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Master's Degree in Management

Exploring the possibilities for MaaS in the everyday mobility

- *A qualitative study of pilot projects in different phases*

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Abstract

The objective of this research is to identify how MaaS solutions can be designed to have a greater impact on everyday mobility. This research contributes by identifying existing barriers for present projects in all of their phases as well as expressing possible solutions moving beyond them, based on state-of-art business model theory. The data was collected through a systematic literature reviews followed by semi-structured interviews with actors within five different MaaS projects. The research identified a lack of applicable business models and that the pilots had deviated from true market conditions making it hard to gain a proof of concept. To successfully implement a commercial service post the pilot phase higher fidelity could be required. The study indicates that the services needs to be fully integrated to achieve high variety, flexibility, accessibility and an ease of use which is identified to be crucial for the end-user. Identified low incentives in an early phase is connected to the network effect, implying that the platform provides little value at a small scale for both the segments. Due to these low incentives it is hard to grow a platform organically and instead directly or indirectly gaining access to large customer segment can be a lucrative. Integrating the service within the public existing public transportation or having a B2B/G focus was identified as possible solutions. This research points towards the fact that complimentary services could be incorporated to achieve a commercial business model where incentives for both the end-users and the mobility service providers are sufficiently attractive.

Keywords:

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Thank you,

Gabriel Bredstenslien Johansson

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TABLE OF CONTENT

TABLE OF FICTURES

TABLE OF TABLES

1. INTRODUCTION

The introduction chapter aims to give the reader an understanding of the background and the problem setting leading to the research topic the thesis aims to study. This naturally paves way for the formulation of the research purpose and the research question itself. Additionally the delimitations and the structure of the thesis is presented.

1.1. GENERAL BACKGROUND

Historically, the transportation industry has been defined by small incremental innovations and has to some extent remained fundamentally unchanged (Kamargianni & Matyas, 2017). However, The digitalization has created a boom in new mobility options which have had an impact on the transport sector (Kamargianni & Matyas, 2017; Polydoropoulou, 2020). There is a wide use of smartphones with strong 4G/5G connection all over the world (Goodall et al, 2017) which largely influenced the transport sectors transformation (Holmberg et al., 2016; Miyata 2018). Progress in deep learning, artificial intelligence, dynamic routing and autonomous driving further supports the transformation (Goodall et al., 2017).

The boom is also connected to a rapidly increasing sharing culture which is based on the idea that humans should limit the resources used in our everyday (Holmberg et al., 2016; Sarasini & Yeh 2016). Conventional logics within the transportation field becomes challenged by the collaborative mindset of the sharing economy (Holmberg et al., 2016). On the same subject, Millennials are a generation with a different, more flexible, working pattern and an increased need for on-demand services (Holmberg et al., 2016). This, Together with a lower desire for owning the transportation vehicle itself (ILO 2020), blurs the line between products and services within transportation. A report from Morgan Stanley (2016) supports this claim and estimates that shared vehicles will account for 26% of the driven miles by 2030 and according to Lacy et al. (2020) one in ten cars is expected to be a shared vehicle by 2030.

Further, todays population has a better understanding of the need to slow down the climate change. There is a consensus regarding the need to lower C02 emissions and according to the European Commission (2016a) the transport sector is responsible for almost 25% of todays emitted green-house gases. Another report from the European Commission (2016b) states that in terms of shifting towards low carbon transportation, digital mobility solutions and multi-

modality have a significant role.

Goodall et al. (2017), Holmberg et al. (2016) and König et al. (2016) pinpoints that the growing urbanization as a reason for the sharp increase of alternative mobility services. Goodall et al. (2017) also states that congestion and gridlock is an increasing issue in many cities and is only bound to worsen as the pace of the migration to urban centers shows no signs of stagnating. MaaS (Mobility as a Service) is presented as a possible solution as it adds variability into the choices of transportations (Goodall et al., 2017; Miyata 2018; Polydoropoulou, 2020). This implies that a larger use of the service can provide faster alternatives to move people within cities. In terms of congestion it is lucrative to have a more flexible mobility as it gives users the possibility to adapt its means of transportation according to how the traffic looks (Goodall et al., 2017) and it makes mobility more efficient as it better matches supply and demand by generally having a higher fill rate for the means of transportations used (Atkins, 2014).

Given these trends there are beliefs that MaaS will influence the mobility of tomorrow (Atkins, 2014; Kamargianni & Matyas, 2017; Sarasini & Yeh, 2016). Various initiatives have been taken to implement services, however these initiatives have a hard time making it past the pilot stage (Karlsson et al., 2016; König et al., 2016). Reports indicate that the seeming lack of applicable business models are holding MaaS back (König et al., 2016; Transport System Catapult, 2016; Karlsson et al., 2017). According to Karlsson et al. (2017) both public and private actors have a hard time fully understanding what roles they could, or rather should, take within the business ecosystem. To succeed MaaS operators need to understand how to create, deliver and capture value (Polydoropoulou, 2020) cooperatively in an environment consisting of many actors, both public and private (Holmberg el al., 2016; Kamargianni & Matyas, 2017). Holmberg et al. (2016) implies that it would be hard to scale a service within solely one organization due to the variety of the needed mobility services. Rather, the authors believe that numerous actors, taking part in a business ecosystem, could add their services to a service provider. There is ambiguity revolved around who should take that role and how the platform should be shaped in the MaaS solution (Holmberg et al, 2016; Kamargianni & Matyas, 2017), which Wong & Heshner (2020) argue can be removed by letting a third part facilitate as an aggregator. Other researchers have discussed whether the

service should be coordinated by the public transportation authority or a private firm (Holmberg et al., 2016; Kamargianni & Matyas, 2017; König et al., 2016).

As of today, there are clear evidence of positive impacts both in terms of social behavior and environmental factors (König et al. 2016) and empirical evidence of perceived benefits from users (Transport System Catapult, 2016; Karlsson et al., 2017). Yet, the uncertainty regarding fitting business models is believed to hold back the combined mobility service concept. Thus, there is a need for research that creates a clearer picture in terms of the practiced business models, and their possibilities, and a better understanding of how these can be optimized to be able, at a greater extent, make MaaS solutions a preferred option in the everyday mobility.

1.2. RESEARCH OBJECTIVE

The study aims to investigate how MaaS can move beyond the small scale solutions of today and become more integrated in the everyday mobility in Sweden. To do so, it then becomes essential to understand the practiced business models of initiatives and the barriers that these face today to decrease the uncertainty regarding appropriate business models for the concept of MaaS. Thus, the goal is to map the factors leading to the difficulties that initiatives have regarding making it past the pilot phase and scale up from a small scale phase and then further express innovative solutions moving beyond them based on state-of-art business model theory.

1.3. RESEARCH QUESTION

In line with the research objective the following research question have been defined:

-What challenges is MaaS facing in terms of implementation, in general, in its different phases?

-How can state-of-art business model theory improve MaaS initiatives to have a greater impact on the everyday mobility?

1.4. DELIMITATIONS

Taking the time frame of the research in account several delimitations have been taken to be able to gain a fitting focus. To begin with this thesis has zoomed in on present projects in

different phases to understand how they can be improved to better incorporate the concept in to the everyday mobility, which forms the basis of the entire empirical data. It is solely focusing on the design of the projects based on individuals within the projects with great experience. In order to get a better overall picture, it could have been of value to additionally turn to other actors, with a different perspective, outside the projects themselves. The understanding of the customer preferences was gained from the perception of the actors within the projects as well as earlier conducted research rather from primary data which could be of value to gain even better insights in to how the development of the service could be designed.

Additionally, to truly understand the barriers and the possibilities of MaaS there is also value to investigate lucrative solutions outside the design of the business model itself. This could be within areas such as legislation, investment in transportation, infrastructure development and branch organizations, to only name a few. Moreover, this research focuses on the design of the business model to benefit the implementation of MaaS as a concept and does not pay attention to the interconnection between the needed actors within the business ecosystem itself. It is limited to the operations and the business model as to how, in a theoretical way, value can be better created.

1.5 STRUCTURE

To clarify the structure of the thesis, a breakdown of all its parts is given below.

Figure 1. Thesis structure.

2. LITERATURE REVIEW

In this chapter the relevant literature will be presented. Initially the concept of MaaS is analyzed focusing on thoroughly defining the concept and the characteristics expressed as fundamental or beneficial by users from prior research, as well as the business ecosystem. Moreover, the existing MaaS business model theory is presented focusing on the business model canvas and operator models. Lastly, relevant Business Model theory is discussed ranging from business model development, innovation, design and multi-sided platform business modelling.

2.1. MOBILITY AS A SERVICE

2.1.1 Mobility as a Service - Definition

For the purpose of the research it is beneficial to display a simple yet powerful definition of MaaS. However, that is easier said than done. Different schemes have already been implemented in various places around the world, yet the concept is full of ambiguity (Karlsson et al 2016; Kamargianni & Matyas, 2017). Jittrapirom et al. (2017) lifts that there are uncertainties regarding the core characteristics of MaaS and how these can be addressed. The present ones share the emphasize on the idea of servicification of mobility rather than mobility derived from owning a physical asset, such as a car. As the Transport System Catapult (2016) explored the opportunities for MaaS in the UK they settled on defining the concept as:

"Using a digital interface to source and manage the provision of a transport related service(s) which meets the mobility requirements of a customer."

These authors argue that the definition is suitable as it, in a simple way, explains the ability of the service to use any form of transportation from any type of travel experience. Additionally, it gives emphasis on the digital aspect, implying that a digital interface is used to source and manage the services. Even though the definition touches upon the most significant features this, according to others, definition misses out on a few characteristic. Atkins (2015) describes MaaS as following:

"MaaS focuses on providing a single platform for combining all transportation options and

presenting them to the customer in a simple and completely integrated manner – the emphasis being on how to get from A to B rather than the individual transport modes and services.”

In this definition the emphasize is instead on the focus of a single platform with different transportation options where utility is put in focus. Hietanen (2014) also highlight that MaaS offers various transportation models through a single interface. These descriptions, according to Jittrapirom et al. (2017), embraces very core characteristics often left out. It is a service-bundling concept with a demand orientation, implying that the focus is on seeking the best transportation solution from the customer's perspective within a single platform (Jittrapirom et al., 2017).

Kamargianni and Matyas (2017) lifts that, within MaaS, several concepts become cornerstones for the definition. These are named as:

- Servicification
- Integration
- Interconnectivity and optimization of the transport service
- Personalization
- Smart and seamless mobility
- Sustainability

The authors put emphasis on integration as it is the part that differentiates MaaS from regular car-sharing and similar which operates in a silo. A fundamental capability of MaaS is the ability to co-operate and connect mobility to a single market (Kamargianni & Matyas, 2017). The authors define MaaS as following:

"Mobility as a Service is a user-centric, intelligent mobility distribution model in which all mobility service providers' offerings are aggregated by a sole mobility provider, the MaaS provider, and supplied to users through a single platform”.

Moving forward this research will define MaaS, based on these approaches, as a concept which, through a digital user-centric service platform, seamlessly integrate transportation

options with the purpose of meeting mobility requirements derived from customers' preferences of shared mobility.

2.1.2 Mobility as a Service - Value Creation

The Transport System Catapult, a non-profit organization started by Innovate UK – the UK's innovation agency – conducted a report 2016 investigating the possibilities and opportunities for MaaS in the UK. From the report it became evident that users, at an increasing rate, see shared mobility as a service they would gladly utilize. Today, users have to use various tools and platforms to find information, plan their trips and respectively pay them, often with different payment methods (Kamargianni & Matyas, 2017). These are according to the authors "pain points" that obstruct users from flexible, easy to use, intermodal mobility. Kamargianni and Matyas (2017) Illustrates the simplification of mobility that MaaS presents in the figure below.
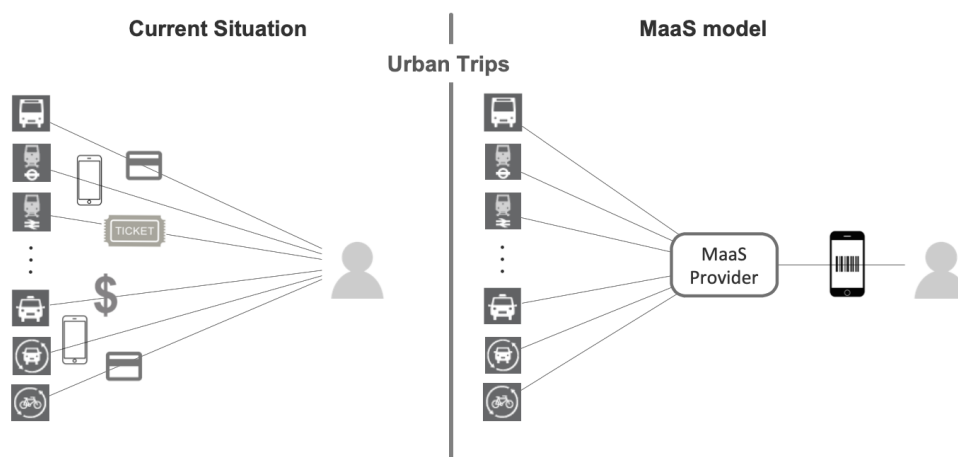
Figure 2. With and without MaaS from user's perspective. Kamargianni & Matyas (2017).

König et al. (2016) conducted a survey aiming to build a foundation of the requirements connected to MaaS implementation. The questionnaire was targeted towards public and private stakeholders working within the transportation industry. The research showcased a strong belief that payment, journey planning and customization together forms the main service which needs to be featured to enable MaaS. An integrated service supply on a single platform was believed to be essential by 60% of the participants.

In terms of spatial availability the urban and suburban areas are deemed as where the focus should be on implementation, according to the same research. Their presented results indicate that more than 60% believe that the concept should be available in the spatial area defined as

"urban" and "suburban". The area defined as "rural areas" is considered to be challenging in terms of implementation (König et al., 2016).

In the report conducted by Transport System Catapult (2016) numerous of possible benefits were identified for the users, as summarized in the table below:

Feature	Benefit Perceived by the Customer
Personalized Service	A personalized service that builds a relationship between the customer and the MaaS provider, so that relevant travel choices can be anticipated and provided
Ease of Transaction	The customer can conveniently access transport operator assets and services by using a range of devices, for example a smartphone, smartwatch, smartcard or bank card.
Ease of Payment	The customer can pay for their mobility to suit their needs, choice of pay-as-you-go, pre-pay or post-pay including the use of a monthly subscription model can be offered.
Dynamic Journey Management	The customer is provided with a dynamic journey management service that keeps the user informed in real time if their journey expectations will need to change
Journey Planning	A journey planning service allows a customer to plan their journey based on their personal preferences – for example, time, cost comfort and convenience.

Table 1. Perceived benefits. Reworked from Transport Systems Catapult (2016).

From these perceived benefits one can see that focus is set around ease of use, flexibility and adaptability for the user. In a report from the MaaS alliance (2019) the authors highlights the focus on freedom, variability and flexibility as the most attractive elements. This freedom gives the user their own possibility to choose the best fitting solution for them to travel from A to B. The report also mentions that "*the best value proposition is not always limited to what is the quickest or most cost-efficient solution*". It rather depends on the user's personal preference. There are many different factors which could play a significant role, such as for example safety, healthiness, environmental friendliness, accessibility and the ability to work while commuting. A framework was created to summarize key aspects for MaaS user

experience which is shown below. The four main parts consisting of safety & security, convenience, inclusivity and customer care. However, it is here important to acknowledge that the report does not handle the aspect of desired amount of mobility services or their level of integration. This due to the idea that it is hard to set a "one-size-fits-all-standard" when there are many different business and operation models present.
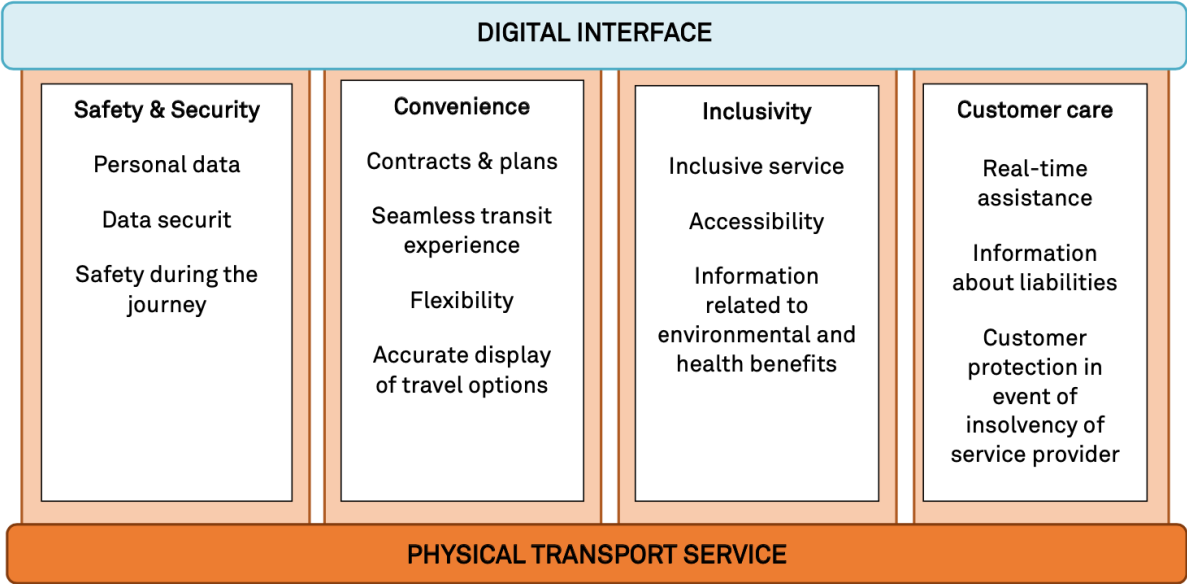
Figure 3. MaaS user experience matrix (MaaS Alliance, 2019).

In a report, conducted by Karlsson et al. (2016), a trial platform for MaaS was analyzed. The trial consisted of 195 paying individuals during a six month period. The result showed a decrease in private car usage from 48% of the participants and an increase in other alternatives. This mainly in car sharing (57%) and in public transport (50%). Further, 97% of the participants wanted to continue as users of the service after the trial, implying a high satisfaction. From Karlsson et al.'s (2016) report the main positive feedback was towards the "transportations smorgasbord". The concept of having all transportation modes packed together gained a high flexibility and an ease of use. Moreover, users highlighted that being a subscriber of a certain transportation mode makes one become locked in, which limits the adaptability of the mobility. Thus, a service where different transportation options are present gives further perceived value.

Another project aimed to understand the attitude towards MaaS was conducted by Kamargianni et al. (2018). The authors looked at the habitants of London's attitude towards changing their means of transportation and their general perception of MaaS. The sample

consisted of 1570 individuals and the data was collected between 2016 and 2017. Relevant findings from the report is showcased in the fixtures below.

Attitude towards MaaS

43% of respondents would be motivated to subscribe if MaaS gave them financial discounts. This percentage increases to over 55% for the most price sensitive age group of those under the age of 30.
52% of respondents would worry about running out of their subscribed amount, while 49% would feel trapped by subscribing to MaaS.
40% of the respondents agreed that they would try modes they previously did not use if their MaaS plan included them.
33% of car owners agree that MaaS would help them depend less on their cars, while a quarter of them would even be willing to sell their cars for unlimited access to car sharing for the next couple of years.
Out of non-car-owning participants, 36% stated that they would delay purchasing a car and 40% stated that they would not purchase a car at all if MaaS were available.

Mode switching – regular public transport users

28% states that if MaaS were available, they would use more public transport.
23% said it would most likely have no impact on their public transport usage.
2% would most likely substitute part of their public transport usage with taxi.
14% stated that they would most likely use more bike sharing, showing that MaaS could help in increasing the use of active transport modes.
12% stated that MaaS would make them substitute part of their public transport use with car sharing.

Mode switching – regular car users

35% stated that they would substitute car usage for public transport.
13% stated that their car usage would not be affected by MaaS.
17% would substitute their car trips with bicycle.

17% would walk more as part of their trips.

