booking, registration and payment. In the deepest level, payment, MaaS will provide one ticket for the complete journey. However, this is a big challenge, not technical difficulties but organizational. For instance, it is easy for mobility partners to provide information and share their data but each of them wants to have the direct contact with customer. An alternative, as Antwerp does it, is to demand partners to share data and have a high level of integration.
Q3: What are the main differences between MaaS in Vienna compared to other cities?	There is different approach to MaaS. In Paris, where public transport operates as central core of MaaS; Finland where all operators need to comply with certain digital interface standards and in the end the best solution will solve the problem, no public intervention, and models such as Vienna and Hamburg, where MaaS is an ecosystem but needs to have the digital layer own by public transport. It requires to be in the hand of public community.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	Yes. The definition of MaaS is difficult one. Most cities interpret MaaS as a digital app with mobility options, however its definition is more complex, requires to be flexible and more than public transport. Before implementing, important to know the demand and offer of the city to make MaaS successful. Yes, any city can do it but is the implementation is tailored to the city, as ecosystem works different.

Name	G
Role and company	Specialist Consultant - Future Mobility and ITS
Area	Melbourne, Australia
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	Public transport is the most important, since without them there is no solution. Government. For instance, it plays a big role to have the right person at the right time… in Sydney, transport minister in pro innovation
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Melbourne?	- Having government support is a challenge, as they want to control the situation. Bureaucracy over customer wellbeing. Being a service provider is already a challenge, as they are afraid to become like hotel industry and pay commission to 3rd parties, as Booking. Also, in transportation services, they are afraid of needing to pay MaaS to get customers. - Ticketing is one of the hardest challenges. Mobile ticket is not possible with iPhone, only android. Another challenge is the physical barrier on public transports, which requires a technology that is highly integrated. - MaaS profit margin is not that attractive and requires a lot of work. Just consider that if users stop using car due to cost, also to bring another alternative has a high cost.
Q3: What are the main differences between MaaS in Melbourne compared to other cities?	Some cities are more interested in creating an open market, with competitors such as Antwerp and Helsinki. In Antwerp has a better policy maker, as MaaS will help sustainability therefore government is willing to change and make the regulations accordingly.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	Cities that have physical barriers on their public transport, MaaS Operators will avoid go into that market. Only MaaS that can develop a good user-friendly app should implement this service. For instance, Uber app looks simple but requires many professionals working on it daily.

Name	H
Role and company	Mobility-as-a-Service Specialist at Stad Antwerpen
Area	Antwerp, Belgium
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	To make the introduction of a MaaS-solution a success you need commitment from the various stakeholders (government, PT-providers, mobility providers, MaaS providers) and you need to give the all players the time to grow. A (local) government plays a crucial role in "putting the noses in the same direction". In Antwerp we've done that through building a strong brand for communication on everything related to mobility (slimnaarantwerpen.be / Smart Ways to Antwerp); organize various project calls in which we support all the service providers in developing their product offering but at the same time, not making them dependent of our financing by making the funding transaction based. We've also put various types of incentives towards end-users in place (both usable for MaaS providers as for mobility providers or even service providers like bicycle shops).
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Antwerp?	- The main challenge for every MaaS-offer (whether it is one platform supported/payed by a local government or a privately owned company trying to get a food in the local market) is the same everywhere I believe: there is no money to be earned in reselling tickets for commission. Nobody can earn back the investments made from 5 to 10% on a 1€ trip. There are only very few mobility players who operate at a large enough scale where the number of transactions might become interesting for such low profits per transaction. Some mobility players hope to earn money on the trip data collected but I believe that companies who see that as their baseline do not belong in mobility and certainly should not be supported by a government. So, the main challenge is to find where there is a real business model for MaaS. In Belgium we now have something called the mobility budget (instead of getting a lease car as part of your salary, you get a budget you can spend on mobility solutions or even rent if you live close enough to work). Since offering a wide array of mobility solutions to employees also means a lot of extra administration, there's now a business model for MaaS-providers to offer B2B2Employee solutions. The MaaS-provider handles the payments and bills the

