GOVERNANCE STRUCTURES FOR DEALING WITH TRANSITIONS IN MOBILITY

A CASE STUDY ON INTELLIGENT MOBILITY FOR THE GREATER COPENHAGEN AREA

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EXECUTIVE SUMMARY

Mobility in the future will be more intelligent. Cities are still facing problems in their urban mobility and the transport market never really changed ever since mobility became a common right. Some say the transport market is ripe for disruption now and that a new era of mobility might be at the doorstep. The concept of Intelligent Mobility promises to put users and their experience at the heart of service with mobility services being built around them. The potential of Intelligent Mobility might sound very promising, yet there could be factors that slow down its introduction. Not only does the realisation of Intelligent Mobility require technical changes, also forces it organisations to change and adapt to new forms of mobility. The question arises whether something is stopping Intelligent Mobility from being introduced or slowing down its introduction. If barriers exist, there might be different governance options such as the structure of the market or the degree of market regulation that can help in overcoming these barriers. Unfortunately, knowledge is lacking about how governance can accommodate changes to more intelligent mobility.

Therefore, the main research question of this study is:

How can transport market governance be organised to make mobility more intelligent?

APPROACH

To answer this question, the research will take the form of a case study, focussing on a possible introduction of Intelligent Mobility in the Greater Copenhagen area in Denmark. The Greater Copenhagen area can be considered similar to other European cities, facing similar challenges in transport and infrastructure. The case study of Copenhagen will be explorative with the aim to find out what barriers are there for a potential introduction of Intelligent Mobility in the area. Later on in the research, an empirical analysis of two examples of Intelligent Mobility will be added, aiming at finding out critical governance choices to be made for Intelligent Mobility. Input for the case study of Copenhagen and the empirical analysis of the two examples of Intelligent Mobility will come from interviews conducted with stakeholders in the field and from literature research.

The research follows an approach in which it is looking at technological, institutional and process elements of the introduction of Intelligent Mobility. With this so-called ‘TIP-approach’ all these three perspectives are considered to be connected, intertwined and necessary to come up with solutions for a possible introduction of Intelligent Mobility. Certain technical decisions could lead to certain organisational behaviour and vice versa. The expectation is that barriers for its introduction not only stem from technological challenges, but also from the alignment of interests from and coordination between ‘old and new’ transport providers, authorities and transport users. Intelligent Mobility is considered as a change in a network environment, where dependencies between stakeholders are crucial and dynamic behaviour influences the outcomes of the transport market.

THE TRANSPORT SYSTEM AND INTELLIGENT MOBILITY

To discuss the interactions, dependencies and dynamics in mobility, the transport market has been looked at from both a technical and organisational perspective. For this reason, stakeholders have been spoken to and systems within transport and infrastructure have been described. Several trends that can be seen in the transport sector are urbanisation, climate change and sustainability, population
growth and aging, social changes brought by the Millennial generation and technological developments. These trends lead to several challenges in transport and infrastructure such as congestion and the demand for infrastructure, sustainability challenges, an aging population, decline in car ownership, rise of the sharing economy, increased penetration of smartphones and technologies in transport.

Now, the transport market is seeing the introduction of Intelligent Mobility. Intelligent Mobility is being defined as the provision of mobility in which the user and their experience and requirements must be at the centre and in which the system must be integrated and focused on the outcome of providing a complete journey as easily and efficiently as possible for every user. Although Intelligent Mobility is a rather broad definition, it can be said to be build up around the following four elements:

- **Access**: access to mobility options will be easy and quick and these services will be more personalized. Examples are bicycle- and car-sharing, transport on demand services and Mobility as a Service;
- **Demand**: Intelligent Mobility initiatives aim at changing demands and travellers’ behaviour and better matching the actual supply to this demand. Examples are intelligent transport systems, intelligent route information, personalized travel information and dynamic supply management;
- **Integration**: multi-modal journeys will become easier in the future and pain points will be removed so travellers do not feel the change between systems of different transport modes or providers. Examples are the integration of transport modes, information systems and ticketing systems;
- **Automation**: these developments are on a range from increasingly sophisticated driver assist features to fully autonomous drive.

Intelligent Mobility has the potential effects of reducing congestion and the burden on the car-dependent population, increasing the efficient use of capacity, lowering emissions, increasing the modal share of public transport and increasing employment and social inclusion. Furthermore, it can lead to more seamless and well-functioning transport services and more developed, personalized and smart mobility services. In this way, Intelligent Mobility can help in solving challenges in transport and infrastructure. But if Intelligent Mobility is to be implemented in the future, this will also lead to new challenges for authorities. The following challenges are expected if Intelligent Mobility is to be introduced in an area:

- **Technical**: a platform that integrates all travel modes and all payment systems has to developed. Integrating all these services might be a difficult task technically;
- **Organisational**: transport providers have to work together, their services have to be integrated and a mobility provider has to be set up. Realising these changes on an organisational level can slow down the process. All actors need to have the same mind-set that is positive towards these changes in mobility;
- **Institutional**: legislation and regulation can prevent a platform as Mobility as a Service from being realised. The integration of ticket systems and travel modes might not be legally feasible (yet);
- **Financial**: the realisation of these initiatives has to be financially supported. An actor or a group of actors has to be willing to provide funding for the realisation of a mobility platform.
CASE: INTELLIGENT MOBILITY IN THE GREATER COPENHAGEN AREA

The transport system of the Greater Copenhagen area is mainly under the governance of the Danish Ministry of Transport and the municipalities such as the City of Copenhagen and the City of Frederiksbjerg. The Capital Region of Denmark, the regional authority, has not so much saying in the planning of transport and infrastructure in the region. Public transport can be seen in the form of trains and suburban trains (s-trains) provided by the Danish State Railways (DSB), metros by Metroselskabet and busses by Movia. The Greater Copenhagen area expects an increase of 10% in the amount of daily car trips in the period between 2012 and 2025. This increase is the result of population growth, urbanisation and the decrease of car prices in Denmark, which is partly the result of the lowering of taxation on car sales. When looking at the topic of sustainability, authorities are experiencing a conflict of interests between different levels of government. The City of Copenhagen wants to be carbon neutral by 2025 and bring back the trips by car to one-third of all trips, while the national Ministry of Transport recently lowered the tax on car sales and removed the tax exemption for electric vehicles. Public transportation in the Greater Copenhagen area is experiencing the higher requirements from the newer generation on the quality of its transportation services, but also on the digitalization of it.

New mobility initiatives are emerging such as car-sharing (DriveNow, LetsGo, GoMore and Snappcar), ride-sharing (GoMore), on-demand ride services (Flextrafik and Uber), bicycle sharing (Bycyklen) and electronic ticketing (Rejsekort). These initiatives have in common to be more customer-centric and demand-orientated than the conventional provision of transport. But it has to be stated that of these initiatives solely the Rejsekort system takes a real integrated approach of transport. The other described platforms, while surely being innovative and more intelligent, are still separate systems and do not cover the complete definition of Intelligent Mobility. This brings forward that well-integrated, demand-driven transport systems are not yet developed in Copenhagen.

A stakeholder analysis of the transport market in the Greater Copenhagen area found that none of the involved parties is strongly against more intelligent mobility. Public organisations share the opinion that more intelligent mobility is a good development, but that for certain initiatives it should be a public organisation that takes the lead. Public values are at stake and a private company is not preferable in that case, for instance with the realisation of Mobility as a Service. Yet, there seems to be no public organisation that can jump into that gap. Rejseplanen, the national public transport travel planner owned by all the transport providers together, is being pointed at as a preferable candidate for an Intelligent Mobility platform. But Rejseplanen has been designed to promote public transport and simply adding other transport modes into the system is not possible. Integrating transport modes also brings in organisational difficulties because all actors have to cooperate and work together. Since there is no strong regional authority in the Greater Copenhagen area, cooperation between municipalities can be difficult. National legislation prohibits the selling of public transport tickets by a third party. Furthermore, electric or shared vehicles cannot be treated much differently from normal cars, making subsidizing these vehicles difficult in a legal way for the City of Copenhagen.
Empirical analysis of Mobility as a Service

The next step in this research is an empirical analysis in which two examples of Intelligent Mobility will be looked at. The analysis of these examples aims at finding out if the expected challenges are actually there and how these can be overcome. The two examples that have been looked at are UbiGo in the Greater Gothenburg area and MaaS Finland in Finland, both cases of the introduction of the concept of Mobility as a Service. Mobility as a Service (MaaS) is a mobility distribution model in which the customer’s all major transportation needs are met over one interface and are offered by a service provider. It can be seen as a key trend within the Intelligent Mobility domain. The organisational structure, market governance and regulation for Mobility as a Service are arranged differently in both cases. The findings from the empirical analysis have been translated into a list of to be expected barriers for Mobility as a Service and a framework of possible governance models for Mobility as a Service.

Barriers to the introduction of Mobility as a Service

The empirical analysis has shown that the following barriers can be expected with an introduction of Mobility as a Service in a region:

- Resistance from public transport providers: public transport providers might be afraid to lose invested interests: a certain position in the market, a vested brand and image, communication channels with customers and expectations of the future;
- Legal challenges: a Mobility as a Service provider cannot make profit from tax money, while public transportation forms the backbone of its services. Also public transport providers might not be able to find a legal basis in legislation to perform Mobility as a Service activities;
- Technical realisation of the platform: a challenge is the integration of travel information and ticketing systems and the realisation of open data and open APIs on the transport market. Nevertheless, willingness (or non-willingness) from authorities and companies to invest in the development of these systems and platforms seems more of a barrier for its introduction than the technological factor.

As can be seen, these barriers correspond largely with the expected challenges for a possible introduction of Intelligent Mobility that were previously stated.

Governance models for Mobility as a Service

Next to barriers, the empirical analysis has shown which critical choices have to be made for a possible introduction of Mobility as a Service. Choices that have to be made are on the field of ownership of a MaaS company, exclusivity with transport providers, market structure and regulation. Following from these choices, a framework of possible governance models for the concept of Mobility as a Service is presented here.

A Mobility as a Service operator could be set up following different approaches regarding the ownership of the company: the company can be a privately owned firm, an institution being run by the government or a public-private partnership. Also within these options, different set-ups are possible. Advantages of the public approach are its safeness for authorities and easiness to work together with public transport providers. Disadvantages are that the company might be inefficiently, not scalable and legally questionable. A private MaaS organisation can offer users the best possible service and is legally more suitable. Disadvantageous is that cooperation with public transport
providers can be difficult. A public-private partnership with a publicly developed and owned MaaS platform and private MaaS service operators offering the actual MaaS product to end-users, can be a good hybrid option. Although legally difficult to set up, it might form a great incentive for the market of Mobility as a Service to develop.

A decision to be made by the Mobility as a Service company, is the choice between integrating all transport options available or only exclusive providers. The main arguments for the choice of exclusivity are the easiness for users to get access to services and the ability to offer lower prices. The downside is that MaaS operators and transport providers having a both-ways-exclusive deal are stuck with each other and have no possibilities to offer better options to their users when either the MaaS operator or the transport provider turns out not to be most promising one.

Another critical choice in the governance of Mobility as a Service is the structure of the transport market. Two forms of market governance are available for authorities: an open market or a public concession. The open market approach is the most straightforward and easiest option to implement. The market is open for private (and public) companies to start up MaaS services for transport users in the area. When regulation is there and interests from private companies exists, this approach will result in a competitive playing field for MaaS operators, leading to the best outcomes for users. The opposite approach, the procurement of a concession for the right to resell tickets on behalf of the public transport providers, can be seen as a safer option for authorities. Setting up a procurement gives authorities the opportunity to precisely describe how the MaaS services within the concession should look like. Tendering procedures are not without time-consuming legal issues and do not necessarily result in the best possible outcomes of the market.

Following from the decisions for organisational ownership and market structure, a higher or lower degree of regulation is needed for Mobility as a Service. First there has to be regulation for the market of mobility services, the reselling of tickets from public transport providers. Also regulation for the exchange and use of data related to these new mobility services has to be set in place. Regulation can be created that is strict, all-including and pro-active or governmental organisations can take a more wait-and-see approach. The allowance for private MaaS operators leads to a higher degree of regulation needed than when a public authority is organising Mobility as a Service itself. Structuring the market as open and competitive requires more regulation to prevent market failures and monopolies than when a concession for MaaS is being tendered out.

The described governance structures have the ability to make mobility more intelligent. The research has shown that transport market governance, which is organised based on the choices above, can accommodate a potential introduction of Intelligent Mobility. The framework, as presented above, describes transport market governance options, considering the implications of these choices that are being made by authorities in a potential change towards Intelligent Mobility.
CASE: BRINGING MOBILITY AS A SERVICE TO COPENHAGEN

Barriers that are expected specifically for a potential introduction of Mobility as a Service in the Greater Copenhagen area are:

- The mind-set from the Danish government: the Ministry of Transport expects higher direct benefits from infrastructure investments than from investments in or commitment to the concept of Mobility as a Service;
- The lack of a strong regional authority in the Greater Copenhagen area: individual cooperation between municipalities in the region is necessary to make Mobility as a Service work in the entire Greater Copenhagen area;
- The presence of relatively high car sales taxes in Denmark: usage of vehicles in Denmark is relatively cheap, especially compared to the purchase of the vehicle, so vehicle owners in Denmark might be difficult to seduce for a service in which they have to give up their personal vehicle such as Mobility as a Service.

In order to overcome these barriers, the following set-up or approach is recommended if Danish authorities want to introduce Mobility as a Service in the Greater Copenhagen area. Regarding the organisation structure, a private company could be a right candidate to set up a Mobility as a Service offering. A prerequisite seems the integration of the Rejsekort into its system, so potential customers could use their existing travel cards to get access to the offered transport services. The expectation is that this MaaS operator will develop a multimodal travel planner that allows its users to plan and compare travel options. Next, the private MaaS operator should ideally include all transport providers that are operating in the Greater Copenhagen area into its system. Thus, a subscription to Mobility as a Service would give users access to transport services from Movia, DSB, Metroselskabet, DriveNow, LetsGo, GoMore, Snappcar, Bycyklen, taxi services, car rental companies, Uber and private bus companies. The market for Mobility as a Service is expected to be at its best when chosen for an open and competitive approach. Realizing the right regulatory environment will lead to a market in which multiple, competing MaaS operators create the best possible outcomes for transport users. In the Greater Copenhagen area, where there is no single legal entity for the provision of public transport, a procurement, as is being done in Gothenburg, will be difficult and time-consuming. Therefore, the creation of an open market seems to be the most promising government structure for Mobility as a Service here. At the same time, having an open market for Mobility as a Service requires the Danish government to come up with pro-active and comprehensive regulation. Proper regulation for an open market should result in the prevention of harming monopolies, market failures and has to prescribe rules for cooperation between MaaS operators and transport providers, for cooperation between MaaS operators themselves and for the sharing and openness of data.
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PART I: PROBLEM DEFINITION
1 INTRODUCTION

Moving from A to B has always played a major role in people’s lives. With the invention of the car, a lot changed for society. Towns could expand, industries could grow and the distances between home and work increased. Mobility became a common right. The transport sector never really changed ever since. Cars have been improved with every model and new roads have been build, but the principle of driving from one place to another with your own private vehicle haven’t been changed much. Roads are being used more and more intensively and the presence of congestion is business as usual for every commuter. The transport market seems to be ripe for disruption. Other sectors such as telecommunications and media have seen major changes already in the past. The transportation sector has not seen these changes yet (Burrows, 2014). Some particular circumstances have help avoiding the transport sector from changing yet. The cost and time for developing transport infrastructure, the difficulties of entering in the market for newcomers and the enormous set of regulation in transportation all make it difficult for the transport market to evolve.

But the transport market is changing. New technologies, products and services are fundamentally changing the way we use transportation (Schuppan, Kettner, Delatte, & Schwedes, 2014). The transport sector has always been quite old-fashioned in its way of serving users. But this is changing rapidly. New technologies are emerging that can help the transport market to become more user-friendly. Transport can become more intelligent. This can lead to transport becoming more efficient with fewer private vehicles and lower emissions. The market for smarter mobility is growing as more and more customers, businesses, governments and transport authorities see its potential (Wappelhorst, Sauer, Hinkeldein, Bocherding, & Glaß, 2014).

Intelligent Mobility is a new way of thinking about how to connect people, places and good across all transport modes (Burrows, 2014). With Intelligent Mobility the user and their experience and requirements are at the heart of service. Mobility services will be built around them. Users could be able to plan their complete journey as easily and efficiently as possible. Developments that are boosting this new form of mobility are the rise of the sharing economy, access over ownership, mobility services on-demand, the convergence of modes and types of transport and the blurring of boundaries between public and private transport. The widespread implementation of smartphones influences the development of Intelligent Mobility. More and more people are continuously in touch with their colleagues, friends and family. When planning travel journeys these smartphones are being used too. There is a potential of the integration of smart, mobile devices in the transport market. Planning of trips could be made easier for travellers. And at the same time transport companies could use all data generated by these smartphones to improve their services.

1.1 THE CHALLENGE OF GOVERNANCE

The development of Intelligent Mobility can be seen as a process of change in a network environment. On the transport market where this development can be seen, are incumbents (transport providers already in the market) and old institutions (regulations designed for a non-digitalized transport market). A first description of Intelligent Mobility in the light of theories of change in networks and the complexity of governance of change will be explained in this section.
First, it is interesting to see what change Intelligent Mobility is exactly causing. Intelligent Mobility differs from the current provision of transport on two important aspects. First, transport is multimodal. Transport modes are integrated and Intelligent Mobility offers a journey as a whole. Second, instead of providing the supply of transport, Intelligent Mobility is based on customers’ demand. Transportation is personal and customer-centric. Challenges that arise with the introduction of Intelligent Mobility can be expected on several fields. The realisation of Intelligent Mobility is complex because of its need for technical integration of systems, cooperation between transport operators and regulation of a changed transport market.

Legislation regarding transport is normally being made by the ministry in charge of transport. Regulation on transport is the responsibility of transport agencies, which are normally part of the ministry. Also lower governmental bodies for regions and cities have their say regarding transport regulation. The potential of Intelligent Mobility is in more efficient use of transport capacity by matching demand with existing supply. This leads to lower emissions and a better living environment. These potential effects of Intelligent Mobility on the region’s liveliness and attractiveness are goals for most governmental authorities. So, from the view of governmental authorities, Intelligent Mobility can help in achieving their goals. A difficult issue for these institutions is then how to legislate and regulate in order to stimulate the implementation of Intelligent Mobility. How can policy be designed such that there is space for innovation in transport and that society is willing to adapt and use new forms of mobility? Following, another important dilemma comes in: governance and the organisation of a redesigned transport market. Not clear is which governance options are possible for a transport market with Intelligent Mobility. To explain why this is such a big challenge, an introduction to other stakeholders in the transport market should be given.

State railways, metro- and bus companies, mostly long-established and governmental owned, are ‘in charge’ of transportation. Taxi companies are used to the same old business model for many years. These operators see the market around them changing, but don’t always know how to change with it. Transport operators can be reluctant when it comes to changes in the transport market. The implementation of more intelligent mobility can disturb their businesses and might force them to change. Yet, the support of these traditional transport companies is necessary to make mobility more intelligent. As more Intelligent Mobility initiatives are emerging, resistance from opponents could arise. Transport providers that do not want to cooperate and work together can create an incomplete redesigned and non-integrated transport market, causing more problems for travellers than benefits (Ambrosino, Nelson, & Pettinelli, 2015).

New players are stepping into the transportation market, mostly privately owned companies seeing opportunities for change. Sometimes they just offer a service (e.g. UbiGo) rather than actually building new transport infrastructure (e.g. DriveNow). These companies introduce new services or offer existing services in a different (better) way. By introducing their services to travellers, they force the transport market to change (Faergeman, 2015). The current provision of different transport modes, all offered by different transport companies will probably not hold in the future. Intelligent Mobility will be customer-centric with the blurring of boundaries, so journey choices will be more flexible. In the future image of Intelligent Mobility, a journey can be easily planned on a user’s smartphone while integrating all types of mobility opportunities to enable users to get from A to B as easily as possible (Burrows, 2014).
Is something stopping the market from making mobility more intelligent? Regardless of the answer to this question, it is unclear how authorities can restructure the transport market, how they can regulate and create a playing field in which new, innovative transport companies work together with the more traditional forms of transport. Authorities might have to find out a way of governance that will stimulate a positive change towards Intelligent Mobility, but also a clear redesign of responsibilities and rules that is ready for more flexible and user-friendly transport. Operators have to work together in order to integrate transport systems (Lane & McGuire, 2015). Governance can be there that makes cooperation between private and public companies possible and efficient. The differences in organisational structures between private and public companies make it difficult, also in the case of Intelligent Mobility.

New business models are being developed in contrast to the current, ordinary provision of transport. Technological development is aiming at more personalized and on-demand services (Buscher, Doody, Webb, & Aoun, 2015). The increasing penetration of smartphones can help in achieving this, but also strengthens the importance of data analytics. Intelligent Mobility is more user-friendly, offering transport from door to door (Buscher et al., 2015). Right now, the new companies in the transport market are the initiators of this concept. Ordinary transport operators are rather inflexible when it comes to time and place. Authorities have to accommodate the change in the market to make sure transport modes work together and are integrated in one system (Heikkila, 2014). The change to Intelligent Mobility brings in, among others, the following technical challenges. By using data from users, ordinary transport modes can become more flexible and be at the right time at the right place. Real-time data from different mobility services can be combined into one system so these transport modes can work together and serve as integrated transport options for travellers (Copenhagen Capacity, 2014). It seems necessary that authorities realise a way to collect, combine, integrate and present transport data. Uncertain is whether transport companies should provide their own information and monitor data themselves (van Audenhove, Dauby, Korniichuk, & Pourbaix, 2014). A private or public data integrator and administrator might be an option to avoid possible opportunistic behaviour by transport companies. To make Intelligent Mobility work, the organisation of the system might have to be well structured and regulated, but maybe Intelligent Mobility will regulate itself efficiently in the future.