11% would travel by taxi (including ride-hailing) instead of private car if MaaS were available.

Table 2. Summarized from: Londoners' attitudes towards car-ownership and Mobility-as-a-Service: Impact assessment and opportunities that lie ahead (Kamargianni et al., 2016).

2.2 MOBILITY AS A SERVICE - BUSINESS ECOSYSTEM

Ramirez & Mannervik (2016) talks about a "socio-ecologial" approach to strategy in their book "Strategy for a networked world". The authors believe that a system-based view to strategy is more effective than the more conventional neoclassical perspective with a strong focus on industrial sectors and the value chain. With such a narrow approach to strategy one can miss out on value creating opportunities (Ramirez & Mannervik, 2016). On the same page, Fehrer et al. (2017) implies that *"business model thinking has evolved away from Porter's (1985) value chain logic to a new logic nested in open networks that focuses on network integration and collaboration."* Ramirez & Mannevik (2016) believes this transitions from "chains to systems" is necessary as the reality of today is one full of collaboration. Cost effective digitalized connections are established within organizations in a complex system rather than linear chains. Designing business ecosystems can thus help organizations realize the importance of actors and the connections between them to better understand the value creation (Ramirez & Mannervik, 2016). This has to be taken into consideration when formulating the business model (Ramirez & Mannervik, 2016; Kamargianni & Matyas, 2017). For example, Holmberg et al. (2016) believes that finding a lucrative way to scale the service of a MaaS solution is tightly connected to the construction of the business ecosystem. The authors indicates that it might be difficult to scale such a service within a singular organization due to the variety of mobility services needed.

The business ecosystem is defined by Kamargianni and Matyas (2018) as *"the wider network of firms that influence how a focal firm, in our case MaaS provider, creates and captures value"*. In the case of MaaS the authors imply that there is a complex value proposition which creates challenges in terms of structuring the unfamiliar value network. In such a network the participating actors need to clarify their function inside the ecosystem and what they add within the delivery of the service. There has to be a deliberate choice concerning their position in the value chain. From the research conducted by Kamargianni and Matyas (2017)

a defined MaaS ecosystem emerged, as seen in the figure below. It illustrates the different actors and the different level of commitment to the MaaS provider. The first layer is defined as the "core business layer" and consists of the focal firm and the very heart of the business. "Extended enterprise" is the name of the following layer, which adds the wider segments of the system. Lastly, the last layer is named "business ecosystem" as it contains the aforementioned whilst also adding less significant yet influencing actors.
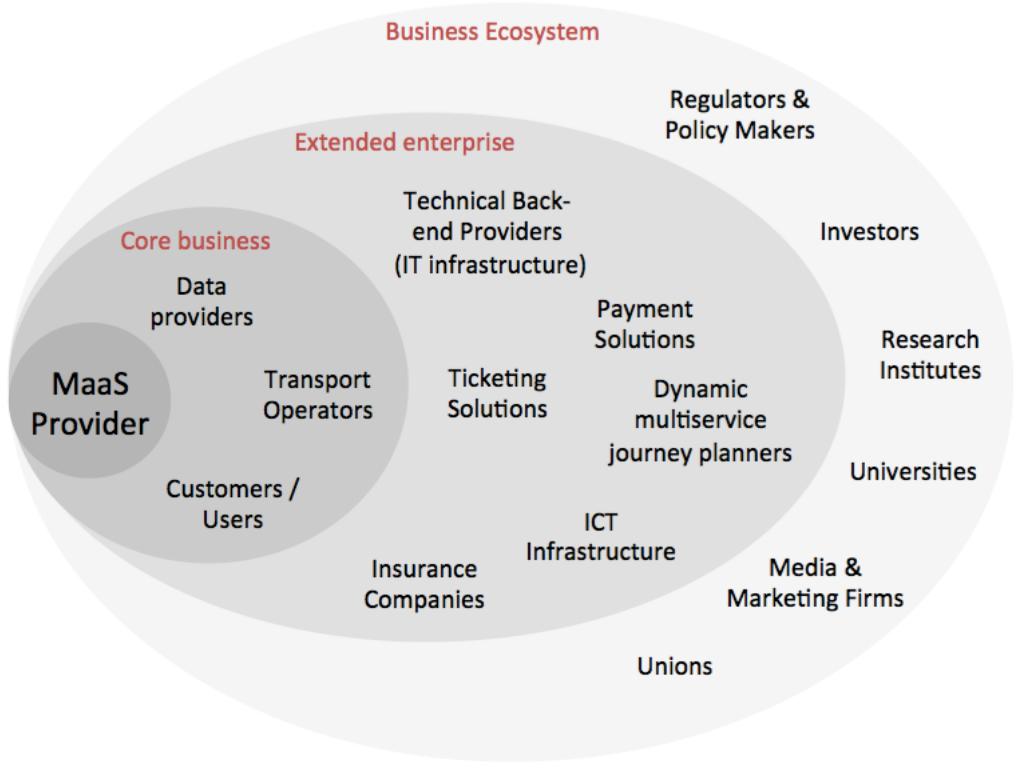
Figure 4. The mobility-as-a-Service Business Ecosystem (Kamargianni and Matyas, 2017).

2.3 BUSINESS MODEL

A business model is the very foundation of a firms function. It defines how the firm aims to capture value (Zott & Amit, 2010; Teece, 2010) and map and store the logic behind it (Osterwalder et al. 2005). In simple terms it is a way to explain how a firm does business (Osterwalder et al. 2005). Zott and Amir (2010) also notes that a business model is often connected with the objective to exploit a business opportunity by creating value for the parties involved. Value is created by fulfilling customers' needs whilst creating a surplus, i.e., generate a profit (Zott & Amit, 2010). A business model is defined by Teece (2010) as the following:

"The essence of a business model is that it crystallizes customers' needs and ability to pay, defines the manner by which the business enterprise responds to and delivers value to customers, entices customers to pay for value, and convert those payments to profit through the proper design and operation of the various elements of the value chain."

The definition, in a simple manner, explains the need for strategy and innovation in creating a business model that can capture value in a defined environment. However, Osterwalder et al. (2015) empathizes that such a definition doesn't tell the whole tale. A business model also functions to reduce the complexity of the business function to a simple and understandable level, so that it can be communicated easily (Osterwalder et al., 2005). The author mentions that this is important to create a common language for all stakeholders to understand.

To fully grasp the concept of a business model one need to understand the differences between "business models" and "business process models". Osterwalder et al. (2005) implies that a business process model is more understood to deal with how a business case is implemented in processes. While business models are generally recognized as a defined logic of how the firm aims to create and commercialize value. Furthermore, the same authors imply that a distinction has to be made between "business models" and "strategy". However, for these two concepts the difference is not as agreed upon. Some researchers use the terms interchangeably although Osterwalder et al. (2015) and Teece (2010) suggests that strategy builds upon the concept of business model whilst also including the factor of competition. Business strategy is involved first when it comes to protecting the competitive advantage created by the invention and implementation of the business model. By the nature of this the business model is more generic whilst the business strategy builds upon it (Teece, 2010).

As mentioned it is important to fully understand the business model at hand, to be able to describe it and discuss it effectively with others. Otherwise it becomes difficult to challenge assumptions of today and innovate fruitfully (Osterwalder, 2005). Osterwalder & Pigneur (2010) believes that a business model can most effectively be described through nine "building blocks" which their framework business model canvas does. According to the authors these nine "building block" can be defined as following.

<center>*Nine Building Blocks*</center>

Customer Segment	An organization serves one or several customer segments.
Value Proposition	It seeks to solve customer problems and satisfy customer needs with value propositions.
Channels	Value propositions are delivered to customers through communication, distribution, and sale channels.
Customer Relationships	Customer relationships are established and maintained with each customer segment.
Revenue Streams	Revenue streams result from value propositions successfully offered to customers.
Key Resources	Key resources are assets required to offer and deliver the previously described elements…
Key Activities	…By performing a number of Key Activities.
Key Partnerships	Some activities are outsourced and some resources are acquired outside the enterprise.
Cost Structure	The business model elements result in the cost structure.

Table 3. Business model canvas. Reworked from Osterwalder & Pigneur (2010).

The business model canvas is most often presented as a large poster, as shown below, to visualize all the nine building blocks and make it easier to illustrate existing business models or conceptualize new business models.
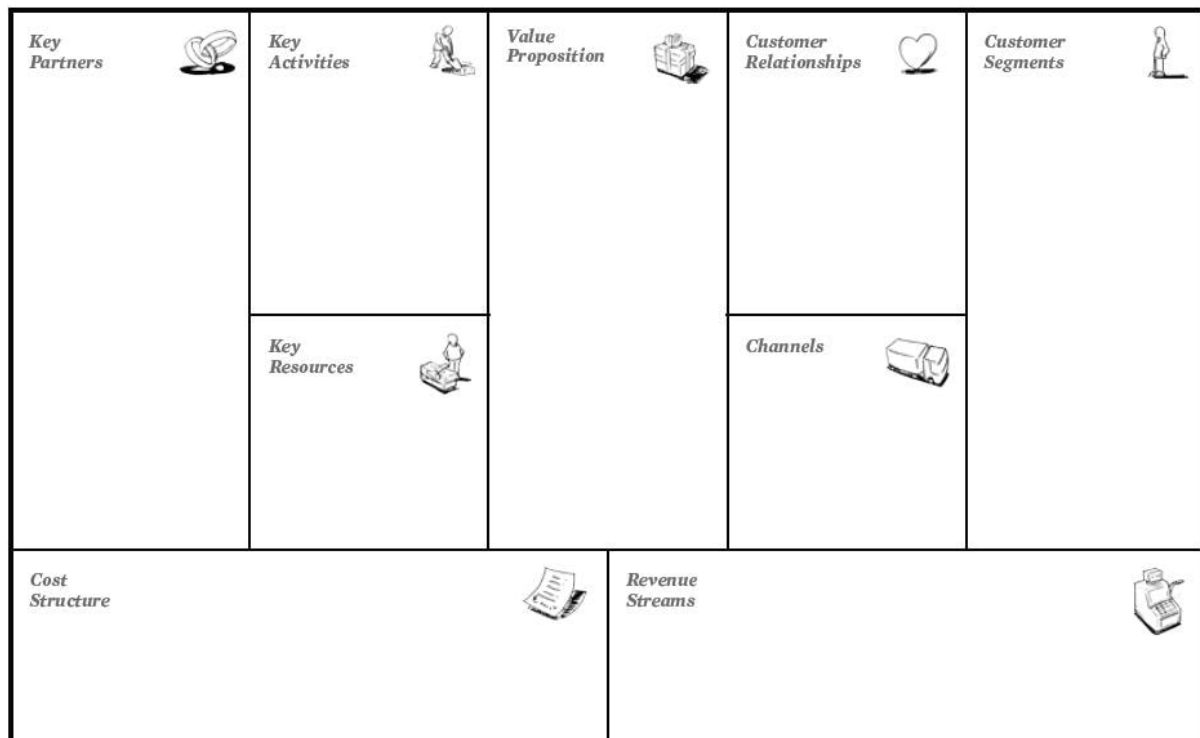
Figure 5. : Business model canvas (Osterwalder & Pigneur, 2010).

2.3.1 Mobility as a service business model

As part of a project called Mobility as a Service for Linking Europe, König et al. (2016) aimed to analyze the value networks and identify new business models in the light of the new transport paradigm of MaaS. The authors illustrates the findings by using the business model canvas as seen below.
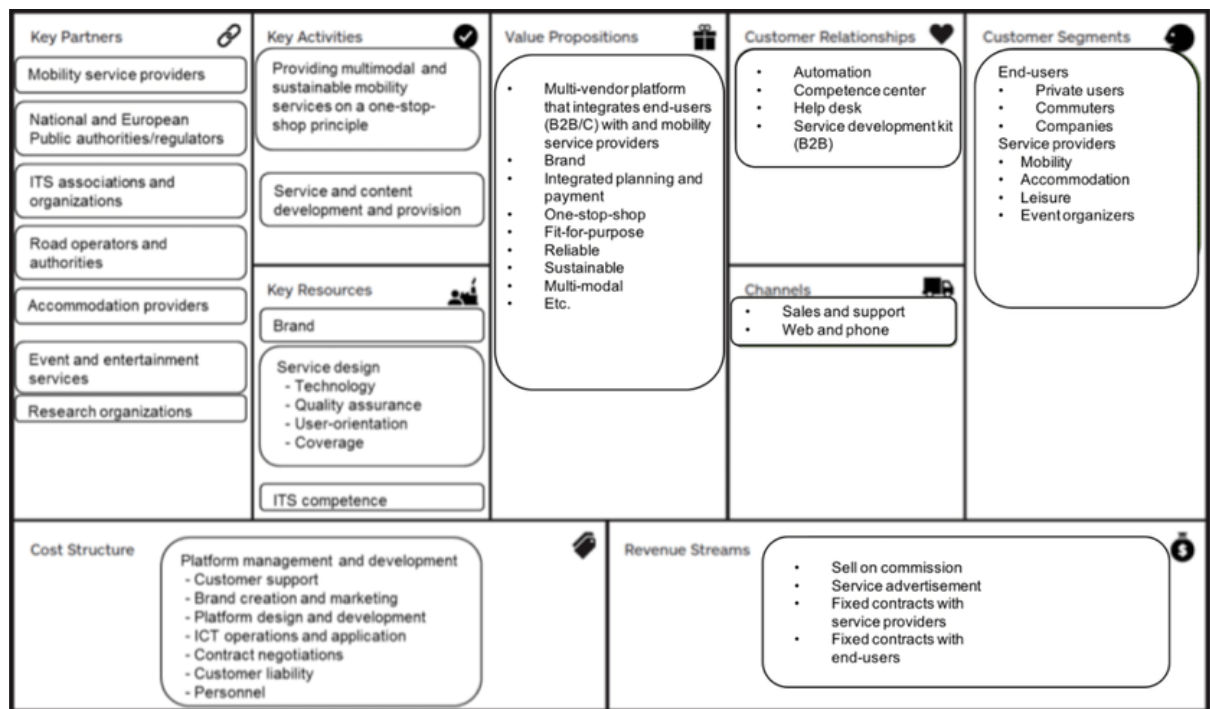
Figure 6. Business model canvas for a MaaS operator (König et al., 2016).

König et al. (2016) implies that there are two purposely noteworthy points to be made. To begin with it is analyzed to exist a wide range of key partners and customers. Moreover, there are also various different types of revenue streams identified. These revenues can range from fixed payments, periodic payments, pay-per-use or commissions. The authors indicate that due to this wide range of possible partners and customers one can argue that there is a large business potential for MaaS services and platforms.

Whilst the business model canvas summarizes the findings and brings them all together another focus had been put on understanding the different possible operation models. The researchers present two different approaches, namely the agency model and the merchant model. The agency model focuses on reselling. In this case the MaaS provider receives a discount when buying transportation tickets due to the large volume bought. Then, the revenue is gained from the marginal profit collected from selling the tickets at normal price.

The merchant model, instead, functions from gaining a commission that the mobility service operators are paying the MaaS operator for their reselling. It is also pointed out by the authors that both these models can be carried out simultaneously within a MaaS solution. Moreover, König et al. (2016) believes that what can be more defined as "mass product articles", that is tickets of those services of large volumes with large demand as for example public transportation, can more lucratively be sold using an agency model. Adding to that, a merchant model might be more fitting for less frequently used individual transportation modes, as for example rental cars. This due to the fact that the volume is generally small, demand is uncertain and commissions higher.

The research also identifies different operator models based on the different premises that shape the business ecosystem. On a commercial basis a reseller operator model and an integrator operator model is presented. The reseller focuses on suppling different transport service providers (TSPs), more often referred to as mobility service providers, from different transport modes and the authors give a travel agency as a good example. A integrator operator model additionally integrates a digital service, becoming a mobile service provider (MSP), that for example provides mobile ticketing, direct payment and/or travel planning. Furthermore, public transportation operators can take the role as a MaaS operator, mainly by integrating additional mobility services to the already existing public transportation platform. These operator models are illustrated in the figures below.
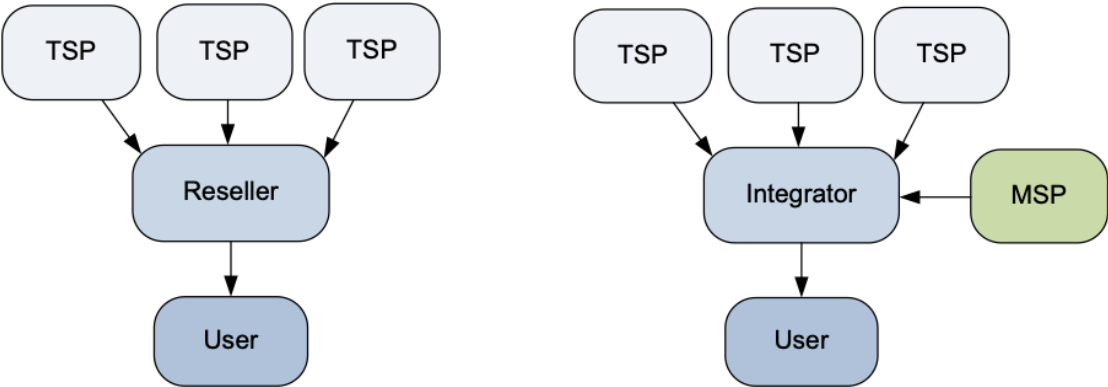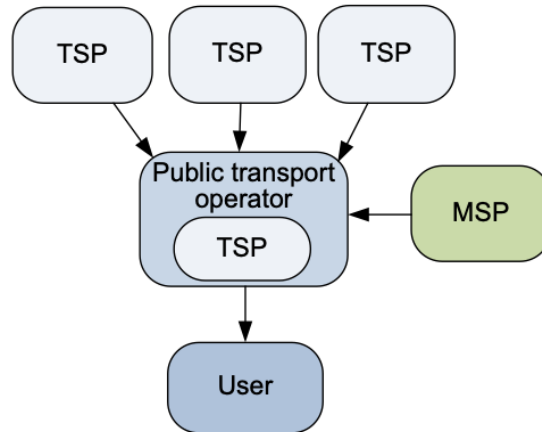
Figure 7. Commercial MaaS operator models and public transport operator as MaaS operator (König et al., 2016).

From the research conducted by Kamargianni and Matyas (2017) the advantages and disadvantages of having a private firm and a public transport authority as an operator were evaluated. In the case of a private firm it can both imply an already existing firm extending its services or a firm established for the purpose of providing a MaaS solution. The researched advantages and disadvantages of these two options have been summarized in the tables below.

Private firm - advantages

Firms can be established for the sole purpose of MaaS, speeding up the development.
Drive for profit maximization can increase the effort of developing unique intelligence and know-how.
Bigger incentives for car-sharing companies to provide their service on the platform as they believe private firms have less of an agenda to market more green transportations.

Public transport authority - advantages

Easier to secure that all the public transportations can be offered.
Public transport authorities are often responsible for authorizing other transport operators (taxi, care sharing) which simplifies their participation.
Public transport authorities are often the transport regulators simplifying the regulation process.

Long expected time for public firms to join the MaaS schemes.
Chance of public transport authorities being afraid to lose reputation as the integrator and provider of the city.

Public transport authority - disadvantages

Issues diversifying and/or extending their role prolonging the transformation.
The public authorities' bureaucracy may slow down the penetration of the innovation.
As public transport authorities are non-profit organizations they may lack incentives to advance the travel experience.
Public transport authorities can be more constrained by law to develop MaaS services.
With a public transport authority it is challenging to widen the MaaS beyond the city limits.

Table 4. Public and private advantages/disadvantages summarized from Kamargianni and Matyas (2017).

2.3.2 Business model development

Teece (2010) states that without a properly developed business model it becomes challenging to deliver and capture value from innovations. Further, the author states that to create a competitively sustainable business model it will require a coupling of the business model and the business strategy.