	company one a month (or more regularly depending on agreements) and the company can offer an incentive to the employee and reach their CSR-goals. - A critical decision for a city to make is to define a license model for all types of mobility providers, where integration and sharing of data is made explicitly required. Forcing the players to work together and find solutions for challenges like insurance of shared cars, privacy, helps to build trust and co-ownership of the network. It is important to let the market play but not to let the market roam freely. - The general public still needs to be educated about what MaaS is, what the potential and value is; the stakeholders still have to learn what the added value is for them; there are legal boundaries that need to be solved; privacy challenges and general trust among stakeholders.
Q3: What are the main differences between MaaS in Antwerp compared to other cities?	In Antwerp we made a clear choice to let the market play. We haven't bought a service like Trafi to integrate all services, but we've also haven't let the market arrange everything. We've build and are building various building blocks for a successful MaaS ecosystem: industry agreements; clear and validated data license models; intermodal route planner; clear and neutral communication; self-sovereign identity for mobility; quality framework; license model framework; APIs; subscription models; market research; data exchange platform. All the generic things that most MaaS and mobility providers need but which cost a lot of money if you have to do it on your own… but the main thing is, we are doing it. We're not talking too much about it; we're doing it. We're making mistakes as we go but we keep on going. All players know this is not a pilot with an end date; this is real, we go for it and we're in it for the long run. This is a marathon, not a sprint. Even after 3 years deep into rolling out and supporting MaaS, we're still learning.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	Certainly, in Europe, a city should never implement MaaS themselves. The cities themselves are too small (even London, Paris or Munich are tricky) and borders are too close. As cities and local governments we have to make sure we support the backbone of an open MaaS Ecosystem: enable roaming (between cities, regions, countries) mobility profiles; exchange information related to validated driver licenses; unify format of data; make detailed information available; make it easy for users and providers to find each other; make it easy for MaaS providers to integrated the local mobility providers; build trust; show vision; build a strong unifying brand and communicate to the people to show them what their possible alternatives are.

Name	**J**
Role and company	Policy and Research Advisor - Urban Transport Group
Area	UK
Relevant information	Conducts research into urban transport policy, spanning a range of current issues and challenges
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	Transport operators, local and metropolitan authorities, technology providers / platforms, user testing groups
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a UK cities?	Deregulated public transport system – in the UK, with the exception of London, public transport services are provided by private sector companies. In the case of bus, this is run as a commercial market, for heavy rail, it is run as a franchised system, with various levels of devolved power to cities / regions, depending on the local circumstances. This represents a barrier to the public sector being a leader in developing a MaaS offer, as they do not have control of all of the necessary levers. In London, Transport for London regulate the bus market, run the underground and some heavy rail services so have more powers to develop such an offer. The role the public sector takes determines the level of risk to the public sector, so if they are the operator, they carry much more risk than just being a facilitator. This could be a challenge / barrier for the public sector. Ensuring that MaaS delivers across public policy goals, so encourages public transport use and active travel, reduces congestion, enhances social inclusion and encourages data

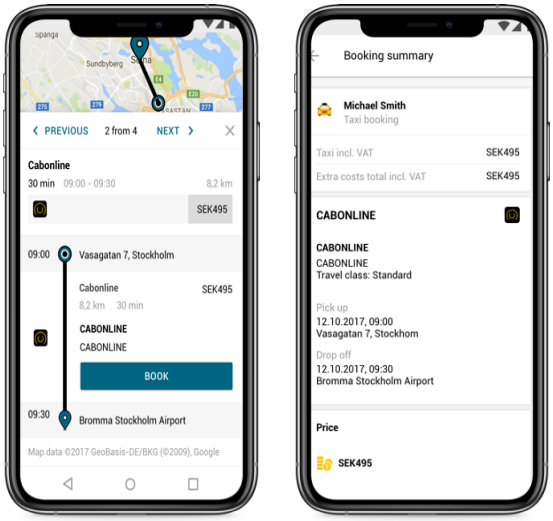
	sharing (while protecting data) – the involvement of the public sector is key to ensure this. Price – it is difficult to establish an economic model for MaaS which enables all the transport operations to be bought together in a subscription package at a price which is attractive to a mass market (there is a risk that MaaS becomes a niche product for affluent urban dwellers)
Q3: What are the main differences between MaaS in UK cities compared to other cities?	The deregulated bus market and privatized railways (see above) While there are some exceptions, there is not a strong culture of public transport and active travel use in UK cities, which makes a MaaS offer difficult to sell and difficult to offer at a competitive price when compared to private car use.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	There are a number of challenges, as outlined above. Examples exist worldwide but tend to be small scale, without widespread uptake, though pilots have often proved popular. But the institutional and economic issues of developing a mass market MaaS package are significant, and it's not clear that cities can implement such a package.