A lot of research is going on concerning these mobility topics. More governments, authorities and businesses feel the need to change transportation radically. New business models in transportation are emerging constantly (Faergeman, 2015). Conferences and events are being organized where local and regional governments, transport authorities and companies discuss new innovative ways of transportation. Furthermore, there is plenty of discussion about these new forms of mobility and how to implement them into current legislation. The most well-known example is the taxi-app Uber, where Uber drivers are being threatened by other ‘normal’ taxi drivers (Mather, 2015). Being so much at the heart of discussion is what makes Intelligent Mobility a highly interesting challenge for mobility.

1.2 Problem statement

Following from the previous section one can see that several unknowns still exist. One could ask if Intelligent Mobility will find its way to the transport market itself or that something is stopping it from
being realised. Although Intelligent Mobility looks promising, it is not being picked up by the market as fast as one could expect. It might be that there is resistance from current players or that market regulation is preventing its introduction. Furthermore, it is unclear how the transport market should be reformed and how governments should play a role in this. Regulation and controlling of the transport market might need to be revised and adapted, especially now the border between public and private is blurring. Uncertain is whether current businesses in the transport sector are ready to adapt and how they could be convinced or forced to change. To conclude, knowledge is lacking about how governance can accommodate changes to more intelligent mobility.

Concluding, the problem statement is as follows:

*It is unknown if something is blocking a potential realisation of Intelligent Mobility and how governance can help in overcoming this.*

After presenting this problem statement it is necessary to define and delineate the research project more detailed. Firstly, the transport market or sector in this research will be considered as wide as possible. All forms of transportation and transport services are taken into account, varying from walking to car-sharing. A demarcation being made is that this research will only be about urban mobility. The reason for this is that the need for changes in the transport market is higher in cities, where the problems of congestion, pollution and expanding population are more at presence (Buscher et al., 2015). Furthermore, the need for mobility is higher in cities and hence the possibilities for change are more at present here.

It is important to have a clear understanding of what is being meant here when we talk about Intelligent Mobility. As an initial working definition when it comes to Intelligent Mobility, the following can be referred to: “Intelligent Mobility is a new way of thinking about the provision of transport to people” (Burrows, 2014). It is about how to use systems thinking and new technologies across the transport network to improve travellers’ decision making. Intelligent Mobility tries to integrate all transport opportunities in a whole, integrated system and to put the user and their experience and requirements at the heart of this service. Mobility opportunities are personalized and meet user’ expectations on every journey. One can see that this definition is rather broad and a more focussed understanding of more intelligent mobility has yet to be found during this research.

An important remark for this research is the desirability of Intelligent Mobility. Nowhere in the report, it is the aim of the researcher to set the realisation of Intelligent Mobility as a goal. The choice for the desirability and the implementation of Intelligent Mobility is always in the decision power of authorities. In this research, the approach is to look at governance options for Intelligent Mobility assuming that Intelligent Mobility is to be implemented. For simplification reasons, this conditional assumption will not always be explicitly written down when discussing Intelligent Mobility in the report.
1.3 Research Questions

In this section the main research question and subquestions relevant for this research will be presented. The main research question resulting from the problem statement in the previous section, is as follows:

*How can transport market governance be organised to make mobility more intelligent?*

Following from this main research question, subquestions can be derived. By answering these subquestions, the main research question is aimed to be answered. Furthermore, these questions provide the research with a clear structure. The subquestions are formulated as follows:

- What is Intelligent Mobility?
- How can Intelligent Mobility tackle and create challenges in transport and infrastructure?
- What factors potentially block the realisation of Intelligent Mobility?
- What conditions can facilitate a possible introduction of Intelligent Mobility?

1.4 Research Objectives and Relevance

This research has the objective to find out how the change to Intelligent Mobility can be regulated and how a redesigned transport market can be governed. Another goal is to increase the current knowledge about challenges for Intelligent Mobility and how possible barriers can be overcome. The deliverable of this research will be a framework proposal for Intelligent Mobility. Bringing back the research objective here, this will lead to recommendations for authorities on how governance of intelligent transport could be organised.

The social relevance of this research seems evident. Having a well-functioning and efficient transport system is of huge value to social welfare (Copenhagen Research Forum, 2012). It offers people access to opportunities such as health and leisure, it improves social inclusion and reduces isolation. People have better access to jobs, skills, services and markets. Intelligent Mobility can make places more attractive to work, live and invest in. These potential effects of Intelligent Mobility are goals of transport authorities, as can be read in policy plans (City of Copenhagen, 2014b). This research aims at providing insights and recommendations to cities for the introduction of Intelligent Mobility.

Scientific relevance is found in the application of the institutional theory to the concept of Intelligent Mobility. Hitherto, literature has described the potential effects of Intelligent Mobility. Most literature about Intelligent Mobility shows what the future of mobility could look like, but does not look at potential barriers on the way. Neither does it look at governance of Intelligent Mobility or governmental approaches to overcome barriers to its introduction. Here, the research will add its value. This research aims at providing a framework proposal for Intelligent Mobility. It aims at exploring options for governance and regulation of mobility while evaluating the role of policy instruments and stakeholder behaviour in the transport market. The use of elements from the institutional theory in exploring governance for Intelligent Mobility can contribute to knowledge about transport market regulation of the future.
1.5 **Methodology**

This section will describe the research methods being used to answer the research questions. Furthermore, it will explain how data will be gathered and what possible drawbacks and difficulties with data can be expected.

1.5.1 **The case study**

To find out how transport market governance could be organised for Intelligent Mobility, this research takes the form of a case study. Using a specific case for the introduction of Intelligent Mobility will be most effective in answering the research question. Mobility challenges in the case study can be studied in depth (Yin, 2009). Since government intervention in the transport market has no clear, single set of outcomes, a case study can be useful to enlighten options or possible scenarios for Intelligent Mobility. Organisations forms, market structures and regulation for Intelligent Mobility can be explored using the case study method. The case study will be based on the Capital Region of Denmark (Danish: *Region Hovedstaden*). COWI, the consulting group guiding this research, is located in this region and having its head office here. Logically it follows that the area of Greater Copenhagen should be focused upon in this research. The capital region consists of 29 municipalities of which Copenhagen is the largest (Region Hovedstaden, 2015b). The Greater Copenhagen area is facing challenges in mobility just as many other European cities. Having the focus on this region makes the research interesting because Denmark always has an open-minded attitude towards social changes. The City of Copenhagen promotes the use of more intelligent transport systems and this area could serve as an example for other, maybe more conservative areas in Scandinavia or elsewhere in Europe (City of Copenhagen, 2014a).

Denmark’s capital, Copenhagen, is facing new opportunities in its urban transport. The Greater Copenhagen region has a population of nearly 1.3 million, almost one-fourth of everyone living in Denmark (Statistics Denmark, 2015a). The population in the area is expected to grow even more in the coming years, while the city remains the same. The increase in population density will put a heavy burden on infrastructure use in the region. Copenhagen consists of a crammed, closely built historical city centre and neighbourhoods around it. There is almost no space to build new roads or further increase road capacity here (City of Copenhagen, 2014b). The Greater Copenhagen area has to look for other solutions in order to meet current and future transport demand in the area. Authorities have realized that the future lies in more innovative and smarter solutions to tackle transport challenges (City of Copenhagen, 2012a). In Copenhagen one can see that more intelligent transport initiatives are popping up. Besides the long established public transport companies, newer private companies launch their transport systems in Copenhagen, offering the public a wider range of transport alternatives to choose from (City of Copenhagen, 2012b). Some examples are Uber, GoMore, DriveNow and Rejsekort. Also in Copenhagen, users don’t necessarily see or think of the difference between public and private alternatives. But at the same time, it is not easy for travellers in the region to plan trips consisting of different public-private alternatives or choosing between the ‘old’ and newer possibilities to travel from A to B (City of Copenhagen, 2014b).
1.5.2 WITHIN THE CASE STUDY

First, it is necessary to find out what Intelligent Mobility exactly is. Desk research has to show what its features and characteristics are and what Intelligent Mobility can do for urban transport. To gain insight in the current transport market in Copenhagen and its present and future challenges extensive desk research is necessary. By using printed literature and digital resources answers can be found to the first research question. Furthermore, interviews will be conducted to find out what stakeholders expect to be future challenges for transport and infrastructure in Copenhagen. The next part is to see how Intelligent Mobility can play a role in tackling these and present challenges. To do so, it is necessary to talk to important stakeholders in the Copenhagen transport system. One can think of the city of Copenhagen and other governmental bodies, transport authorities, transport operators, travellers’ organizations and more. Since COWI is an important player in this field of research in Copenhagen, interviewees are contacted with the help of COWI. Interviewees are being questioned in a semi-structured way: they are not being asked a list of questions but expected to talk freely about challenges for Intelligent Mobility from their perception. A checklist can be useful to make sure the interviewees answer all the questions.

To find out how Intelligent Mobility could be realised in Copenhagen an empirical analysis of other cities will be done. Some Intelligent Mobility initiatives have already been realised in other cities in Europe, for example in Gothenburg and Helsinki. Best practices coming from these cities can be of great use for the introduction of Intelligent Mobility in Copenhagen. Also for this empirical analysis, the input is data collected from literature and interviews with stakeholders (Yin, 2009). These stakeholders might vary from municipalities to transport companies or mobility providers. Important is to see how different stakeholders see the ‘rules of the game’ in the transport market and how trust between transport operators is being valued. Different forms of governance and different market structures can lead to different outcomes. Stakeholders are already on their way realising Intelligent Mobility in other cities. Interesting is to see how their behaviour might have led to certain technical configurations. An empirical analysis of examples of Intelligent Mobility can help in finding answers to the raised questions.

The case study on the Greater Copenhagen area and the empirical analysis of Intelligent Mobility in Finland and Gothenburg have to provide answers to the research questions as stated before in this chapter. Findings from the Copenhagen case study have to be generalised to innovations in other fields of study and other areas (Gomm et al., 2000). It is necessary to know in which area innovations are comparable so it is justifiable to make generalisations (Gomm et al., 2000). By discussing the outcomes of the case study with important stakeholders, its external validity can be proved (Yin, 2009). To do so, interviews have been conducted with the some of the same stakeholders in Copenhagen that have been talked to before. So, the first series of interviews in Copenhagen is more explorative, while the second series is aimed to test findings and evaluate outcomes.

So, this research will be about governance of Intelligent Mobility in which the case of Copenhagen will be looked at in depth. To learn from findings from previous examples, a multiple-cases study will be done on Intelligent Mobility in Gothenburg and Helsinki. The research has not the aim to rank, but more to explore governance of Intelligent Mobility for Copenhagen and to learn from other cities.
1.5.3 DRAWBACKS

One of the major drawbacks of these research methods will be the gathering of data concerning Intelligent Mobility. Current transport companies might be reluctant in publicly sharing their honest beliefs during interviews. Newer and possibly more innovative forms of transportation can change the transport market and ordinary transport operators might not be enthusiastic about these changes. This can make it difficult to find accurate and up-to-date data that is necessary for the case study (Simon, 2003). Furthermore, most or all of the interviewees will be Danish, Swedish or Finnish. Although their level of English is most-probably proficient, there might still be a barrier in expressing their honest beliefs in a language other than their native one.

An exploratory case study is a useful tool to investigate how to implement Intelligent Mobility if desired by authorities. At the same time, it might be hard to generalize the results coming from this research (Tsang, 2014). Outcomes that have been experienced in Finland or Gothenburg might not hold for future mobility challenges in other cities or countries. A golden solution might not work for Copenhagen. Generalization done for other cities or countries should be done with care and one should always keep its limitations in mind. However, this research is aiming at cover broader theoretical issues in mobility planning, rather than just reflecting the single experiences in these cities.

1.6 READING AHEAD: THE STORYLINE

The structure of this report is as follows. Now the research has been defined and scoped. The research questions and the methodology have been presented. In the next chapter, the theoretical landscape of this research will be drawn. An exploration of the transport market will follow and challenges for transport and infrastructure will be looked at. Next, the concept of Intelligent Mobility will be introduced together with its potential effects on transport, the difficulty of change and expected challenges of its introduction. Part 3 brings an empirical analysis looking at two already existing examples of Intelligent Mobility. In the fourth part, governance models for Mobility as a Service will be presented and applied to the case of the Greater Copenhagen area. To get back to the topic of Intelligent Mobility, the generalization of the findings for Mobility as a Service will be looked at. Finally, this report includes a conclusion, recommendations, discussion and reflection.
PART II: EXPLORATION
2 THEORETICAL LANDSCAPE

Hitherto, research about Intelligent Mobility has been focusing mostly on the future of mobility and what a future of Intelligent Mobility could look like. Literature on this topic describes the potential effects of Intelligent Mobility. However, none of the research looks at the process of change towards Intelligent Mobility and the barriers on its way. Some effort has been done in looking how the technical system has to be changed in order to accommodate Intelligent Mobility, but an analysis that takes into account both technical and institutional barriers in the process of change has never been done. At this point, this proposed research steps in. Instead of an approach that assumes that Intelligent Mobility will be here in the future, this research looks at the process of change and possible complexities that prevent the introduction of Intelligent Mobility. The expectation is that the research will lead to a more realistic understanding of governance structures and approaches that take into account technical uncertainties, organisational behaviour and dynamics on the transport market. The theoretical approach taken in this research will be described below.

The transport system is an impressive and complex system in several ways. Technically, it integrates infrastructure and transport modes. The system consists of roads, railways, energy infrastructure, cars, busses, trains, metros, bicycles and many more transport elements. Socially, the transport system integrates dozens of stakeholders. Authorities, transport operators, car drivers, bus and train passengers, cyclists, pedestrians and more involved actors are part of the system. The sociotechnical system of transport can be described as complex and advanced. For analysing multi-actor and technical complex systems, the so-called ‘TIP-approach’ can be useful and applicable. The TIP-approach or framework structures a system with the distinction of three different perspectives: a technological, an institutional and a process one (Koppenjan & Groenewegen, 2005). The technological perspective is about the technical system, its demarcation, components, relations and processes. The institutional perspective is about arrangements between actors that regulation their relations and includes tasks and responsibilities. The process perspective is about who participates in the decision process and what the conditions, rules, roles and steps in this process are. These perspectives are connected, intertwined and all three necessary in order to come up with a recommended approach or solution for the introduction of Intelligent Mobility (Bauer & Herder, 2009).

As described above, the transport system in which Intelligent Mobility is making its appearance is not only about technical elements. Just as important is to look at the stakeholders and their behaviour on the transport market. The theory of institutionalism is the perspective being taken in this research. The institutional thinking focuses on the deeper aspects of the social structure (Groenewegen, Spithoven, & Berg, 2010). Institutions are "systems of social rules that structure behaviour and social interaction" (Hodgson, 2006). This seems as a suitable approach to find out how the transport market is organised and how Intelligent Mobility could be governed to make it successful. Some key elements from the institutional theory are relevant issues in the change to more intelligent mobility, highlighting the theory’s usefulness to define interactions in the network. The market for Intelligent Mobility is not merely a game between demand from travellers and supply from transport providers. It is, maybe even more, about interactions between travellers and operators, between operators which systems have to be integrated and between regulators of transport and the service providers (Lindenau & Böhler-Baedeker, 2014). For this reason, a stakeholder analysis of mobility in Copenhagen will be
done. The way in which markets are organised and structured will determine the efficiency and well-working of the transport system (Lane & McGuire, 2015). Different network configurations and institutional designs for Intelligent Mobility will lead to different outcomes, which highlights the importance of appropriate governance and regulation for the transport sector (Spiller & Tommasi, 2004).

Finally, this research will look at the process part of the transport system, the P from the TIP-approach. Here the network of stakeholders is important, in which the realisation of Intelligent Mobility can be described as a process of change. It is about the change of how transportation modes are being used, about how transport operators work together and about how users interact with their mobility providers. These changes are happening in a network consisting of all users and organisations that are involved in the transport market. So, this research will focus on change management in a network environment and to be precise: governance of the change towards Intelligent Mobility in the transport sector. For networks, institutions are as a social infrastructure that make interactions possible (Koppenjan & Klijn, 2004). Stakeholders in the networks need rules to justify their actions and networks need rules as robust characteristics. Rules, on their turn, are being formed by interactions between actors. When interactions change, rules can change. Solutions coming from a network environment are dependent on actors’ strategies and thus on rules. So interactions between actors can make changes in a network (Koppenjan & Klijn, 2004). It seems necessary to determine precisely which interactions are there between actors and how these can make a potential change towards Intelligent Mobility possible.

A useful framework here is Williamson’s four-layer model that focusses on institutions in sociotechnical systems and their embeddedness or easiness to change. The four-layer model distinguishes between four layers of institutions in organisations and systems (Koppenjan & Groenewegen, 2005). The highest level in this model consists of culture, values, norms and attitudes, the so-called ‘informal rules of the game’. The third level can be seen as the formal rules of the game and consists of legal rules (laws and regulation). In the second layer we can find institutional arrangements or governance structures: mechanisms to coordinate transactions between stakeholders. The last and lowest layer is on the level of individual actors and looks at their interactions in a system. Not surprisingly, the higher the level an institution is in, the more difficult it is to change this institution. Williamson’s four-layer model will find its application several times throughout the research, providing the opportunity to look at the change of Intelligent Mobility from an institutional point of view.
So far, a theoretical overview has been given for the introduction of Intelligent Mobility. As one can see, technical, institutional and process elements have been discussed. To summarize the chapter, it can be said that the close interdependence of technical and social systems requires the joint optimization of technological and social variables together with an effective process design in order to design the system of Intelligent Mobility. To do so, the TIP-framework will be guiding throughout the research, starting with the next section, in which both the technical and the social subsystem of the transport system in Copenhagen will be at the point of discussion.
CASE: THE TRANSPORT SYSTEM IN COPENHAGEN

This section looks at the case of the Greater Copenhagen area. The transport system here, in which Intelligent Mobility is expected to make its appearance, is at the point of discussion from both a technical and an institutional perspective. The technical configuration of the transport system in the Greater Copenhagen and the stakeholders in this system are presented here. A more detailed description of these analyses can be found in appendix A.

TECHNICAL

The transport system in the Greater Copenhagen area consists of several different transport networks, shortly explained in this section. Starting with an extensive road network: a big part of Denmark’s road infrastructure is focussed on Copenhagen, which is the only metropolitan area in the country. Furthermore, the region has 390 kilometres of designated bike lanes and 29% of all trips are done by bicycle. Finally, there is a dense public transportation network in the Greater Copenhagen area. Trains are connecting the Greater Copenhagen area with the rest of Denmark and with Sweden and Germany. The s-train, a metro-like urban rapid transit system connects Copenhagen and its inner boroughs with the suburban areas. Furthermore, there are two metro lines with a new circle line under development, an extensive bus network in the whole region and three harbour bus lines connecting different parts of the city.

ORGANISATIONAL

The most important stakeholders of the transport system in the Greater Copenhagen area are the following. The Ministry of Transport and Building is the highest governing body for the transport market in Denmark. The Capital Region of Denmark is the regional authority of the Greater Copenhagen area and together with Region Zealand and 45 municipalities, it finances the transport company Movia. The City of Copenhagen is the largest municipality in the Greater Copenhagen area. Then, there are several public transport providers in the area including the Danish State Railways (DSB), the largest train operating company in Denmark, Metroselskabet, a public owned company responsible for all metro transport and Movia, which is responsible for bus transport in the Capital Region of Denmark and the Region Zealand, but also for certain local railways and water busses. The largest taxi companies in Copenhagen are Taxa 4x35 and DanTaxi. Rejsekort A/S is the organization in charge of the Rejsekort, Denmark’s electronic ticketing system for public transport, owned by all transport companies together. Rejseplanen is Denmark’s largest public internet service, providing more than 20 million itineraries a month through the website and mobile application and is owned by the regions and transport providers. Din Offentlige Transport is a cooperation between DSB, Movia and Metroselskabet to make public transport in Zealand better and more coherent. Finally, there are the users of the transport system in the Greater Copenhagen area.
3 CHALLENGES IN TRANSPORT AND INFRASTRUCTURE

As described in the introduction, mobility might look different in the future. Important to see is what challenges in mobility there are, now and in the future. Issues that are important for transport and infrastructure planning will be discussed. A more detailed description of global trends in mobility and challenges in transport and infrastructure can be found in appendix B.

3.1 CONGESTION AND DEMAND FOR NEW INFRASTRUCTURE

Urbanisation and population growth will have a large effect on the current provision of infrastructure. The current growth of population will put a huge pressure on transport networks and its capacity. Increasing mobility is associated with increasing traffic. More congestion can be expected due to the overexploitation of the system’s capacity. As a response to increasing congestion, there will be a growing demand for new infrastructure. There will be an investment requirement for authorities in the coming years. Investments in transport and infrastructure have to be made in order to keep pace with the rapidly growing demands on the transport network. Existing infrastructure needs to be upgraded and supplemented to meet modern requirements. Authorities need to find the right balance between infrastructure investment, congestion management and the improvement of public transport.

Due to urbanisation and population growth, markets and habits are changing. Car ownership in urban areas is usually lower and there is greater reliance on public transport and active modes of transportation (cycling and walking). Decreasing use of cars can be expected from the ongoing urbanisation (Haustein, Nielsen, & Siren, 2014). For people living in large urban areas, car usage appears to be lower than for people outside these urban areas, even when car ownership is controlled for. Research shows that when an area becomes more urbanized, offering better transport alternatives to a car, there seems to be less need for the possibility to drive for young and middle aged people. For older people, this compensation seems to be less significant and thus better access to alternative transport modes cannot sufficiently replace older people’s need for a car (Haustein et al., 2014). With a growing population in a growing urban area, an increase in ridership on public transport can be expected and also more new and innovative mobility services are expected to emerge.

3.2 SUSTAINABILITY CHALLENGES

The trend of sustainability brings in many considerations for transport planning. Due to climate change some consequences have to be taken into account. The transport sector faces several challenges in the field of sustainability. Mobility has to become ‘green’, meaning emission-free forms of transportation have to be used and the traffic flow has to become more sustainable. Together with the focus on lower emissions and a higher air quality, the problem of resource depletion comes in. Fuel efficiency is an important term for improving air quality and reducing the transport’s dependency on oil. Making vehicles more fuel efficient in order to emit less pollutants is a requirement for future improvements.