Teece (2010) also implies that designing and implementing a business with a compelling value proposition whilst presenting a strong value capture and a low cost structure is essential. However, superiority in terms of technology, products, work force and good governance and leadership will not alone yield profitability if the business model is not adapted to the competitive environment (Teece, 2010; Chesbrough, 2010). The art of choosing, adjusting and improving the business models is generally not easy (Teece, 2010). Teece (2010) further mentions that there is no best practice for good design, instead it is highly situational and will often require an iterative process. Seldom is the spot-on business model obvious right away, instead, it is found through learning and making adjustments (Teece, 2010).

Experimentation and testing can be helpful to rationalize and articulate a business model, as it is not always obvious initially how it should be shaped (Chesbrough, 2010). The business

model is built upon assumptions that create the go-to-market strategy. However, a business model cannot, in anyway, be fully assessed prior to the deployment in to the business environment (Teece, 2010). The underlying logic will initially be tested once deployed in the market. It is essential to be able to finetune and modify this logic as these assumptions becomes confirmed or denied. This is especially true in emerging opportunities in new markets where there are no real business model templates and there is a lack of deep data (Teece, 2010; Chesbrough, 2010). Teece (2010) mentions that the ones who have a good position and who can adjust as they learn are better faired for success.

Even in relatively short term it is insufficient to rely on a successful business model to reassure competitive advantage (Teece, 2010). This, according to the author, because when implemented the models often becomes easy to imitate. It becomes evident in practice as lucrative business models often becomes shared by multiple firms (Teece, 2010). In some cases, the nature of the business model makes it hard to imitate due to the required systems, processes and assets. Furthermore, there might be ambiguity regarding what capabilities and processes constitutes the success of the model, which also halters imitation. Lastly, incumbent firms can be constrained by their present business model and in some cases be reluctant to change due to cannibalizing of existing sales and a negative impact on business relationships. Nevertheless, to create a long term sustainable competitive advantage it is important to have a differentiated and hard-to-imitate business model as competition will be forceful. In general, Teece (2010), believes that a lucrative approach is to systematically deconstruct existing business models and evaluate their elements. Designing a business model with reference to other successful models can be a rewarding method, especially when entering novel and ambiguous territory.

2.3.3 Business model innovation

Teece (2020) clarifies that business success is not guaranteed with technological innovation. New, well performing, products or services still needs to be coupled with a well-functioning business model which defines their strategy to enter the market and capture value. If innovators seek to gain profit and sustainable competitive advantage both the technology strategy and business model have to be skillfully composed (Teece, 2010). Similarly, Chesbrough (2010) implies that technology itself doesn't have any intrinsic value until it becomes commercialized by a business model. Business models are a new subject of

innovation, accompanying process, product and organizational innovation and creates new relationships and cooperation (Zott & Amit, 2011). Not only product innovation can be sufficient to profit from innovation (Zott & Amit, 2011). According to the aforementioned authors, business pioneers rather also need to outclass competitors in terms of business model design. Nevertheless, if the business model innovation is differentiated and tough to replicate for new entrants it can, on its own, derive to a competitive advantage (Zott & Amit, 2011). Chesbrough (2010) is on the same page as he mentions that *"…It's probably true that a mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model"*.

Zott and Amir (2011) further believe that an important role of the business model is to unlock value from new emerging technology and to bring it to the market. However, as discussed earlier, managers might be reluctant to form new business models fitting disruptive technology. Chesbrough (2010) mentions that, typically, the gross margin for emerging disruptive technology is much below that of the established technology. A part from the internal barrier of reluctancy there is also another phenomena blocking the emerge of business model innovation fitting disruptive technology. Chesbrough (2010) explains that firms with a strict understanding of how business should be conducted will filter information that doesn't fit that logic. Only information that fit the logic of the business models of today will be sought which can give high risk of missing potential value.

2.3.4 Business model design

Zott & Amit (2010) proposes that an activity system perspective can be used to conceptualize a business model and give a toolbox for business model designing. The authors implies that a focus on activities is a natural approach for decision makers regarding business model design. An activity system is a combination of interdependent activities, an action with the purpose of fulfilling an objective, conducted by the firm, its partners, vendors or customers.

The activity system can be split into content, structure and governance. To begin with, activity system content deals with the selection of activities that the firm aims to perform. When looking to adopt new abilities it is important to fully incorporate them which implies developing new capabilities, training relevant staff and linking the purposed activities to the existing system. Activity system structure instead refers to how the activities are linked.

Further it describes the activities importance for the business model. Lastly, activity system governance describes who should perform the activities. (Zott & Amit, 2010)

Activity System Design Framework

Content	What activities should be performed?
Structure	How should they be linked and sequenced?
Governance	Who should perform them, and where?

Table 5. Activity System Design Framework. Reworked from Business model design: An Activity System Perspective (Zott & Amit, 2010).

Weaving together these interdependent activities creates the essence of the business model, according to Zott & Amit (2010). This approach encourages a systematic and holistic thinking, rather than concentrating on topics that are isolated. This is helpful to conceptualize an over-all picture of the business models logic (Zott & Amit, 2010).

To further understand the logic of the business model and detail the systems' dominant drivers for value creation the authors propose that the activity system can be characterized by certain design themes. They are recognized as four different themes; Novelty, Lock-in, Complementarities and Efficiency.

Design Themes characterizing the activity system

Novelty	Adopt Innovative content, structure of governance.
Lock-in	Build in elements to retain business model stakeholders, e.g, customers.
Complementarities	Bundle activities to generate more value.
Efficiency	Reorganize activities to reduce transaction costs.

Table 6. Design Themes characterizing the activity system. Reworked from Business model design: An Activity System Perspective (Zott & Amit, 2010).

Novelty-based activity systems focus on adopting new activities, finding new ways of linking activities and/or structures for governing the activities. Lock-in themes instead aim to be designed so that third parties remain involved as business model participants. This can be manifested by a focus on switching costs and/or network externalities (Zott & Amit, 2010). Further, activity systems focusing on complementarities put an empathize on bundling activities together with the logic that doing so creates more value than providing them separate. Lastly, design focused around efficiency aim to reduce transactions costs as a way of

increasing value. This approach has been praised by Chesbrough (2010). However, the same author also mentions that these themes might conflict with the present assets of the firm leading to a reluctancy from managers as they might threaten the present value. Reflecting around the main focus of the business model according to the recognized themes can, as claimed by Zott and Amit (2010), create new value. The model might become significantly different from the original design as it becomes shaped according to a well-defined overriding design theme.

According to Chesbrough (2010), one auspicious approach is to clearly map out the business model to better understand the fundamental processes. This gives chance to experiment with combinations of these processes. The earlier presented business model canvas can then be of good use. However, mapping and gaining further understanding of the business model can't by itself pave way for successful innovation and experimentation (Chesbrough, 2010). The abovementioned author indicates the importance of authority to make experiments and the ability and willingness to take action derived from the tests. When conducting experimentation there are certain principles that can indicate for successful such. The most important parameter is that of fidelity, which indicates to what extent the conditions in the experiment are representative for the targeted market (Chesbrough, 2010). The author implies that the highest fidelity is gained from "trying out an alternative business model on real customers paying real money in real economic transactions…" (Chesbrough, 2010, 360).

2.3.5 Multi-sided platform business model

According to a report issued by Goodall et al. (2017), the latest and most successful components of the servicizing of mobility are the companies running a platform business model such as Alibaba, Airbnb and Uber. These business models links the services provided to the users whilst also handling the bookings and the payments. This success has according to Ardolino et al (2020) been made possible by the digitalization. The authors argue that it has significantly increased the distance that the platform can reach while also improving the match-making mechanism between the supplier and user. It has enabled a greater management of transactions and made an effective trust-building possible (Ardolino et al., 2020). Internet technology has also paved way for an increased ease of use and perceived utility which creates a more lucrative value proposition (Ardolino et al., 2020). The authors defines the concept, based on three characteristics, as following:

- *Based on the presence of a virtual or physical place (the "platform") which enables and facilitates the interactions between two or more different groups of users.*
- *Characterized by interdependent relationships among the sides, because of the presence of indirect and bilateral positive network effects.*
- *Potentially able to track the interaction events between the users involved.*

Earlier Osterwalder and Pigneur (2010) defined a multi-sided platform as following:

"Multi-sided platforms brings together two or more distinct but interdependent groups of customers. Such platforms are of value to one group of customer if the other group of customers are also present."

The latter's definition rather focus on the value creation of the business model and doesn't precise the structure in the same way as Ardolino et al. (2020). The authors implies that the sole value creation is done by facilitating interactions between these two sides of the platform. A multi-sided platforms functions and grows due to the concept knowns as a network effect. It implies that the value of the platform becomes larger as more users become attracted (Osterwalder and Pigneur, 2010). Thus, at larger scale the multi-sided platforms preforms better. Ardolino et al. (2020) further implies that it is *"fundamental to implement a structure able to maximize the size of the sides"* as the fundamental value of a multi-sided platform is created between interactions and transactions between the participating sides, which is a very strict distinction from traditional business models. The authors indicate that to handle these interactions it thus becomes important to integrate a control mechanisms such as a rating and/or a review system. This can both help the user find a better fit but also alarm the ones managing the platform of incorrect behavior (Ardolino, 2020).

Ardolino et al. (2020) mentions that it is generally possible to identify a supply side and one demand side in a multi-sided platform. To succeed with such a business model it becomes vital to attract both groups on both sides of the platform (Osterwalder and Pigneur, 2010). Further, it becomes important to do so simultaneously as it becomes hard to attract one of the groups without the other being present (Osterwalder and Pigneur, 2010). The authors equates the situation with the "chicken and egg" dilemma which is also brought up by Ardolino et al. (2020) and Evans (2003). To solve this issue, Osterwalder and Pigneur (2010) mentions that firms can subsidize one of the customer segments which can be lucrative as it lures one of the

segments to the platform making it more profitable for the other segment to also take part. However, the authors comments on the fact that it can be difficult for the operators to realize which side to subsidize and to what extent. There are, according to Osterwalder and Pigneur (2010) a few questions to ask oneself to gain better understanding regarding the matter:

- Can we attract sufficient numbers of customers for each side of the platform?
- Which side is more price sensitive?
- Can that side be enticed by a subsidized offer?
- Will the other side of the platform generate sufficient revenues to cover the subsidies?

After going through the entry-face further strategic decisions must be made. Evans (2003) lifts the importance of formulating the pricing structure. The author mentions that, usually, in such markets firms lean towards having much higher margins towards one group. With the nature of a somewhat unique implementation there are also ambiguities regarding the scaling of a multi-sided platform. According to the Evans (2003) the firms gradually scale up their platform over a period of time. It is initially hard to understand the needed technology and the operational model due to a complex structure, thus testing and modifying the platform on a smaller scale can be rewarding (Evans, 2003). The author also point out that, in contrary to the conventional understanding of network theory, there is no proof that scaling quickly and building up a large market share will give a dominant position in the market the long run.

3. METHODOLOGY

Throughout this part of this research the methodological approach will be described. These approaches are chosen exclusively to answer the research question. Moreover, the rationale behind the decided approach is argued for. Initially in this chapter the research strategy is explained to provide the reader with an indication of how the research was conducted. Following, the research design and the research method is clarified to provide a more comprehensive plan of the strategy utilized for the research. Additionally, the tools used to execute the analysis is discussed as well as the justification behind the chosen process.

3.1. RESEARCH STRATEGY

The function of the research strategy is to guide the study and thus influence the choices of methods used. Bryman and Bell (2011) defines it as a "general orientation to the conduct of business research". The strategy is made to facilitate the way towards answering the research question. Therefore, it is important to, with precision, define a research strategy that is well adapted to the purpose.

As MaaS is yet an relatively unmapped subject of study an exploratory approach was taken. It fits well for investigating a problem which is not clearly defined and understood. It allows the researcher to explore the subject widely to identify possibilities that can be of focus in future research. For the purpose of this thesis solely qualitative research methods will be used as it is highly preferred when one look for in-depth insights of rather unexplored topics. Qualitative research gives the interviewee a chance to broadly present their thoughts which is needed when the research aims to gain an understanding of unknown factors haltering the implementation. To identify and understand such factors there is a need for an openness and a flexibility in the interviews. Moreover, further argument for such a strategy is that the in-depth knowledge needed to properly contribute to the research is possessed by a very limited number of professionals. Thus, detailed qualitative interviews are needed to soak up the knowledge that is available. Full interaction is available in qualitative studies but with the disadvantage that one can't gain the same width of the study and generalizability is not easy to reach (Patel & Davidson, 2019). Furthermore, it is by nature harder to maintain objectivity (Bryman & Bell, 2011). However, Gioia et al. (2013) lifts the importance of not limiting oneself to impressionistic studies and that qualitative inductive studies should be considered a competent method in terms of generating new concepts.

In terms of a qualitative study the term validity embraces the entire research process (Patel & Davidson, 2019). It is defined by the theory foundation, the accuracy and the meticulousness of the executed data collection. During this research a constant thought has been given to guarantee that the strengths of a qualitative study can be gained whilst still minimizing deviations from a high validity. What this means in practice is that the used techniques are appropriate and that the measurements actually measure what one want to know. These techniques are influenced or adapted from previously successful studies, with similar aims and components, to assure such fit.

As often with a qualitative research an inductive approach is taken. An inductive approach is defined by Bryman and Bell (2011) as a relationship between the theory and research where the outcome of research creates the theory. It fits well with the nature of the research as it aims to grasp a rather new concept and try to understand it's barriers and possibilities. For this thesis the outcome of the research result will be connected back to prior theory to give further legitimization for generalized findings. What this means is that both the precision of the primary data collection and the secondary data collection becomes crucial.

The process of the research started from a general interest in mobility and its transformation lying ahead. From there, discussions with actors in the researchers personal network took place aiming to find an interesting topic within this area. With the topic set, being MaaS, an initial literature screening took place to identify a research gap. Discussions where then held with relevant actors to formulate a better personal understanding of the subject and the interesting aspects being worked on today to assure a relevant research. Based on the identified research gap an initial formulation of the research question was made and then a more narrow literature review took place. Following this review the research questions were redefined to better fit the more clarified research gap given from a more extensive literature review. With the research question and the literature review intact the fitting interviewees were contacted. An initial interview guide was created and later used on the first interviewee as a pilot interview. Succeeding that, the research questions were once more finetuned and thereafter the final interview guide was shaped and used to collect the primary data. With the empirical findings at hand the data was analyzed creating the result which paved way for the discussion and later conclusion of the research. A summarized figure of the research process can be seen below.
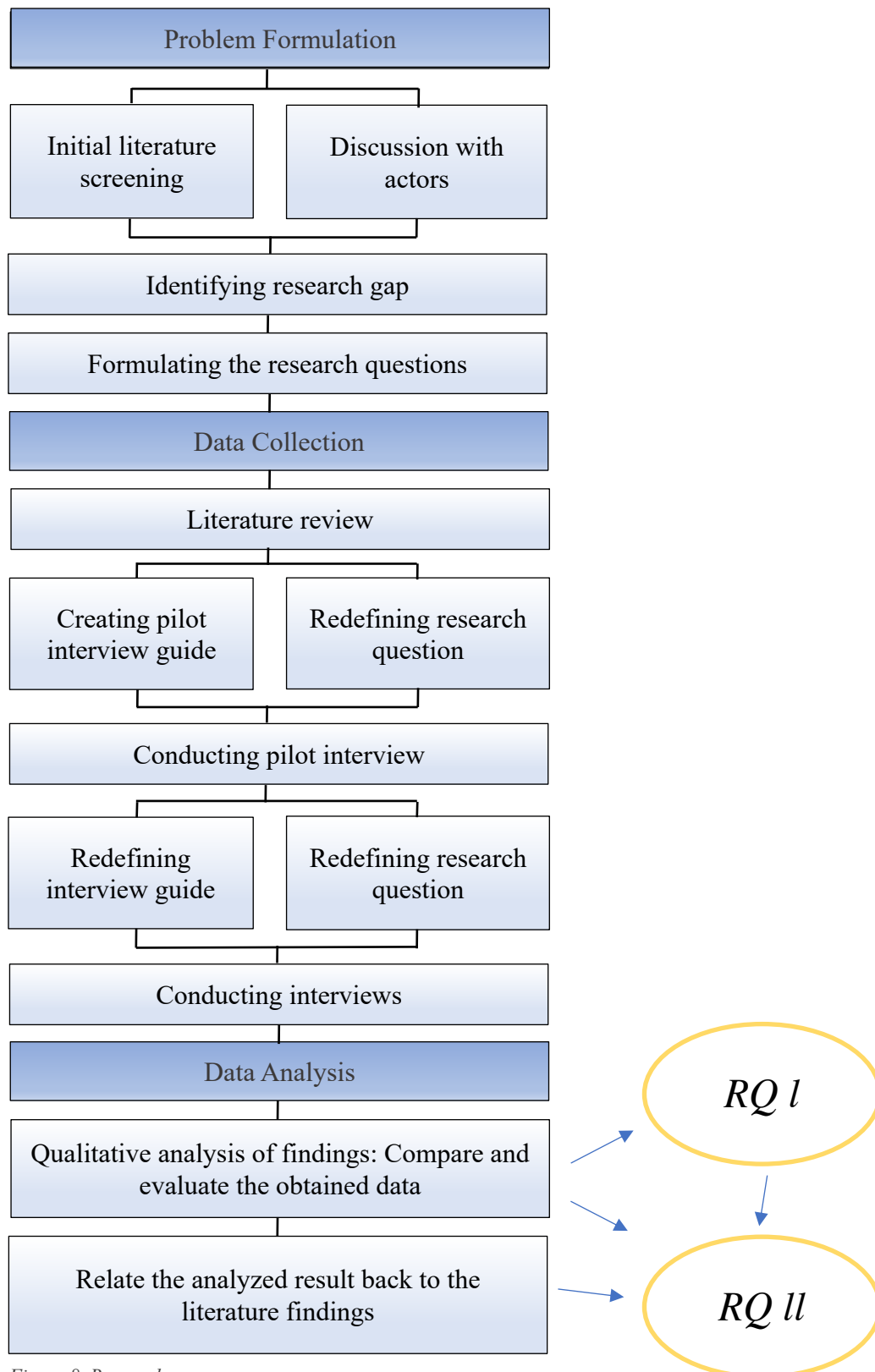
Figure 8. Research process

3.2. RESEARCH DESIGN

With the research strategy set the focus moved on to the choice of the research design. It aims to openly explain the taken approach and argue why it is appropriate for the purpose. As Bryman & Bell (2011) puts it, research design clarifies the priorities that is being given to a large range of dimensions of the research process. As with research strategy it is also favorable to clearly define the research design. This gives indications to the reader of the process which is important in terms of reliability. It is also helpful for the actual execution during the process of conducting the thesis as it provides a framework in terms of collection and analysis of the data (Bryman & Bell, 2011).

For this research multiple case studies were conducted. It is, by Bryman and Bell (2011), defined a cross-sectional design that is further described as a design which intends to collect qualitative data from more than one case with the purpose to detect patterns and/or associations. Patel and Davidson (2019) instead labels such an approach as a multiple case study. However, the authors give support to the claim that it is a preferable technique when studying processes and changes. It becomes necessary to look at multiple cases as it gives greater legitimization to generalize. Additionally, it gives the author the chance to examine the concept from various sources giving a greater width which may be of even bigger importance in a, yet, relatively unexplored subject.

3.3. METHOD OF DATA COLLECTION AND ANALYSIS

Research methods are techniques for collecting and analyzing data. To further describe the methodology the methods used in terms of data collections are provided and the underlying reasoning behind it. The process of the data collection is presented in a chronological order. Thus, initially methods connected to the secondary data will be presented and thereafter connected to the primary data collection.

2.3.1. Approach to secondary data collection

3.3.1.1 initial literature screening

The initial literature screening serves to give an overview of the subject in question. This allows for a better possibility to understand where there is a research gap and how the research question can be formulated. The initial literature screening aims to, in a methodical

way, screen the existing literature. To remain unbiased in the screening key search words were defined and used within specific chosen databases. Although adding more key words and using a larger number of databases adds quality to the research limitations were needed due to time restrictions. Google Scholar as well as the Gothenburg Universities own search function called "Supersök" was used to search for the research and the search words was formed by *"Mobility as a Service"* plus *"possibilities"*, *"potential"*, *"barriers"*, *"challenges"* and *"business model"*. Moreover, the screening also included articles found via references or citations from the authors of the initially identified research. All the material was subject to a critical review in terms of relevancy and quality. Aspects defining these factors were such as the number of citations, if the articles were peer reviewed, the education and experience of the author and the year of publication.