Name	K
Role and company	Smart and Green Mobility Expert
Area	Aarhus, Denmark
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	The key stakeholders are not only the city of Aarhus but also surrounding of municipalities (12) who are more concerned about this lack of mobility in rural areas. All the mobility providers, such as public transport authority, carpooling, bike share, city (carpooling) but haven't been able to penetrate the market and don't have resources. FDM - Federation of Danish Motorist.
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Aarhus?	- The biggest challenge that we have is the different mobility focus and different business model between private and public operators. Ex: The innovation or emerging of e-scooters, it doesn't actually replace the use of a private car but instead offers another option. This company aim is to offer many scooters even if people are not using them. - Improving incentives so individuals chose car alternatives is not easy. - No challenge with ticketing as Denmark MaaS is not integrated. In this city there is already only one card for every transport and paying is very easy, the true goal of MaaS in Aarhus is to increase the number of people per car and avoid at any cost have one person per car. It wouldn't be worth to have a common payment in out model the complexity doesn't compensate taking into consideration the advanced scenario of payment in Aarhus. MaaS is just gathering all services, to pay the app will direct the user to the mobility operator.
Q3: What are the main differences between MaaS in Aarhus compared to other cities?	Ticketing, for instance, MaaS in Madrid is an example of many journeys so ticketing can be a barrier. Aarhus is a city that aims for a MaaS to fix a specific problem, and I haven't seen this approach. We do not want to offer private services that are good but won't necessarily help in increasing the number of people per car or use as alternative of private vehicle. In my view, Helsinki when uses Whim is offering mobility options that already exist, such as taxi or car renting, It is not that much revolution and instead of increasing the users, it's just shifting them from public transport to buying from MaaS to go anyway to public transport.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	There is still a lot to learn about MaaS, and before start to implement there is a big variety of services. I think is important to have some pilots. The worst that can happen now is private companies selling services where are not actually fixing the problem of traffic, but municipality just pays for them.

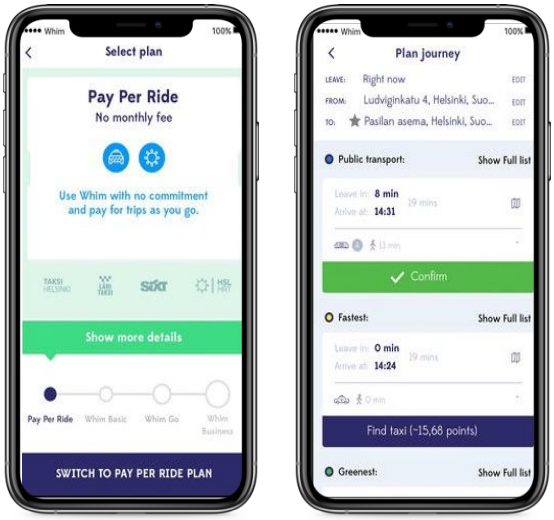
Name	L
Role and company	Program Manager Smart Mobility at Gemeente Amsterdam

Area	Amsterdam
Relevant information	Works for Municipality
Q1: Who are the key stakeholders/partners for the success of a MaaS pilot?	- The users, that they adapt it and are willing to use end promote it - Government (International, legislations and standards; National, legislations and standards; Local, legislations and standards and create place in de public area and stimulate shared mobility) - Companies: Working together with other partners to have enough offer and choice for the users and affordable; Working together with government to have also good effects on cities e.g. use of public space, sharing data etc.
Q2: What do you see as the main challenges or critical decisions when deciding how to implement MaaS in a city like Amsterdam?	- Interoperability - Ticketing – different partners work together, for instance public transport are not able to have different prices in the app. - Collaboration between public transport and private partners e.g. use op metro station, checking in and out points - Seamless journey based on real-time and shared data - Bikes are not really a really add for users because most citizens have their own bike in Amsterdam - Regulation: Amsterdam has different policy and regulation, a maximum number of people when car sharing. - Public space is scarce in Amsterdam, so not always possible to offer a lot of shared cars, shared bikes on the streets, so smart use of the public space is necessary
Q3: What are the main differences between MaaS in Amsterdam compared to other cities?	- Important that the data is used via standard of TOMP - Sharing data with municipality For instance, Whim (Helsinki) said 3 years ago they would launch it in Amsterdam, as they did in Helsinki. However, they have technical problems… having government partnership can facilitate on those things. Also, less challenges on partners sharing their data.
Q4: Do you believe any city can implement MaaS? What are the necessary factors to consider?	The scale should be enough