There is a huge challenge for regulatory action and authorities face this challenge in regulation to limit pollution and/or incentivise new technologies. Finding a right balance between negatively charging (by taxation) and positively rewarding (by subsidizing) can be troublesome. Some regulation measures
can be more effective in limiting pollution than others. Governmental planning requires considerations to be made between economic and environmental values, making the challenge of proper regulatory action difficult.

3.3 SOCIAL CHANGES

The ageing of the population brings in several challenges for transport. Older people are healthier and more active in general than ever before, making them also more mobile. This will increase the demand for transport as the population grows and ages. Besides that, urban environments put elderly at a greater risk of social isolation and loneliness. Mobility of elderly and the accessibility to transport form crucial factors in mitigating the risk of isolation (The Knowledge Exchange, 2014). Since older people normally have less financial means, a lack of funding to support more services from the public purse, can consequently mean a decrease in mobility for this group. Another challenge is to ensure a satisfactory level of quality for transport. Older people have a specific set of requirements for transport. The ease of use and convenience, high safety and clear information and communication are important for this group (The Knowledge Exchange, 2014).

Other consequences for transport come from the social changes brought by the Millennial generation. The rise of the sharing economy and the trend of access over ownership are two developments. In most developed countries recent years show a decrease in car ownership. Less cars are being sold and owning a vehicle is not as important anymore as it used to be before.

3.4 TECHNOLOGICAL DEVELOPMENT

The increasing penetration of smartphones has huge consequences for transport. People, now constantly being connected to everyone and everything in the world, expect more real-time information on the road and while using public transport. Data analytics in transport will become increasingly important. Several challenges can be seen regarding the use of data analytics in mobility (Parliamentary Office of Science & Technology, 2014). To open up the data for developers and transport companies, data needs to be archived and made available in a usable and standardised format. Accessibility and standardization of data is something in which authorities have to play a role. A last important governmental issue for data analytics in transport is privacy. Effective regulation on the protection of user data seems necessary, but when privacy protection becomes too severe, the collection and sharing of information becomes difficult. Authorities should find a way in which data coming from these smartphones can be used to improve the provision of transport, but that also protects the privacy from travellers and smartphones users.

The development of electric cars involves challenges including the roll-out and design of infrastructure, market penetration and the consequences for the population’s transport patterns and the total traffic load. Charging infrastructure is needed to provide these vehicles with the necessary energy. The availability of charging stations in the public area is important to promote the use of electric vehicles. Relevant standards and legislation have to be made ready for the large-scale introduction of electric vehicles. Transport patterns could look different when the charging of vehicles has to be taken into account. More knowledge is needed about possible changes in population’s transport patterns after the large-scale implementation of electric vehicles. Dealing with these
changes and anticipating on differences in the total traffic load is a major challenge for transport planning in the future.

**CASE: CHALLENGES FOR THE GREATER COPENHAGEN AREA**

The same challenges as described above can be seen in the Greater Copenhagen area. Some interesting findings and consequences of these challenges for the Copenhagen area are shown below.

**CONGESTION AND DEMAND FOR NEW INFRASTRUCTURE**

Already over the next 10 years, the City of Copenhagen is expecting 20% more citizens (Krogsgaard Niss, 2016; Statistics Denmark, 2015c). Currently Copenhagen has an average congestion level of 21%, meaning 21% additional travel time compared to normal traffic can be expected on average. In the period between 2012 and 2025 an increase of 10% in the amount of daily car trips is expected for the Greater Copenhagen area (Trængselskommissionen, 2013). Consequently, more congestion can be expected in the area.

**SUSTAINABLE CHALLENGES**

The City of Copenhagen states an environment goal of becoming carbon neutral by 2025 (City of Copenhagen, 2012a). This aim puts a huge pressure on transport in the region. Cycling and public transport are being promoted, while the use of private vehicles has to decrease. However, national Danish legislation can be conflicting sometimes with goals of the City of Copenhagen and the Region. The recent debate on the abolishment of the tax break on electric vehicles in Denmark gives a clear illustration of the challenge in regulatory action for sustainable transport (CPH Post, 2013).

**SOCIAL CHANGES**

The substantially lower tax rate in Denmark for cheaper cars (under 81,700 kroner) and the discount for fuel efficient vehicles have resulted in an increase in the sales of small, cheaper cars (CPH Post, 2013). The increasing sales of these small cars can explain the growth in car ownership in Denmark, achieving the opposite of the City’s goals (Krogsgaard Niss, 2016). Although the ownership of cars in Denmark is still growing, car-sharing is also seeing a positive trend here. Car-sharing services in Copenhagen are emerging and attracting more members every year (Krogsgaard Niss, 2016).

**TECHNOLOGICAL DEVELOPMENT**

The City of Copenhagen already states a goal of reserving 500 parking spaces in Copenhagen for providers to set up and operate charging stations for a period of ten years. To date, 106 charging points and 218 parking spaces have been made available (City of Copenhagen, 2015b). The City of Copenhagen states around 600 public charging stations for electric vehicles have been made available in the last couple of years. Because of national legislation, the City of Copenhagen is not allowed to treat electric vehicles differently from ordinary cars (Krogsgaard Niss, 2016). This makes it difficult for them to offer free or cheaper parking places to electric vehicles owners.
4 THE CONCEPT OF INTELLIGENT MOBILITY

Now, the transport market is seeing the introduction of Intelligent Mobility. In this chapter, the concept of Intelligent Mobility will be looked at in detail. It will compare different definitions and concepts that are being discussed at the moment. Furthermore, it explains the differences between mobility now and mobility in the era of Intelligent Mobility. Next, this chapter aims at giving a systematic overview of the content of Intelligent Mobility by describing its four ‘pillars’. Finally, potential effects of Intelligent Mobility are described and challenges for its introduction will be discussed.

4.1 THE DEFINITION OF INTELLIGENT MOBILITY

In this section the concept of Intelligent Mobility will be explained. It tries to present how transport is changing and what is actually different between the current provision of transport and transport in the era of Intelligent Mobility.

First, the connectedness between Intelligent Mobility and the concept of Smart Cities should be made clear. A Smart City can be defined as “a liveable, resilient city, which is inclusive, climate friendly, data insight driven and fosters innovation and a sustainable economy” (City of Copenhagen, 2014c). To ensure the development of a Smart City, the focus on 6 dimensions can be distinguished. These are:

- “Smart economy: High productivity, entrepreneurship and ability to transform;
- Smart mobility: Strong ICT infrastructure and sustainable transport systems;
- Smart environment: Sustainable resource management, pollution prevention, environmental protection;
- Smart people: Diversity, creativity and participation in public life;
- Smart living: Cultural facilities, housing quality, health and safety issues;
- Smart governance: Political strategies and perspectives, transparency and community participation in decision making” (State of Green, 2015).

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Figure 2 – Smart City
One can see that Intelligent Mobility fits in the field of smart mobility. The realisation of Intelligent Mobility can help in strengthening a city as a Smart City. The figure above gives a graphical representation of a Smart City with its dimensions and Intelligent Mobility (or Smart Mobility) in it.

Now, it is important to have a clear definition of what Intelligent Mobility is. Unfortunately, there is no single definition of Intelligent Mobility and every organization has a different perspective on the actual meaning of Intelligent Mobility. In its leading white paper from 2011, the European Commission states the following about Intelligent Mobility: “the further integrating of different passenger transport modes to provide seamless multimodal door-to-door travel” (European Commission, 2011). Further the paper explains that Intelligent Mobility consists of “intelligent systems for interoperable and multimodal scheduling, information, online reservation systems and smart ticketing” (European Commission, 2011). A recent study by Transport Systems Catapult in the UK describes Intelligent Mobility as “the smarter, greener and more efficient movement of people and goods around the world” (Transport Systems Catapult, 2015). Another study by Atkins defines Intelligent Mobility as the provision of mobility in which “the user and their experience and requirements must be at the centre and in which the system must be integrated and focused on the outcome of providing a complete journey as easily and efficiently as possible for every user” (Burrows, 2014). This last definition seems most complete and all-including and will therefore also be followed in this research, when talking about Intelligent Mobility.

A closely related definition is the concept of so-called ‘Mobility as a Service’. Mobility as a Service is a “mobility distribution model in which the customer’s all major transportation needs are met over one interface and are offered by a service provider”. Typically, services are bundled into a package similar to current mobile operator services (Hietanen, 2015). Transport Systems Catapult describes Mobility as a Service as “the shift away from purchasing products (vehicles) towards instead purchasing the access (service) for the benefits of mobility” (Transport Systems Catapult, 2015).

Mobility as a Service (MaaS) is an interesting development that can change the way in which transportation is organised completely. With the concept of Mobility as a Service, users pay a month fee to their ‘mobility provider’. All different kinds of transport modes might be included in this monthly package. The mobility provider offers users a certain combination of transport modes depending on the users’ actual travel needs. Weather conditions, traffic information and the preferences of the user can influence the advised travel itinerary. Users plan and book their trips using a mobile application. All planning, booking and payments are arranged by the mobility provider.
Following both definitions, Mobility as a Service and Intelligent Mobility are closely related, but not similar concepts. Mobility as a Service can be seen as a key trend within the Intelligent Mobility domain. MaaS is a tangible product that consumers can decide to buy if offered. The concept of Intelligent Mobility includes the actual integration of transport modes and is seen as a paradigm change in which services are being built around the user, entailing more than just a digitalisation of infrastructure.

Intelligent Mobility should not be confused with Intelligent Transport Systems (ITS). Intelligent Transport Systems are defined as “systems and technological equipment which helps to ease the traffic and make transport of people and goods more efficient, cleaner and safer. ITS are systems that intelligently control the road to make transportation more efficient” (Copenhagen Capacity, 2014). Clearly, this definition is less broad than Intelligent Mobility and one can see that it only comprises technical systems that aim at making traffic more efficient. The use of Intelligent Transport Systems could be part of Intelligent Mobility and thus can be seen as one of the tools in realising more intelligent mobility in a region.

In the figure below, the hierarchy and relations between the concepts of Intelligent Mobility, Mobility as a Service and Intelligent Transport Systems have been visualised. The figure tries to clarify the differences and similarities between these three definitions.

![Figure 3 – Hierarchy of concepts](image)

So what makes Intelligent Mobility more intelligent than the current provision of transport? The concept of Intelligent Mobility has been defined before, but it seems necessary to explain more precisely what would be different for transportation in the era of Intelligent Mobility. First, the provision of transport now is somewhat inflexible. One can say that customers can ‘take it or leave it’ when it comes to transportation options. There is a clear, established range of transport modes. Furthermore, car ownership and long-term season tickets for public transport are common. Public transport has fixed train- and bus routes, a fixed service timetable and stops in fixed places. Travellers have to do their own calculations to find their cheapest travel option and they have to try to fit the
journey with their own individual requirements and preferences. Normally the last mile falls outside the system and travellers have to do separate planning for this last part of their journey.

In the future of Intelligent Mobility, mobility is customer-centric and on-demand. The user can decide when, where and how to travel. Transportation for these requirements will be provided to them, whenever they want. Bringing a greater flexibility, the provision of transport is way more personalised. Instead of having to plan every single part of the journey separately, transport will be integrated and planning will look at a traveller’s whole journey. Users will have less commitment to one particular way of getting around and boundaries between transport modes will blur. Car ownership will decrease in the sharing economy where users prefer access to mobility opportunities and not necessarily need their own car or season ticket for public transport.

The differences between how mobility is organized now and Intelligent Mobility, as described before, can be found summarized in the table below.

<table>
<thead>
<tr>
<th>Now</th>
<th>Intelligent Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflexible service</td>
<td>On-demand</td>
</tr>
<tr>
<td>‘Take it or leave it’</td>
<td>Customer-centric</td>
</tr>
<tr>
<td>Fixed train/bus routes</td>
<td>Flexibility in routes</td>
</tr>
<tr>
<td>Fixed service timetable</td>
<td>Flexibility in time</td>
</tr>
<tr>
<td>Stops in fixed place</td>
<td>Flexible journey choices</td>
</tr>
<tr>
<td>Own calculations</td>
<td>Personalised recommendation</td>
</tr>
<tr>
<td>Plot whole door-to-door</td>
<td>Integrated</td>
</tr>
<tr>
<td>‘Last mile’ outside system</td>
<td>Look at whole journey</td>
</tr>
<tr>
<td>Requires separate planning</td>
<td>Blurring of boundaries</td>
</tr>
<tr>
<td>Clear, established range of transport modes</td>
<td>Less commitment to one</td>
</tr>
<tr>
<td>Car ownership / long-term season tickets</td>
<td>Sharing economy and access to mobility opportunities</td>
</tr>
</tbody>
</table>

4.2 THE FOUR PILLARS OF INTELLIGENT MOBILITY

The impacts of Intelligent Mobility can best be seen when the concept is described around its central themes. Four pillars can be said to form the basis of Intelligent Mobility (Goodall, Fishman, Dixon, & Perricos, 2015). These pillars can be seen as subconcepts that together form the concept of Intelligent Mobility. These are access, demand, integration and automation. Next, these components will be explored in more detail.

4.2.1 PILLAR 1: ACCESS

In the future, more mobility opportunities are expected to become available to users. Travellers can use more mobility products and services than just private cars and public transport. New mobility services will emerge and existing mobility options will innovate and change. For these new and improved services, the experience of the user is extremely important. Access to mobility options will be easy and quick and these services will be more personalized. Expected developments in the light of access are the following:
• Shared-use mobility such as car and bike sharing platforms, but also peer-to-peer car-sharing;
• Mobility on demand services such as taxi hailing apps and demand responsive busses;
• Mobility as a Service in which a mobility provider offers all forms of transport to users;
• ‘Democratisation’ of mobility that makes elements of mobility more personalized and customised (Goodall et al., 2015).

4.2.2 PILLAR 2: DEMAND

Transport systems can become more efficient. Balancing demand and supply of these systems more effectively is an important aspect of Intelligent Mobility. Vehicles are getting more intelligent, smartphones are getting more widespread and digital travel tickets are being used in public transport. Data coming from these devices will be used and predictive analytics can help in better understanding traveller journeys and optimally match transport supply. In this way, Intelligent Mobility can help in reducing the downtime of mobility assets with spare capacity, like parked cars or half-empty busses. But, it will not only be about listening better to users’ demand, there will also be more focus on the change of demand. This involves the shifting of traffic flows to less congested routes and the reducing of peak demand. So, transport systems will be made smarter in two ways: firstly, by changing demands and travellers’ behaviour and secondly, by better matching supply to this demand. Developments that can be expected, are:

• Geo-shifting of demand through intelligent transport systems, intelligent route information and personalized travel information;
• Time-shifting of demand through off-peak discounts for public transport and shared-use mobility, real-time travel information through smartphones;
• Dynamic supply management to optimise asset utilisation such as dynamic timetabling and routes of public transport and dynamic parking (Goodall et al., 2015).

4.2.3 PILLAR 3: INTEGRATION

Integration of functions is a key word for Intelligent Mobility. Integration in mobility is about bringing together disparate information, systems and services. The ultimate goal is to provide users with a seamless door-to-door experience. Multi-modal journeys are expected to become easier in the future and pain points might be removed. Travellers should not feel the change between systems of different transport modes or providers. Especially for users of public transport, integration is highly needed. Here, the last mile of travelling often falls outside the system, making a trip incomplete. Developments under the umbrella of integration are:

• Integration of transport modes through enhanced indoor navigation or more dynamic platforming and timetabling;
• Integrated information systems such as multi-modal travel or full journey planners;
• Full ticketing systems for mobile devices that do not require physical payment and optimise costs for the traveller (Goodall et al., 2015).

4.2.4 PILLAR 4: AUTOMATION

Following the trend of technological developments in the automotive sector, automation in transport will become increasingly important. Autonomous functions will find its way to transport and can help in making mobility more intelligent. These developments are on a range from increasingly
sophisticated driver assist features to fully autonomous drive. Eventually, transport efficiency can be increased enormously when enough vehicles are driving autonomously (Goodall et al., 2015).

CASE: INTELLIGENT MOBILITY INITIATIVES IN COPENHAGEN

Intelligent Mobility initiatives in five different categories are popping up in Copenhagen. These are car-sharing, on-demand ride services, ride-sharing, integrated ticketing and bicycle sharing schemes. A more detailed description of these initiatives can be found in appendix C.

CAR-SHARING
Both Car2Go and DriveNow offer a free-floating car scheme in Copenhagen and the urban areas around it. Shared vehicles (Smart or BMW) can be found anywhere on the streets, used by members and parked somewhere else again. LetsGo is also offering car-sharing for the Greater Copenhagen area, but uses stationary vehicles that have to be placed back on the same parking spot after using them. GoMore and MinbilDinbil (now: Snappcar) both facilitate peer-to-peer car-sharing, providing transport users with an online platform that enables them to rent out vehicles to other users.

ON-DEMAND RIDE SERVICES
Uber is a taxi-hailing application for smartphones, allowing users to get access to taxi services whenever they want, wherever they are. Flextrafik, which is organised by Movia, is a system of minibuses and taxis as an additional service to normal bus transport on routes where there are not so many customers.

INTEGRATED TICKETING
Rejsekort is the electronic travel card for public transport in Denmark. Topping it up with money, travellers can use it on busses, trains and metros in the Greater Copenhagen area. Also a subscription to DriveNow can be added to the Rejsekort.

BICYCLE SHARING
Bycyklen is the municipal bicycle sharing scheme. Electrical bicycles are spread around the city and can be taken from docking stations on a daily or hourly basis.

RIDE-SHARING
Next to car-sharing, the online platform GoMore also offers users the opportunity to share rides.

The initiatives shown above have in common to be more customer-centric and demand-orientated than the conventional provision of transport. But it has to be stated that of these initiatives solely the Rejsekort system takes a real integrated approach of transport. The other described platforms, while surely being innovative and more intelligent, are still separate systems and do not cover the complete definition of Intelligent Mobility. This brings forward that well-integrated, demand-driven transport systems are not yet developed in Copenhagen.
4.3 Potential effects of Intelligent Mobility

Challenges for transport and infrastructure have been made clear in the previous chapter. Now it is interesting to have a look at the role that Intelligent Mobility can play in solving these challenges. This section examines what effects more intelligent mobility can have on transport and on society as a whole. It is important to see what benefits and impacts initiatives of Intelligent Mobility may have on these challenges. Not all developments and initiatives have the same influence on these challenges, some are more effective than others. Still, this section aims at describing the impacts of Intelligent Mobility as a whole and not as separate Intelligent Mobility developments.

Here, the challenges for transport and infrastructure from the previous chapter are divided into challenges for society and challenges for the transport sector. Societal challenges are growing congestion, demand for new infrastructure and the trend of sustainability. Challenges for the transport sector itself are the challenges coming from technological developments and changing users’ needs and requirements for transport. Literature shows that the following impacts on societal challenges are expected (Transport Systems Catapult, 2015):

- A higher effectiveness of the whole transport system: less congestion and a reduction of the burden on the car-dependent population;
- A more efficient allocation of resources: more efficient use of capacity (matching more demand with existing supply) including infrastructure, vehicles and parking capacity;
- Lower emissions by helping the urban population in reducing its transport footprint;
- Higher modal share of public transport
- Increasing employment and vitality generated by new businesses;
- Higher social inclusion and lower isolation of certain population groups.

Effects that Intelligent Mobility may have on challenges for the transport sector are the following (Transport Systems Catapult, 2015):

- More seamless and well-functioning transport services that provide better multi-modal journeys: less complexity, more enhanced connectivity and improved speed and reliability;
- More developed, personalized and smart mobility services reflecting the users’ diverse needs and more actively engagement of users in journey planning and transport modal consideration;
- Easier access to mobility;
- Faster journeys and increased confidence in arrival time;
- Higher user experience and perceived value of public transport;
- More relevant, personalised and context-aware information;
- Profitable markets for new transport services and renewed opportunities for the traditional transport and infrastructure business sectors as part of innovative service concepts and cooperation.
CASE: STAKEHOLDERS’ VIEWS ON INTELLIGENT MOBILITY

A categorisation of each stakeholder’s interest, power and attitude has been made with the input from interviews in the Greater Copenhagen area. A graphical representation of stakeholders’ positions following Murray-Webster and Simon can be made (Murray-Webster & Simon, 2006) can be seen below. A more detailed description of stakeholders’ goals and views can be found in appendix D.

Figure 4 – Categorisation of stakeholders’ views

Governmental organisations and authorities seem to have a positive attitude towards Intelligent Mobility, much power but maybe not always a great interest. For instance, the municipality of Copenhagen is realizing relatively small initiatives that make mobility more intelligent. The city is following the developments but not necessarily actively promoting or stimulating them (Krogsgaard Niss, 2016). The Ministry of Transport is supportive to Intelligent Mobility initiatives, but does not see guaranteed benefits from these and thus is not focusing on such developments (Skrumsager Hansen, 2016). For transport providers a distinction has to be made, between ‘traditional’ transport providers and providers of new mobility services. The traditional transport providers have great power and a sharp interest in the development of Intelligent Mobility, but such companies do not always have a positive attitude towards it. Movia is thinking about integrating more with new modalities as last-mile transport, but keeps seeing itself as the main provider of public transport (Enemark, 2016b). Movia is not afraid of new entrants to the market for mobility and in this sense Movia should not be considered as a ‘traditional’ transport provider. Taxi companies have a more negative attitude towards working together with new mobility services that will change the current way of doing business. Providers of new mobility services have power, positive attitudes and great interest in Intelligent Mobility.

Mobility users in the Greater Copenhagen do not have much direct decision making power regarding the development of transport. Their attitude towards Intelligent Mobility is probably mostly positive, since it will increase the ease and quality of transport. Interests are low and users just wait until something changes in the way they travel. Lastly, data providers will become increasingly important in the future of mobility. To this development, data providers will have a positive attitude and great interest. To date, most of these providers like Rejseplanen or Rejsekort do not really have much power. Partly or completely owned by transport operators, data providers just gather data and provide information to the customer. Their degree of power might change rapidly in the future, when transport becomes more intelligent and the ownership of the data concerned with it becomes highly valuable.
4.4 THE CHANGE TOWARDS INTELLIGENT MOBILITY

Now that the concept of Intelligent Mobility and its impacts have been made clear, it is interesting to look at interactions between stakeholders and the easiness to change these. The four-layer model by Williamson can be useful in finding out about institutions in complex (technological) systems like the transport system (Williamson, 1998). Williamson’s four-layer model distinguishes between four layers of institutions in organisations and systems (Koppenjan & Groenewegen, 2005). The highest level in this model consists of culture, values, norms and attitudes, the so-called ‘informal rules of the game’. The third level can be seen as the formal rules of the game and consists of legal rules (laws and regulation). In the second layer we can find institutional arrangements or governance structures: mechanisms to coordinate transactions between stakeholders. The last and lowest layer is on the level of individual actors and looks at their interactions in a system.