2.3.1.2 Initial open discussions

Early on in the work process two open discussions took place to gain better understanding of the subject and interesting research topics that have a more practical relevance. The rationale to this decision is mainly due to the novelty of the subject and its quick evolvement. However, this is argued more in detail in the research design. The two discussions took place online using a platform for business communication with the management consultant company Fortos, from which a Partner and a consultant participated. Their focus has been within the automobile and mobility business and have extensively worked with the transformation journey and had just finished a report regarding the ecosystem of mobility services, thus making a great fit for initial discussion with its deep industry knowledge.

For this research unstructured interviews, or rather discussions, was held for the purpose of gaining necessary, up to date, understanding of the subject. As these interviews took place early in the process of the thesis it is beneficial to have a low level of structure and a low standardization since the author at that point is yet to be fully acquainted with the subject. These occasions were more like a conversation. This created an environment where the interviewee was given power to control the interview and give inputs what he/she thinks is of interest. The discussions didn't intend to be a part of the empirical findings creating the result but rather formulate a personal understanding of the subject and the interesting aspects being worked on today to assure a relevant research.

2.3.1.3 Literature review

As Bryman and Bell (2011) mentions, the literature review should be viewed upon as a foundation of the research project as a whole. It gives strength to the raised arguments and helps to define and narrow the work. This foundation helps to plan the research work and also to define the research question. When conducting the literature review the approach was strongly influenced by Patel & Davidson's (2019) exemplified process. It begins by making preparations based on the purpose and the intended research question. Here understanding is gained on what will be central for the research and where one can, and should, draw boundaries. In other words, this is where one define which subject areas and concepts need to be included. The articles used came from different databases such as ScienceDirect, AIS eLibrary and SAGE and were also searched for by using Google Scholar and the Gothenburg Universities "Supersök". Literature was also searched for in the physical library of the School of Business, Economic and Law department. These books were still searched for using the "Sökersök" function and then localized in the library. However, due to the current pandemic the access was limited and during a period only books available for home loans were accessible. At this stage more specific keywords such as Business Model, Business Model Design, Business model development and for example Business Model Innovation were used. Same critical review was applied for this process.

Lastly, as illustrated by the figure below, the literature review helps to gradually limit the research area as it takes place. Both initially defining the research question in the early literature screening and then later redefining the research question in the literature review. From there the problem formulation can be more narrowly defined. This becomes a natural process when first reading literature that touches on the subject broadly to later look for more narrow such with the help of certain keywords.

Figure 9. From research area to problem formulation. Reworked from Patel & Davidsons (2019).

The concept has been developed in recent years and thus there is yet a limited amount of published research on the subject. In addition to this this, the relevance of the concept and its

impact to the industry is difficult to know for sure. To create a clear picture of MaaS focus has been put on initially defining the concept, understanding it's value creation and the business ecosystem and identifying the possible business models. With time as it is further researched, and it can further be observed in the business environment, more knowledge and truths will become available. Therefore it is of great importance that the theory is new to assure relevancy. As the thesis aims to initially investigate the barriers limiting the implementation of MaaS in today's everyday mobility it becomes essential to map the theory of today regarding possibilities, barriers and such as perceived value from users. As the aim is further to illustrate possibilities moving beyond them based on business model theory it becomes important to establish said theory. Focusing on business modelling, development, innovation and design. Regarding this section of the literature review there are large amount of relevant theory that has stood the test of time and has been taught from managerial institutions and practiced by companies for many years. However, with the innovative nature of transformation more recent framework and business model theory regarding innovation will be reviewed. A large number of research have been done on the subject in recent years and, also here, one can imply with certainty that there is a strong theoretical foundation to use. Moreover, also such business model theory more applicable to the characteristics of MaaS has been explored to be able to understand how one can overcome barriers in a more specific context. Present studies mapping the business models of MaaS will naturally be important to build further upon. These parts are detrimental in terms of creating a strong foundation and an uncompromising understanding of the subject prior to conducting interviews. Moreover, the there is also of importance in terms of answering the research question as the purpose is to use the findings to connect back to applicable theory in the analysis.

3.3.2. Sources of primary data

The primary data collection represents the empirical data that paves way for the research question to be answered. When deciding on how the collection is going to be made one has to take a starting point from the purpose of the research, as advised by Patel & Davidsons (2019). Furthermore the author mentions that decisions, such as how the information should be collected and whom the information should be collected from, needs to be defined with a constant consideration of the time, and other means, we have at our disposal.

Patel & Davidson (2019) implies that the generalizability of the study is connected to how one comes to choose its cases and the participants. The authors mean that its only reasonable to assert this generalizability within the population that the case study takes place. With other words, it's hard to create general theory from case studies as such studies only look at a narrow field. However, other authors opposes such claims. Flyvbjerg (2006), for example, suggests that one can create generalizable results from only a few cases and even a single case. He implies that formal generalizations doesn't have to give more validity than specific examples. To conceptualize this he refers to Karl Poppers falsification principle. A part from that, the author lift single case studies, of course then also multiple case studies, can be of scientific value as it can help develop new generalizations as a supplement to other methods. Bryman & Bell (2011) also touches upon the subject when mentioning that knowledge can be of different sorts and that case studies bring a more profound knowledge and understanding of a phenomenon, which in some cases is preferable. For this research it is also important to acknowledge that there is a limited number of cases present.

3.3.2.1 Interview Structure

For the interviews aiming to form the empirical data the interviews took a semi-structured shape. The decision was made by taking in to account the desired level of standardization and structure. It allows for a format with discussions rather than only straightforward answers, giving less focus on details and instead aims to be able to create a broader picture. Furthermore it makes the interviewee able to focus on what she believes might be of value. Some questions were still fully defined in advance within clear themes, however, the order of the questions could be changed during the interview to facilitate a good flow of conversation. Furthermore, follow-up questions could take place. This format fits the research design well as it enables a high flexibility which is favorable when one tries to examine a relatively unexplored subject. At times direct questions were asked to make sure that the respondent was fully understood.

Prior to the interviews taking place the author critically examined the questions. Patel and Davidson (2019) mentions that often interviews tend to be too long and that some questions would be better to be left out. Furthermore the authors give the advice to carefully go through whether all sub-areas are treated and that these areas are in an optimal order. External help in terms of weather the questions could be misinterpreted was taken. This because when one has

become very well-read in an area it can be hard to evaluate how hard the questions are to understand (Patel & Davidson, 2019). Moreover, the first interview was conducted as a pilot interview with the aim to test the interview strategy and the interview guide. The interviewee was not aware of this to simulate maximum fidelity. Throughout the pilot interview it became evident that the accuracy of the presentation of the essay's area and issue could be improved to reduce misunderstandings. Moreover, the pilot interview was evaluated to be too unstructured which would be troublesome in terms of creating generalizable results.

The interviews were conducted using a technique inspired by the funnel technique. Patel and Davidson (2019) defines the technique as one where the interviewers begins with big, general, questions. Eventually to move over to more specific ones. This way of conducting an interviews is, by the authors, motivating as the interviewee can start freely and become comfortable with the interview. The interview guide was split into different small themes from where a funnel technique was used. The interview guide can be found in its entirety in Appendix 1.1.

The interviews were conducted in Swedish since the interviewees themselves had a better understanding of said language. Thus, the conversation could be freer and misunderstandings greatly reduced. The presented interview guide was therefore translated from Swedish to English to give the reader of this thesis an understanding of the design of the interviews. The interviews were recorded as it lets the interviewer focus fully on the responses in real time making it easier to bring discussion (Patel & Davidson 2019). Having the interviews recorded is also beneficial in terms of the analysis process. Patel and Davidson (2019) mentions that respondents might be influenced in terms of their answers when being recorded but for the sake of giving reliability to the study it is still favored. All participants were acknowledged on the purpose of the research as well as the estimated needed time. With the current situation in mind, the interviews were conducted online rather than face-to-face. An assessment was made that this does not harm the legitimacy of the study as there is no direct interest in the factors that are omitted when the interviews take place over zoom. These factors could have been such as tone of voice and body language. Right after the interviews the full recordings were transcribed as they are essential for the thematic analysis.

3.3.2.2 Sample

With the research objective in mind the intended interviewees were actors with practical experience of implementing and leading MaaS projects. This, as they can provide insights from concrete initiatives in a real, practical, setting. To find relevant initiatives the mapping provided by KOMPIS (Karlsson et al., 2019) was used. Throughout their project they have explored the MaaS pilot projects and implementations in Sweden. KOMPIS is an initiative by the Swedish government's collaboration group for "Next generation travel and transport" which aims to promote the growth of combined mobility in Sweden. It is a project run by Drive Sweden and is financed by Vinnova, which is a Swedish public administrative authority. The different projects provided differ in their respective phase of development and implementation which is lucrative to be able to gain a holistic understanding. This ranges from being in the starting pits of deploying the pilot, being in the middle of operating the pilot, evaluating the pilot and operating a commercialized service. With relevant projects and services being identified the next step was to find suitable actors within these.

In order for the interviews to provide the desired value, it was required that the interviewees had strong insights into their respective projects, where he or she had been involved throughout its development and had participated in the internal discussions regarding strategic choices. In addition, a good understanding of MaaS as a concept and also in the context of business modelling was further required. Initially project managers, within each respective project, were identified as suitable actors. However, as there are various individuals, often many project leaders, working within the projects and limited information regarding the projects and their structure it can be hard to, from the outside, identify suitable interviewees. Thus, initially an email was sent out to project managers for each respective project with the aim to present the purpose of the thesis and what areas the interview would touch upon. This, to let the contacted project managers gain an understanding of whether he or she would be a good fit to answer these questions in terms of knowledge and experience or if someone else within the project instead would be of a better fit. In most of the cases a project managers was deemed to be suitable for the interview. In some instances the representant instead made clear that some questions were better asked to another individual within the project and thus forwarded accordingly. All projects contacted except one, which was in a very early start-up phase, chose to participate in one or more interviews.

This general approach to the sampling could be described as purposive sampling, as defined by Denscombe (2014). The author describes purpose sampling as hand-picked for the topic on the basis of relevance to the issue being studied and the knowledge or experience regarding the topic. This characterization fits well with the execution. Further the author implies purpose sampling can be seen as a representative sample. However, this comes down to the delicacy of the researcher. It is important to be able to argue for a representative sample as it increases accuracy and minimizes bias. Thus, extensive thoughts have been put in the selection of the participants to ensure that the interviews could provide high quality data as argued for above.

From the table below one can see projects taking part in the research. Data in terms of date, position of interviewed actor and time of interview is presented. Moreover, the interviewees are labeled, both in terms of the individual interviews and their respective projects.

Interview Number	Date	Project/Company	Role	Time	Interview label	Project label
1 – Pilot Interview	31st Mars	WHIM	Head of customer insights	53 min	-	-
2	1st April	LIMA	Project Manager	37 min	1A	P1
3	6th April	LIMA	Project Manager and researcher	60 min	1B	P1
4	6th April	UbiGo Stockholm	Former CEO	58 min	2A	P2
5	16th April	MoJo Johanneberg	Project Manager	39 min	3A	P3
6	22nd April	MaaS Skåne	Project Manager	34 min	4A	P4
7	23rd April	Modern Mobilitet I Barkabystaden	Project Manager	24 min	5A	P5
8	26th April	Modern Mobilitet I Barkabystaden	Traffic planner	39 min	5B	P5

Table 7. Participating projects.

3.4 DESCRIPTION OF PARTICIPATING PROJECTS

3.4.1 Drive Sweden – LIMA

LIMA is a pilot project taking place at Lindholmen, Gothenburg, available for employees and companies in the area. The pilot provides an application from which users can attain a large variety of mobility services and pay directly in the application. Moreover, the application can help users separate private travelling and business travelling and simply the administrative work connected to accounting of business travelling. The pilot also uses mobility hubs where the mobility services are gathered in one place with the intention to help one find the means of transportation more easily.

The project is financed by Vinnova, the Swedish government agency for innovation systems. It was initiated August 2018 and is planned to take place until September 2021. The described purpose of the pilot is to evaluate how a MaaS solution can become economically sustainable and be continued after the projects end to improve the mobility for employees at Lindholmen and create a better traffic environment. Throughout the project focus is put on developing technology and business models to make this possible. The project consists of a variety of partners within different areas providing their competence.

LIMA is a part of the larger strategic innovation program Drive Sweden, which is an ecosystem of around 150 actors active in business or academia. The program aims to develop, test and implement efficient, connected, shared and automated mobility solution.

3.4.2 UbiGo Innovations - UbiGo

UbiGo was a commercialized MaaS solution that started operating in Stockholm 2019. In 2013 UbiGo started their journey as a pilot project in Gothenburg which was funded by Vinnova and The University of Chalmers. This year they ceased their operations due to Covid19 related loses. The service provided various of different mobility services via an application. The service was bought differently depending on the different mobility services. In terms of car-pool and public transportation the service is bought by choosing a subscription model that fits the wanted used, and is then priced accordingly. For bicycle there is a fixed monthly price and for the car rental and taxi services the service is booked and paid for at each use. The goal with the service was to provide a complete substitute to owning a private car and thus decrease the car usage. The company's goal was to increase the amount of

provided services as the demand increased. Further the aim was to establish their services in other cities and implied to do so by partnering with local actor. Post the pilot-phase the company has been financed by private actors.

3.4.3 Skånetrafiken - MaaS Skåne

MaaS Skåne is a pilot project that will incorporate a variety of mobility services to the already existing public transportation application in the Skåne area. The service aims to have an open interface that makes it possible to more freely integrate various travel services in the platform. However, as the project is still in an early stage the participating mobility services are yet unknown. The aim is to be able to give invited users the change to try out the service from Autumn 2021. The pilot project aims to run until March 2022 and the goal is to then reach a public procurement so that the service can continue to operate in the long run.

The purposes of the project is to accelerate a market introduction for innovative mobility services that have a smaller ecological footprint as a way to contribute to achieving the climate goal of a fossil-free transport sector by 2045. The project is a collaboration between six actors, both from the private and the public sector. Skånetrafiken, the authority for public transportation within Skåne county, is the owner of the project. The city of Malmö, the city of Lund, the city of Helsingborg and Innovation Skåne is also taking part in the project. Innovation Skåne is fully owned by the Region of Skåne and aims to create better services for the inhabitants by supporting innovative projects in the region. Their goal is also to build innovation capacity and stimulate collaboration and knowledge sharing. Lastly, the start-up Iomob Technologies AB takes part in the project and will develop parts of the technological solution. The start-up delivers open mobility marketplaces aimed to rapidly deploy integrated shared mobility experiences both for public and private partners. Around 50% of the funding comes from Energimyndigheten, the other funding comes from earlier mentioned project participants.

3.4.4 IRIS - MoJo

MoJo is a pilot project that provides individuals working at specific companies located around Chalmers and Johanneberg Science Park the chance to try out a MaaS application. The project started 2019 and is set to run until November 2021. The pilot phase is now completed and the project is being evaluated. The application provided the possibility for the user to attain a

various amount of mobility services and pay for them directly in the application. One could either use it for business travel for which the employer is billed automatically or one can use the service for private travelling. The mobility services were available at mobility hubs. There are four strategically placed hubs in the inner city of Gothenburg, around Campus Johanneberg.

The project aims to investigate the conditions for a continued, scaled-up joint mobility service in the area and increase the general knowledge about the effects on travel behavior, given the introduction of a new sustainable mobility solution.

The project is coordinated by EC2B Mobility AB, a company that, through their service EC2B, develops sustainable transport solutions and mobility services for real estates. The MoJo project is a collaboration between said company EC2B Mobility AB, Chalmers University and various of real estate companies. The project is funded by Energimyndigheten.

3.4.5 Modern Mobilitet i Barkarebystaden - Travis

The project Modern Mobilitet i Barkarebystaden is built on the previously Vinnova-funded innovation project Autopiloten and integrates several modern mobility solutions in an approach to increased sustainable travel in Barkarbystaden, an area within Stockholm. As part of the project Modern Mobilitet I Barkarebystaden an application named Travis was launched 2018 were users could book and pay for a variety of different mobility services directly in the application. This part of the project aimed to investigate what is required to establish MaaS solutions and how the concept can be further established in various places. The pilot phase ended at the end of 2020 and the vision is to continue to run the application Travis. The vision is to make the private car redundant and to influence more travelers to travel with public transportation.

The project is coordinated by Nobina, an operator within public transport, and it is funded by Vinnova. Further partners are Barkarby Science, Stockholm public transportation and Järfälla municipality, located north of Stockholm. Barkarby Science is owned by different actors, both public and private, in the Stockholm region and aims to create a platform stimulating collaboration in sustainable urban development.

3.4.6 Project's timeline

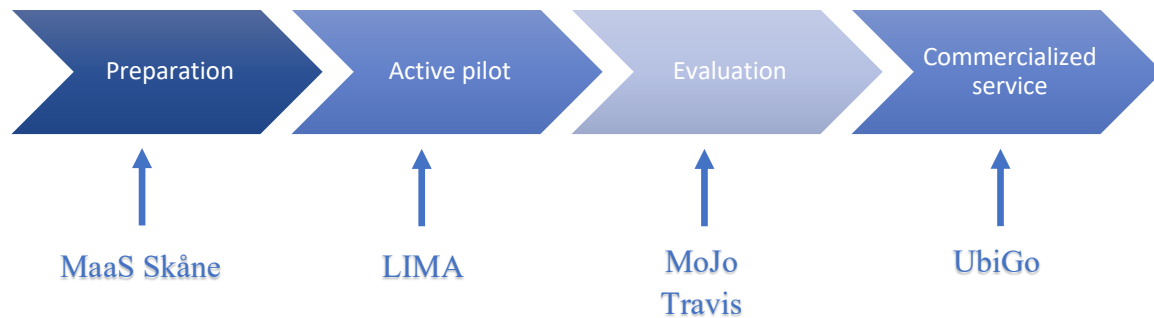Below is a timeline showing were the projects are today and how they differ in that matter.

Figure 10. Project's timeline.

2.5. DATA ANALYSIS

Qualitative data is by nature unstructured which implies that it can't be grouped directly (Patel & Davidson, 2019). To be able to analyze the data one first has to structure it which can be done through various ways. For this research a thematic analysis was used. It fits well as it's great at examining themes and patterns from collected qualitative data (Patel & Davidson 2011). Guest et al. (2012) lifts that thematic analysis goes beyond the counting of phrases. Instead it focuses on identifying and describing the real meaning of the data, which is done within themes. To analyze the empirical findings in a structured way the software MAXQDA was used. MAXQDA is a program specifically designed to help structure, code and analyze qualitative data and/or mixed data. After further familiarizing with the transcribed interviews the data were highlighted with different color schemes acting as codes. As part of the software the highlighted parts automatically becomes grouped together into themes from were one, in a structured way, can sort the data needed to conduct the empirical findings. Further, it also makes it easier to acknowledge the similarities.

Reliability is of more concern when conducting thematic analysis as the researcher needs to interpret the data, i.e. create codes (Guest et al., 2012). The author is not solely searching for manifest content but rather also latent content. With that mentioned, the authors still believes that thematic analysis was the preferred way of capturing complexities of textual data. In terms of the coding a inductive approach was taken, meaning that the process of coding is done without trying to fit the data to any existing framework. However, it is important to acknowledge that it is impossible to not be affected by assumptions, making it not purely inductive (Patel & Davidson, 2019).

The data was handled in Swedish and was first translated when shared in the chapter of empirical findings. The author believes that whether the data was in English or Swedish did not play a role in an internal structuring and analysis phase. Thus, translating the full text becomes unnecessary and it serves a purpose first as it is presented in the thesis. In this phase it becomes very important to work with caution when translating, for example quotes. This, to make sure that the intended meaning from the interviewee does not in any way deviate post translation.