Table A.11 - MaaS smartphone Apps analysis



Criteria	Pilot in Sweden
Application	UbiGo
Project initiated	November 2013
Platform operating since	Finished in April 2014
Area covered	Gothenburg (2014), West Sweden (2018), Stockholm (2019)
Transport modes included	Public transit, taxi, rental cars and carpools
Organizations involved	UbiGo (Mobility service provider / project lead), Via-ID (UbiGo investor), Fluidtime (SaaS provider / MaaS enabler), Citizens of Stockholm (Using of UbiGo MaaS offer), City of Stockholm (Operational area), Hertz car rentals (Transport service provider), SL Trafiken (Transport service provider), Cabonline (Transport service provider) MoveAbout (Transport service provider)
Level of MaaS Integration	3
Relevant information	Low car usage or might be considering whether to buy a car or not. Participants were evenly split by gender, with an average age of 38, the youngest adult participant was 21 and the oldest 73.
Revenue mechanism/pricing	**Small:** 95€/month access to 10 days of public transport, 6h of carpool, Taxi set price and car rental for extra price. **Medium:** 200€/month access to 20 days of public transport, 18h of carpool, Taxi set price and car rental for extra price. **Big:** 380€/month access to 50 days of public transport, 36h of carpool, Taxi set price and car rental for extra price.



Criteria	Pilot in Hensinki
Application	Whim
Project initiated	May 2015
Platform operating since	November 2017
Area covered	Helsinki
Transport modes included	Public transit, taxi, city bike, e-scooters and rental cars.
Organizations involved	Toyota, Sixt, Hertz, Go, Tier, Kajon, Ald sharing, Meneva; Taksihelsinki
Level of MaaS Integration	3
Revenue mechanism/pricing	**Pay as you go:** no subscription fee, no surcharges. **Plans** **Whim To Go:** City bikes season 2020 only 24.90€ (Whim To Go) **Whim Urban 30*:** Access to different areas in Helsinki from €59,7 to 139,7€, access to free 30 min city bike rides, max of 10€ for taxi service until 5km ride. **Whim weekend:** 249€ for 30 days. Access to car rentals during weekend, 15% discount on all taxi rides, 30-day HSL ticket, access to book and pay TIER e-scooters and unlimited 30-minute rides with city bikes. **Whim unlimited:** 499€ per month: Access to car rental, car sharing with 2h per day for free, up to 80 taxi rides of 5km rides, unlimited HSL single tickets, access to free 30 min city bike rides

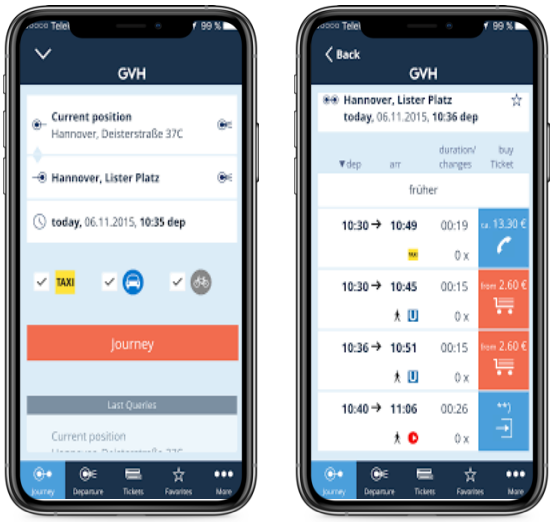
Criteria	Pilot in Antwerp, Belgium
Application	Whim
Project initiated	May 2015
Platform operating since	October 2018
Area covered	Antwerp
Transport modes included	Train, bus, taxis, car rental, shared bikes
Organizations involved	De Lijn, DTM Taxi, Velo, Q-Park, NMBS
Level of MaaS Integration	3
Revenue mechanism/pricing	**Whim to Go:** Pay per ride without subscription costs or other additional costs **Plans** **Whim Everyday:** 55€ per month, which included unlimited use of bus and train, 30 min bike ride, taxi rides max of 10€, rent a car for 49€ per day. Included in every city where Whim exists.