To illustrate interactions between stakeholders the transport system, Williamson’s four-layer model is displayed below. Institutions on different levels for the previously described stakeholders can be seen here.

<table>
<thead>
<tr>
<th>Layer</th>
<th>Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Travel behaviour, mobility needs, car ownership</td>
</tr>
<tr>
<td>3</td>
<td>Transport law, competition law, data law, market regulation, road and vehicle taxation</td>
</tr>
<tr>
<td>2</td>
<td>Concession agreements, transport arrangements, agreements between providers, strategic alliances, timetables, transport prices, subscriptions</td>
</tr>
<tr>
<td>1</td>
<td>Reservations, payments, network management, fleet management, traffic information</td>
</tr>
</tbody>
</table>

*Figure 5 – Layer model of institutions*

On the highest level one can see norms and values deeply rooted into our culture. These include the way we travel and how we use different travel modes. The third layer describes formal rules of the games: legislation and regulation regarding transport, data and markets. On the second level one can find agreements between transport companies, arrangements between governmental institutions and transport operators, information to passengers and users and public transport subscriptions. The lowest level of institutions includes daily decisions of individual agents. These are reservations of taxis and vehicles, payments in public transport, toll roads and parking places, the management of the road network, fleet management and traffic information.
When combining the defined four pillars of Intelligent Mobility and the four layers of Williamson’s model, more insightful conclusions can be drawn. The pillar of ‘access’ involves developments like Mobility as a Service and the sharing of cars. These initiatives require changes in all levels of institutions. Dependencies and contracts between operators, users and governments will change. Also legislation and regulation have to be (re)designed for these new forms of mobility services. But probably most difficult to change will be the institutions from the fourth level: travel behaviour and mobility needs. A government focussing on the concept of Mobility as a Service, aims at changing these. But the way in which we travel and use certain transport modes is deeply rooted in our society. Ever since the introduction of the private car, owners feel attachment to it and these days having a car is a normal phenomenon. The change from owning a car or public transport subscription towards mobility offered as a service will not be easy to embed in society. Changing institutions on this level can take up to 100 years.

But also changes in institutions on the third level are not so easy to achieve. Changing these formal rules of the game can take between 10 and 100 years. Designing rules and laws regarding new mobility services (the ‘access’ theme), regulate integrated transport systems (the ‘integrate’ theme) and legislate automated vehicles (the ‘automation’ theme) can be time-consuming and difficult procedures. For several initiatives of Intelligent Mobility there is no regulation yet. National authorities or organisations in the area need to set up appropriate regulation and governance structures for redesigned transport systems. When travel modes get integrated or when a single mobility provider will operate, data has to be shared across organisations. will require changes to be made in market structures and rules. A mobility provider that integrates and offers all forms of transport to customers, needs to be regulated. The use of data by this mobility provider has to be regulated and rules need to be set up that ensure the privacy of users. The question who owns this data and who is responsible for the safe exchange of it, requires important legislative arrangements. Other challenges lie in terms of regulation of a shared-transport market. Questions here are which body is regulating and how regulation is being done. Other important issues are the taxation and insurance of shared vehicles. Parking regulation for shared vehicles needs to be arranged. Supporting shared-mobility platforms by subsidizing or offering parking spots for these vehicles, can be prevented by national legislation that does not allow electric or shared vehicles to be treated differently (Krogsgaard Niss, 2016). Other parties might not be legally allowed to resell tickets for public transportation services (Enemark, 2016b). This would make the introduction of Mobility as a Service including bus transport impossible. Again can be concluded that changing institutions in this layer can take a long time and form barriers to the realisation of more intelligent mobility.

Institutions on lower levels will have to change too, in order to realise Intelligent Mobility. Examples are new contracts between transport companies, increased dependencies of transport operators on each other, but also of users on a possible mobility provider or data integrator. Network management for operators will be different and payment systems might change. Changes in these institutions may be plentiful, but also less difficult and time-consuming to achieve.

4.5 IMPLICATIONS FROM THE EXPLORATION PART

The introduction of Intelligent Mobility brings about changes in society and as can be read in previous sections, it can help in solving several challenges for transport and infrastructure. At the same time,
the change towards more intelligent mobility also leads to new challenges and consequences for authorities. The previous section has explained how the embeddedness of institutions can lead to challenges for the introduction of Intelligent Mobility. This section summarizes these expected barriers and adds the financial and technical challenge to this.

Concluding from the exploration part of this research, the following challenges are expected if Intelligent Mobility is to be introduced in an area:

- Technical: a platform that integrates all travel modes and all payment systems has to be developed. Integrating all these services might be a difficult task technically;
- Organisational: transport providers have to work together, their services have to be integrated and a mobility provider has to be set up. Realising these changes on an organisational level can slow down the process. All actors need to have the same mind-set that is positive towards these changes in mobility;
- Institutional: legislation and regulation can prevent a platform as Mobility as a Service from being realised. The integration of ticket systems and travel modes might not be legally feasible (yet);
- Financial: the realisation of these initiatives has to be financially supported. An actor or a group of actors has to be willing to provide funding for the realisation of a mobility platform.

These challenges are intentionally kept abstract, but one can already see an indication of where to expect barriers with the implementation of Intelligent Mobility. The expectation is that barriers might be there on a technical, institutional and process-wise level. The next step in this research will be an empirical analysis in which two examples of Intelligent Mobility will be looked at. The analysis of these examples has to show whether the expected challenges are actually there and whether there are other or more barriers to the introduction of Intelligent Mobility.
CASE: CHALLENGES FOR INTELLIGENT MOBILITY IN THE GREATER COPENHAGEN AREA

Next to the challenges discussed above, some specific challenges for the introduction of Intelligent Mobility in the Greater Copenhagen area have been identified during the interviews with stakeholders in the region. These challenges or possible barriers can be seen both on a technical and on an institutional or organisational level.

None of the stakeholders in the Greater Copenhagen area is strongly against more intelligent mobility. Still, change is always difficult and organisations, especially big and old organisations, are by default reluctant to that. There needs to be an urge that mobility should be organised differently before a change will be accepted. These mind-sets are not yet at presence deeply enough within some organisations, like the Danish national government and traditional transport providers (Skrumsager Hansen, 2016). As a consequence, there seems to be no public funding available at the moment for Intelligent Mobility initiatives in the Greater Copenhagen area.

At the same time, public organisations like Movia are afraid of being too late and being dragged into the process by a third, private party (Enemark, 2016b). Public organisations share the opinion that more intelligent mobility is a good development, but that for certain initiatives it should be a public organisation that takes the lead (Enemark, 2016b). Public values are at stake and a private company is not preferable in that case, for instance with the realisation of Mobility as a Service.

Yet, there seems to be no public organisation that can jump into that gap. Rejseplanen, as being owned by all public transport providers together, could be a preferable candidate for an Intelligent Mobility platform. But Rejseplanen has been designed to promote public transport and simply adding other transport modes into their system is not possible (Enemark, 2016b). This path dependency of the system architecture of Rejseplanen brings in technical difficulties.

A possible barrier for the introduction of Intelligent Mobility in the Greater Copenhagen area is that there is not a strong central authority. Every municipality has its own jurisdiction regarding mobility planning in their area (Krogsgaard Niss, 2016). Only state-owned roads are not its responsibility, since these belong to the working area of the Danish Road Directorate (Danish: Vejdirektoratet). Mobility planning across the borders of one municipality requires coordination between different municipalities. The Capital Region of Denmark, the central authority of the area, is normally not involved in mobility issues and infrastructure planning (Grell, 2015). The lack of a strong central authority in the area complicates the realisation of Intelligent Mobility. Many initiatives have to come now from local municipalities that all have their own objectives and interests. Without coordination between developments, there is the risk that systems will be incompatible and non-integrated. This can harm the effectiveness of the more intelligent mobility in the Greater Copenhagen area and thus this issue should be taken into account for the implementation of Intelligent Mobility.

Lastly, some state that there are legal barriers that can prevent mobility to become more intelligent. National legislation prohibits the selling of public transport tickets by a third party. Furthermore, electric or shared vehicles cannot be treated much differently from normal cars, making subsidizing these vehicles difficult for local governments (Krogsgaard Niss, 2016).
PART III: EMPIRICAL ANALYSIS
5 TWO EXAMPLES OF INTELLIGENT MOBILITY

In this chapter, two examples of Intelligent Mobility in Europe will be looked at. These case studies will form an important backbone for the research. The case study method is being used to gain an in-depth understanding of these two examples (Yin, 2009). The aim is to learn more about real-world behaviour of Intelligent Mobility by getting an insightful appreciation of the cases. Next, the research questions for the empirical analysis will be presented. Then, the two cases will be defined and the selection of these cases will be explained.

5.1 STUDY QUESTIONS

Before selecting cases for the study, a list of questions will be presented. For each case, these study questions should be answered. The answering of these questions forms a basis for exploration of the cases. Without predefined questions it might be difficult to know what to look for and where to focus on in the cases. The questions give a certain scope to the case study. Together, the study questions should comprise all topics relevant for this research. To do so, the questions cover technical, institutional and decision process elements in the cases.

First, looking at it from a technical perspective, the case study should be able to explain the working and functioning of the Intelligent Mobility initiative. Just as has been done for the Greater Copenhagen area, challenges and the way the platform can help in solving these, should be discussed for the cases. Already in the first chapter of this research, the main research question has been formulated. It aims at finding out how transport market governance can be organised to make mobility more intelligent. This empirical analysis will be used in order to find answers to that question and thus, the study questions will be derived from the main research question. As seen, transport market governance is a large concept that contains out of several elements. For Intelligent Mobility, it includes the organisation of the platform or initiative. Furthermore, transport market governance is about the structuring and regulation of the market, both institutional elements. Also, one can see that regulation of the initiative or platform and the responsibility for data are part of transport market governance. Finally, from a process-wise point of view, barriers and facilitators for the introduction of the platform need to be discussed for both cases. Summarizing this section, the empirical analysis will touch upon the following questions:

• How does the platform work?
• Which challenges can be seen in its environment?
• How does the platform help in solving these challenges?
• What does the organisation of the platform look like?
• How is the transport market structured?
• How is the transport market regulated?
• How is the platform regulated?
• How is taken care of transport data?
• What are barriers to implement the platform?
• What are factors that stimulate the implementation of the platform?
5.2 INTRODUCTION OF THE CASES

The previously described concept of Mobility as a Service is a development within the broader domain of Intelligent Mobility. Mobility as a Service is an initiative of more intelligent mobility with the potential to change the way transport modes are being used. To explore possibilities and difficulties with the realisation of Mobility as a Service, examples of this initiative have been selected as case studies in this research. To date, only two examples of Mobility as a Service can be seen. These two examples are Mobility as a Service in Finland and UbiGo in Gothenburg. Both UbiGo in Gothenburg and Mobility as a Service in Finland will be used as cases in this research.

First, the choice for the selection of these two cases should be explained. The case study has the form of an explorative, multiple-case research. Its aim is to find out more about the realisation of Intelligent Mobility. Important in selecting cases is their compliance with the research’s definition of Intelligent Mobility. The list with characteristics of Intelligent Mobility can serve as a useful guideline for this purpose. Cases have to include certain elements of Intelligent Mobility to be potentially selected for this study. Characteristics are flexibility in routes, time and journey choice, customer-centric and personalization, on-demand, integrated and a whole journey perspective. The cases selected for this study include these elements.

By looking at examples of the implementation of Mobility as a Service, possible recommendations and best practices for its implementation can be found. The concepts of UbiGo in Gothenburg and Mobility as a Service in Finland are believed to be comparable, since these are both examples of Mobility as a Service. The case study focusses on how and why the exemplary outcomes from the cases might have occurred and hopes for literal replications of these conditions (Yin, 2009).

To summarize, the cases being selected for this study are the following:
1. MaaS in Finland
2. UbiGo in Gothenburg

The figure below shows how these cases are being used. Overall, Intelligent Mobility in the Greater Copenhagen area is the case of this research and thus will be analysed in-depth. The cases of UbiGo in Gothenburg and Mobility as a Service in Finland can serve as lessons for Copenhagen and other areas. These cases can provide useful insights and best practices for a potential realisation of Mobility as a Service.
5.3 **Approach**

The input for the case studies comes from interviews conducted with major stakeholders. During the entire research 10 interviews will be carried out and out of these, 5 interviews are conducted in Gothenburg and Helsinki. The stakeholder analysis of the Copenhagen area in chapter 4 has shown that different stakeholders of the transport system have different views and interests. For that reason, the stakeholders that will be spoken to in Finland and Sweden, are varying from private MaaS operating companies to governmental organisations. The following persons in Gothenburg and Helsinki have been interviewed:

- Hans Arby, CEO of UbiGo Innovations AB, Gothenburg, Sweden;
- Malin Andersson, Head of Department, Development & International Affairs, Trafikkontoret, City of Gothenburg, Gothenburg, Sweden;
- Sampo Hietanen, CEO of MaaS Finland Oy, Helsinki, Finland;
- Krista Huhtala-Jenks, Senior Officer for Digitalization in Transport and Mobility as a Service, Ministry of Transport and Communications, Helsinki, Finland;
- Sami Sahala, ITS Chief Advisor, City of Helsinki, Helsinki, Finland.

The stated study questions will be used as the starting point for discussion during these interviews. Furthermore, it shapes the structure of this empirical analysis chapter. Also the interviews done in the Copenhagen area influenced the structure of the case study. Both cases will be firstly introduced and described, next challenges in transport and infrastructure for Gothenburg and Finland will be given. Then the study focusses on the organisation of the Mobility as a Service provider. After that, the structure of the market is at point of discussion. Following, the chapter looks at regulation of the market and the MaaS provider(s). Change-preventing factors or barriers for both cases will be discussed, while in the final part it is about lessons learned: approaches to overcome barriers and to facilitate the development of Mobility as a Service.
5.4 **CASE 1: MOBILITY AS A SERVICE IN FINLAND**

The first case is based on the company MaaS Finland in Helsinki, Finland. This section will start with an introduction of the mobility service, a description of challenges for transport in Finland and it will look at the organisation of MaaS Finland. Next, there will be a look at the structure of the transport market in Finland and how regulation is changing with MaaS’ introduction. The last part of this section is an overview of barriers for change and taken approaches to overcome these.

5.4.1 **INTRODUCTION**

The concept of Mobility as a Service is considered to be ‘born’ in Finland. Not surprisingly, the realisation of mobility operators is nowhere else as much developed as in Finland. Multiple Mobility as a Service providers have started pilots or are aiming on launching their services soon in Finland. The most developed and most promising of these is MaaS Finland, on which this case study will focus.

MaaS Finland, claiming to be the world’s first mobility-as-a-service company, started its operations on February 1st 2016 (Hietanen, 2016a). MaaS Finland is planning for a limited launch of its services at the end of September 2016. Considering itself as the ‘Finnish Netflix’ in transportation, MaaS Finland will offer mobility to its users in a new way. There has not been a pilot yet for MaaS Finland, like for UbiGo in Gothenburg, so detailed information on what the service is exactly going to look like, is not available. Nevertheless, after extensive literature researching and several interviews with stakeholders, a proper description of MaaS’ functioning can be given.

MaaS Finland offers mobility as a service to its users. Users will get access, through a smartphone application, to all possible forms of transportation in Finland. In this sense, MaaS Finland will serve as an operator or integrator between transport service providers, users and third parties. All the existing transport services are to be combined into a single mobile application, so users don’t have to buy separate tickets or subscriptions for different transport services anymore. It will provide users with a 24/7 customer support and a monthly invoice for all services. MaaS Finland aims at integrating all available transport options into its services. These include public transport, car-sharing, car rental, bicycle sharing, taxi services and other transport services on demand. But also users’ private cars are intended to become part of the system, since MaaS Finland doesn’t expect people to “give up their car directly” (Hietanen, 2016a).

Differences in customers’ preferences and travel patterns have made MaaS Finland decide to offer multiple mobility packages. The pricing system, available transport services and guarantees to the user differ per package. The exact monthly prices for the packages are yet to be published, but a price indication for every package can be given already. MaaS Finland announced that its offered mobility packages are probably going to look like as follows (Hietanen, 2016a):

- **One click travel**: a pay-as-you-go type of model;
- **Monthly commuter**: a hybrid model that is integrating the user’s private vehicle into the system;
- **Ultimate mobility**: the real Mobility as a Service package.

The most basic package is the so-called “one click travel”. With this package, users are offered a pay-as-you-go type of service. MaaS Finland describes this package as a platform-model for mobility that
is comparable to platforms like Booking.com for hotels or Skyscanner for flights. Users have access to all transport services at the same individual costs as when they would have to buy them separately. The platform offers Mobility as a Service to users but it doesn’t really add value yet. It bundles all transport options, but requires the user to make a comparison between all of these.

The second type of offer is the “monthly commuter” package. This package can be seen as a hybrid model that focusses on users that don’t want to give up their private vehicles (yet). The package is designed in order to integrate a customer’s private vehicle into the service. For some trips, the user will decide to use included credits for transport services. On other moments, it might be more useful to make the trip by own private car.

The last package is the real Mobility as a Service deal and for this reason called “ultimate mobility”. Again, it combines all forms of transportation in Finland, but “this package also provides users with a real promise: the promise of mobility”. With this package people can actually get rid of their cars and trust MaaS Finland to offer them the same level of mobility. According to MaaS Finland, people own a car as a form of insurance of mobility (Hietanen, 2016a). With this package MaaS Finland hopes to replace that insurance by giving users a service level promise. Compared to the previously described platform and hybrid models, this package can be seen as an operator model. The package come in two options: limited or unlimited access to all transport services in Finland, where both are complemented with a Service Level Agreement to the user. Different from the pay-as-you-go type of package, this package comes with lower prices than when services are to be bought individually.

For users, the functioning of the service is supposed to be pretty straightforward. After downloading the mobile application on their smartphones, users can subscribe to their preferred mobility package. Depending on the package that is purchased, either available credits or pay-as-you-go prices are shown for different transport services. The application comes with a built-in multi modal travel planner, that allows users to plan their trip from door to door. The travel planner gives a comparison of transport services based on trip duration, ease and price. For users with an unlimited transport subscription for all services, prices or available credits are non-relevant and will not be shown when planning a trip. It should be equally easy to plan a trip by public transport, get a taxi or book a shared car. The application will save the confirmation of the booking and users always have access to the validated ticket for the service. At the end of the month, users will be charged for their monthly subscription to the chosen package plus possible costs for the use of transport services if not included in their monthly subscription.

Mobility as a Service by MaaS Finland is not available to customers yet, but expectations are that it will be launched this year. A more detailed time schedule or roadmap for the introduction of MaaS Finland is shown below (Hietanen, 2016a).

Early March: the packages and prices are ready
End of June: MaaS Finland has access to all transportation services
End of September: a limited launch of Mobility as a Service in Finland based on the minimum viable product: some hundreds customers for full package and access to everything
End of 2016: MaaS Finland is opening up to a wider public in Finland
2017: MaaS Finland is expanding to two more areas in Europe
2018: MaaS Finland is globally active

MaaS’ mission for this year is to prove that the concept of Mobility as a Service is possible in reality, that it can get users from any A to any B and that there is huge demand for these packages (Hietanen, 2016a). Furthermore, it wants to prove on paper that by scaling up the platform, a financially interesting service can be run. This reflects MaaS Finland’s assumption that realising a well-functioning MaaS platform is about the right pricing power and volume and about getting the critical mass involved.

5.4.2 CHALLENGES IN HELSINKI

In this section a short overview of challenges for transport and infrastructure in Finland, or more precisely in Helsinki, will be given. It is difficult to see yet how big the role of Mobility as a Service is or can be in solving these challenges. Some stakeholders’ expectations about MaaS’ effectiveness in helping to overcome these challenges will be presented here.

Challenges seen in Finland on the field of transport, infrastructure and mobility are similar to other Nordic countries. In Helsinki, there are locations of congestion and the aim is to make transport more sustainable: travelling less by private vehicle, reducing emissions and congestion (Sahala, 2015). The population in Finland is aging and at the same time growing in Helsinki. More traffic is being expected in the future. The government wants to cover this growth by public transport and more shared-use of vehicles.

The Ministry of Transport in Finland and the City of Helsinki definitely see Mobility as a Service as the answer to challenges in transport and infrastructure in the country. The governmental focus is, consequently, largely on the implementation of this concept (Huhtala-Jenks, 2016). Authorities in Finland believe in the effectiveness of Mobility as a Service in getting travellers out of their private vehicles, using more sustainable ways of transportation. Although its effects on congestion- and CO2-reduction are not proven yet, the results and outcomes of Mobility as a Service are perceived by authorities as being beneficial to society in Finland.