3.6 RESEARCH QUALITY

There are three factors that help form the quality of the research. Namely, validity, reliability and replicability (Bryman & Bell, 2011). Below a short argumentation is presented regarding how the three factors are taken in to account for this research.

3.6.1 Validity

The concept of validity is connected to how the conclusions made can actually be derived from the empirical findings (Bryman & Bell, 2011). To achieve a high credibility, that there is truly a causality, between the empirical findings and the conclusions the study was ensured to hold great standard in the practices made. Moreover, credibility was achieved by minimizing ambiguities by consistently providing clear and well defined text. This, above all, in terms of the research question, aim of the study and the final findings.

Validity also concerns to what degree the generalizations of the findings are true in a different setting. To achieve this, a wide range of projects have been targeted in various phases to gain a more holistic result that can lead to more generalizing findings. However, the sample of the research will be influenced by the restricting time span. Thus, one can argue about the general generalization of a limited sample. This is done more thoroughly in section 3.3.2.

3.6.2 Reliability

Reliability concerns the ability to repeat the conducted study (Brymann & Bell, 2011). Meaning, that with high reliability the findings would be consistent with similar studies that in the future take place. Within this explorative research in an evolving topic it can be hard to reach reliability. For example technical improvements, increased knowledge of the concept

and political regulations may alternate the conditions which could imply that the contributions of this thesis might become outdated. However, as the main purpose is to express possibilities the contributions are still considered relevant. Reliability can also be measured by the research accordance to other researchers findings. To demonstration this in the findings references are made to earlier findings.

2.6.3 Replicability

The study's replicability deals with to what extent the study can be replicated (Bryman & Bell, 2011). To achieve a high level of replicability it is important to detail the study's work flow. All of the components within the thesis have been recognized in the methodology section chronologically as a way to increase replicability. Moreover, the research process is, in its entirety, illustrated in figure 8 and the interview questions are available in appendix 1.1 to assure as high transparency as possible.

4.0 EMPIRICAL FINDINGS

This part will present the empirical findings collected from the interview process. Initially the findings connected to an understanding of the vision of the projects and their present business models, in accordance with the business model canvas, will be presented. Thereafter, the expressed barriers to successfully implementing MaaS solutions will be presented. These finding will be structured in to different sections depending on the factors touched upon by the interviewees.

4.1 PROJECT VISIONS

For all the participating projects there is a desire to continue the project and in a way commercialize the service. However, P2, which took the step towards a commercialized service ceased their operation due to losses related to the pandemic. The project had a vision to gradually scale from their service provided in the urban Stockholm. There is in many cases an ambiguity regarding how the continuation of the projects would be designed. For example, one interviewee mentions:

- "It is an objective to see how viable it is to run a project on a commercial basis. Commercializing directly within the project is a completely different thing. There is an idea that after the project ends in November, there will be a discussion and a dialogue about how something can live on. The forms in which this could be done are still undecided."

-2A

Another interviewee (4A) mentions that the vision is to be able to pursue the project as seamlessly as possible and in their case there will be a need for the public transportation to begin a government procurement. The success of this vision is believed to be connected to the number of active users the pilot can achieve. Moreover, another interviewee (3A) mentions that their project intends to tie up the service to property owners. However, as an effect of the pandemic, the interviewee mentions that it is more difficult to have a dialogue with possible customers as their priority regarding such a service has dropped. The approach and level of ambition are thus quite different from one project to another. On the other hand, the vision is shared that the project will result in a service that can influence how the daily mobility is carried out and be part of the journey towards a more sustainable everyday transportation.

4.2 BUSINESS MODELS

4.1.2 Customer segment

It was examined that there are two clear differences in the targeted customer for the initiated projects. Some projects (P2, P4, P5) have a B2C focus. More practically this means that the transactions of the service is between the company and the consumer market. The remaining projects (P1, P3,) have a different approach, rather having a B2B/G focus. Thus, targeting companies, government and real estate owners rather than the end users directly. One interviewee (3A) implied that it's easier to have a dialog with companies and that they have an easier time understanding the potential. Another interviewee (1A) pointed out that the companies desire for their employees to travel sustainably has begun to increase. Moreover, the mobility service providers are customers as well. The service provides a platform for the mobility service providers leading to more customers and an increased use.

It is mentioned by many interviewees (1A, 1B, 2A, 5A) that it is more specifically car travelers who need to be persuaded to change their travel habits for the mobility solution to have a greater impact, from an environmental and spatial value perspective. This also for the projects where the end users are not the actual customer. It was also pointed out that these individuals might be the hardest segment to convince.

4.1.3 Value propositions

From the interviews there was a consensus regarding the fact that the value for the end user is connected to flexibility, accessibility and an easy-to-use service. More practically, many interviewees (1B, 2A, 3A, 4A) believed that to provide an attractive mobility service it becomes important to attach many different types of services. This implies that to achieve an attractive service, a variety is required in order to be able to satisfy the varied needs of mobility. Another interviewee (2A) expressed a bigger focus on converting car users and making their service become a substitute for owning a car. Further the interviewee mentioned that then there is a the need for the service to truly substitute all the reasons for why one owns a car. Thus, the value proposition needs to compensate the needs connected to the car for the entire household.

For the projects with an B2B/G focus (P1, P3) the value proposition is different. One interviewee (3A) mentioned that a part of the business logic is that the integrated mobility

service should reduce administrative work for the companies. For business travel, invoicing can be integrated into employees' travelling. in addition to this, the interviewees of these projects (1A, 1B, 3A) also pointed out that there are other values to be gained for companies that use the service. First of all the organization will receive good will. Furthermore, there is also the aspect that you can provide health benefits for the personnel. This, as an effect of a higher use of healthier mobility services. Lastly, one interviewee (3A) pointed out that health benefits are something you can gain value from as a company in the long term.

4.1.4 Channels

Channels are quite an uncomplex matter when it comes to MaaS solutions. Using webservices and applications is fundamental to realize the abovementioned value proposition. However, there are still variations in terms of the design of these channels and above all the type of actor that manages the platform and thus the interface with the customer. In terms of one project (P3) the service aims to be directly incorporated in to the application used for today's public transportation. Two other projects (P2, P5) operates under their own application. The two B2B/G focused projects (P1, P3) also uses independent applications. These last mentioned projects has also chosen to use mobility hubs. These are strategic areas where multiple mobility services are located. It serves the purpose of limiting the gap between conventional mobility and one using a digital platform.

4.1.5 Customer Relationship

The nature of the service is automated. A B2C platform service provided all necessities for the customer to help themselves with an automated process. The service can be used to its fullest without interacting at all with the platform provider. However, as earlier presented a lot of value is created from factors such as availability and accessibility, thus a help desk is important. Again, for the B2B/B2G projects it differs. In this case the interviewees (1A, 3A) imply there is a larger need for a direct relationship with the customer. It requires commitment from the buying side in order to integrate the service and to maintain it.

4.1.6 Revenue streams

There are two distinctive ways the end users could possibly buy the service for the B2C services. That is either from a subscription or from a pay-by-use. One project (P2) tried to commercialize the service focused on a subscription model. However, some mobility services were still only available for pay-by-use. In regards to the other B2C pilots this far solely pay-

by-use is possible. Two interviewees (1A, 1B) believed that a subscription model would be hard to run due to the commitment needed from customers and that the market thus is not yet ready for it. It is implied that in an early phase where the focus in on attracting users, less direct commitment makes the step to try the service easier. Moreover, there is a margin to be gained from the mobility service providers as the platform offers mobility service providers an opportunity to reach a larger number of customers. One interviewee (2A) mentioned that this becomes particularly true if the MaaS solution handles such as customer service and similar which simplifies the company's operations.

From the interviewees the revenues streams seems to be a part of the business model still yet to be fully understood by the pilot projects. It was expressed by one interviewee (4A) that there is no margin for the service during the pilot and the strategy towards realizing one is not conceptualized as the learning from the operations itself are more prioritized. Moreover, One interviewee (5B) mentioned that the mobility service providers today doesn't pay anything in regards to certain factors that would normally have a cost. One example is the electric scooters that doesn't have to pay to be allowed to place their vehicles within the municipality. These exceptions are made because the focus is on creating the best service possible and the mobility service providers is then a vital part.

In the case of B2B/B2G the interviewees (1A, 3A) explained that the revenues initially comes from selling the service to companies which gives recurring revenues as a value proposition is delivered to the end users and for example post-purchase customer support. However, one interviewee (3A) mentioned the ability to incorporate a variable revenue depending on the usage of the service, so that the service has incentives to attract more users, has also been discussed.

4.1.7 Key resources

Regarding key resources the modelling of the service itself is believed to be most important. It is mentioned by interviewees (3A, 5B) that it becomes important to have great coverage and be able to reach important transportations nodes in the urban area. Moreover, the technological competence is important for two reasons. To begin, interviewees (1B, 3A, 4A, 5B) mentioned that it becomes important to have a functioning structure to fully integrate new mobility services to the application as it is central for the value proposition. Additionally, In order to be able to sell the service B2B/B2G, it becomes important to be able to integrate the

service well. Further, as earlier mentioned it is important in terms of the value proposition that the application is easy to use for the end users. The application needs to be user-oriented and thus the quality of service for the end user is strongly connected to the technological capabilities. Further, the brand has been lifted as important. It is believed that trust and recognition towards the service provider is importance. Some interviewees (2A, 3A, 4A) lifts that the strong brand could ease the process for potential users to try a MaaS solution. Moreover, one interviewee (4A) believed that the brand of the local public transportation authority can be helpful to make users take the step. The same interviewee mentions that they believe there is a reluctancy for users to download an unknown app where personal information is required to be shared.

4.1.8 Key activities

The key activities is connected to enabling the value proposition. Thus, providing multimodal mobility services with a high availability and flexibility the most important activity as argued by the interviewees (1B, 2A, 3A, 4A). Additionally, one key activity mentioned by many interviewees (1A, 1B, 3A, 4A, 5A, 5B) becomes creating and developing the service and its platform, including the integration. With a strong need for user-friendliness and a platform with a lucrative offer of mobility services the design, development and the maintenance of the service's different parts becomes vital.

4.1.9 Key partnerships

In order to deliver the value proposition the most important partnership is with the mobility service providers. Further, As addressed by the interviewees (2A, 4A) it is important to partner with research organizations as they are a vital part in constructing the pilots and developing the service further. Moreover, many interviewees (1A, 1B, 4A, 5B) believed that an involvement from public authorities is lucrative to be more effective and contribute to positive societal effects. Also, to be able to provide the service there might be instances where public authorities needs to be a part of the decision, as for example when dealing with the mobility hubs and the general placement of vehicles such as electric scooters. Lastly, in an early stage MaaS solutions are in need of financings which has, in the case of these pilots, been granted by research institutes or state authorities. However, in the case of one project (P2) the financing was instead venture capital-backed.

4.1.10 Cost structure

Most of the costs are connected to the platform design, its development and administration. For example designing and running the application itself, in other words, the creation of the value proposition. Moreover, marketing is mentioned by some interviewees (2A, 3A, 5B) to be a substantial contributor to the cost of running a project and trying to attract users and actors in an early stage.

4.3 BARRIERS

4.3.1 The business model

It became clear that well-defined business models have not yet emerged from most of the projects (P1, P2, P4, P5). One interviewee summarized it by mentioning that:

- "Sometimes it feels like we're running in all directions to get this working. We still lack an understanding of what we can really achieve."

-A2

It summarizes the ambiguity and uncertainty still present regarding MaaS and how a functional business model could be developed and designed. During the course of these projects they've rather focused on testing the service as a whole. For example understanding the user preferences, the integration of the technical aspects and the general cooperation between the participating actors. Another interviewee mentioned, while answering a question regarding their business model, that:

- "Time and effort has been put into enabling the integration and fixing an app. Thus, the other processes have not gotten as far".

-A1

Moreover, another interviewee (5A) stated that the novelty of the idea that MaaS present is still in a very early phase. This according to the interviewee is why there is a lack of applicable business models. One interviewee (3A) believed that many who participate do so because they think it is an exciting project and want to be a part of the learning phase. A result of this, the interviewee believes, is that the business model remains fuzzy throughout the project and thus it will be needed to closer review the business model in a later stage when

one aims to advance with the project. One interviewee (3A) had a defined idea of the business model moving forward. However, there are still question marks regarding the division of responsibilities and the influence from different actors. Lasty, the interviewee (2A) from the MaaS solution that has already been commercialized had a more defined business model but still mentioned that in this period they've had a hard time finding fully identifying a working business model. From Mars 2021, the service has been discontinued.

4.3.2 Public transportation authority's involvement

There is an uncertainty regarding the public authorities place in the ecosystem. Some interviewees (1A, 2A, 4A, 5A) mentioned that with a more direct involvement from the public authorities MaaS solutions could more successfully be implemented. Two interviewees (1A, 5A) more specifically mentioned that the public transportation authorities can increase the legitimacy of the service but also be helpful in informing the public about the concept. This, according to the same interviewee, should be of interest due to the societal effects that MaaS can contribute too. Another interviewee (2A) implied that a public involvement can be beneficial at an early stage as cooperation with other actors can becomes easier. However, the interviewee continued by claiming that it can be difficult to get the same level of innovation within the project with an involvement from a public actor. Interviewee 4 lifted that a direct implementation within the already established public transportation can be beneficial as it provides access to a large group of users and that the step for trying the service would be significantly smaller. In addition, there are already user-friendly payment systems and search engines present.

Many of the interviewees (1A, 2A, 3A, 5A) implied that it is unfortunate for the development of the concept that an interest from the public transportation authorities is in many ways lacking, with the above-mentioned advantages as an argument. The interest from these actors differs markedly between the different projects as they are present in different areas of Sweden.

4.3.3 The end-users

In terms of encountered difficulties in regards to the end-users the interviewees lifts various factors. Many interviewees (1A, 1B, 2A, 3A) implied that an issue is the lack of information regarding the benefits of the service. This is connected to the lack of knowledge regarding

their cost of travelling today and the economic benefits that a MaaS solution could give. One interviewee puts it as following:

- "Most people who own a car do not understand what it costs. If you divide it as a monthly cost, the cheapest option is probably SEK 4,000 a month and you must include all costs such as fuel, service, insurance, parking. It is an obstacle for mobility services that individuals doesn't understand. You get a large amount of mobility for SEK 5,000 a month."

-1B

Interviewee 2A implied that it has been documented that those who have better understanding of their car costs were generally more interested in using a MaaS solution. Further, interviewees argued that it is not solely the economic aspects that are not understood. Interviewees (2A, 3A) explained that they have experienced that it is hard for individuals to grasp the general benefits that can be gained. However, interviewees (1A, 1B, 5B) rather believed that there is a general lack of knowledge in regards to the concept as a whole. Shortly explained by one interviewee as:

- "if you just ask anyone what MaaS is, I do not think they can answer that."

-1A

On the same subject one interviewee (5A) mentioned that they did a survey during the project and asked the citizens if they knew about their application and the numbers were extremely low, around 6%. They had been working on the project for two years and had yet not been able to reach out to the public in regards to the service.

Many interviewees (1A, 2A, 3A, 4A, 5B) express that there is a high price sensitivity of users that already travel with public transportation. One interviewee (1A) explained this by mentioning that they are frequently asked if the user will receive the same price as they would buying the service from Västtrafik, the public transportation in Gothenburg. The same interviewee believed that the potential customers doesn't want to feel "tricked" in to paying more. Another interviewee (2A) put it simple stating that users do not want to pay a premium of for example 10% just because they can use an application. Moreover, an interviewee (4A) touched upon the same problematic. In their case the service will be integrated in to the public

transportation application used by the citizens. The concern is that if the value is not truly understood it is not likely that users will pay more for a subscription with additional services.

Lastly, various interviewees mentioned that it is very hard to create a service that truly can substitute owning a car. To begin with, interviewees (1A, 5A) mentioned that one can't solely look at a car as a means of transportation but also as a sign of status, which becomes very hard to replace. Moreover one interviewee puts it as following:

- "You have a car for various reasons, partly as a way to get from A to B, for example to drop off children. But also as storage. You buy food, shop, have your golf equipment there. You go on holiday sometimes. If you replace the functionality with a service, you need a lot of different things."

-1B

This opinion is supported by another interviewee (2A) that mentioned that one need to be able to substitute the needs of the whole household. Not just travelling from A to B at specific hours but rather morning to evening, January to December.

4.3.4 Mobility service providers

One important factor that is complicating the development of MaaS is according to some interviewees (1B, 3A) the lack of collaboration from the public transportation. Both of these are present in Gothenburg and one interviewee (1B) claimed that they lack a willingness to let third parties sell tickets through a commercial platform. Another interviewee (3A) supported that claim and implied that it is somewhat unclear regarding who is allowed to sell the Gothenburg public transportation tickets through a third party platform. However, the same interviewee implied that it is starting to change a little bit in that regards. One interviewee (1A) mentioned that the public transportation authorities are looking at implementing a national wide ticketing system that would make it easier to integrate the service to MaaS solutions. However, it is mentioned to be a long way to go still.

A frequently touched upon issue by the interviewees (1B, 3A, 4A, 5A, 5B) is the lack of technical maturity by mobility service providers. It was explained that when trying to create a service for the pilot project and going forward it is a requirement that the mobility service

provider has a certain level of technical maturity so that the service can be fully integrated without too much work. One interviewee puts it as following:

- "Something that makes it impossible for mobility service providers to participate is if they don't have the technical possibilities. If you have not come a long way on that journey, you cannot join."

-A4

Moreover, another interviewee (5B) explained that initially all the services present in the application could not be bought directly in the application but one would instead be directed to another page to purchase the service. This was troublesome as it decreases the value of the platform.

One interviewee (3A) who manages a project selling the platform to organizations rather than directly to private users also lifts the issue of integrating all the companies and in this case their financial systems. For them it seemed to be a challenge in terms of the technical aspect. To be able to create the application and make it work with all the companies that it needs to interact with. Another interviewee, also with a B2B-focus, mentioned a similar situation:

- There is a big challenge to integrate different companies to the platform as all companies have different systems. They have procured different systems that have different processes. To be able to integrate the payment can be difficult. So it will require some integration, we do not yet know at what level it will take place at.

-1B

Many interviewees (2A,3A 5A, 5B) mentioned the lack of incentives from mobility service providers. One interviewee explains this by giving an example:

- "If you are thinking of a platform that makes it easy to compare taxi services without actually adding new customers, because everyone can already order a taxi today, then you are not giving any new value to the suppliers."

-2A

Same interviewee mentioned that to give new value to mobility service providers there has to be an exposure to new users. This is however as stated not always the easiest. Often they

already have a large part of the market with direct relationship to the customer. For example, the interviewee (2A) gave an example from a large automobile company that they were in negotiating with. This firm was worried that they would lose their customer relationship providing a service through the platform. Continuing, one interviewee (2A) explained that it felt as if some mobility service provider rather have less customers with a good relationship than exposure to a larger market, with no direct relationship to the customers. Another interviewee (5A) mentioned that initially they had troubles with convincing a large scooter company as they had specific key figures they look at when entering a new area. However, at this point they started to review their business model as the market started to get matured in the more urban areas. Another interviewee (5B) explained that it can be hard to expand the service as the mobility providers might not want to move their services to those proposed areas. One interviewee (3A) also explained that some mobility service providers see themselves as "mobility providers" rather than a sole mobility service provider. In this case it can be hard to convince the mobility service provider as they might consider the platform to be a direct competitor.

4.3.5 Incentives in an early phase

Some interviewees (1B, 2A, 3A) implied that there is a dilemma in regards to attracting users and mobility service providers in a starting phase. It is implied that it is hard for the mobility service providers to have any incentives to take part when there are no users already present. However, with the same logic it becomes hard to entice users when there is no great value proposition present, driven by the various mobility services. One interviewee (1B) believed that this is the main issue MaaS solutions have as the business model stand or falls depending on if it can achieve a sufficiently large number of users and a sufficient number of service providers who are willing to work together to create as much value as possible. Moreover, the interviewee added that he believes that there might not be any solutions to this dilemma at this point.