Criteria	Pilot in West Midlands, UK
Application	Whim
Project initiated	May 2015
Platform operating since	April 2018
Area covered	West Midlands, UK
Transport modes included	Public transport, taxi rides and Car hire
Organizations involved	National express West Midlands
Level of MaaS Integration	3
Revenue mechanism/pricing	**Pay as you Go**, £0 to access pay per ride on public transport, taxi and car hire

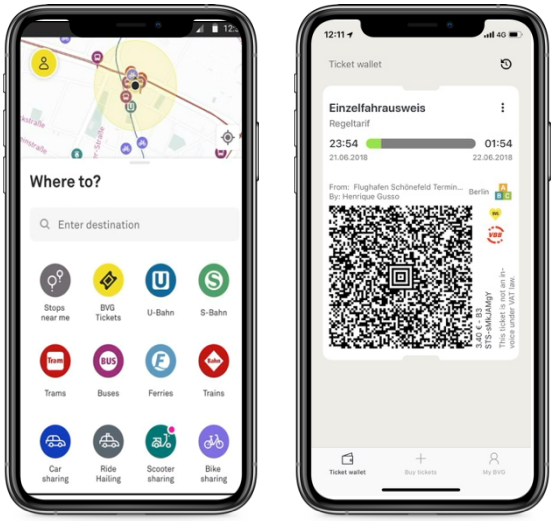
Criteria	Pilot in Vienna, Austria
Application	Whim
Project initiated	May 2015
Platform operating since	October 2019
Area covered	Vienna
Transport modes included	Public Transport, airport train, E-scooters, taxi, rental cars
Organizations involved	Wiener Linien, Cat, Taxi 31300, Tier, Hertz
Level of MaaS Integration	3
Revenue mechanism/pricing	**Pay as you Go**

Criteria	Pilot in USA & Canada
Application	Migo
Project initiated	N/A
Platform operating since	2017
Area covered	USA – 75 Cities
Transport modes included	Ride share, Taxi, carshare, bike share and public transport
Organizations involved	Yellow cab co., Zoro, curb, Flywheel radiocab, Car2go, Lime, Jump, Spin, Biketown, Transit
Level of MaaS Integration	2
Revenue mechanism/pricing	Free

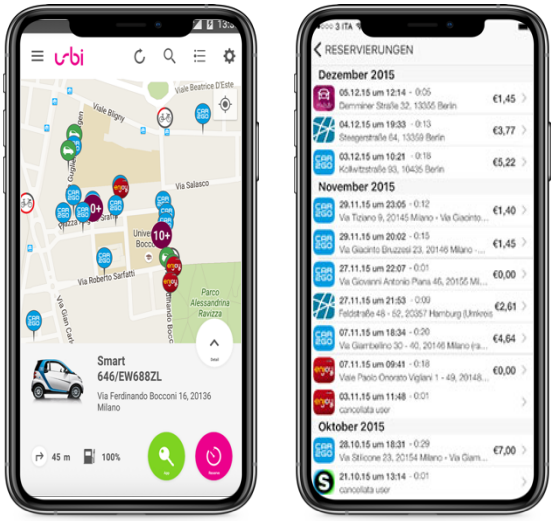
Criteria	Pilot in Vienna, Austria
Application	Smile
Project initiated	2013
Platform operating since	It finished in 2015
Area covered	Vienna
Transport modes included	Public transport, car share, bike share and taxi
Organizations involved	Wiener Linien, Österreichische Bundesbahnen ÖBB, VAO (Verkehrsauskunft), Austrian Institute of Technology, Linz Linien, Citybike Wien, nextbike, Grazbike, TwinCity Liner Wien – Bratislava, taxi 31300, car2go, Flinkser, EMIL, emorail, e-Carage, Wipark, Wien Energie Tanke, Energie Steiermark, Parkgaragen Elbl, toursprung
Level of MaaS Integration	2
Relevant information	Almost 80% of participants were male and over 60% of participants were under 45 years old93. Participants already had high public transport use and many used car sharing, suggesting these were early adopters in new mobility. The findings and experience with SMILE has led to the development of WienMobil, an app which enables the booking of and payment for a range of mobility services in Vienna.
Revenue mechanism/pricing	Pay as you go