5.4.3 ORGANISATIONAL STRUCTURE

This section aims to analyse the organisation of the mobility broker MaaS Finland in Helsinki. MaaS Finland is a private company registered in Finland as MaaS Finland Oy. MaaS Finland is responsible itself for most of its operations. It will design the mobility packages, contract transport providers, develop the mobile application including travel planner, integrate ticket and planning systems and attract new customers with marketing. Customer support, which is available 24/7, is outsourced to a specialised company. At the time of writing, before the launch of its services, 3 people are employed at MaaS Finland (Hietanen, 2016a). The expectation is that during the year the amount of employees will grow to about 10 persons. MaaS Finland states that it doesn’t have to grow huge regarding the amount of employees, because their role is that of an integrator. The actual transport services are being done by transport providers with their own personnel. MaaS Finland, that integrates these services and offers them to users, doesn’t have to be involved in the operations of the transportation and thus, for now, can stay relatively small.
For the financial part, MaaS Finland is dependent on mostly private investors. In its first call for funding it raised a total of 2.2 million euro from private investors and the Finnish Funding Agency for Technology and Innovation Tekes (Hietanen, 2016b). During the investment round, the interest by international players was that big that the number of potential investors exceeded the stock available. A second investment round is planned for autumn 2016 to raise hundreds of millions for MaaS Finland’s global expansion. The 2.2 million euro that has been raised now, is expected to be enough to finalize the product and start up in three countries including Finland. The biggest single owners with a 20 percent interest in MaaS Finland are Transdev, a French transportation provider operating worldwide and Karsan Otomotiv Sanayii and Ticaret AS, a Turkish car manufacturer (Hietanen, 2016b). A ten percent stake is being held by Sampo Hietanen, CEO of MaaS Finland. Other investors are InMob Holdings of Cyprus, Neocard, Korsisaari, GoSwift, MaaS Australia, Goodsign, IQ Payments and Delta Capital Force. Tekes, the Finnish Funding Agency for Technology and Innovation is also funding MaaS Finland in the form of a soft loan. The interest rate for this loan is only one percent and in this way the Finnish government is financially supporting the development of a Mobility as a Service platform in Finland (Huhtala-Jenks, 2016).

MaaS Finland is a private company that is not owned by any public organisation. MaaS Finland thinks that is a good thing and a necessity in order to scale (Hietanen, 2016a). A public transport provider or a private transport provider becoming a Mobility as a Service operator might not be the right option, according to MaaS Finland. It states that this has to be a third party offering these services, because the Mobility as a Service operator cannot have its own transport services. It would in some way always try to favour its own services. In order for a mobility broker service to be successful and legitimate, it has to be offered by an independent third party. This mobility operator like MaaS Finland has to rely on other companies and their ability to offer transport services. The City of Helsinki also doesn’t believe that transport providers, public and private, can properly integrate their services themselves so it is important that a third party takes that role, looking at it from a couple steps back (Sahala, 2016).

Concerning government involvement in the platform, MaaS Finland thinks it would not be effective if a public organisation is setting up a service like Mobility as a Service. The problem is that a governmental organisation cannot scale and grow as fast as a private company can (Hietanen, 2016a). It will always focus on offering the service within its region or country. According to MaaS Finland, having a public organisation funding the system and getting it started, can be useful, but it shouldn’t become the solely body of a MaaS platform. It says that investments are needed of course, but when a public organisation does so, it should be a minority shareholder with an exit plan. Next to that, any exclusivity between a public investor and a MaaS company should be avoided. The city recognizes this too and states that there needs to be a strong and clear line where the activities of public transport operators stop and where the government leaves it to private companies (Sahala, 2016).

Finland will be the starting point for the service offered by MaaS Finland, but already within a year it plans to expand towards two other countries. In 2018, it hopes to be globally active. Probably activities for services abroad will not all be arranged from the office in Helsinki, but it certainly is not MaaS’ intention to work on a franchise basis. In this sense, it will decide about its own expansions and roll out activities in other countries itself.
This section will focus on the structure of the transport market in Finland. It aims at analysing how the introduction of MaaS Finland would change the structure of the market and interactions between organisations. First, the current structure of the transport market will be looked at. MaaS Finland will operate in entire Finland, but large parts of Finland have a very low population density. The services offered by MaaS Finland will be most useful to inhabitants of Helsinki and its surroundings. Therefore, this analysis will put strong emphasis on the Helsinki area and changes in the transport market here.

Having a look at train transport in Finland, the description is pretty simple: the state-owned railway company VR is responsible for all passenger rail services in Finland (VR Group, 2016). It does so under a transportation agreement with the Finnish government. Tramway traffic, metro and ferry services in Helsinki are being operated and managed by Helsinki City Transport (HKL), a public transport company owned by the City of Helsinki (City of Helsinki, 2016). The Helsinki Regional Transport Authority (HSL) is responsible for the planning and procuring of public transport in Greater Helsinki. This governmental body is in charge of the network planning, fare system, marketing and customer information. It also does the tendering of bus services and thus does not own any busses itself. Different public, mostly city or region-owned bus companies operate in different parts of the country. In recent years, more regional express services have been established in Finland, mostly operated by private companies. ExpressBus is serving a large network of connections between all major cities and is facing severe competition from Onnibus, a low-cost provider of express bus services (ExpressBus, 2016).

Other transport options in Finland are taxi services and car rental, both offered by several private companies. Helsinki also has transport on demand and soon a bicycle sharing scheme. Transport on demand in Helsinki is being offered by Uber and a demand-responsive bus service called Kutsuplus (Uber, 2016a). The latter, offered by the Helsinki Regional Transport Authority, can be seen as a hybrid form of a taxi service and public transport. Operations of Kutsuplus were ended by the end of 2015, but are expected to resume in 2017 (Sahala, 2016). Deregulation was necessary for the continuation of Kutsuplus, allowing private companies to offer the service. Now it has proved to be profitable, the service needs private investors. The need for deregulation and search for private investors explains the one-year gap in Kutsuplus’ operations. A bicycle sharing scheme is currently being procured by the City of Helsinki and is planned to be operational by May this year (Yle, 2015).

And now Mobility as a Service is making its appearance here. According to MaaS Finland, this will change a lot to the Finnish transport market (Hietanen, 2016a). Players on the transport market almost always operate locally and there are not real global service brands in transport. The introduction of Mobility as a Service will change this and the market, currently full of local players with relatively low profitability, will become more digitalized and consolidated. MaaS Finland predicts that the profit increase for transport providers doesn’t come from higher users’ spending, but from lower car ownership and thus lower revenues for car manufacturers (Hietanen, 2016a).

What can be seen now is that three companies are entering the market for Mobility as a Service in Finland. These are MaaS Finland, Tuup and TeliaSonera (Huhtala-Jenks, 2016). All companies take a different approach for the introduction of their service. Tuup will be active in the region of Turku,
Finland’s third-largest urban area. TeliaSonera, the leading telecom provider in the Nordic countries, starts services on a small scale in Finland. MaaS Finland seems to have the largest offering for its services in Finland and hence so far the highest potential of the three. The market for Mobility as a Service is an open one, meaning as many providers as interested can enter the market. Consequently, the market will be competitive and the Finnish government hopes to keep the sector innovative in this way (Huhtala-Jenks, 2016). MaaS Finland supports the open character of the market and thinks that transport is too big for monopolistic ideas. It presumes that a competitive market will result in the best possible outcomes for users and the largest market share for the Mobility as a Service provider with the best offering (Hietanen, 2016a). Also the City of Helsinki is supportive of a market with multiple mobility operators available (Sahala, 2016). For all organisations involved it might be difficult to establish a competitive market for Mobility as a Service, while it is considered the most-efficient market structure. Difficulties come from technical issues (e.g. when several MaaS operators have to use the same shared car system) and institutional issues (making sure that providers don’t harm each other or set up entry barriers for newcomers in the market).

Another point of attention is the cooperation between Mobility as a Service operators and transport providers. Also here, MaaS Finland prefers to take the competitive market-approach. It aims at including all providers of transport in its system if these providers are interested. Exclusivity between a mobility operator and a transport provider might limit the end-user’s potential. Developments in the market are expected to go faster when there is no bottle neck in the market in the form of a mobility operator with an exclusive contract. MaaS Finland describes its system as a puzzle: “What if we would have a both-ways-exclusive deal with a car rental company that turns out not to be best one? Other companies might have better offers for our users, but we are stuck with company A. The whole puzzle will suffer from that since all transport services are integrated and connected.” (Hietanen, 2016a) It also works the other way around, when a transport provider can’t change its mobility partner because of an exclusive contract. So from both the market perspective and the transport provider perspective, exclusivity between mobility operators and transport providers should be prevented. If you bring back the discussion of competition between mobility operators, exclusivity between mobility operators and transport providers can be harmful. When the market is open, but one operator gets exclusive access to an important provider, like a monopolistic train company, it can seriously destroy businesses for the other mobility operators. The current market structure and the market structure with Mobility as a Service in Finland are illustrated in the figure below, showing that multiple MaaS operators can be active here and that not all MaaS operators need to have non-exclusivity. One need to keep in mind that transport users can, also after the introduction of MaaS, still purchase transport services from the transport providers themselves without interference of MaaS Finland, though these lines have been left out of the figure for simplification reasons.

Looking at information sharing between providers and MaaS Finland, there are several possibilities for the organisation of it. The option of a centralized data platform, is a no-go for MaaS Finland (Hietanen, 2016a). Such a platform can aggregate all data regarding travel time, connections, availability and user status from all transport providers. The tendering phase of one platform that serves them all, would take up to a year according to MaaS and then it still wouldn’t be efficient. For a Mobility as a Service operator, a platform of data is another entrepreneur in the value chain. The information from travel providers is an essential part for MaaS’ business and with a platform it doesn’t have any control over that, so MaaS will be a cost base for the data platform operator. MaaS Finland
wants to provide a good service to the end-user and it thinks it cannot offer that when there is a government-run platform in which it has no saying. MaaS Finland, then, cannot control the accuracy and the delivery time of the data because it gets the information for free from public and open system. In order to ensure accurate and real-time data, MaaS Finland needs direct integration with transport providers’ systems. It argues for an open-up of the so-called APIs or system interfaces so a collective data platform is not needed.

Figure 7 – The transport market before and after the introduction of MaaS Finland together with possible other MaaS operators

5.4.5 Regulation

Together with changes to the structure of the market, the introduction of MaaS Finland will have consequences for market regulation. This section aims at finding out what is changing in regulation and legislation in Helsinki area and Finland with the realisation of Mobility as a Service here.

Mobility as a Service is the core policy regarding transport at the moment for the Ministry of Transport and Communications. Generally said, the ministry aims at creating the right environment or the ecosystem for new and better services to be developed in Finland. It states that the public sector is too heavily involved in organising and providing transport services, which is something that has to be changed (Huhtala-Jenks, 2016). Public actors shouldn’t mingle with the market where private sector could be making a profit. When asking the Finnish Ministry of Transport or the City of Helsinki about their role in the development of Mobility as a Service, they would describe it as ‘enabling’ (Huhtala-Jenks, 2016; Sahala, 2016). This means that the government doesn’t want to take an active role as a player in the market, but wants to steer the market by creating rules of the game and regulating. This
regulation seems necessary on two areas in the market: on the line between MaaS Finland and transport operators and between MaaS operators themselves. This section will have a look at both.

Starting with regulation on the playing field between Mobility as a Service operators and transport service providers. None of the players thinks this area should be overregulated. But it seems important that regulation is there that allows parties to open up their systems for each other. An often-heard term is ‘opening up APIs’, which means that everyone can get access to data from a certain system because it has an open interface. The API is the interface of a system, the connection with the outside of the system. Open APIs make it possible for MaaS Finland to get the necessary data from transport providers into its system. In this way MaaS Finland can offer for instance the planning of public transport or booking of shared cars to its users. The other way around, it also gives transport providers the opportunity to verify purchased tickets or bookings made in the mobile application of MaaS Finland. The optimal solution is not to force transport providers to open up their APIs, according to MaaS Finland (Hietanen, 2016a). Regulation has to allow them to open up, but not force. However, for monopolistic players such as the railway company, regulation that forces them to open up their systems, might be necessary. When these players don’t allow anyone to use their data and in this way prevent another party from coming on top of them, the market for Mobility as a Service will not work. MaaS Finland thinks that there is no justification for such a move and therefore regulation could force them to share their data (Hietanen, 2016a).

The Ministry of Transport in Finland agrees on the importance of regulation for open APIs of transport providers. It works on a new transport code that should be in place by next year. With these rules, the openness of data in transport will be promoted. But the Finnish government realises that enabling is more than just opening up the APIs of transport providers (Huhtala-Jenks, 2016). It has to understand the players and customers to make an efficient market possible. Regulation has to be there to prevent that ‘the winner can take it all’. It should be possible for new companies to enter the MaaS market in Finland, not being impeded by existing MaaS operators to commence services. Exclusivity between a major transport provider and a MaaS operator should be prevented so no MaaS operator can get a monopolistic position in the market according to the ministry (Huhtala-Jenks, 2016).

The Finnish government is not trying to enable or sell a single solution, but trying to create the right environment for a whole scale of new types or services. It states that it is not in the place to tell what types of services those will be, because that is not its expertise (Huhtala-Jenks, 2016). Public values have to be taken care of tough and this is done via regulation. This includes guaranteeing consumer protection for end-users and non-exclusion of certain groups, but also that on a systematic level it is geared to the same policy goals of sustainability and safety (Huhtala-Jenks, 2016). A MaaS operator that puts everyone in taxis and consequently creates more traffic in Finland, does not support higher level policy goals. Furthermore, the ministry needs to have the right means to tackle monopolies, whenever they occur. A MaaS operator having an exclusive deal with a taxi company is not a problem from a ministerial point of view, but one having exclusivity with the only operating train company, that is a barrier. Said differently, exclusivity is not a problem, monopoly is. With regulation the ministry wants to prevent monopolies or any other types of major market failures.

Needless to say, the use of personal data in the transport market needs regulation. The introduction of Mobility as a Service requires rules for the safe keeping of users’ data and for customers’ privacy.
Finland is already known to be a country with a high level of data privacy and security. It has stringent rules for the gathering and using of data. Regarding data privacy, the Finnish government is focussing on the initiative of MyData, that is not only a transport topic. MyData is being described as a “human centred approach in personal data management that combines industry need to data with digital human right” (MyData, 2016). The main thought is to let individuals be in control of their own data. The development of this model, its services and infrastructure are being facilitated by the Ministry of Transport and Communications. The system would give MaaS’ users the option to access their data and control how and which parties can use their data. MaaS Finland adds to this that it does not see a point in making money from selling users’ data, since users are already paying for MaaS’ services. The government is interested in getting data, aggregated or anonymous, from Mobility as a Service operators (Huhtala-Jenks, 2016). The question remains whether this will be forced upon them or strongly requested under the saying of “you get our data, in return we also want yours”.

To summarize, one can see that measures from the ministry are threefold. The first subject on which the Finnish government is working, is regulation. More specifically, it is working on the so-called transport code that includes re- and deregulation, the gathering of all laws and regulation dealing with markets, market access and the functioning of the market. The transport code is aiming at streamlining regulation. The transport sector in Finland is heavily regulated and with the establishing of the transport code, the ministry tries to make transport regulation technology and mode neutral. Technology and mode neutral means that regulation is not different for different transport modes and technologies in transport. The transport code will be developed in three steps and its first package will be issued to the parliament by this summer. The first major changes are then expected to come into force by the beginning of 2017 (Huhtala-Jenks, 2016).

A second ongoing project is making the regulative environment suitable for new, innovative digital services based on data. By doing so, the Finnish government is the first one in the world looking at data regulation for the transport sector (Huhtala-Jenks, 2016). A third point of interest for the ministry is the concept of open data and open APIs. And again, the ministry wants to draw the fine line that characterises the border for public involvement. It is looking at how to be actively involved and pushing the sector forwards without mingling with the end-user. Specifically, this means finding ways to do pilots and supporting those across the country.

To conclude, it is interesting to see Mobility as a Service from a European perspective. When you look at transport regulation, Finland is way more strictly regulated than other countries in the European Union and regulation on transport in Finland goes well beyond EU regulation (Huhtala-Jenks, 2016). The Finnish ministry thinks that European regulation is not always helping the realisation of MaaS: a lot of it is very specific technical regulation, focussing on separate and individual modality silos. Where Mobility as a Service is removing borders between transport modes and not thinking in modal silos, European legislation that has different rules for each transport mode can form a difficulty for its development. Following the Finnish opinion, the European Commissioner for Transport, Violeta Bulc, also stresses the need for a reform of European transport regulation. She states that European legislation takes too much of a ‘silo’ approach, thinking in individual modes of transport, where an integrated regulatory framework is needed (Bulc, 2016).
5.4.6 Change-preventing factors

This section looks at the factors that are being seen as barriers for the introduction of Mobility as a Service in Finland. Barriers from three different perspectives can be distinguished: technological, institutional and process barriers facing the introduction of MaaS. All three types of barriers will be discussed more detailed below.

The biggest barrier for the introduction of Mobility as a Service is resistance from current players, such as the national train operator in Finland. The Ministry of Transport, the City of Helsinki and MaaS Finland see this as the factor that is mostly slowing down the realisation of mobility operators in Finland (Hietanen, 2016a; Huhtala-Jenks, 2016; Sahala, 2016). The resistance is coming from a mind-set in some transport providers, especially public ones, that are reluctant to change. Current players have invested interests: a certain position in the market, a vested brand and image, communication channels with customers and expectations of the future. These companies are not so eager on doing things differently and prefer to hold on to the system that is there. The City of Helsinki calls it ‘fighting the inevitable’ (Sahala, 2016). MaaS Finland explains that transportation providers don’t want to be just a cost base (Hietanen, 2016a): they are afraid that MaaS is getting on top of it and will try to get some of their profits. These providers find it scary to give away customer access and relationships. But MaaS Finland wants to stress the opposite. Instead of losing market share, Mobility as a Service can help these providers to scale, to improve usage and efficiency and thus increasing profits, according to MaaS Finland. The business case that MaaS Finland is working with, is seeing increased profits for transport providers and MaaS operators coming from lower ownership of private vehicles. It says there is an excessive amount of money available at the poor usage of cars. MaaS Finland expects that it can increase profits for all included transport providers by increasing the demand for these modes and by lowering private vehicle usage. In Finland, a lot of providers recognize the inevitability of the change and realized that they can better get along. The ministry agrees that public transport is not disappearing or getting less important with the introduction of Mobility as a Service (Huhtala-Jenks, 2016). It thinks that there are new transport modes popping up next to public transport and Mobility as a Service makes it easier to use all of these options without replacing them.

According to MaaS Finland, everyone is on board now and the ecosystem in Finland is getting ready (Hietanen, 2016a). Organisations had to change their mind-sets, had to change their systems and goals and government’s role had to change from doing to enabling. The bulk of that process has been gone through now, but other areas developing a MaaS service can expect similar difficulties in the process.

Both the Ministry of Transport and MaaS Finland agree with each other that technology isn’t much of a barrier for the realisation of Mobility as a Service (Hietanen, 2016a; Huhtala-Jenks, 2016). MaaS Finland stresses that a critical mission in technology is getting access to both APIs: the one for route planning and the one for ticketing (Hietanen, 2016a). Especially the API for ticketing in public transport is difficult to get access to as a MaaS operator. It has to run in the background and the mobile validation of tickets forms a problematic issue that had to be solved.

Regarding customers’ mind-sets, the ministry argues that consumers’ habits and behaviour will change with the introduction of Mobility as a Service (Huhtala-Jenks, 2016). It thinks that society’s habits of owning private vehicles does not form a barrier for the realisation of mobility services and
that users will change their behaviour when they are offered something that is worthwhile for them. MaaS Finland adds to this that it is important to have a large enough cover area for customers (Hietanen, 2016a). Mobility as a Service might not be something that you can implement on a city or regional level. Also the City of Helsinki acknowledges that transportation doesn’t stop at the borders of the Helsinki region (Sahala, 2016).

5.4.7 Lessons learned

Already in the previous section, there has been a discussion on the barriers for the introduction of Mobility as a Service in Finland and which approach has been taken to overcome those. This section will continue on that topic and furthermore draw some preconditions that should be met for a city, region or country introducing the concept of MaaS in its area. The taken approaches on how to overcome barriers can be considered as facilitators coming from the introduction of MaaS in Finland and best practices that can serve as a starting point for the realisation of Mobility as a Service in other areas.

A first point of attention is the need for a different approach in urban and transport planning. The role of urban planning is not something that will change with the appearance of Mobility as a Service, it should only be planned more modular and more flexible on a smaller timescale (Huhtala-Jenks, 2016). These days, urban planning is looking at what mobility looks like now, while the future can be completely different from today. When the city is building or redeveloping a certain hub or transport node, it should also consider transportation of the future. This can prevent the emergence of a chaotic situation in which dozens of different transport options, that are not anticipated for, come together at that hub. The urban landscape will change if MaaS offers an attractive solution to not just having a single-occupant car. One can see that transport infrastructure is changing and moving from a corridor-based system towards a more hub-based system (Huhtala-Jenks, 2016). Integration of and changing between transport modes will become increasingly important and with this also the role of hubs or nodes in the system. Investments in infrastructure will still be needed, but not just somewhere. Instead of building huge corridors or parking spaces, cities have to think more in infrastructure that is as ‘pluggable’ as possible. In this way, the transportation system can become an ecosystem in which someone can come up with a new service and integrate that into the current transport system without years of development. This ‘pluggability’ asks for standardization, in which one can see a role for the European Union. Other infrastructure investments are those in data networks. Now transport is becoming more heavily data-based, the development of the 5G-technology is essential. For transport services from the future, data has to be precise and exact. Finland sees the realisation of 5G important for Mobility as a Service and crucial for the introduction of automated vehicles (Huhtala-Jenks, 2016).

A second ‘lesson’ from Finland is the governmental approach taken in the process towards Mobility as a Service. An important part of this approach is the cooperation between public and private organisations in Finland. The Finnish ministry aimed for open discussions regarding the topic with the early involvement of the private sector (Huhtala-Jenks, 2016). Both sectors came together for dialogs, think-tanks on many levels and open discussions between public and private companies. In this phase of dialog, there was a total lack of hierarchy, so anyone could talk to anyone. Of course the public sector cannot avoid procurement legislation, but by involving the private sector in an early stage, the tendering has been much more sophisticated and a couple steps beyond how it would have otherwise
been. Not only the governmental approach in Finland is open, the government has also been pushing for openness of the technical environment. This includes openness of data and APIs and more than 1300 datasets that are already open for some years now (Huhtala-Jenks, 2016). Finally, the active and supportive role of the ministry characterizes the approach taken concerning MaaS in Finland. The ministry is heavily looking into deregulation, because current legislation really pinpoints what is allowed and subsequently doesn’t leave much room for new services. The Finnish government recognizes the opportunity that MaaS gives them in helping to achieve sustainability and transportation targets. Realizing that, the ministry has been really keen on enabling that change to happen.