4.3.6 Internal factors

One interviewee (1A) mentioned that it, at times, have been complicated to bring the project forward due to the large number of actors taking part. In their project there are 19 present actors and the interviewee mentioned that the level of commitment varies quite a lot, which makes decision-making slow. Another interviewee (5B) mentioned that different actors had

different visions of what they wanted to further develop towards the end of the project. In this case, it made it much more difficult to create a comprehensive service in the area where the pilot took place. One driving part was rather interested in expanding the profitable parts nationally instead of further testing and developing the entire pilot project. One of the interviewees (3A) handing a project with B2B focus also touches upon the issue of the project structure. However, this more in terms of the ambiguity regarding how much of the work should be conducted by the platform provider and how much should be handled by the, in this case, the property owner. This for example in regards to mobility hubs where there is a need for cooperation from the buying organization. The interviewee put it as following:

- Property owners are very important when it comes to mobility hubs as they have complete control over the land. We cannot move parking spaces or such. So property owners need to be involved or give away a great deal of disposal.

-3A

4.3.7 Summarizing table:

As a summarization from the empirical finding a table was created. This table concerns the observed barriers for the investigated projects and these factors will be structured in the relevant area, ranging from those connected to the business model, the end users, the mobility service providers and other internal and external factors.

Area	Factor
The business Model	
	Lack of well-defined business models
The end users	
	Lack of knowledge regarding MaaS
	Lack of knowledge regarding general cost of mobility
	High price sensitivity
	Difficulties to substitute the qualities of a car
	Low incentives in an early phase
The mobility service providers	
	Lack of commitment from public transportation

	Lack of technical maturity	
	Low incentives in an early phase	
	Reluctancy to not have direct relationship with customer	
Internal factors		
	Participating actors with differing vision and commitment	
	Uncertainty regarding responsibilities within the project	
External factors		
	Lack of involvement from public transportation authorities	
	Covid-19	

Table 8. Summarization of observed barriers.

5.0 ANALYSIS

The purpose of this chapter is to examine the findings presented in the preceding chapter and compare it to the previously presented theory. By doing so, the analysis aims to gain a better understanding of the concept and its possibilities to overcome identified barriers. As with the earlier chapter the analysis will be structured in different sections following the factors discussed with an aim to throughout the discussion create a foundation which upon the research question can be answered in the conclusion.

5.1 MOBILITY AS A SERVICE BUSINESS MODELS

5.1.1 Business model canvas

From the thesis' empirical findings, it appears that the examined projects are different in terms of their business models in many ways. It is important to understand that MaaS is not a specific business model but rather a concept that can be designed in a variety of ways as showcased by König et al. (2016) in their use of the business model canvas. The business model canvas can help map the possibilities, yet there is an indefinite amount of models which can be created from this mapping. Rather it serves to gain an understanding of the possibilities that the concept of MaaS creates in terms of business model development. In the cases examined, there are differences in most parts which, according to Osterwalder (2011) form the basis for a business model. König et al. (2016) implies that this is one of the most noteworthy points to be made. The large number of possible key partners and customers indicate a wide range of possible lucrative business models. However, as examined from the pilot projects there are various distinctive approaches that due to its business logic limits the possibilities. This distinction, as realized from the empirical findings, can be made between the B2C and the B2B/G targeting pilots and services.

The mapping made by König et al. (2016) is extensive and covers options not touched upon by the participating interviewees. From the empirical findings no interviewee indicated that event organizers, entertainment services or accommodations providers are relevant, whilst according König et al. (2016) these as a possible customer segment and/or key partner. The authors imagines that MaaS benefits from expanding its business and creating further value by also offering, for example, tickets for events and/or hotel rooms in addition to the actual transportation. Activities connected to such as accommodation and events can be considered as complementarities in the activity system as defined by Zott & Amit (2010). Integrating

such services could be a way to create greater value for the user and be able to reach higher margins by offering these actors access to a larger number of customers via the platform and in return receiving commission. Yet, this is not mentioned by the interviewees. These projects, which are at an early stage, have more of a focus on shaping the cornerstones that create a well-functioning service and, above all, enable the service to be tested in its entirety. In the case of MaaS the design theme is a novelty-based activity system which according to the Zott & Amir (2010) implies that the focus should remain on adopting the innovative content and understanding the structure of the governance.

From the interviewees there was a consensus regarding the fact that the value created for the end user is connected to flexibility, accessibility and ease of use that an integrated solution can provide. Thus, there is also where the focus lies. More practically, this becomes rationalized by a diverse multi-modal service offer. In order to achieve an attractive service, a variety is required, to be able to satisfy the varied needs of mobility. This goes hand in hand with the results given from Karlsson et al.'s evaluation of a trial platform conducted 2016. There, the authors claim that the main positive feedback was towards the "transportation smorgasbord". Additionally, the report conducted 2019 by the MaaS Alliance also highlights the freedom and flexibility that a service with a great variety of transportation means offer as the most attractive element. However, the report also highlights that personal preference of users makes variety important as it becomes attractive to a larger group of users. For the concept of MaaS to have a greater impact on the everyday mobility it has to provide services that attract a vast variety of customers, which thus stresses a variety of transportation modes.

Moreover, what seemed to be a vital factor for the service's attractiveness was the full integration of the mobility services and the payment of the services. The interviewees indicates that this enhances the user experience in terms of ease-of-use. This is upheld by the reports conducted by the Transport System Catapult (2016) and MaaS Alliance (2019). The former identified benefits perceived by the users. Here, both the ease of transaction and the ease of payments are mentioned. Further, the latter mentions convenience as an important pillar. Lastly, towards the mobility service providers value is created as the companies access new potential customers by offering their service on the platform. However, interviewees also proposed that value is created as the MaaS solution simplifies their operations, more specifically their customer service and help desk.

The other key take away from König et al.'s research (2016) is the large variety of identified types of revenue streams. To begin with, revenues can originate from end users and the mobility service providers. Moreover, the revenues can range from different fixed payments to commissions. For many of the research projects, there is still an uncertainty regarding how this would plan out in a commercialized service. During the pilots this question was left for later to be able to easier attract users and mobility service providers in the test phase, on better terms. However, one project had commercialized a business model using a subscription model aimed to be a full substitute to the private car. This implies a periodic fixed payment. Conversely, interviewees from the other projects indicate that it might be hard to, at this point, run a subscription model. It is implied that the market might not be ready for such a commitment yet. For the B2C pilots the general logic seems to be to receive margins from both parts of the platform. The margin is legitimized by the earlier described value proposition. The pilots with a B2B/G focus are understood to rather gain their revenue from selling the service to companies, universities or for example business parks. Often this will be through a public procurement due to the buyers being part of the public sector. Although, for these pilots there are uncertainties as well. It is mentioned that it can be lucrative to incorporate a variable revenue depending on the service usage to increase the incentive to attract users.

However, König et al.'s business model canvas (2016) also lack some parameters that were described by the interviewees as relevant. These are mostly connected to the B2B/G approach, but not exclusively. To begin with, the value proposition proposed by the pilots having a B2B/G focus includes reducing the administrative work and simplify the process in regards to business trips as the payment for business trips becomes automated and done directly by the company. Moreover, it is argued that the organization will receive goodwill for their actions towards a more sustainable everyday mobility. Lastly, it was also mentioned that the nature of the available services will give health benefits for the employees which of course have a direct value for the company itself. Earlier research also indicates that MaaS can influence users to increase their use of active transport modes (Kamargianni et al., 2017). With encouragement from an organization such as your university or the company in which you are employed it could be the case that this influence increases. Besides that, the customer segment for such a business model is not limited to strictly companies buying the service but rather a variety of organizations including property owners, of for example business parks.

The concept of mobility hubs is further not addressed but indicated to be an important part for the pilots with a B2B/G focus. It serves the purpose of limiting the gap between conventional mobility and shared mobility using a digital platform, making the initial step to try out the service lower for possible end-users. It becomes easier to realize value from a mobility hub in such a business model as these can be located at strategic areas nearby the organizations building. However, mobility hubs does not have to be limited to a service that is connected to a specific organization or business park. Locating a mobility hub at a crowded public transportation node could achieve the same effect.

Lastly, more generally the economical enabling of these pilot projects comes from funding from almost exclusively government agencies, apart from one project being venture capital-backed. Thus, it is reasonable to state that financers/investors is a key partner for MaaS solutions at this present times where no profitable services are present with applicable business models.

5.1.2 Revised business model canvas

As a summarize from the chapter above a revised version of the MaaS business model canvas is constructed. Added in bold style are the contributed factors. Although, as discussed above, all factors are not supported by this thesis' conducted research, however, they remain present in the figure. This, because the business canvas is not a framework showcasing a specific business model or a best practice business model of MaaS but rather visualize the possibilities within each building block constituting the business model.

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments

-Mobility service providers
-National and European Public authorities/regulators
-ITS associations and organizations
-Road operators and authorities
-Accommodation providers
-Event and entertainment services
-Research organizations
 	
-Financers/Investors
	-Providing multimodal and sustainable mobility services on a one-stop-shop principle
	-Service and content development and provision
		-Multi-vendor platform that integrates end-users (B2B/C) with mobility service providers
		
		-Integrates the mobility services which reduces the providers administrative work
		
		-Brand
		-Integrated planning and payment
		-One-stop-shop
		-Fit-for-purpose
		-Reliable
		-Sustainable
		-Multi-modal
		
		-Automate administrative work
		-Good will
		-Health and well-being benefits for employees
			-Automation
			-Competence center
			-Help desk
			-Service development kit (B2B)
				End-users
				  -Private users
				  -Commuters
				  -Companies
				
				Service providers
				  -Mobility
				  -Accommodation
				  -Leisure
				  -Event organizers
				
				-Universities, Business Parks

	Key Resources -Brand -Service design (Technology, Quality assurance, User-orientation, Coverage, ITS competence) **-Competence for integrating the mobility services and payment solutions**		**Channels** -Sales and support -Web and phone **-Mobility hubs**	
Cost Structure Platform management and development -Customer support -Brand creation and marketing -Platform design and development -ICT operations and application -Contract negotiations -Customer liability -Personnel			**Revenue Streams** -Sell on commission -Service advertisement -Fixed contracts with service providers -Fixed contract with end-users	

Table 9. Revised version of König et al.' MaaS operator business model canvas (2016).

5.1.3 MaaS operator models

By definition it becomes problematic to label the reseller operator model as MaaS. Both Atkins (2015) and Kamargianni & Matyas (2017) state that integration is a core characteristic of MaaS. What differentiates the reseller operator model and the integrator operator model is just that, the integration that the latter model provide. Moreover, it became evident that all the projects believed that value for the user is strictly connected to fully integrating the services and not merely acting as a reseller. Initially, in unique situations, some services were not fully integrated right away but the vision had always been to integrate all services, including the likes of payment and similar, to create a completeness that is fundamental for the value of the end users. On the same page, the identified perceived benefits by customers, according to the report conducted by Transport System Catapult (2016), are well connected to a fully integrated service. To begin with, *ease of transaction* and *ease of payment* implies a convenient access to the mobility services and an effective payment solution. Moreover, *journey planning* is by nature demanding an integration to truly function. Thus, there are reasons to believe that the proposed reseller model is not anymore relevant due to the development of MaaS.

Instead, the integrator business model is more fitting for the projects having a B2C focus. In this case P1 and P5 fits well to the proposed operator model with a focus on fully integrating the mobility services with booking and payments directly in the application. In addition there are various other data sources which creates added value. For all of the projects the public transportation plays a central role as that is the mode of transport best fit for the projects being accessible and flexible with a large coverage. The mode of transportation is crucial for the quality of the service. Moreover, the projects have a shared vision to reduce the environmental impact of the everyday mobility and move toward a more sustainable mobility. Therefore, public transportation is a great substitute with its low environmental footprint, compared to the commonly used car. However, public transportation authorities have no direct role in the project and is simply integrated into the platform like the other services. This is what distinguishes the projects from P4. In the case of this project, the public transport operator model fits in well. The logic is the same as for the above-mentioned projects, except that the service is added to the application already used for the public transportation. Kamargianni & Matyas (2017) have earlier investigated the advantages and the disadvantages of having a private firm or a public authority as the operator.

The proposed different operator models seem to lack an applicable such for the projects with a B2B/G focus. Based on the research that has been carried out, there seems to be a clear distinction from directly targeting the end customer to instead selling a service to companies, universities, or similar. As previously argued above, many premises regarding the business model change and it is important to pay attention to this in the mapping of the operator models. Thus one should illustrate, and include, such a MaaS business model to give an even clearer picture of how a MaaS solution can be structured to create, deliver and capture value. Below is an illustration of such a figure, building upon the structure created by König et al. (2016).
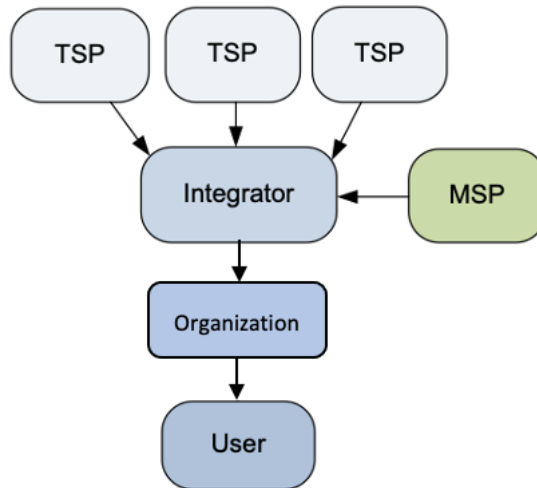
Figure 11. B2B/G MaaS operator model.

5.2 LACK OF APPLICABLE BUSINESS MODELS

A lack of well-defined business models are evident in most of the projects. This has previously been highlighted by Karlsson et al. (2017) and König et al. (2016) as problematic for the development of MaaS solutions. As mentioned by the participating interviewees, the focus from the pilot projects is not to directly apply a clear model in a market, but rather to see the pilot as a learning process. This has been pointed out to concern such areas as customers' preferences, how interconnection between different actors can best take place and how one can integrate necessary parts, such as payment and the mobility services, how one can achieve social and environmental benefits and how the service can run in the long term, with profit. The logic lies in gaining a better understanding so that at a later stage one can, more accurately, create a fully defined business model.

As Teece (2010) mentions, the design and implementation of a business model is not an easy process and is also often mentioned to require an iterative process. Chesbrough (2010) also argues that experimentation and testing can be of value in shaping and rationalizing a business model. However, it is important to understanding that these projects do not necessarily test specific business models to the level required to be able to draw such conclusions. For example, if you do not have an understanding of the project's revenue streams, because this issue is pushed aside in favor of learning about the use of the service and the creation of the ecosystem, the pilot loses fidelity. Chesbrough (2010) indicates that fidelity is one of the most important parameters when testing a service and its business model. It is easy to understand

that moving from having no margin to trying to incorporate a commercially sustainable such changes a lot for the end users and the mobility services.

Instead, the pilots are at a stage where they aim to become more familiar with the concept of MaaS and identify its functionality through different approaches. The projects, apart from P2 which was in a more commercialized stage, focus rather on issues Zott & Amit (2011) raise in their research within business model design. During the project, it is evaluated which activities are to be carried out, how these are to be structured and who should perform them. Zott & Amir (2011) claim that this is a good systematic way to weave together, and gain a good understanding, of the business model logic in a holistic way. Summarized, there is still a ambiguity regarding a possible proof of concept which requires these pilots to take more of an investigational approach. This is thus a good starting point, but requires that, when the design regarding these factors becomes clearer, more specific parts of the business logic are defined to create a complete business model. This is of great importance in order to succeed with the initiatives and have a greater impact on everyday mobility. This is based on the idea that a well-defined business model is at least as important as the technology and the service itself as claimed by Chesbrough's (2010).

As mentioned, all projects have a vision to scale up and build a real service based on the initiated pilot. Thus, it should be of interest to maintain as high of a fidelity as possible. This, in order to form an understanding, as accurately as possible, of how the service would function in a real practical environment under its true conditions. There seems to be uncertainty about how a commercialized service could possibly be designed even though a comprehensive pilot has been carried out.

5.3 LACK OF TECHNICAL MATURITY

Another factor that has proven to be problematic during the projects is the lack of technical maturity, both internally, from the mobility services and other actors. In these cases, it becomes time consuming and thus expensive to handle the integration. This was even more so true for the integration of organizations for the B2B/G targeting pilots. Some interviewees have pointed out that it is simply not possible to integrate all the desired mobility services for this reason. This reduces the value of the service as the offer can become sub-optimal. Though, as argued earlier it is crucial for the service attractiveness that there is a full

integration. The interviewees indicates that this enhances the user experience in terms of ease-of-use. The competence of the mobility services will also increase with the pace of digitization, which facilitates the general integration. However, Standardizations are required to simplify the work initially and during expansion, something that is evaluated within the projects.

5.4 UNCERTAIN RESPONSIBILITIES AND DIFFERING VISION

Evident from the research is that the commitment from actors within the projects differ and that that the vision of what the outcome should be is not always shared. Moreover, there is an uncertainty regarding responsibilities is some areas. Kamargianni and Matyas (2017) have earlier discussed the challenges in structuring the value network of MaaS. It is of importance that the participating actors understand their function in the ecosystem and what they add in terms of delivering the service. This has been proven to be difficult for these experimental business models as the process is still ambiguous. This can hamper the development of the pilot project as it can lead to slow decision making, as mentioned by an interviewee.

5.3 DIFFICULTIES ATTRACTING END-USERS AND MOBILTY SERVICE PROVIDERS

The pilot projects claim that they fail to reach out to potential customers to a desired extent. As above argued there are still uncertainties regarding the proof of concept however earlier pilots have witnessed that users have given significant positive feedback regarding the service (Karlsson et al., 2016; Kamargianni et al., 2017). Rather, a larger issue seems to be that there is a general lack of knowledge regarding MaaS as a concept. This is naturally the case as the concept is rather novel and no services are today operating at a large scale in Sweden. Moreover, it is quite understandable that knowledge of new mobility services is deficient during these times. Informing about new mobility solutions, and especially shared mobility, during a period where all types of travelling should be minimized it is understandably difficult.

Adding to the lack of knowledge regarding the general concept of the service, it was identified that potential users are not aware of the benefits of MaaS. This, especially connected to the economical such. It is difficult to get individuals to break patterns and change their car habits. They do not have insight into how much it actually costs to own a car and how much mobility one can get for the same money via other alternatives. Interviewees

have mentioned that the projects possibilities to continue past the end of the pilot phase is connected to the number of active users. During the pandemic it is hard to maintain the goal regarding active users which reduces the chances that a service can emerge from the pilot project. However, one can assume that post this pandemic, users will again have an interest in taking part in new mobility services. The execution of projects similar to those studied will of course over time increase knowledge about MaaS in general in the society and more individuals will come into contact with the concept. Marketing can be used to try to reach more users and demonstrate the benefits, however, it is very expensive. Rather many projects imply that as it can be difficult to attract users in an early phase more support, and involvement, from political actors are needed. The public transportation authority has a mandate to influence how transport is carried out on a daily basis and to impel green transportation options should be in their interest.

It was discovered that there are low incentives from users and mobility service providers in an early stage of a platform service making it hard to organically grow. Much of the value for one side of the segment depends on the presence of the other segment. Users can only access a flexible and comprehensive service if a large variety of mobility services exist. In the same way, there is only value for mobility service providers if there are a large number of users that these services providers are exposed towards. This is a recurring phenomenon in platform business models where network effects are present. It thus becomes difficult to organically grow a service as a substantial amount of the value for both segments lies in the completeness of the platform service. Osterwalder and Pigneur (2010) argue that one can approach this problematic by subsidizing one of the segments which can then attract the other segment. The authors claim that it is then of interest to understand which segment is most price sensitive.