Criteria	Pilot in Hanover, Germany
Application	Hanover Mobility Shop integrator into GVH app (public transport)
Project initiated	February 2016
Platform operating since	N/A
Area covered	Hanover
Transport modes included	Public transport, taxi and car sharing
Organizations involved	PTO ÜSTRA Hannoversche Verkehrsbetriebe AG and Greater Hanover Transport Association (GVH), Volkswagen and GmbH
Level of MaaS Integration	2
Revenue mechanism/pricing	Registered users get discounts on taxi fares and a free Bahn Card 25 (worth €62 a year), giving 25% discount on rail trips

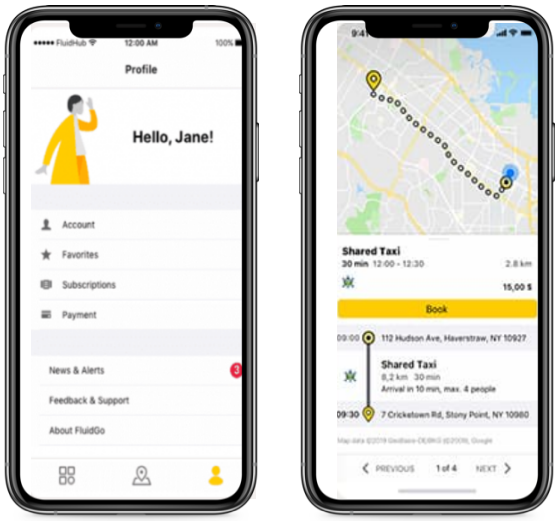


Criteria	Pilot in Berlin, Germany
Application	Jelbi
Project initiated	2019
Platform operating since	2019
Area covered	Berlin
Transport modes included	Bike share, scooters, ride share, car sharing, taxis and all public transport modes
Organizations involved	VBB, DB, TIER, Nextbike, Emmy, MILES, DB Flinkster, Mobileee and Oply
Governance/Platform operator	Tech company Trafi on behalf of BVG (public transport company)
Level of MaaS Integration	3
Revenue mechanism/pricing	Pay as you Go



Criteria	Pilot in Berlin, Germany
Application	Urbi
Project initiated	N/A
Platform operating since	N/A
Area covered	Berlin
Transport modes included	Taxi, bike sharing, e-scooter sharing
Organizations involved	iMove, European Union
Level of MaaS Integration	2
Revenue mechanism/pricing	Urbi still does not provide a complete Maas scheme with a single subscription that includes different providers.

Criteria	Pilot in Madrid, Spain
Application	MaaS Madrid
Project initiated	N/A
Platform operating since	July 2018
Area covered	Madrid
Transport modes included	City e-bikesharing scheme (BiciMAD, with 2,500 pedelecs), five electric car sharing providers with more than 2,300 electric cars, six electric motosharing providers with more than 4,100 e-motorbikes, e-scootersharing services (with 19 companies and more than 9,000 e-scooters) and Public Transport
Organizations involved	The Municipal Transport Company (EMT)
Governance/Platform operator	EMT Madrid (Empresa Municipal de Transportes de Madrid), Imove, Bicimad, Coup, Car2Go, Muving, eCooltra, EMT Pay, Respiro, Bluemove
Level of MaaS Integration	3
Revenue mechanism/pricing	N/A



Criteria	Pilot in Aarhus, Denmark
Application	FluidTime
Project initiated	June 2018
Platform operating since	July 2019
Area covered	Aarhus and rural area (12 municipalities)
Transport modes included	Public transport operators, carpooling services, taxi companies, car sharing.
Organizations involved	Fluidtime
Governance/Platform operator	Aarhus government
Level of MaaS Integration	2
Revenue mechanism/pricing	Pay as you Go