5.5 CASE 2: UbiGO IN GOTHENBURG

The second case is based on the company UbiGo in Gothenburg, Sweden. This section will start with an introduction of the mobility service, a description of challenges for transport in Gothenburg and then it will look at the organisation of UbiGo. Next, there will be a look at the structure of the transport market in Gothenburg and how regulation is changing with UbiGo’s introduction. The last part of this section is an overview of barriers for change and taken approaches to overcome these.

5.5.1 INTRODUCTION TO UbiGO

UbiGo describes itself as “a charter company for everyday travel” (Arby, 2016). It provides mobility to its customers ‘as a service’. UbiGo is an example of a Mobility as a Service platform and is currently under development in the city of Gothenburg in Sweden. The platform integrates public transport, car-sharing, taxi services, car rental and a shared-bicycle system (UbiGo, 2015a). Users can order these transport services in one mobile application for smartphones. There is a 24/7 customer support available to users. The service works as a monthly subscription and can be compared to a flexible mobile phone subscription. Instead of having a monthly package of minutes for calling and MBs for data, UbiGo offers a monthly package with units for transport by public transport, car, taxi and bicycle. UbiGo is focussing on households and provides one package of transport for a household, so all members from that household can order transport from the same bundle. Because UbiGo can buy transport services in greater volumes from transport providers, it can offer its services at competitive prices to customers. By making transport services simple, flexible and affordable for users, UbiGo aims at making everyday life easier and cities more sustainable (UbiGo, 2015a). Providing an alternative to car ownership is its mission. The next paragraph will explain in some more detail how UbiGo actually works.

The UbiGo service offers one-stop access to a range of transport services through a web-interface adapted to smartphones (in other words: an app). Households sign up for a subscription service, that includes a monthly package of their desired combination of, and amount of credit for, the following transport services (Sochor, Strömberg, & Karlsson, 2014):

- Public transport
- Car-sharing
- Car rental
- Bike-sharing
- Taxi service
For public transport, users receive credit in the form of daily tickets for four zones. When more zones are needed on a particular day, an upgrade is possible for an additional fee per additional zone. When in need of less than four zones, a downgrade is possible and a rebate is offered. Public transport in the Gothenburg area is provided by Västtrafik and includes train, bus, tram and ferry. With a daily ticket, UbiGo users can travel for 24 hours using all modes of public transportation offered by Västtrafik. For car-sharing, credits are provided in the form of hours. A whole day is charged as 12 hours. Car-sharing in Gothenburg is offered by Sunfleet. Sunfleet offers more than 100 shared vehicles in and around Gothenburg, most of them Volvo cars in different size categories. Regardless of the car model of the rented vehicle, the price is the same. All vehicles have their own reserved, dedicated parking spots, where vehicles have to be placed again after renting. For every hour of rental, 10 kilometres of driving are included. Also fuel is already included in the price. Additional kilometres incur fees per 10 kilometres. For car rentals, credits are also provided in the form of hours. The minimum rental period is 24 hours and charged as 18 hours of credit. Additional rental days were charged at lower rates (days 2 to 4 cost 12 hours of credits per rental day). There are higher prices for larger car models and users are also charged a daily insurance fee and a fixed fuel fee per 10 km and litre. The provider for car rentals is Hertz. UbiGo’ customers have access to Gothenburg’s bicycle sharing system, for which their subscription to UbiGo covers the membership fee. The bike-sharing system is called Styr & Ställ and provides cyclists in Gothenburg with 1000 bicycles, available at 60 stations spread out in the city. Every first 30 minutes are for free. Additional fees are invoiced when a bicycle is being used longer than half an hour. The system is only available during ‘the season’, running from March till December. A taxi service is available at a reduced price for UbiGo users. Bookings are invoiced at the end of the month. Gothenburg’s largest taxi company, TaxiKurir, provides these taxi services.

Households can purchase a certain amount of prepaid credit every month. When households run out of credit for a particular travel service during the month, more credit for that service can be purchased in the app. The costs for the additional credit will appear on the next invoice. Households are able to change the amount of credits for services every month, both up and down. Credit that is not being used during the month, is being rolled over to the next month.

UbiGo users can log into the app with a Facebook or Google account. In the app users can activate tickets and trips, make and check their bookings and access tickets that are already activated. The app also gives access to details about users’ balance, bonus and trip history. If support is needed, users can access the FAQ in the app or contact the customer service. Customer service is available 24 hours per day through phone. After subscribing to the UbiGo service, households receive a smartcard that can be used to unlock booked cars and bicycles. When travelling with public transport, the activated ticket can be shown from the app.

UbiGo provides users with a simple, flexible and priceworthy way of travelling, all available from one app. Besides this, UbiGo offers some more benefits to its users, which are:

- “An improved travel guarantee;
- A more generous public transport zone system;
- A bonus system for eco-friendly travel.” (Sochor et al., 2014)
For public transport in Gothenburg, a ‘travel guarantee’ exists. If customers estimate that they will be at least 20 minutes late using Västrafik and the fault is by Västrafik, they are compensated for taking a taxi to their destination. UbiGo extends this service in the sense that UbiGo takes care of all the paperwork. UbiGo customers can use the app to order a taxi if their public transport service is delayed by 20 minutes or more. At that moment, UbiGo is paying for this taxi service. UbiGo will reclaim the extra expenditure from Västrafik later, saving the customer a lot of hassle.

Secondly, the public transport zone system has expanded zones for users of the UbiGo service. For travellers living outside of the current inner zone, this means cheaper public transport while using UbiGo because they stay within the inner zone now.

Also, UbiGo is offering a bonus system or reward scheme for environmental friendly travelling. When users decide to use eco-friendly travel mode choices, UbiGo rewards them with points. The points given are calculated based on the amount of CO2 that is being reduced by using a particular travel mode relatively to making the same trip with a private car. When enough points are collected, these can be exchanged for goods and services provided by sponsors. Rewards include tickets to museums, the opera or a swimming hall, gift cards, audio books and more.

The UbiGo service has been tested in Gothenburg for half a year (Sochor et al., 2014). During this pilot or Field Operating Test (FOT) 70 paying households have been subscribed to UbiGo. The pilot ran from November 1, 2013 to April 30, 2014. More than 12000 transactions have been made during the pilot period, varying from public transport ticket to car and taxi reservations. The pilot of UbiGo had some characteristics that probably will be different in the ‘real’ version of UbiGo, which launch is planned for 2016. One of these derogations is that households have been paid back their remaining credit at the end of the pilot period. Furthermore, during the pilot households have been compensated for not using their private vehicles. They received a compensation to offset the costs for insurance and parking of the car up to a certain level.

Before, during and after the pilot, research has been done on motivations, expectations and evaluations by users (Sochor, Strömberg, & Karlsson, 2015). The research has led to published outcomes from the pilot and its results were very positive. Almost 97% of the participants in the pilot stated that they definitely want to continue using UbiGo’s services in the future; 93% would recommend UbiGo to others; and 69% had become more satisfied with their travel (Sochor et al., 2015). The pilot showed a swift away from private car use towards more environmental friendly forms of transport such as public transport, cycling and car-sharing. Participants of the UbiGo pilot have been using shared cars more (a 200% increase) and using their own cars less (a 50% decrease). Furthermore, 97% of the participants that experienced changed travel behaviour, stated that they were satisfied with these changes (Sochor et al., 2015).

Coming from the evaluation of the pilot, some improvements in UbiGo’s services were required in follow-up versions by users. These include an upgrade of the app, the including of a multi-modal travel planner instead of ‘just’ a booking service and feedback about travel patterns. Furthermore, users are expecting the service to remain economically advantageous and they would prefer paying for services used at the end of the month instead of before. Furthermore, the pilot of UbiGo has shown some mismatches between expectations of different stakeholders. Firstly, it turned out that users of UbiGo have been travelling less by car than expected beforehand. For that reason, they purchased too many minutes for car travelling at the beginning of the month. Participants were satisfied with this change.
and lower car use is also a Swedish societal goal, but from the perspective of a profit-driven company this lower revenue is less beneficial. Another mismatch can be seen in the basic structure of UbiGo. Public transport forms the core of UbiGo’s service and it is a Swedish national and local societal goal to increase public transport use. At the same time, the more customers of UbiGo using public transport, the lower the profit for UbiGo. The paradox comes from the public character or status of public transport and the fact that it is being subsidized by taxes. It is not possible for UbiGo to benefit from volume purchasing on public transport because it is being subsidized. UbiGo cannot make profit on public transport trips because users will not buy the service if public transport within UbiGo would be more expensive than it is normally. Lastly, the City of Gothenburg found out during the pilot project that it should not frame itself as a stakeholder in Mobility as a Service. Although the city was promoting UbiGo during the pilot, it decided that there is no role for the municipality in a follow-up version. Marketing of the UbiGo service should be left to the company and the city doesn’t want to interfere too much with the implementation of Mobility as a Service in Gothenburg.

5.5.2 CHALLENGES IN GOTHENBURG

In this section a short overview of challenges for transport and infrastructure in the Greater Gothenburg area will be given. It is difficult to see yet how big the role of Mobility as a Service is or can be in solving these challenges due to the relatively limited scope of the pilot and the short test period. Some stakeholders’ expectations about UbiGo’s effectiveness in helping to overcome these challenges will be presented here.

The most important challenge for the area of Gothenburg is the problem of congestion. According to the city, population is growing and thus the amount of cars on the streets. The City of Gothenburg has an aim to decrease car traffic by 25 percent in the next years (Andersson, 2016). A system of congestion charges has been set up to decrease the amount of cars coming into the city zone. So far, this measure seems to have decreased car traffic here with 10 percent (Andersson, 2016). Furthermore, public transport is not as reliable and widely spread as the city is aiming for. Therefore, in the coming years, big investments are planned in the expansion and improvement of public transport in the Gothenburg region. The city hopes to increase the share of trips being walked, cycled or made by public transport and consequently aims at decreasing car traffic in the city.

The company of UbiGo is convinced that it can help in solving these challenges, by getting people out of their private vehicles and into busses and shared-vehicles. The City of Gothenburg is not convinced of UbiGo’s effectiveness yet. It argues that shared car systems like Car2Go and DriveNow have not proven yet that people own less private cars and make less car kilometres (Andersson, 2016). It believes that such a system initially puts more cars on the street without proven results. It agrees that every initiative that leads to less cars and better access to transport also for less affluent citizens is being supported by the city. But, with the results shown so far, it favours the improvement of public transport, walking and cycling in the area over actively promoting of Mobility as a Service.

5.5.3 ORGANISATIONAL STRUCTURE

This section aims to analyse the organisation of the mobility broker UbiGo in Gothenburg. UbiGo is a private company registered in Sweden as UbiGo Innovation AB (UbiGo, 2015b). UbiGo works closely together with Ericsson AB, a Swedish corporation that provides communication technology and
services. Ericsson is responsible for the technical platform (the mobile application and everything ‘behind that’), while UbiGo provides the business concept. The contract between UbiGo and Ericsson works on a ‘pay-as-you-grow’ basis: Ericsson develops the Mobility as a Service platforms and UbiGo pays for the usage of that platform (Arby, 2016). In this way, the still relatively small company of UbiGo doesn’t have to reach out for investors to put millions of kroner into the development of the platform. Ericsson is responsible for the development of and the investment in Mobility as a Service platform and UbiGo uses that platform for its services.

At the moment, before the actual re-launch of the platform, there are two people working at UbiGo. Together they are responsible for the set-up of the mobility broker service and the building of the brand UbiGo. The customer support, available 24/7, is a part of UbiGo that is being outsourced. The same company as is responsible for Sunfleet’s car-sharing customer service is UbiGo’s subcontractor for these services. The reason for this is that most questions from customers are expected to be about the shared cars service, as being relatively new to most users. The invoicing to customers of UbiGo is a part of business that UbiGo will do itself. Same goes for the payment to transport providers, or ‘suppliers’ as UbiGo titles them. The company UbiGo will focus on the development of a package service to customers, marketing and negotiations with suppliers.

UbiGo focuses on getting access to transport services, not on the planning of travel or finding out how to get from A to B. UbiGo is about the ease of transport services, not about finding the right transport service. The idea is that travellers normally know what transport mode to choose when travelling in their hometown, but that getting a ticket for the service or payment for the trip is an annoyance. When travelling in another city or making trips that you normally don’t make, a travel planner is needed. People expect this information, the trip advice coming from the travel planner, to be free and so for a private company as UbiGo, there is no profit to gain from a travel planner and its development is costly (Arby, 2016). While UbiGo’s app will focus on the access to transport service, it will nevertheless include a multi-modal travel planner. The travel planner is not something UbiGo will develop itself. Instead, an already existing platform will be integrated into the UbiGo app.

UbiGo hopes to grow and scale up to other geographical areas within the years after its introduction. Its approach in this will be a franchise concept for other cities or areas. A Mobility as a Service provider in another city can start up and use UbiGo’s concept under a franchise agreement. The MaaS operator then uses the UbiGo brand, concept and mobile application, but remains a completely separate entity with its own employees, suppliers and customers. The idea is that local entrepreneurs are more capable of starting up a MaaS service in their city and possess the necessary local knowledge and connections needed for creating a service (Arby, 2016).

5.5.4 Market structure

The next section will focus on the structure of the transport market in the Gothenburg area. It aims at analysing how the introduction of UbiGo changes the structure of the market and interactions between organisations. First, the current structure of the transport market will be looked at.

In Gothenburg, there are several providers of transport. One can see different forms of public transport, car-sharing, rental cars, taxi services and bicycle sharing. The market for public transport is
organised on several levels. There is the Swedish national government that is responsible for national transport policy and the legal framework for passenger transport (Government Offices of Sweden, 2016). Urban, local and some regional transport is within the jurisdiction of Västra Götaland, the county in West Sweden in which Gothenburg is located (Västra Götalandsregionen, 2016a). In the county of Västra Götaland there is a single public transport authority, called Västrafik (English: West traffic). Västrafik is responsible for bus, tram, ferry and most train traffic in the county and consequently also in the Gothenburg area (Västrafik, 2016). Västrafik’s funding consists both of income from transport services and of public funding by local authorities, such as the City of Gothenburg. Västrafik decides the route network, frequency, quality, information and fare and ticketing system. It tenders out the actual operation of transport services to transport operators (Västra Götalandsregionen, 2016b). This means that Västrafik doesn’t own any vehicles (except for trains) and does not employ personnel for running the services. Operators are rewarded concessions for a period of 5 years. Trams are being owned and operated by a subsidiary of the City of Gothenburg.

The local authority on the field of transport is Trafikkontoret, which is a department of the City of Gothenburg (Göteborgs Stad, 2016). Transport providers in the Gothenburg area mostly have to communicate with this organisation. Trafikkontoret talks to providers of transport about the planning and operation of their transport services in Gothenburg. Besides public transport, there are more transport services offered to travellers in Gothenburg. Sunfleet, owned by Volvo, operates a car-sharing service with 100 vehicles in the region (Sunfleet, 2016). Car rental is being offered by several companies, such as Hertz, Europcar, Sixt and Avis. There is a bicycle sharing system in Gothenburg, Styr & Ställ, operated by JCDecaux on behalf of the City of Gothenburg (Andersson, 2016). Private taxi companies offer their taxi services throughout the region. Also services from Uber are available to users in Gothenburg (Uber, 2016b). While public transport providers operate within a concession, other transport services need to possess the required licenses or establish necessary contracts with the City of Gothenburg (Andersson, 2016).
Interesting to see is what will change to the structure of the transport market in Gothenburg due to the introduction of UbiGo here. First it seems necessary to have a look at UbiGo and its connection towards transport providers or suppliers. UbiGo includes five transport providers in its platform. In this sense, UbiGo has exclusive partnerships with these suppliers. For every transport service, a single provider is available for UbiGo users. So far, it doesn’t seem to be thinking about including more transportation options or different transport providers in its product. UbiGo has an exclusive contract with Hertz for car rental, with Sunfleet for car-sharing, with TaxiKurir for taxi services, with Västtrafik for public transport and with Styr & Ställ for bicycle sharing (Sochor et al., 2014). For the latter two, there aren’t any alternative providers that could have been included in UbiGo’s platform. Västtrafik is the solely provider of public transport in Gothenburg and Styr & Ställ is owned by the City of Gothenburg, giving it also a monopolistic position (Andersson, 2016). For car rental, car-sharing and taxi services, there are, however, multiple providers serving the Gothenburg market.

UbiGo decided to include only one provider for every service to make it easier for the user to get access to these services and to be able to offer lower prices. Having an exclusive contract with a provider of transport, gives UbiGo more negotiation power to get lower prices for the use of these transport services. UbiGo buys transport services upfront in large volumes as a business customer. Also, users of UbiGo don’t have to compare different providers offering the same service, UbiGo already made a choice for them. As Hans Arby, CEO of UbiGo, says it: “in order to win over car owners, UbiGo has to offer them a big promise. When integrating all different forms of transportation and all different providers of these services, you give users a platform that will not be a good alternative to owning a car because it takes too much time to find out which provider to use and to compare price structures of different providers. The set-up of UbiGo gives users a mobility solution that is just as reliable and flexible as having an own car” (Arby, 2016).
Looking at it from a provider’s perspective, being an exclusive supplier of transport to UbiGo users has its advantages, according to UbiGo. New customer groups can be reached and transport providers can increase their market. UbiGo can provide them with insights about travellers’ patterns and help these providers in optimizing their use. The current market structure and the market structure with UbiGo are illustrated in the figure on the next page. One need to keep in mind that transport users, also after the introduction of UbiGo, can still purchase transport services from the transport providers themselves without interference of UbiGo, though these lines have been left out of the figure for simplification reasons.

![Figure 9 – The transport market before and after the introduction of UbiGo](image)

### 5.5.5 REGULATION

Together with changes to the structure of the market, the introduction of UbiGo will have consequences for market regulation. This section aims at finding out what is changing in regulation and legislation in Gothenburg area and Sweden with the realisation of Mobility as a Service here.

Västtrafik, the region’s public transport authority is working on a framework for public procurement of Mobility as a Service. The aim is to create a regional concession for the reselling of public transport tickets. A tendering procedure should find the best candidate for this concession. It is unclear yet what this procurement will look like, whether there will be concessions for more than one service provider and under which conditions and rules a provider has to operate (Holmberg, Collado, Sarasini, & Williander, 2016). Västtrafik wants to develop a pre-commercial procurement together with commercial actors’ competence and experience to “ensure the best service possible” (Västtrafik,
This framework could serve as a model for the inclusion of public transport in a mobility service in other cities and regions, within Sweden and abroad.

UbiGo is afraid that there will be only room for one Mobility as a Service provider in this public concession and therefore it advocates for an open market in which several parties are allowed to resell public transport tickets (Arby, 2016). According to UbiGo, the government’s role should be to set the rules, provide proper regulation and ensure that the public transport brand is taken care of. In this sense, the provision of services will be left to the market. UbiGo thinks that an open market will lead to the best provider getting the largest market share (Arby, 2016). Furthermore, it will prevent parties from being reluctant to invest in Mobility as a Service due to the risk of losing the concession.

If every city has its own concession, the development of a MaaS platform is going to take way longer and more expensive than when a Mobility as a Service provider can start up in different cities with the same platform. According to UbiGo, in order to be cost-effective, it has to ‘reuse’ much of the platform, knowledge, concepts and agreements with suppliers in other cities. However, in order to do so, an open market is needed and not a different concession procurement in every city (Arby, 2016).

Looking at the regulation of data for UbiGo, legislation doesn’t seem to be there yet. With the introduction of Mobility as a Service in Gothenburg, lots of information is going to be exchanged between transport providers and UbiGo, between UbiGo and its customers and between UbiGo and authorities. Both UbiGo and the City of Gothenburg realise that regulation has to be there that takes care of data safety and users’ privacy (Andersson, 2016; Arby, 2016). Sweden is, at the moment of writing, implementing rules about transport data into its legislation system (Holmberg et al., 2016).

UbiGo has agreements with its suppliers about the direct integration of providers’ ticketing systems into UbiGo’s platform. In this sense, the sharing of data between transport providers and UbiGo seems self-regulatory. Because UbiGo doesn’t offer a travel planner in its application, input concerning travel information is not necessary. The data that UbiGo possesses about its customers is potentially interesting for transport providers and authorities. UbiGo will not publicly release this information to prevent other mobility operators from getting insight in competitive-sensitive information (Arby, 2016). At the same time, aggregate data from users might be shared with providers in order to optimize transport systems and with authorities to get better insight in traffic flows. The City of Gothenburg, for instance, could use data from UbiGo for city planning and traffic management. The city sees that there is no regulation yet that forces providers or UbiGo to open up its data (Andersson, 2016).

**5.5.6 CHANGE-PREVENTING FACTORS**

This section looks at the factors that are being perceived as barriers for the introduction of UbiGo in the greater Gothenburg area. Barriers from three different perspectives can be distinguished: technological, institutional and process barriers or challenges facing the introduction of UbiGo. All three types of barriers will be discussed more detailed below.

There is a technological barrier for the introduction of UbiGo, although this challenge is easy to overcome according to UbiGo (Arby, 2016). It is about the development of the Mobility as a Service platform, the application and ticketing system. The platform has to include data coming from different
suppliers and all this information has to be updated whenever needed. From a technical point of view, this is not a large barrier to overcome, but someone had to be willing to invest and spend the money on its development, UbiGo says. UbiGo teamed up with the technology company Ericsson for the realisation of the platform.

On the field of the process towards the introduction of UbiGo, there are more barriers to see. As UbiGo states it: 80% of the challenge is on getting the public transport provider involved, the rest are other barriers (Arby, 2016). Not having access to public transport services can be a real show stopper for UbiGo. Public transport forms the basis for UbiGo in the number of trips, but not in revenues. The importance of access to public transport services for UbiGo seems obvious. UbiGo needs the authority to sell ticket for public transport on behalf of the provider. Even more, UbiGo not only wants the right to resell the existing tickets for public transport, it also needs to be able to have its own price model and its own packages. Consequently, convincing Västtrafik to be part of UbiGo services forms the largest and most important barrier for UbiGo to overcome (Arby, 2016).