One issue that was frequently addressed was the price sensitivity from the end-users. It was implied that individuals focus heavily on the cost of the mobility options when it comes to services, and may not take into account the increased value that the service provides. As previously argued, there is also a general lack of knowledge regarding this proposed value. The public transportation offered in Sweden is of high quality and provides high availability and flexibility, which are main parts of the MaaS value proposition. Thus, it is understandable that users have little incentives to pay a premium for a MaaS solution. If one instead look at those who today drive a car, where there are natural financial incentives to substitute the car for MaaS, it has been witnessed to be hard to create a service that can act as a substitute of a

car. A car has many different values for private families and is not just a mode of transport that takes one from A to B. From a report (Kamargianni et al., 2017) regarding the attitude towards MaaS it was identified that to take part in a MaaS potential users even expects a financial discount. It is hard to gain any margins from the user-side of the platform and to attract users the offer might need to be subsidized by the other mobility service providers. Thus, the other side of the platform would be required to generate enough revenue to cover the losses. In general, a large number of users on a stand-alone platform is required to be financially sustainable as the margins are low.

However, the mobility services are often subsidized to participate in the pilots as the project aims to increase the interest for actors to participate. Thus, It might be difficult to achieve the necessary margins that can maintain a long-term financial sustainability for an integrator operator model when commercializing a service post-pilot. Regarding the mobility services there are also other factors that hinder the interest in participating. There is a reluctancy towards not having a direct contact with the customers. In addition, there are some mobility service providers which consider a MaaS solution to be a direct competitor as they define themselves as a mobility provider rather than a mobility service. All in all, this implies that in order to attract mobility services providers, great value is required in the form of exposure to new customers, and once again it is about the size of the segment from the other side of the platform.

As identified from the research the lack of collaboration from public transportation is complicating the operations of MaaS solutions. The public transportation plays a central part in shared mobility and not least if one intend to move towards a more sustainable everyday mobility. Not being able to include public transportation on good term within the service thus significantly reduce the value of the service. The willingness to participate and cooperate differs between the areas where the pilots are located. The investigated project, which has not yet started its pilot, has fully integrated its service within the local transport application and will further investigate such a solution where the public transportation authority is a key player in the project. In the Gothenburg region, the willingness to participate seems to be lower. However, it appears that the interest from these actors has increased and the willingness to cooperate has improved. Using a public transport operator can be lucrative for many reasons and not just to make these services fully accessible and integrated. Most of the interviewees believe that greater trust for the service is gained by potential customers and that

they have a more natural step to test the service when it is already so close at hand. More importantly, such an actor has the opportunity to run a project without a strict need to make profit due to access to tax funds. Moreover, a public actor can more easily motivate social and ecological effects and meet the demands for large investments.

The public operator model and the B2B/G operator model can ease implementation of MaaS as it somewhat moves around the identified "chicken and egg" dilemma. Applying the mobility service directly to the existing public transportation application gives the service exposure to a large existing customer segment. Same logic can be applied when organization incorporate the service as the platform gains exposure to the employees and the organization can influence them towards using MaaS. As earlier argued both organizations and the public transport authorities have incentives to take part in such a service.

6.0 CONCLUSION

This final chapter will present the concluding marks and answer the research questions. Firstly, the identified challenges that MaaS projects are facing throughout its different phases will be presented. Thereafter follows a clarification of the identified approaches that can be beneficial to increase the presence of MaaS in the everyday mobility. Lastly, future areas of research have been presented.

6.1 ANSWERING THE RESEARCH QUESTION

This study aimed to investigate the barriers that active MaaS projects face today in different phases, to gain a holistic view of the concepts progress. Building on that the study further aimed to identify possible improvements, based on business model theory, that can increase the concepts' impact on the everyday mobility. To approach this the following research questions had been formulated:

> *-What challenges is MaaS facing in terms of implementation, in general, in its different phases?*
>
> *-How can state-of-art business model theory improve MaaS initiatives to have a greater impact on the everyday mobility?*

During the research process it became evident that there is a lack of applicable business models and that the general concept of MaaS lacks proofs of concept regarding a large scale commercial service. The focus from the pilots has been to gain a better understanding of how a business model could be conducted and how it could be operated to increase the knowledge in terms of these uncertainties. In order to achieve these goals, the projects have deviated from true market conditions to stimulate actors taking part. All the pilot projects have a vision to be able to build upon their project and formulate a service that can be commercialized. To do so lucratively there is a need for a high fidelity in the pilot projects so that an accurate understanding of how the service would function under real market conditions can be gained.

Due to low incentives, especially in an early phase from both of the segments, the end-users and the mobility service providers, it is hard to grow an integrator model organically. Moreover, the novelty of the concepts halter the success as the general knowledge of MaaS

and the knowledge regarding the benefits are low. With a high identified price sensitivity within mobility services it is hard to create margins and thus require a large platform where the mobility service providers subsidize the other segment. Additionally, it is proven to be difficult to attract and convince car users that the service is a viable substitute. However, there are doubts regarding the value for mobility service providers as well, as they are reluctant to lose the direct customer relationship.

The value for the user is identified to be connected to the variety of mobility services and the integration of such as booking and payment. The services needs to be fully integrated to provide a high variety, flexibility, accessibility and an ease of use. Whilst the value for mobility service providers is strictly connected to the exposure towards new potential customers. However, a lack of technical maturity makes it difficult to effectively achieve this fully integrated service. Low incentives in an early phase is connected to the network effect, the platform provides little value prior to the other segment being present at large scale. Thus, it is difficult to grow the platform organically. Instead business models where the platform directly or indirectly gains access to a large customer segment can be lucrative. Both the public transportation authority operator model and the B2B/G targeting operator model seems to be moving beyond this problematic. Applying the service directly to the already existing public transportation application gives exposure to a large user base which can easily be introduced to the service. The public transportation authorities also provide a higher level of trust which can be important to influence the users to more frequently use shared mobility. Integrating the service to organizations creates additional value as the administrative work regarding the reporting of business trips can be handled automatically. Furthermore, there seems to be an interest from organizations to integrate shared mobility with regard to the well-being of employees. Organizations can also influence individuals internally which can improve the integration of MaaS in the everyday mobility.

The social, spatial and environmental benefits of MaaS are quite well understood, but it is still ambiguous how one can create value for both the end-users and mobility services providers that can lead to an economically viable service. As a factor of the pandemic these projects have not been able to gain as much experience regarding the functionality of the service as the goal initially was. This makes it difficult for the pilot projects to continue the service seamlessly following the pilot phase. However, this research points towards the fact that

complimentary services need to be incorporated to achieve a feasible business model where incentives for both the end-users and the mobility service providers are sufficiently attractive.

6.2 IMPLICATIONS AND FURTHER RESEARCH

This thesis could increase the knowledge regarding a growing topic that is MaaS. The experience from the participating pilot projects, and comparisons them in between, can give significant sources of additional knowledge that creates a foundation for understanding important questions regarding the implementation of MaaS solutions to provide social, spatial and environmental benefits. The thesis contributes to the existing literature and potentially gives more aspects to study for forthcoming explorative research. This, more specifically regarding the implementation of MaaS with its mapping of present barriers for pilot projects in different phases and the further demonstration of theoretical approaches to move beyond them from a business model perspective. Lastly, to reach this, contribution has been made in terms of the mapping of possible business models, using business model canvas, and operator models based on the previous research conducted by König et al. (2016).

As MaaS is a novel, to an extent unexplored, topic there are various of interesting continuations for future research. To begin with similar more comprehensive studies could be conducted to further legitimize the finding and investigate them more thoroughly. This, by also studying other important actors rather the only the MaaS projects themselves. Moreover, it could be of interest to for example, move away from the strict business model approach aiming to find functioning models, and a structure supporting it, to further investigate the complex business ecosystem and the connection between actors within the value chain. It has been demonstrated that it is a difficult task where, above all, it is of interest to investigate how the interaction between private actors and public actors can take place. This, to take advantage of innovativeness and speed of a firm established for the purpose of MaaS with the public transport authorities strength to ensure trust, secure that all transportations can be offered and that the and that political governance can simplify the regulation process.

7. APPENDIX

7.1 Appendix 1 – Interview guide

Interview Guide

The Interviewee

What is your role in the project?

How long have you been part of the project?

The Project

How far have you come in the process?

What are you working with right now?

What is the goal of the project?
    -Is it on track?
    -Has it changed from the start?

How is the division within the project regarding:
    -commitments for the participating actors?
    -areas of responsibility for the participating actors?

To what extent has public transportation authority's been involved?

The business model

Do you have a defined Business model?

How have you worked with such as:
    -The value proposition?
    -The targeted customer segments?
    -The revenue streams?

Evaluation of pilot

What has worked well in terms of:
- Users
- Mobility service providers
- Internal structure and governance
- Other external factors

What difficulties have you encountered in terms of:
- Users
- Mobility service providers
- Internal structure and governance
- Other external factors

What impact has Covid19 had?
- How have you adapted?

What is required for the pilot to be able to continue after the end of the project?
- What opportunities do you see?
- What barriers do you see?

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THESIS SUMMARY

Exploring the possibilities for MaaS in the everyday mobility

- *A qualitative study of pilot projects in different phases*

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Introduction

Digitalization (Kamargianni & Matyas, 2017; Polydoropoulou, 2020), an rapidly increasing sharing culture (Holmberg, et al., 2016), an increased knowledge regarding the need to slow down the climate change (European commission, 2016a) and a growing urbanization (Goodall et al., 2017; Holmberg et al., 2016) have created a boom in new mobility options which have had an impact on the transport sector. Mobility as a Service is presented as a possible solution to the raised needs above (Goodall et al., 2017; Miyata 2018; Polydoropoulou, 2020), whilst the digitalization is an enabler for the platform service. Mobility as a Service is a mobility distribution model in which all mobility service providers' offerings are aggregated by a sole mobility provider, the MaaS provider, and supplied to users through a single platform (Kamargianni & Matyas, 2017). Various initiatives have been taken to implement services, however these initiatives have a hard time making it past the pilot stage (Karlsson et al., 2016; König et al., 2016). As of today, there are clear evidence of positive impacts both in terms of social and environmental factors (König et al. 2016) and empirical evidence of perceived benefits from users (Transport System Catapult, 2016; Karlsson et al., 2017). Yet, the uncertainty regarding fitting business models is believed to hold back the combined mobility service concept. Thus, there is a need for research that creates a clearer picture in terms of the practiced business models, their possibilities, and a better understanding of how these can be optimized to be able, at a greater extent, make MaaS solutions a preferred option in the everyday mobility.

This research aims to investigate how MaaS can move beyond the small scale solutions of today and become more integrated in the everyday mobility in Sweden. To do so, it then becomes essential to understand the practiced business models of initiatives and the barriers that these face today to decrease the uncertainty regarding appropriate business models for the concept of MaaS. Thus, the goal is to map the factors leading to the difficulties that initiatives have regarding making it past the pilot phase and scale up from a small scale phase and then further express innovative solutions moving beyond them based on state-of-art business model theory. In line with the research objective the following research questions have been defined:

-What challenges is MaaS facing in terms of implementation, in general, in its different phases?

-How can state-of-art business model theory improve MaaS initiatives to have a greater impact on the everyday mobility?

Literature review

Mobility as a Service - Definition

Moving forward this research will define MaaS, based on earlier approaches (Hietanen, 2014; Atkins, 2015; Transport System Catapult, 2016; Jittrapirom et al., 2017; Kamargianni & Matyas, 2017), as a concept which, through a digital user-centric service platform, seamlessly integrate transportation options with the purpose of meeting mobility requirements derived from customers' preferences of shared mobility. Kamargianni and Matyas (2017) Illustrates the simplification of mobility that MaaS presents in the figure below.
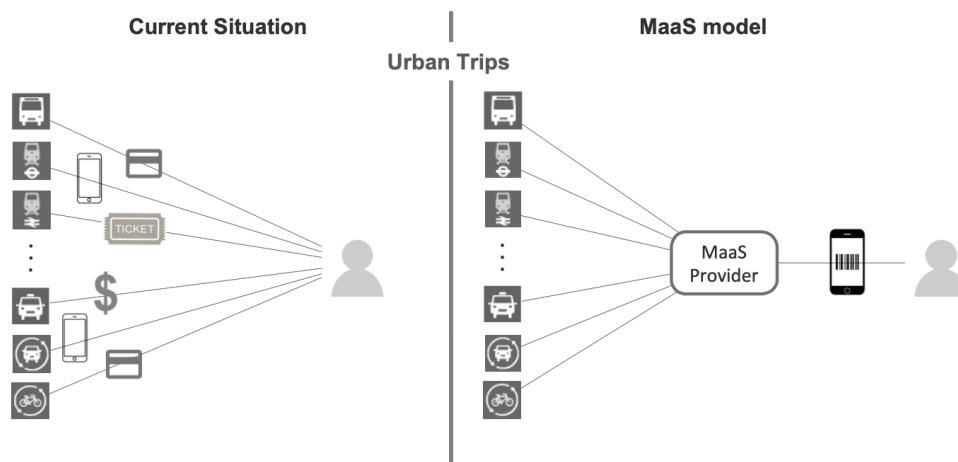

Figure 1. With and without MaaS from user's perspective. Kamargianni & Matyas (2017).

Mobility as a Service – Value Creation

König et al. (2016) conducted a survey aiming to build a foundation of the requirements connected to MaaS implementation. The research showcased a strong belief that payment, journey planning and customization together forms the main service which needs to be featured to enable MaaS. An integrated service supply on a single platform was believed to be essential by 60% of the participants. In the report conducted by Transport System Catapult (2016) the perceived benefits was focused around ease of use, flexibility and adaptability for the user. In a report from the MaaS alliance (n.d.) the authors highlights the focus on freedom, variability and flexibility as the most attractive elements. This freedom gives the user their own possibility to choose the best fitting solution for them to travel from A to B. The report also mentions that "*the best value proposition is not always limited to what is the quickest or most cost-efficient solution*". In another report, conducted by Karlsson et al. (2016), a trial platform for MaaS was analyzed. 97% of the participants wanted to continue as users of the service after the trial, implying a high satisfaction. From Karlsson et al.'s (2016) report the

main positive feedback was towards the "transportations smorgasbord". The concept of having all transportation modes packed together gained a high flexibility and an ease of use.

Mobility as a Service – Business Ecosystem

In the case of MaaS the authors imply that there is a complex value proposition which creates challenges in terms of structuring the unfamiliar value network. In such a network the participating actors need to clarify their function inside the ecosystem and what they add within the delivery of the service. There has to be a deliberate choice concerning their position in the value chain. From the research conducted by Kamargianni and Matyas (2017) a defined MaaS ecosystem emerged, as seen in the figure below.
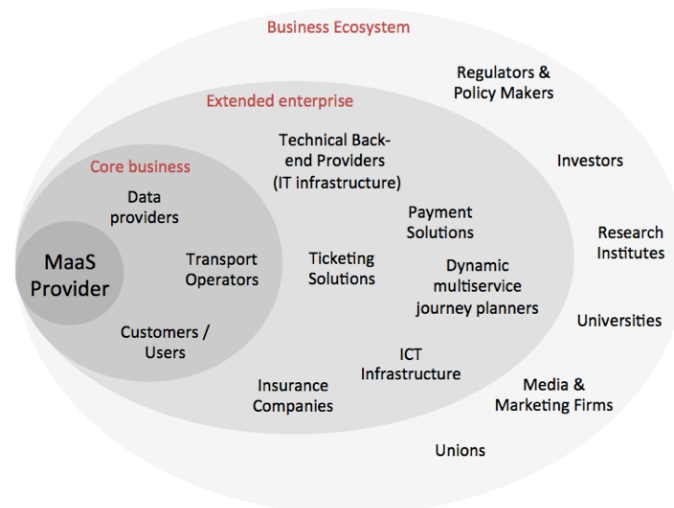

Figure 2. The mobility-as-a-Service Business Ecosystem (Kamargianni and Matyas, 2017).

Business Model - Definitions

A business model is the very foundation of a firms function. It defines how the firm aims to capture value (Zott & Amit, 2010; Teece, 2010) and map and store the logic behind it (Osterwalder et al. 2005). A business model is defined by Teece (2010) as the following:

"The essence of a business model is that it crystallizes customers' needs and ability to pay, defines the manner by which the business enterprise responds to and delivers value to customers, entices customers to pay for value, and convert those payments to profit through the proper design and operation of the various elements of the value chain."

As mentioned it is important to fully understand the business model at hand, to be able to describe it and discuss it effectively with others. Otherwise it becomes difficult to challenge

assumptions of today and innovate fruitfully (Osterwalder, 2005). Osterwalder & Pigneur (2010) believes that a business model can most effectively be described through nine "building blocks" which their framework business model canvas does.

Business model – Mobility as a Service

As part of a the project Mobility as a Service for Linking Europe, König et al. (2016) aimed to analyze the value networks and identify new business models in the light of the new transport paradigm of MaaS. The authors illustrates the findings by using the business model canvas as seen below.
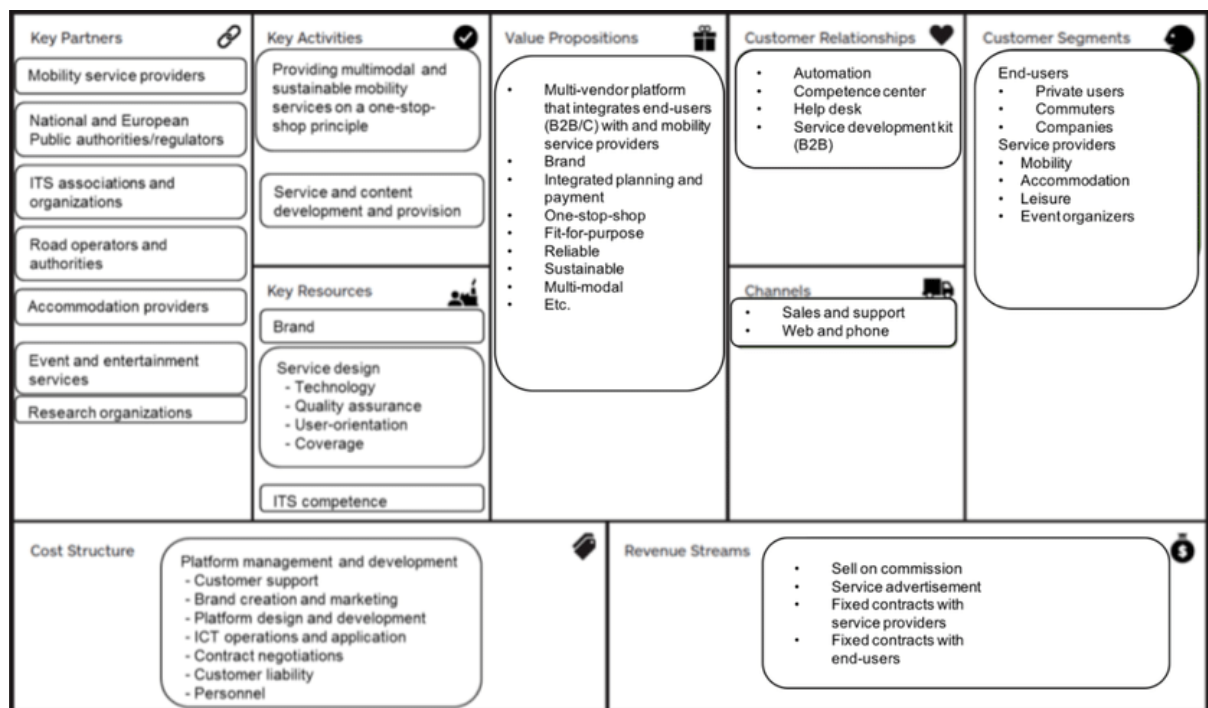

Figure 3. Business model canvas for a MaaS operator (König et al., 2016).

König et al. (2016) implies that there are two purposely noteworthy points to be made. To begin with it is analyzed to exist a wide range of key partners and customers. Moreover, there are also various different types of revenue streams identified. These revenues can range from fixed payments, periodic payments, pay-per-use or commissions. The authors indicate that due to this wide range of possible partners and customers one can argue that there is a large business potential for MaaS services and platforms.