Criteria	Pilot in Taipei-Yilan, Taiwan
Application	Umaji
Project initiated	2016
Platform operating since	N/A
Area covered	Taipei-Yilan
Transport modes included	Train, MRT, Bus, Taxi, light rail, bus, Ferry, Ride Sharing, E-Bike, Bicycle
Organizations involved	ChungHua Telecom, Iisi (IT+OT), KingwayTek (3D Mapping), Public Transport Operators (TaiRail, Freeway Bus, City Bus, taxi…), EasyCard (Multi-Media Payment System), Research Institutes
Service providers	Transfer & journey planning, offering optimal departure time, routes and modes, special offers/ discounts to encourage private vehicle drivers to drive at off-peak times or alternative routes, Personalized travel. Value added services: Restaurant & Cuisine, parking, accomodation
Level of MaaS Integration	3
Revenue mechanism/pricing	N/A

Criteria	Pilot in Kaohsiung, Taiwan
Application	MenGo
Project initiated	N/A
Platform operating since	N/A
Area covered	Kaohsiung Metropolitan
Transport modes included	Bus, taxi, chartered vehicle, highway bus, train, local bus, Taiwan tour bus, rental car, car sharing
Organizations involved	Government with all stakeholders
Governance/Platform operator	Government
Level of MaaS Integration	3
Revenue mechanism/pricing	Unlimited use of Public Transport. 1. Infinity travel (NT. 1,499): MRT, City Bus, Light Rail (unlimited use), Ferry (4 times), City-Bike (free in the first 30 minutes), MeN-Go point : 600 for supporting service 2. City bus travel unlimited (NT 479) 3. City / Intercity Bus Travel (NT. 1,499) 4. Ferry travel (NT. 1,800)

Figure 7 - Checklist for MaaS implementation

THE MARKET

- [ ] 1.EVALUATE IF THE CITY HAS MOBILITY ISSUES. E.G. CONGESTION.
- [ ] 2. ASSESS IF THE CITY HAS THE NECESSARY SUPPLY OF MOBILITY SERVICES. E.G. GOOD PUBLIC TRANSPORT, TAXI OFFER, …
- [ ] 3. STUDY THE NEED AND COST OF OWNING AND USING A CAR IN THE DESIRED CITY VS COST OF MAAS SUBSCRIPTION PLAN.
- [ ] 4. ALIGN IN DETAIL YOUR MAAS IDEA. WHAT ADDED VALUE DO YOU BRING THAT OTHERS DON'T? WHAT PROBLEM ARE YOU TRYING TO FIX?
- [ ] 5. STUDY OTHER MOBILITY-AS-A-SERVICE PROJECTS. UNDERSTAND THEIR CONQUERS, CHALLENGES AND FEEDBACK
- [ ] 6. GO TO CONFERENCES ABOUT INNOVATION AND MOBILITY. NETWORK WITH EXPERTS OF THIS INDUSTRY.
- [ ] 7. IF YOU ARE PART OF THE GOVERNMENT TEAM TO LAUNCH MAAS, MAKE SURE THE COMPANY SEES THE PROJECT AS A PRIORITY.
- [ ] 8. DEFINE WHICH MOBILITY SERVICES DO YOU WANT TO HAVE IN YOUR PLATFORM.
- [ ] 9. STUDY REGULATION TO IMPLEMENT MAAS IN THE DESIRED CITY.
- [ ] 10. STUDY THE FEASIBILITY OF A B2B EMPLOYEE SOLUTION. IS IT ADVANTAGEOUS FOR COMPANIES TO OFFER MAAS SUBSCRIPTION INSTEAD OF A COMPANY CAR?
- [ ] 11. DEFINE THE VISION STATEMENT FOR YOUR MAAS.
- [ ] 12. DETERMINE IF YOU WANT TO LAUNCH A MAAS PILOT BEFORE THE FINAL PLATFORM.
- [ ] 13. DEFINE THE LEVEL OF MAAS INTEGRATION YOU ARE SEEKING FOR.