UbiGo states that convincing commercial transport providers like car rental companies is not that difficult (Arby, 2016). When presenting these with proper conditions and good prospects of new customers segments to be reached, commercial transport providers are positive and willing to be included in UbiGo’s platform. Having the public transport provider involved is a different thing. Västtrafik might be afraid to lose customers when put together in a platform with other forms of transport. Furthermore, Västtrafik is concerned about its brand and image towards customers. According to UbiGo, public transport providers then take one of the following two approaches (Arby, 2016). Either they are reluctant towards Mobility as a Service or they embrace it and want to do it themselves. UbiGo thinks both mind-sets are not preferable. The first mind-set can, as explained before, form a serious obstacle for the realisation of UbiGo and prevent the company from doing business. The second mind-set however, is an approach in the opposite direction, that can also get UbiGo out of business. Furthermore, public transport providers are too slow when reacting to new developments, not allowed to do everything that needs to be done and they have a focus on their own services, according to UbiGo (Arby, 2016). Västtrafik is not allowed to be a reseller of taxi services, rental cars or other commercial market activities. Furthermore, it can’t have common invoices and has to be politically correct and promote public transport. Therefore, services by public transportation always have to be given the highest priority when the authority functions as a mobility operator. Public transport has to be at the heart of service, while other forms of transportation are add-on options for the user. Unfortunately, UbiGo states, this will not lead to the attraction of new customer segments and to the development of getting people out of their private cars (Arby, 2016). For this reason, UbiGo thinks that the public transport provider should have the willingness and the mind-set to be an active party, but not the leading.

Other barriers are on an institutional level and while these are important and non-negligible, their significance in slowing down the introduction of UbiGo is lower compared to the barrier of a non-supportive public transport provider. These institutional barriers are visible on a local level, in the Gothenburg area, but most of the time have to be solved on a national, Swedish, level or even on an international, EU-wide, level.
A tricky challenge is to include public subsidized services into a commercial model. As in most cities in developed countries, public transport in Gothenburg is subsidized. That means that tax money is being used to create a viable public transport system. UbiGo is a private company, having an aim to generate profit from its services. For UbiGo, public transport trips form the backbone of its concept. The difficulty lies in the fact that UbiGo cannot offer lower prices for public transport to its customers than other companies or than the public transport provider itself (Sochor et al., 2015). UbiGo cannot make profit from tax money. At the same time, it wants to attract customers by offering transport at lower prices than when they would have to buy it themselves. As said, for public transport services, this is not possible. UbiGo is allowed to keep a 5 to 6 percent fee on public transport ticket sales as this percentage of commission is considered reasonably by law for the administrative burden of selling tickets (Arby, 2016). Being full of legal issues, the mixing of public funded services with private services is a difficult and sensitive one.

Another institutional barrier can be seen in parking regulation for shared cars. From national legislation, shared cars are not allowed to be treated differently from ordinary vehicles. Shared cars cannot be given private, reserved parking spots in the Gothenburg area (yet) (Andersson, 2016). The provider of shared cars in Gothenburg, Sunfleet, is facing difficulties with getting access to parking facilities for its vehicles (Arby, 2016). Although this problem might be for the account of Sunfleet and not UbiGo, UbiGo is largely dependent on the well-functioning of its shared car services, since these form an essential part of UbiGo’s offering. The City of Gothenburg confirms the difficulties with parking spaces for shared vehicles and states that it aims to convince the Ministry of Transport of legislation adjustments, but so far this has not led to any changes yet (Andersson, 2016).

The City of Gothenburg is supportive in the realisation of UbiGo and the introduction of Mobility as a Service in the Gothenburg area (Andersson, 2016). The city is really a testing site for new innovations and projects, trying out new concepts and innovative developments. On a financial level, the city cannot fund UbiGo directly, because that would be an illegal act by law (Andersson, 2016). Also, the City of Gothenburg, although highly supportive of UbiGo, does not see itself as a stakeholder in the realisation of the service.

UbiGo sees local conditions and circumstances as a big challenge for the implementation of its services. Conditions in every city are different, but people want the same service. UbiGo decided for that reason that franchising the UbiGo concept is better. Local UbiGo operators could be more competent and more effective in dealing with local conditions (Arby, 2016).

5.5.7 LESSONS LEARNED

Already in the previous section, there has been a discussion on the barriers for the introduction of Mobility as a Service in Gothenburg and which approach has been taken to overcome those. This section will continue on that topic and furthermore draw some preconditions that should be met for a city, region or country introducing the concept of Mobility as a Service in its area. The taken approaches on how to overcome barriers can be considered as facilitators coming from the introduction of UbiGo in Gothenburg and best practices that can serve as a starting point for the realisation of Mobility as a Service in other areas.
In Gothenburg there is very close cooperation between governmental organisations, universities and private companies. The set-up of UbiGo has also been done with this kind of cooperation. The working culture is open and cooperative with an atmosphere and not just a slow bureaucratic approach. Important is that public transport providers realize that they have to open up and accept that they can be part of the solution, but not own the solution (Arby, 2016). These players shouldn’t try to do Mobility as a Service themselves by adding services to their activities. As explained before, UbiGo thinks that public transport providers cannot make the change that is necessary for the introduction of Mobility as a Service.

A second lesson is that a city or region should aim at taking away the need of owning a private vehicle. With appropriate city planning, the right conditions for the implementation of UbiGo can be created (Arby, 2016). There should be a sufficient availability of parking spaces in the city, but with a high price for private parking. This makes it less attractive for citizens to own a private vehicle. Public transport forms the backbone of the UbiGo system. Needless to say, the provision of public transport in a region has to be well arranged and the system has to function properly in order to make a service as UbiGo attractive and convincing.

5.6 DIFFERENCES BETWEEN MaaS IN GOTHENBURG AND HELSINKI

In this section the differences between both cases will be looked at. The case study found several differences between UbiGo in Gothenburg and MaaS in Finland. By looking at these, the implementation of Mobility as a Service in both areas can be compared. Differences can be distinguished on three fields: organisation, market structure and regulation. All three types will be discussed below.

![Diagram of differences between UbiGo and MaaS](image)

*Figure 10 – Differences between UbiGo and MaaS Finland*
UbiGo in Gothenburg and MaaS Finland differ mostly in their organisational structure. Both can be considered Mobility as a Service providers, although they differ significantly in their proposed business model. Four major differences in both companies’ organisational approach can be pointed at. Firstly, there is a difference in the inclusion of transport service providers. Where MaaS Finland aims at integrating all available transport options in its service, UbiGo only works together with 5 exclusive transport providers. In this sense, users of MaaS Finland can choose from several providers for every mode of transport, but UbiGo users are limited to one option for their choice of travel: one taxi company, one shared car provider, one rental car provider. Both approaches have advantages and disadvantages. The major advantage of having exclusive service providers is lower prices that can be offered to UbiGo users. The advantage of having all providers included is efficiency by competition and guaranteeing the best possible service to users.

A second difference between UbiGo and Maas Finland, is the offering of price plans. MaaS Finland offers its users the option to choose from three or four different price plans, varying from pay-as-you-go to unlimited travel. UbiGo focusses its packages at households and gives them the opportunity to decide themselves how many minutes of travelling with certain transport modes they want to purchase. MaaS Finland assumes it can attract more customers by offering three or four specialised packages, possibly integrated with private vehicle use. UbiGo thinks its price plans are more tailor made because users can decide themselves upon the amount of travelling minutes.

The geographical scales on which both Mobility as a Service providers are focussing, differ. UbiGo’s services are available to customers in the Greater Gothenburg area. MaaS Finland wants to include transport in whole Finland, not only the metropolitan region of Helsinki. It does so because it argues that travel doesn’t stop at municipal or regional borders. MaaS Finland hopes to be able to include even flight travel abroad in its future packages.

The geographical focus of both services also influences its planned expansion approach. UbiGo states that it will expand to other geographical areas under a franchise model. Companies that want to start Mobility as a Service in another city or region can franchise the brand of UbiGo and its business model. The required platform and mobile application will be provided by Ericsson, using a pay-as-you-grow approach. UbiGo states that local knowledge in each city will result in a higher efficiency and better working business model and ensure that the best deals with local transport providers can be realised. MaaS Finland argues that it will go for a worldwide expansion when there turns out to be a market for it. The organisation of MaaS Finland will expand to other countries and areas so it can grow its own network of transport options worldwide and offer this to its customers.

Another important difference can be found in the structure of the market for Mobility as a Service. In Finland, authorities really want to create an open market in which several Mobility as a Service providers can operate. Here, no monopolies or exclusive deals between MaaS Finland and transport providers should exist. In Gothenburg, a different approach is taken for the market of Mobility as a Service. Here, the public transport authority in the region, Västrafik, is designing a commercial procurement for the reselling of public transport tickets. The expectation is that possibly only one provider is allowed to resell public transport tickets on behalf of Västrafik for a certain period of time. This wouldn’t allow more than one MaaS operator to offer its services to users in Gothenburg.
Whether the market is open or being tendered out under a concession, makes a huge difference for the working of Mobility as a Service in an area.

A last dissimilarity between the cases of UbiGo and MaaS Finland is seen in its regulation. Authorities in Sweden and Finland take a completely different approach concerning regulation and legislation of Mobility as a Service in its area. In Finland, authorities are working pro-actively on a new transport code that has to reshape the regulative context for MaaS services. It wants to have regulation and legislation ready before the actual services are making its entrance to the market. The approach taken in Sweden is more reactive or passively. Authorities here are considering and following the developments of Mobility as a Service without actively changing regulation now. The mind-set is that the introduction of UbiGo in Gothenburg will show if regulation regarding transport and transport data has to be changed. When this seems to be the case, authorities will decide how transport regulation has to change in accordance to the current developments.

**CASE: COMPARABILITY TO COPENHAGEN**

The question arises whether the findings from Gothenburg and Helsinki can be used as a guideline for the potential implementation of Mobility as a Service in Copenhagen. For this reason, it seems necessary to compare the Greater Copenhagen area with Gothenburg and Helsinki. The aim of this section is to present similarities and differences in mobility between Copenhagen and Gothenburg and Helsinki that are relevant to the introduction of Mobility as a Service.

All three cities share the presence of a highly effective public transportation network (Krogsgaard Niss, 2016; Scheurer, 2013). Compared to Gothenburg and Helsinki, the region of Copenhagen is more centred and concentrated (Sahala, 2016). Public transport in the Greater Copenhagen is highly effective, has a very high density and serves all areas. It could be said that the efficiency of public transport in Copenhagen is higher than in the areas of Gothenburg and Helsinki (Scheurer, 2013). This can be seen as an advantage for the introduction of Mobility as a Service in the Copenhagen area, because public transport forms the backbone of the MaaS offering. Together with a high share of public transport usage in Copenhagen, the use of bicycles is also higher than in the areas of Helsinki and Gothenburg (Gössling, 2013). Having citizens that are already less car-favoured than those in Helsinki and Gothenburg, seems to make Copenhagen an easier market for MaaS operators.

A final difference between the areas of Helsinki, Gothenburg and Copenhagen can be seen in the presence of a free-floating shared car scheme. Both Gothenburg and Helsinki do not have such a system (yet), Copenhagen does. Gothenburg and Helsinki do have a car-sharing system, but those follow the ‘old approach’ of stationary vehicles and reserved spots (CityCarClub, 2016; Sunfleet, 2016). DriveNow offers 400 vehicles in and around Copenhagen that can be taken and parked everywhere in the area (DriveNow, 2016). The system is operational for almost a year and is being perceived as highly effective and well-functioning (Krogsgaard Niss, 2016). The availability of 400 free-floating shared vehicles will give users of Mobility as a Service in Copenhagen a huge advantage compared to their fellow MaaS users in Helsinki and Gothenburg.
5.7 CONCLUSIONS FROM THE EMPIRICAL ANALYSIS

Now that both cases have been looked at and differences and similarities have been discussed, useful conclusions from the case studies can be drawn. This section looks at the big issues that have experienced in the case studies and the lessons that can be learned from both. The part below functions as an overview of big issues from the implementation of MaaS in Gothenburg and Finland and lessons learned for its potential introduction elsewhere.

The empirical analysis has shown that several critical choices were or are to be made by authorities in both regions. Governance choices are to be made regarding the ownership of a MaaS company, the structure of the market and regulation of the market. Critical choices for authorities implementing Mobility as a Service in their region will be discussed in the next chapter, together with implications of these choices.

The case of MaaS Finland shows us that exclusivity between MaaS operators and transport providers should be prevented. It leads to inefficiency and suboptimal outcomes for the users of Mobility as a Service. At the same time, UbiGo shows that an exclusive contract with a provider of transport, gives a MaaS operator more negotiation power to get lower prices. It stresses the issue of public transport providers, that are either reluctant towards Mobility as a Service or embrace it and want to do it themselves. Both are not preferable, according to UbiGo. In Finland, MaaS Finland is expecting issues with urban planning that doesn’t anticipate on transport infrastructure changing from a corridor-based system towards a more hub-based system.

On the field of data integration, the lesson from Finland is that a MaaS operator needs direct integration with transport providers’ systems, because an operator cannot offer a good service to the end-user when there is a government-run platform in which it has no saying. This makes the critical mission in technology to give a MaaS operator access to both APIs: the one for route planning and the one for ticketing. Technically, there does not seem to be much of a barrier for this. In Finland, authorities see a need for regulation on data-exchange and here the focus is on MyData, open data and open APIs. UbiGo concludes that the sharing of data between transport providers and the MaaS operator seems self-regulatory, although Swedish authorities are not convinced of that.

Institutional issues can be seen in both cases. In Finland, the government cannot avoid procurement regulation, but by involving the private sector in an early stage, the tendering has been much more sophisticated and a couple steps beyond how it would have been otherwise. Also in Gothenburg, there seems to be very close cooperation between governmental organisations, universities and private companies. Difficulties that have been experienced here, are with including public subsidized services into a commercial model and the legal fact that shared cars are not allowed to be treated differently from ordinary vehicles. It is not possible for UbiGo to benefit from volume purchasing on public transport because it is being subsidized, which means that the more customers using public transport, the lower the profit for UbiGo.
PART IV: APPLICATION
6 GOVERNANCE MODELS FOR MOBILITY AS A SERVICE

The previous section took the approach of a case study and looked at the initiatives of MaaS in Finland and UbiGo in Gothenburg. In this section, the insights learned from the cases will be applied on a framework of governance models for the introduction of Mobility as a Service. The chapter will cover best practices from Gothenburg and Finland and possible configurations for Mobility as a Service. Finally, choices and their consequences will be looked at in section 6.5.

6.1 APPROACH AND PERSPECTIVE

This chapter describes possible configurations or critical choices for Mobility as a Service. The chapter covers three elements: the organisational structure of Mobility as a Service, market governance and regulation. For these elements, different options will be discussed, describing advantages and disadvantages as has been experienced in or learned from the case studies in Gothenburg and Helsinki. The perspective being taken here, when describing advantages of different choices, is that from a societal point of view. Critical choices being discussed here are those for authorities and the advantages are those for the government and users of Mobility as a Service. Configurations being described, might also, intentionally and unintentionally, affect outcomes for a Mobility as a Service operator, but its perspective as such is not taken as the approach for this chapter. The options for Mobility as a Service that are being discussed in this chapter are all on an institutional level. As seen in the empirical analysis, technical barriers are less relevant and seem more easily solvable. Furthermore, considerations on a technical field are within the decision space of MaaS operators and not authorities. Challenges in the process towards the introduction of Mobility as a Service are being discussed in the next chapter, which is on expected barriers and how to overcome these.

6.2 ORGANISATIONAL STRUCTURE OF MOBILITY AS A SERVICE

The first step when authorities decide to introduce Mobility as a Service is the set-up of an operator for these services. As seen in Gothenburg and Finland, several configurations are possible for the structure of such an operator. This section aims at presenting different configurations for every design option of a Mobility as a Service operator.

6.2.1 OWNERSHIP OF THE COMPANY

A Mobility as a Service operator could be set up following different approaches regarding the ownership of the company: the company can be a privately owned firm or an institution being run by the publicly owned organisation. Even a combination of these, a public-private partnership, can be seen as an option for MaaS. The choice for either of those will have a major influence on the functioning of the organisation, which will be discussed in this paragraph.

The decision for a governmental introduction of Mobility as a Service sounds reasonable. Mobility as a Service involves public services and forms a layer on top of transport services that are essential to society. Public values are at stake and the access to mobility for all citizens has to be assured. Moreover, public transport is heavily subsidized and it is in the government’s responsibility to ensure a proper allocation of those financial resources. Having a public organisation as the provider of Mobility as a Service gives three options:
• A public transport provider as the MaaS operator
• A public third party as the MaaS operator
• A newly set-up public MaaS operator

With the first approach, a public transport provider will take the role of a Mobility as a Service provider in the area. Instead of only selling tickets for its own services, such a transport provider could offer packages to customers that include travelling with other transport providers such as car-sharing or ride-sharing. A second possibility is to make a governmental third party responsible for Mobility as a Service. For instance, a public company in charge of an electronic travel card could take this role and start selling tickets on behalf of all transport providers. Also a municipality could decide to become the Mobility as a Service provider in the area by setting up a platform. A last public option is the set-up of a completely new organisation that will be in charge of Mobility as a Service in the area. Giving this company a public status will give it easier access to public transportation services from public companies.

The opposite approach is to let the provision of Mobility as a Service to the market, trying to attract a private company to take on the role of a Mobility as a Service provider. Here, a third-party, private company like UbiGo or MaaS Finland starts operations for mobility services. It offers different subscriptions or packages to users and aims at making a profit, while potentially competing with other private MaaS operators.

Finally, the option of public-private partnership should be looked at. The set-up here is that the MaaS platform (the integration of data, MaaS payment and planning system and mobile application) is being developed and operated by a public entity. The provision of the actual MaaS offering and the communication and marketing to customers could be left to a private MaaS service provider, because here a public organisation could get into legal problems when offering MaaS. The MaaS platform could be developed by a consortium of municipalities in the area, possibly together with the region or province.
All three options (and suboptions) have their advantages and disadvantages that will be discussed here.

Table 1 – Options for organisation structure

<table>
<thead>
<tr>
<th>Organisation structure</th>
<th>+</th>
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<tbody>
<tr>
<td><strong>Public</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public transport provider</td>
<td>Connectedness with public transport</td>
<td>Possibly ineffective</td>
</tr>
<tr>
<td></td>
<td>Safe and secure option for public transport providers</td>
<td>Cannot scale</td>
</tr>
<tr>
<td>Public third party</td>
<td>Dedicated</td>
<td>Incapable of the necessary change</td>
</tr>
<tr>
<td></td>
<td>Existing customer base</td>
<td>Cannot scale</td>
</tr>
<tr>
<td></td>
<td>Easy to control</td>
<td></td>
</tr>
<tr>
<td>New organisation</td>
<td>Dedicated company</td>
<td>Yet another public organisation</td>
</tr>
<tr>
<td></td>
<td>Public values assured</td>
<td></td>
</tr>
<tr>
<td><strong>Private</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private transport provider</td>
<td>Profit driven, efficient</td>
<td>Preferring own services</td>
</tr>
<tr>
<td></td>
<td>Attracting customers</td>
<td>Cooperation difficult with public transport providers</td>
</tr>
<tr>
<td></td>
<td>Existing customer base and brand image</td>
<td></td>
</tr>
<tr>
<td>Private MaaS operator</td>
<td>Profit driven, efficient</td>
<td>Public values insecure</td>
</tr>
<tr>
<td></td>
<td>Attracting customers</td>
<td>Cooperation difficult</td>
</tr>
<tr>
<td></td>
<td>Getting good deals</td>
<td>Reluctance from public transport providers</td>
</tr>
<tr>
<td></td>
<td>Independent broker</td>
<td></td>
</tr>
<tr>
<td><strong>Public-private</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public MaaS platform with private MaaS service providers</td>
<td>Profit driven, efficient</td>
<td>Expensive set-up</td>
</tr>
<tr>
<td></td>
<td>Facilitating the market / taking the initial step</td>
<td>Legal issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reluctance from private MaaS operator</td>
</tr>
</tbody>
</table>

The main reason to choose for a public Mobility as a Service operator is to assure public values and guarantee the acceptance and willingness to cooperate of public transport providers. Movia, the public organisation in charge of bus transport in the whole Copenhagen area, initially stressed the importance of a public transport company taking the role of a Mobility as a Service provider in Copenhagen (Enemark, 2016b). Its main arguments are that the introduction of a public MaaS operator leads to a more efficient process and better outcomes than when a private third party is at presence (Enemark, 2016b). Movia assumed here that a public Mobility as a Service operator will take better care of public values in transportation, but also that it will establish better connections and a more effective cooperation with other public transport providers when the organisation is not as a profit-driven company active on the transport market but ‘part’ of the public transport system itself. In later discussions, Movia states that it can also see disadvantages of this approach and that it likes to keep all options open for the organisational structure of a MaaS operator (Enemark, 2016a).

In Gothenburg and Helsinki, public transport providers can be said to be very reluctant when a private MaaS company wants to integrate them into its services. Public transport companies in other areas are expected to have similar reluctance for a private third party building its services on top of them,
being afraid to lose profit, brand and image exposure and customer bonding (Enemark, 2016a). Both UbiGo and MaaS Finland substantiated that a public transport provider cannot operate as a Mobility as a Service provider (Arby, 2016; Hietanen, 2016a). Their argumentation is two-folded. Regarding public ownership, MaaS Finland states that a governmental organisation cannot scale and grow as fast as a private company can (Hietanen, 2016a). It will always focus on offering the service within its own region or country. Movia thinks that the introduction of a public MaaS operator will face a lot of legal issues (Enemark, 2016a), on which section 7.3 will further elaborate.

UbiGo adds to this argumentation that public transport providers are too slow when reacting to new developments, not allowed to do everything that needs to be done and having a focus on their own services (Arby, 2016). In order to attract new customer segments that previously have been using private cars, public transport should not be put at the heart of service of MaaS subscriptions. All transport services should be considered equally important and preferred. This brings in the second argument against a public transport provider as the MaaS operator. According to MaaS Finland, in order for a mobility broker service to be successful and legitimate, it has to be offered by an independent third party, relying on other companies and their ability to offer transport services (Hietanen, 2016a). A Mobility as a Service operator that is also offering transport services would in some way always try to favour its own services. The City of Helsinki affirms this statement and agrees that transport providers, public and private, cannot properly integrate their services themselves, thus a third party is needed to take that role (Sahala, 2016).