The research also identifies different operator models based on the different premises that shape the business ecosystem. On a commercial basis a reseller operator model and an integrator operator model is presented. The reseller focuses on suppling different transport service providers (TSPs), more often referred to as mobility service providers, from different transport modes. A integrator operator model additionally integrates a digital service, adding a mobile service provider (MSP), that for example provides mobile ticketing, direct payment and/or travel planning. Furthermore, public transportation operators can take the role as a MaaS operator, mainly by integrating additional mobility services to the already existing public transportation platform. These operator models are illustrated in the figures below.
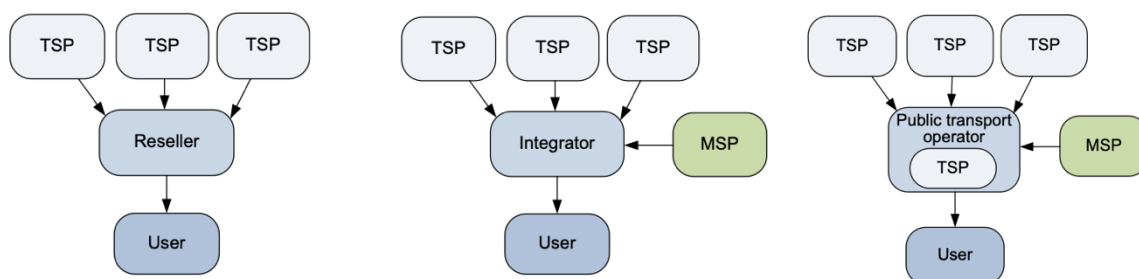

Figure 4. Commercial MaaS operator models and public transport operator as MaaS operator (König et al., 2016).

Business model development, innovation and design

The art of choosing, adjusting and improving the business models is generally not easy (Teece, 2010). Experimentation and testing can be helpful to rationalize and articulate a business model, as it is not always obvious initially how it should be shaped (Chesbrough, 2010). A business model cannot, in anyway, be fully assessed prior to the deployment in to the business environment (Teece, 2010). The underlying logic will initially be tested once deployed in the market. It is essential to be able to finetune and modify this logic as these assumptions becomes confirmed or denied.

New, well performing, products or services need to be coupled with a well-functioning business model which defines their strategy to enter the market and capture value. If innovators seek to gain profit and sustainable competitive advantage both the technology strategy and business model have to be skillfully composed (Teece, 2010). Similarly, Chesbrough (2010) implies that technology itself doesn't have any intrinsic value until it becomes commercialized by a business model. Moreover, the author mentions that *"…It's*

probably true that a mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model".

According to Chesbrough (2010), one auspicious approach is to clearly map out the business model to better understand the fundamental processes. This gives chance to experiment with combinations of these processes. The earlier presented business model canvas can then be of good use. However, mapping and gaining further understanding of the business model can't by itself pave way for successful innovation and experimentation (Chesbrough, 2010). The abovementioned author indicates the importance of authority to make experiments and the ability and willingness to take action derived from the tests. When conducting experimentation there are certain principles that can indicate for successful such. The most important parameter is that of fidelity, which indicates to what extent the conditions in the experiment are representative for the targeted market (Chesbrough, 2010). The author implies that the highest fidelity is gained from "trying out an alternative business model on real customers paying real money in real economic transactions…".

Multi-sided platform Business model

Ardolino et al. (2020) implies that the sole value creation in a multi-sided business model is done by facilitating interactions between these two sides of the platform. A multi-sided platforms functions and grows due to the concept knowns as a network effect. It implies that the value of the platform becomes larger as more users become attracted (Osterwalder and Pigneur, 2010). Ardolino et al. (2020) further implies that it is *"fundamental to implement a structure able to maximize the size of the sides"* as the fundamental value of a multi-sided platform is created between interactions and transactions between the participating sides, which is a very strict distinction from traditional business models.

It becomes vital to attract both groups on both sides simultaneously as it becomes hard to attract one of the groups without the other being present (Osterwalder and Pigneur, 2010). The authors equates the situation with the "chicken and egg" dilemma which is also brought up by Ardolino et al. (2020) and Evans (2003). To solve this issue, Osterwalder and Pigneur (2010) mentions that firms can subsidize one of the customer segments which can be lucrative as it lures one of the segments to the platform making it more profitable for the other segment to also take part. There are, according to Osterwalder and Pigneur (2010) a few questions to ask oneself to gain better understanding regarding the matter:

- Can we attract sufficient numbers of customers for each side of the platform?
- Which side is more price sensitive?
- Can that side be enticed by a subsidized offer?
- Will the other side of the platform generate sufficient revenues to cover the subsidies?

According to the Evans (2003) the firms gradually scale up their platform over a period of time. It is initially hard to understand the needed technology and the operational model due to a complex structure, thus testing and modifying the platform on a smaller scale can be rewarding (Evans, 2003). The author also point out that, in contrary to the conventional understanding of network theory, there is no proof that scaling quickly and building up a large market share will give a dominant position in the market the long run.

Methodology

The process of the research started from a general interest in mobility and its transformation lying ahead. From there, discussions with actors in the researchers personal network took place aiming to find an interesting topic within this area. With the topic set, being MaaS, an initial literature screening took place to identify a research gap. Discussions where then held with relevant actors to formulate a better personal understanding of the subject and the interesting aspects being worked on today to assure a relevant research. Based on the identified research gap an initial formulation of the research question was made and then a more narrow literature review took place. Following this review the research questions were redefined to better fit the more clarified research gap given from a more extensive literature review. With the research question and the literature review intact the fitting interviewees were contacted. An initial interview guide was created and later used on the first interviewee as a pilot interview. Succeeding that, the research questions were once more finetuned and thereafter the final interview guide was shaped and used to collect the primary data. With the empirical findings at hand the data was analyzed creating the result which paved way for the discussion and later conclusion of the research.

Concerning the research strategy an exploratory approach was taken. It fits well for investigating a problem which is not clearly defined and understood. It allows the researcher to explore the subject widely to identify possibilities that can be of focus in future research.

For the purpose of this thesis solely qualitative research methods will be used as it is highly preferred when one look for in-depth insights of rather unexplored topics. Qualitative research gives the interviewee a chance to broadly present their thoughts which is needed when the research aims to gain an understanding of unknown factors haltering the implementation. To identify and understand such factors there is a need for an openness and a flexibility in the interviews. As often with a qualitative research an inductive approach is taken. It fits well with the nature of the research as it aims to grasp a rather new concept and try to understand it's barriers and possibilities.

In this research, multiple case studies were conducted. It gives the research a chance to examine the concept from various sources giving a greater width which may be of even bigger importance in a relatively unexplored subject. Patel & Davidson (2019) supports that claim and implies that it is a preferable technique when studying processes and changes. With the research objective in mind the intended interviewees were actors with practical experience of implementing and leading MaaS projects. This, as they can provide insights from concrete initiatives in a real, practical, setting. To find relevant initiatives the mapping provided by KOMPIS (Karlsson et al., 2019) was used. Throughout their project they have explored the MaaS pilot projects and implementations in Sweden. The projects differ in their respective phase of development and implementation which is lucrative to be able to gain a holistic understanding. This ranges from being in the starting pits of deploying the pilot, being in the middle of operating the pilot, evaluating the pilot and operating a commercialized service. Below is a timeline showing the participating projects, were they are today and how they differ in that matter.
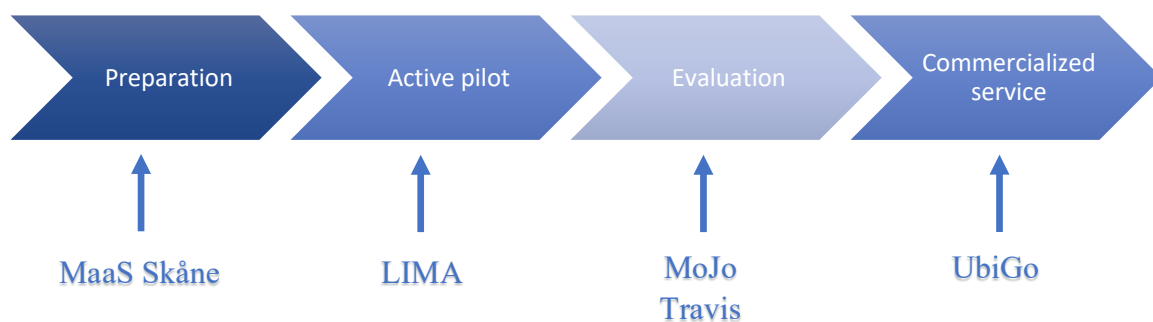

Figure 5. Project's timeline.

This general approach to the sampling could be described as purposive sampling, as defined by Denscombe (2014). The author describes purpose sampling as hand-picked for the topic on the basis of relevance to the issue being studied and the knowledge or experience regarding

the topic. Further the author implies purpose sampling can be seen as a representative sample. However, this comes down to the delicacy of the researcher. It is important to be able to argue for a representative sample as it increases accuracy and minimizes bias. Thus, extensive thoughts have been put in the selection of the participants to ensure that the interviews could provide high quality data as argued for above. To analyze the empirical findings in a structured way the software MAXQDA, a program specifically designed to help structure, code and analyze qualitative data and/or mixed data, was used. After further familiarizing with the transcribed interviews the data were highlighted with different color schemes acting as codes.

Thesis result and Conclusion

As a summarize from the chapter above a revised version of the MaaS business model canvas is constructed. Added in bold style are the contributed factors. Although all factors are not supported by this thesis' conducted research, however, they remain present in the figure. This, because the business canvas is not a framework showcasing a specific business model or a best practice business model of MaaS but rather visualize the possibilities within each building block constituting the business model.
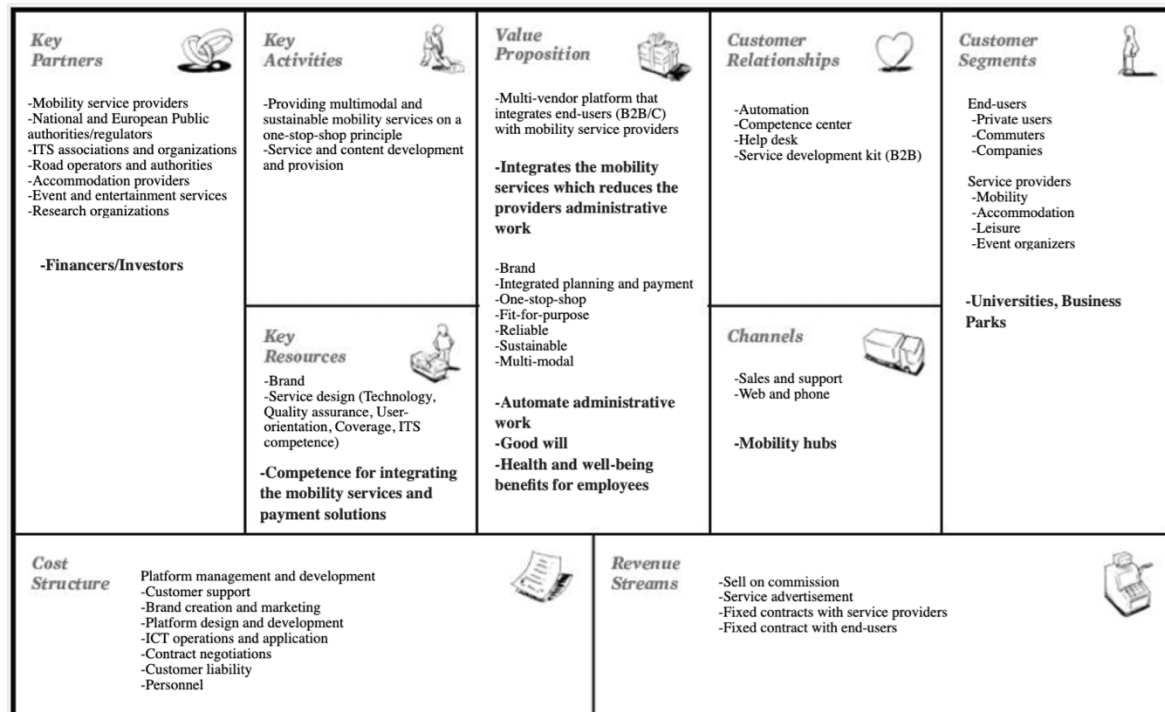
By definition it becomes problematic to label the reseller operator model as MaaS. Both Atkins (2015) and Kamargianni & Matyas (2017) state that integration is a core characteristic of MaaS. What differentiates the reseller operator model and the integrator operator model is

Figure 6. Revised version of König et al.' MaaS operator business model canvas (2016).

just that, the integration that the latter model provide. Moreover, it became evident that all the projects believed that value for the user is strictly connected to fully integrating the services and not merely acting as a reseller. Initially, in unique situations, some services were not fully integrated right away but the vision had always been to integrate all services, including the likes of payment and similar, to create a completeness that is fundamental for the value of the end users. On the same page, the identified perceived benefits by customers, according to the report conducted by Transport System Catapult (2016), are well connected to a fully integrated service. To begin with, *ease of transaction* and *ease of payment* implies a convenient access to the mobility services and an effective payment solution. Moreover, *journey planning* is by nature demanding an integration to truly function. Thus, there are reasons to believe that the proposed reseller model is not anymore relevant due to the development of MaaS.

Instead, the integrator business model is more fitting for the projects having a B2C focus. In this case P1 and P5 fits well to the proposed operator model with a focus on fully integrating the mobility services with booking and payments directly in the application. In addition there are various other data sources which creates added value. For all of the projects the public transportation plays a central role as that is the mode of transport best fit for the projects being accessible and flexible with a large coverage. The mode of transportation is crucial for the quality of the service. Moreover, the projects have a shared vision to reduce the environmental impact of the everyday mobility and move toward a more sustainable mobility. Therefore, public transportation is a great substitute with its low environmental footprint, compared to the commonly used car. However, public transportation authorities have no direct role in the project and is simply integrated into the platform like the other services apart from the project P4. In the case the MaaS services are intergrated in to the already existing platform of the public transportation, as identified as a possible operator model by König et al. (2016). The logic is the same as for the above-mentioned projects, except that the service is added to the application already used for the public transportation. Kamargianni & Matyas (2017) have earlier investigated the advantages and the disadvantages of having a private firm or a public authority as the operator.

The proposed different operator models seem to lack an applicable such for the projects with a B2B/G focus. Based on the research that has been carried out, there seems to be a clear distinction from directly targeting the end customer to instead selling a service to companies, universities, or similar. As previously argued above, many premises regarding the business

model change and it is important to pay attention to this in the mapping of the operator models. Thus one should illustrate, and include, such a MaaS business model to give an even clearer picture of how a MaaS solution can be structured to create, deliver and capture value. Below is an illustration of such a figure, building upon the structure created by König et al. (2016).
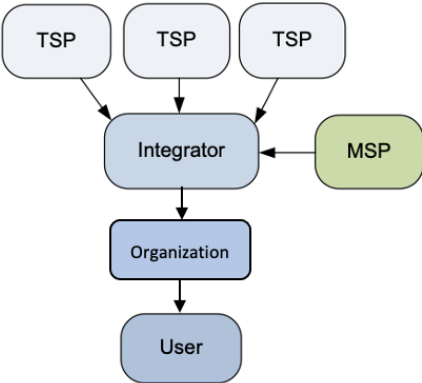

Figure 12. B2B/G MaaS operator model.

This table concerns the observed barriers for the investigated projects and these factors will be structured in the relevant area, ranging from those connected to the business model, the end users, the mobility service providers and other internal and external factors.

Area	Factor
The business Model	
	Lack of well-defined business models
The end users	
	Lack of knowledge regarding MaaS
	Lack of knowledge regarding general cost of mobility
	High price sensitivity
	Difficulties to substitute the qualities of a car
	Low incentives in an early phase
The mobility service providers	
	Lack of commitment from public transportation
	Lack of technical maturity
	Low incentives in an early phase
	Reluctancy to not have direct relationship with customer
Internal factors	
	Participating actors with differing vision and commitment

	Uncertainty regarding responsibilities within the project	
External factors		
	Lack of involvement from public transportation authorities	
	Covid-19	

Table 10. Summarization of observed barriers.

During the research process it became evident that there is a lack of applicable business models and that the general concept of MaaS lacks proofs of concept regarding a large scale commercial service. The focus from the pilots has been to gain a better understanding of how a business model could be conducted and how it could be operated to increase the knowledge in terms of these uncertainties. In order to achieve these goals, the projects have deviated from true market conditions to stimulate actors taking part. All the pilot projects have a vision to be able to build upon their project and formulate a service that can be commercialized. To do so lucratively there is a need for a high fidelity in the pilot projects so that an accurate understanding of how the service would function under real market conditions can be gained.

Due to low incentives, especially in an early phase from both of the segments, the end-users and the mobility service providers, it is hard to grow an integrator model organically. Moreover, the novelty of the concepts halter the success as the general knowledge of MaaS and the knowledge regarding the benefits are low. With a high identified price sensitivity within mobility services it is hard to create margins and thus require a large platform where the mobility service providers subsidize the other segment. Additionally, it is proven to be difficult to attract and convince car users that the service is a viable substitute. However, there are doubts regarding the value for mobility service providers as well, as they are reluctant to lose the direct customer relationship.

The value for the user is identified to be connected to the variety of mobility services and the integration of such as booking and payment. The services needs to be fully integrated to provide a high variety, flexibility, accessibility and an ease of use. Whilst the value for mobility service providers is strictly connected to the exposure towards new potential customers. However, a lack of technical maturity makes it difficult to effectively achieve this fully integrated service. Low incentives in the early phase is connected to the network effect, the platform provides little value prior to the other segment being present at large scale. Thus, it is difficult to grow the platform organically. Instead business models where the platform

directly or indirectly gains access to a large customer segment can be lucrative. Both the public transportation authority operator model and the B2B/G targeting operator model seems to be moving beyond this problematic. Applying the service directly to the already existing public transportation application gives exposure to a large user base which can easily be introduced to the service. The public transportation authorities also provide a higher level of trust which can be important to influence the users to more frequently use shared mobility. Integrating the service to organizations creates additional value as the administrative work regarding the reporting of business trips can be handled automatically. Furthermore, there seems to be an interest from organizations to integrate shared mobility with regard to the well-being of employees. Organizations can also influence individuals internally which can improve the integration of MaaS in the everyday mobility.

The social, spatial and environmental benefits of MaaS are quite well understood, but it is still ambiguous how one can create value for both the end-users and mobility services providers that can lead to an economically viable service. As a factor of the pandemic these projects have not been able to gain as much experience regarding the functionality of the service as the goal initially was. This makes it difficult for the pilot projects to continue the service seamlessly following the pilot phase. However, this research points towards the fact that complimentary services need to be incorporated to achieve a feasible business model where incentives for both the end-users and the mobility service providers are sufficiently attractive.

This thesis could increase the knowledge regarding a growing topic that is MaaS. The experience from the participating pilot projects, and comparisons them in between, can give significant sources of additional knowledge that creates a foundation for understanding important questions regarding the implementation of MaaS solutions to provide social, spatial and environmental benefits. The thesis contributes to the existing literature and potentially gives more aspects to study for forthcoming explorative research. This, more specifically regarding the implementation of MaaS with its mapping of present barriers for pilot projects in different phases and the further demonstration of theoretical approaches to move beyond them from a business model perspective. Lastly, to reach this, contribution has been made in terms of the mapping of possible business models, using business model canvas, and operator models based on the previous research conducted by König et al. (2016).

As MaaS is a novel, to an extent unexplored, topic there are various of interesting continuations for future research. To begin with similar more comprehensive studies could be conducted to further legitimize the finding and investigate them more thoroughly. This, by also studying other important actors rather the only the MaaS projects themselves. Moreover, it could be of interest to for example, move away from the strict business model approach aiming to find functioning models, and a structure supporting it, to further investigate the complex business ecosystem and the connection between actors within the value chain. It has been demonstrated that it is a difficult task where, above all, it is of interest to investigate how the interaction between private actors and public actors can take place. This, to take advantage of innovativeness and speed of a firm established for the purpose of MaaS with the public transport authorities strength to ensure trust, secure that all transportations can be offered and that political governance can simplify the regulation process.

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