STAKEHOLDERS

- [ ] 14. IDENTIFY MAAS KEY STAKEHOLDERS, THEIR ROLE, CAPABILITIES THEY BRING TO THE TABLE, STRATEGIC INTENTIONS AND GOALS.
- [ ] 15. UNDERSTAND WHAT THE MOTIVATION FROM STAKEHOLDERS IS TO JOIN A MAAS PROJECT.
- [ ] 16. DEFINE STRATEGIES TO RETAIN MOBILITY PARTNERS FOR A LONG TERM COMMITMENT.
- [ ] 17. MAKE SURE YOUR MAAS PLATFORM IS NOT CAR-CENTRIC, BUT INSTEAD BALANCED WITH PUBLIC MOBILITY OPTIONS.
- [ ] 18. REQUEST SUPPORT FROM THE GOVERNMENT FOR A COMMUNICATION CHANNEL TO THE CITY.
- [ ] 19. EVALUATE IF THERE ARE ANY CONFLICTS OF INTEREST BETWEEN STAKEHOLDERS.
- [ ] 20. FIND A METHOD TO CHANGE THE RELATIONSHIP BETWEEN MOBILITY PARTNERS FROM COMPETITION TO COOPERATION
- [ ] 21. EVALUATE WHAT IS THE ROLE OF THE GOVERNMENT IN MAAS IMPLEMENTATION. E.G. FUND PROVIDED OR COMMUNICATION SUPPORT.
- [ ] 22. HAVE A CLEAR UNDERSTAND OF WHAT THE PUBLIC TRANSPORT AUTHORITIES SUPPORT IS.
- [ ] 23. IN SITUATIONS WHERE PUBLIC TRANSPORT IS PRIVATIZED, AS WHEN BUS SERVICES ARE PROVIDED BY DIFFERENT COMPANIES, DEFINE A STRATEGY TO MAKE SURE THEY ARE ALL ON BOARD FOR MAAS.
- [ ] 24. IN THE LIKELY SCENARIO OF MOBILITY PARTNERS UNWILLINGNESS TO SHARE DATA, ELABORATE A STRATEGY TO NEGOTIATE

CUSTOMERS

- [ ] 25. EXPLORE THE CITY CUSTOMER PREFERENCES TO ON-DEMAND TRANSPORT AND WHERE MAAS FITS IN. E.G. MODAL SPLIT, ACTIVE TRANSPORTATION RATE, …
- [ ] 26. ARRANGE INTERVIEWS WITH POTENTIAL CUSTOMERS.
- [ ] 27. BUILD PERSONAS FOR MAAS CUSTOMERS, DEFINE WHICH USERS COULD USE THE SERVICE.
- [ ] 28. BUILD A CUSTOMER JOURNEY MAP, DEFINE AN UNDERSTANDING OF WHAT DRIVES THE PAYING CUSTOMER TO PURCHASE MAAS
- [ ] 29. BUILD A CUSTOMER JOURNEY MAP, DEFINE AN UNDERSTANDING OF WHAT DRIVES THE PAYING CUSTOMER TO PURCHASE MAAS.
- [ ] 30. EVALUATE THE POSSIBILITY FOR B2B. E.G. IN EXCHANGE OF MAAS SERVICE, WHICH HELPS COMPANIES TO REACH CSR GOAL, THE OTHER COMPANY PROVIDES A SERVICE. E.G. ACCOUNTING.

BUSINESS MODEL

- [ ] 31. STUDY POSSIBLE REVENUE STREAMS. DEFINE THE VALUE OF YOUR SUBSCRIPTION PLANS.
- [ ] 32. WHAT NEWNESS CAN YOU BRING TO THE SERVICE? E.G. LOYALTY CARD WITH REWARDS.
- [ ] 34. IS YOUR MAAS PLATFORM USER FRIENDLY AND ENABLES CUSTOMIZATION?
- [ ] 35. DEFINE IF MAAS OPERATOR WILL BE OUTSOURCED.
- [ ] 36. EXPLORE BUYING A SERVICE TO INTEGRATE MOBILITY PARTNERS. E.G. TRAFI.
- [ ] 37. CONSIDER POSSIBLE OUTCOMES FROM EXPANSION.
- [ ] 38. STUDY POSSIBLE BARRIERS TO OVERCOME. E.G. MAAS IS MORE CHALLENGING TO IMPLEMENT IN CITIES WITH PHYSICAL BARRIER TO ENTER INTO THE PUBLIC TRANSPORT.
- [ ] 39. ANALYSE THE DIGITAL CAPABILITIES OF EACH MOBILITY PARTNER. E.G. API'S
- [ ] 40. BUILD A BUSINESS MODEL, E.G. BUSINESS MODEL CANVAS