As described above, experiences from Gothenburg and Finland also advocate for an independent third party when private ownership for a MaaS company is preferred. At the same time, a private transport provider as MaaS operator already has connections with other public and private transport providers in the area. Private transport providers are profit-driven and expected to run MaaS efficiently. Yet, the question remains whether a company like DriveNow would be interested in running a MaaS service. What is left on the private side, is an independent third party running a complete MaaS service. Such a company is expected to work cost-efficiently and generate good outcomes for customers. Nevertheless, it might be very difficult for a private, third-party MaaS operator to get public and private transport providers involved and get access to all needed travel and ticketing APIs. This barrier for the introduction of MaaS shall also be discussed in more detail in section 7.3.

The other option of a public-private-partnership combines the advantages of public and private MaaS ownership. Such a company will probably be run efficiently and able to scale up to a larger area because the actual service part is being operated by a private company. Then, by having a publicly-operated MaaS platform under it, the involvement of all transport providers and integration of data from all transport providers can be assured. This organisational structure can facilitate the introduction of Mobility as a Service when the expectation is there that no private companies are interested in investing in and starting up a complete MaaS service in the area. In this case, the set-up of a public MaaS platform can serve as a first step to create and stimulate a market for private MaaS services (Enemark, 2016a). The downside is, as MaaS Finland argues, that private MaaS operators are not supportive towards a centralized, government-run MaaS platform (Hietanen, 2016a). Furthermore, the realisation of a MaaS platform by a public company will result in several legal issues to be dealt with (Enemark, 2016a). These include the ownership of the platform, its allowance for
profit making and the legal basis on which a public entity is able to take such a role as a transport data integrator.

6.2.2 EXCLUSIVITY WITH TRANSPORT PROVIDER

A next important decision that is to be made for the set-up of a Mobility as a Service company, is the choice between integrating all transport options available or only exclusive providers. Although in the case of a private, non-government owned MaaS operator this might not be a decision to be made by authorities, exclusivity or not may have real consequences for the functioning of the transport market. This makes it an important characteristic of MaaS that has to be taken into account when adapting transport regulation to the introduction of Mobility as a Service. The topic of regulation will be looked upon in subsequent sections. For now, it seems necessary to have a look at both options and see which benefits either of them can bring to society.

The option of integrating all transport services into a Mobility as a Service platform is pretty straightforward. A Mobility as a Service operator aims at contracting all available transport providers in the area and subsequently includes all available transport options in its packages. For users this means freedom of choice, all means of transport are available to them and all providers can be chosen from. Providers of these transport services feel the pressure to deliver the highest quality and to compete on prices with similar, also available means of transport. Including all transport providers in Mobility as a Service will probably lead to the best possible outcomes for users of the service in terms of price, quality and availability (Hietanen, 2016a).

Looking at the option of exclusivity into a Mobility as a Service platform, there are different advantages that can be seen. Exclusivity here means that a Mobility as a Service operator signs exclusive contracts with certain transport service providers in the area. This exclusivity works in both directions: the Mobility as a Service operator only offers transport services from a particular transport provider, but at the same time this transport provider does not offer its services through another Mobility as a Service company in the area. An example could be when a future MaaS operator decides to only offer car-sharing with DriveNow, leaving all the other car-sharing companies (like LetsGo and Car2Go) out of its packages. DriveNow, in return, makes sure its vehicles are not bookable through another MaaS company in the area. In many regions bus, train, metro and ferry services are operated by public companies. Often, a bike sharing scheme is tendered out to a public company too. Those public transport providers are the only parties offering these services and consequently agreements with these providers will be automatically ‘exclusive’ from the MaaS operator’s point of view. Exclusivity on the entire line arises when a MaaS operator also creates exclusive deals with providers of taxi, shared car, rental car and ride-sharing services.

Exclusivity for Mobility as a Service is the approach taken by UbiGo in Gothenburg. Its main arguments for this choice are the easiness for users to get access to services and the ability to offer lower prices (Arby, 2016). Having an exclusive contract with a provider of transport, gives a MaaS operator more negotiation power to get lower prices for the use of these transport services. Also, MaaS users do not have to compare different providers offering the same service, saving them time to find out which provider to use and to compare price structure of different providers. From a transport provider’s perspective, being an exclusive supplier of transport for MaaS has the clear advantages of reaching
new customer groups and increasing its markets (Arby, 2016). Yet, the approach taken in Finland, differs from the Swedish one. Here, MaaS Finland found out, that exclusivity leads to inefficiency (Hietanen, 2016a). MaaS operators and transport providers having a both-ways-exclusive deal are stuck with each other and have no possibilities to offer better options to their users when either the MaaS operator or the transport provider turns out not to be most promising one. It doesn’t cause the transport provider to feel the need to compete on price and quality with other providers and doesn’t provide the pressure to improve services constantly, according to MaaS Finland. Finally, developments in the transport market are expected to go faster when there is no bottleneck in the market in the form of a MaaS operator with exclusive contracts (Hietanen, 2016a).

Table 2 – Options for exclusivity

<table>
<thead>
<tr>
<th>Exclusivity</th>
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<tbody>
<tr>
<td>Lower prices</td>
<td>Easiness for users</td>
<td>Inefficient</td>
</tr>
<tr>
<td>Less options for users</td>
<td>Slower developments</td>
<td></td>
</tr>
<tr>
<td>Freedom of choice</td>
<td>Most efficient</td>
<td>Too large scale of options</td>
</tr>
<tr>
<td>Possibly higher prices</td>
<td></td>
<td></td>
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</table>

6.3 Governance of the transport market

The next critical choice is about governance of the market in which a Mobility as a Service provider is operating. This transport market has been described in chapter 2. The Mobility as a Service provider will operate on a level between transport users and the providers of transport. Different configurations for the structure of the market are possible and this section aims at comparing those. The market for Mobility as a Service can be structured in two different ways, either by a public procurement with a concession or by an open market. Both options shall be explained and advantages and disadvantages for both shall be given.

The approach of a public procurement will be taken in the Greater Gothenburg area. Here, the regional public transport authority Västrafik shall tender out the right or concession to sell public transportation ticket on their behalf (Västrafik, 2015). The inclusion of public transport is a prerequisite for Mobility as a Service, which makes a public procurement of this concession equal to a tendering for Mobility as a Service. Looking at the other option, which is an open market, companies are allowed to resell public transport tickets on behalf of these public transport providers, considering certain rules are taken into account. This open market structure is the approach taken in Finland, where the Ministry of Transport is actively working on a restructuring of the transport market and a redesigning of transport regulation. The biggest difference with the Swedish approach of procurement is that with an open market the operators of Mobility as a Service can take the leading role, whereas in Gothenburg the public transport authority Västrafik gets to decide which parties get access to its ticketing system. When an open market for the reselling of tickets will be established, public transport providers are expected to open up their ticketing systems. Companies interested in offering tickets for public transport are allowed to do so, while taking care of the rules concerned with these activities. Opening up public transportation ticketing systems might not necessarily only attract Mobility as a Service providers, but also other types of businesses could be interested in doing so, such as event and festival organisations.
UbiGo, soon to be operational in the Gothenburg area, fears that Västtrafik’s concession-based procurement will only give room to one Mobility as a Service provider in the region (Arby, 2016). Yet, both UbiGo and MaaS Finland advocate for an open market (Arby, 2016; Hietanen, 2016a). The advantage of an open market is that there is competition between MaaS operators, leading to the best provider getting the largest market share. According to UbiGo, a procurement done by the public transport authority will lead to reluctance to invest in MaaS services due to the risk of losing the concession (Arby, 2016). Furthermore, with every region having its own concession, the development of a MaaS platform will be more difficult and expensive, because companies will have to go through separate procurement procedures in each different region (Arby, 2016). MaaS Finland adds to this that transport is too big for monopolistic ideas and that a competitive market will result in the best possible outcomes for users and the largest market share for the MaaS provider with the best offering (Hietanen, 2016a). Experiences from Finland show that the government can take the role as an enabler, creating the regulative landscape for a market in which private, competitive companies can shape the exact content of Mobility as a Service. In this sense, public transport providers should take a collaborating, and not an initiating or coordinating, role.

Movia agrees that this ‘Finnish-model’ is the most easy and simple approach for a MaaS-market, yet it fears that there might be no market for Mobility as a Service, meaning that no private companies are interested in starting up these services without government incentives (Enemark, 2016a). Movia thinks that a public tendering or a public-private partnership takes away much of the concerns regarding the maturity and the preparedness of the market. In that sense, ‘the Swedish approach’ or a public-private partnership is much safer for authorities because these can be more confident that MaaS will actually happen (Enemark, 2016a). In the case of a public-private partnership, the same choice between a public concession and an open market has to be made. The underlying MaaS platform might be government-developed and run, the private MaaS service providers on top of that platform can be either freely allowed to use the platform or one or some of them can be rewarded with a concession for those services. With this construction of a public-private partnership, there is still competition possible between different private MaaS operators and even between private and public MaaS operators (Enemark, 2016a).

6.4 Regulation on Mobility as a Service

The introduction of Mobility as a Service brings in the clear need to (re)design legislation and regulation concerning the digitalization of transport services. Regulation has to be made or changed in two areas, which will be discussed in this section.

Firstly, there has to be regulation for the market of mobility services, the reselling of tickets from public transport providers. Transport ministries can learn here from the Finnish ministry that is actively reshaping its transport market legislation with the creation of the so-called Transport Code. The new transport code has to make room for new business models and better meet the needs of users (Huhtala-Jenks, 2016). Furthermore, it aims at reviewing the transport system as a whole, making market access easier and promote the interoperability of the different part of the transport system (Huhtala-Jenks, 2016). Similar goals could be taken for the reshaping of transport data regulation in other countries. When the market will be structured as an open one, regulation has to make sure that
the market is truly open and competitive. This starts with a government that exactly has to know and understand the players and customers that will be active on the market. Then, it can create regulation that prevents that ‘the winner takes it all’. It should be possible for new companies to enter the MaaS market, not being impeded by existing MaaS operators to commence services. Monopolies have to be avoided, both resulting from exclusivity between a MaaS operator and a monopolistic transport provider as well as from market failures that give a single MaaS operator an unfairly preferred market position. Public values have to be taken care of and this is done via regulation that includes guaranteeing of customer protection for end-users and non-exclusion of certain groups. Finally, market regulation has to ensure that MaaS operators’ behaviour and activities on a systematic level are geared to national policy goals as sustainability and safety.

Also regulation for the exchange and use of data related to these new mobility services has to be set in place. The digitalization of transport services is a relatively new development and most data legislation is not fitted for future needs. Again, a government could follow the Finnish example. Interesting is to see what the data regulation could actually look like for a country. First of all, it seems important that regulation is there that allows parties to open up their systems to each other. This ‘opening up of APIs’ means that everyone can get access to data from a certain system because it has an open interface. Open APIs make it possible for a Mobility as a Service provider to get the necessary data from transport providers into its system. This enables MaaS operators to offer for instance the planning of public transport or booking of shared cars to its users. At the same time, transport providers have the possibility to verify purchased tickets or bookings made within the MaaS platform. Regulation should allow transport providers and MaaS operators to open up their APIs, but not force them to (Huhtala-Jenks, 2016). When looking at transport providers that are holding monopolies for their services, regulation might be necessary that is forcing them to open up APIs in order to make a business model for Mobility as a Service possible. Mobility as a Service operators should have a legal foundation to use the data from these transport providers and regulation might be necessary for this justification. The other side of data regulation for mobility services is about the safe keeping of users’ data and protection of customers’ privacy. Strict rules are necessary for the sharing of data with third parties, internal storage of data and data-exchange between providers and MaaS operators. The Finnish concept of MyData could serve as an example for other countries’ approaches to data regulation in their changing transport sectors (MyData, 2016).

But again here, authorities face a choice. Regulation can be created that is strict, all-including and pro-active or governmental organisations can take a more wait-and-see approach. Both options have its advantages and disadvantages. Pro-actively regulating and legislating results in a market with a fair level of competition, without harming monopolies and with open data-exchange. Important to see is that when regulation ensures open APIs, it takes away the need for a centralized data platform that collects all transport data. Not only does this save authorities time and costs, it is also assumed that direct integration of transport companies’ systems leads to more accurate and real-time data-exchange than when a centralized, governmental data platform is being used (Hietanen, 2016a). Transport ministries have to be careful not to overregulate the market or trying to actively steer the market. Whenever there can be made profit by the private sector, excessive government intervention will lead to inefficiency (Huhtala-Jenks, 2016). It should not be the role of authorities to dictate the exact content of new mobility services because that is not in its expertise. Creating the right regulatory
environment is important, but in the end regulation needs to enable Mobility as a Service operators to come up with their businesses and offer the best possible services to its users.

6.5 IMPLICATIONS

In the previous sections critical choices for a possible introduction of Mobility as a Service have been discussed. Furthermore, advantages and disadvantages for different possibilities have been given. When decisions are to be made, about the previously discussed design options, authorities have to understand the consequences of these choices. In order to create a clear understanding of the mechanisms concerned with these choices, the implications of different design options will be looked at in this section.

Authorities have the option to allow private companies to start Mobility as a Service operations. The decision could also be to organise Mobility as a Service itself, either in the form of a new or by an existing public organisation. When the government decides to let a public entity develop a complete Mobility as a Service offering, this MaaS operator will get a monopolistic position. With this choice of policy, a market for MaaS services will not be possible. Instead, the designated public organisation will be the sole developer and provider of Mobility as a Service in the area.

When choosing for an allowance of private parties on the MaaS market, also in the case of a publicly-owned MaaS platform, the choice between a procurement or an open market arises. Again, also the decision being made here, can result in a monopolistic market for a MaaS operator. A procurement process, in which a single, private MaaS operator is being selected, gives this company the right to offer MaaS services to users in the area. In that case, no other companies are allowed to do the same. If authorities want to create a competitive playing field for Mobility as a Service, they have to opt for an open market in which all players are welcome to operate. The expectation is that an open market for Mobility as a Service will lead to several businesses starting up their services, competing with each other on price, service level and offering. Similar implications go for a public-private partnership. The development of a public MaaS platform still gives the opportunity for multiple, competing MaaS service providers to use it when authorities opt for an open market.

As described before, the element of exclusivity between a Maas operator and transport providers has serious implications for the functioning of the market, although the choice of being exclusive with certain providers is not necessarily a government’s decision. This makes the understanding of this mechanism important. As long as the market for MaaS is competitive and there are multiple companies offering MaaS services, exclusivity is not a problem. There is a single exception: a monopolistic transport provider having an exclusive contract with one MaaS operator, will, even in a competitive market, lead to inefficiency. In that case, other MaaS operators will not have the opportunity to include this provider’s services in its offering, making it impossible for them to properly compete with the exclusive MaaS provider. Here, regulation is needed. Although private MaaS operators cannot be prohibited to make exclusive contracts with transport providers, regulation can make sure that monopolistic transport providers, either publicly owned or operating within a public concession, are not allowed to get into such exclusive agreements. Needless to say, when a MaaS operator is already granted a monopolistic position in the market, either by a concession or because it is a public entity, exclusivity does not harm the competitiveness (or non-competitiveness). Here,
exclusivity only decreases the range of available transport options, directly limiting the MaaS user’s freedom of choice.

From the previous discussions, one can see that under certain circumstances more or less regulation seems necessary. The choice for certain forms of organisation or governance structure has consequences for the degree and type of regulation that is needed. To summarize this, the allowance for private MaaS operators leads to a higher degree of regulation needed than when a public authority is organising Mobility as a Service itself. Structuring the market as open and competitive requires more regulation to prevent market failures and monopolies than when a concession for MaaS is being tendered out. The consequences from choices regarding MaaS design options are summarized in the figure below.

Figure 11 – Implications of design choices
7 BRINGING MOBILITY AS A SERVICE TO COPENHAGEN

Now that different governance models for a possible introduction of Mobility as a Service have been described, the case of Copenhagen can be brought back as the point of discussion. This chapter will look at governance options for a possible introduction of Mobility as a Service in the Greater Copenhagen area. Furthermore, it will discuss expected barriers and possible approaches on how to overcome these.

7.1 SPECIFIC REMARKS FOR COPENHAGEN

The framework as described in the previous sections has been designed with the consideration of the Greater Copenhagen area and thus it can be said that the proposed governance models are applicable to the Greater Copenhagen area. Yet, a few remarks concerning the framework have to be made that are specific to the Greater Copenhagen area. These will be discussed below.

For the structure of the organisation of a MaaS company, several options have been presented. All models are relevant for the Greater Copenhagen area, but in order to make these more specific an example of each organisational structure option for a MaaS company in Copenhagen will be given below.

- Public company
  - A public transport provider, for example Movia or DSB
  - A public third party, for example Rejsekort
  - A new organisation
- Private company
  - A private transport provider, for example DriveNow
  - A private MaaS operator, for example UbiGo or MaaS Finland
- Public MaaS platform with private MaaS service provider(s), for example Movia + UbiGo

Regarding the market for Mobility as a Service in the Greater Copenhagen area, the decision between an open market or a concession has to be made. A concession-based approach in the Greater Copenhagen area would require a different construction than in Gothenburg. In contrast to Gothenburg, there is no single public transport authority in the Greater Copenhagen area. Movia is responsible for bus, harbour bus and certain train services (Movia, 2015b), DSB for trains and s-trains (DSB, 2015a) and Metroselskabet for the metro in Copenhagen (Metroselskabet, 2015b). Every company has its own ticketing system and its own jurisdiction on the selling of these tickets. Working together in Rejsekort A/S, these public transport providers have a common electronic ticketing system (Rejsekort, 2015). DOT or in full “Din Offentlige Transport” is a cooperation between Movia, Metroselskabet and DSB for customer service, traffic information and ticketing of public transport on the Sjælland island that includes the Copenhagen area (DOT, 2015). To make a concession-based procurement for Mobility as a Service possible, it should be commissioned by DOT as the overarching organisation of public transport in the region. Problematically, DOT is not much more than a concept or a brand name and cannot be seen as a legal entity being able to tender out a concession for reselling of tickets. Consequently, two options remain. Either, DSB, Movia and Metroselskabet individually have to do a concession-based procurement or another governance structure than a procurement has to be found in order to allow third-parties to resell public transport tickets. On the other hand, the
approach of an open market would mean for the Greater Copenhagen area that the Ministry of Transport realizes an open market that enables potential MaaS operators to resell tickets for transport services of Movia, DSB and Metroselskabet, while leaving the regulation of this market to the Danish Transport Agency.

7.2 PROPOSED ORGANISATION STRUCTURE AND MARKET GOVERNANCE

So far, options for the organisation and governance of Mobility as a Service have been given. Furthermore, different configurations have been compared and implications have been shown. In this section, the aim is to present an organisation structure and market governance for Mobility as a Service in the Greater Copenhagen area, that could be preferred. This recommended set-up has been carefully selected, learning from the case studies in Gothenburg and Finland and weighting advantages and disadvantages of different options.

First it seems interesting to see what the organisation structure of a Mobility as a Service operator for the Greater Copenhagen area could look like. Just as in Gothenburg and Finland, a private company could be a right candidate to set up a Mobility as a Service offering. The exact offering, business plan and pricing of packages should be left to this company to come up with. A prerequisite seems the integration of the Rejsekort into its system, so potential customers could use their existing travel cards to get access to the offered transport services. The expectation is that this MaaS operator will develop a multimodal travel planner that allows its users to plan and compare travel options. The existing, government-owned travel planner Rejseplanen is not geared for this purpose and might subsequently lose its function in the future. Meanwhile it could also be argued that Rejseplanen will keep its reason for existence since not all transport users are expected to switch to MaaS.

Next, the private MaaS operator should ideally include all transport providers that are operating in the Greater Copenhagen area into its system. Thus, a subscription to Mobility as a Service would give users access to transport services from Movia, DSB, Metroselskabet, DriveNow, LetsGo, GoMore, Snappcar, Bycyklen, taxi services, car rental companies, Uber and private bus companies. Although exclusivity could lead to lower prices for transport services offered to MaaS users, it doesn’t give users the same freedom of choice as when all Copenhagen’s transport options are available. Especially as a first MaaS operator in the region, exclusivity with transport providers might be best avoided.

Then, when looking at the market and its governance structure, a consequential proposal for Copenhagen can be given. The market for Mobility as a Service is expected to be at its best when chosen for an open and competitive approach. Realizing the right regulatory environment will lead to a market in which multiple, competing MaaS operators create the best possible outcomes for transport users. In the Greater Copenhagen area, where there is no single legal entity for the provision of public transport, a procurement, as is being done in Gothenburg, will be difficult and time-consuming. Therefore, the creation of an open market seems to be the most promising government structure for Mobility as a Service here. At the same time, having an open market for MaaS requires the Danish government to come up with pro-active and comprehensive regulation. As described in the previous paragraph, proper regulation for an open market should result in the prevention of harming monopolies, market failures and has to prescribe rules for cooperation between MaaS
operators and transport providers, for cooperation between MaaS operators themselves and for the sharing and openness of data.

7.3 EXPECTED BARRIERS AND RECOMMENDED APPROACH

The last paragraph of this chapter will complement the analysis of governance options for Mobility as a Service with an overview of challenges for a possible introduction of MaaS that can be expected in Copenhagen. The case studies on Gothenburg and Finland aimed at finding out whether the expected barriers were at presence or if there were other barriers for the introduction of Mobility as a Service. Furthermore, lessons can be drawn from the taken approaches to overcome these barriers in Gothenburg and Helsinki. Barriers for Mobility as a Service and proposed strategies for its introduction can serve as valid guidelines for the Greater Copenhagen area. Not all challenges might be significant for the Copenhagen area and possibly other, not yet experienced barriers specific for Copenhagen could be there. This section aims at showing barriers for the introduction of Mobility as a Service, as experienced in Gothenburg or Finland that are relevant for the Copenhagen area, plus the analysis of expected barriers specific for Copenhagen.

The cases of Mobility as a Service in Gothenburg and in Finland have shown an important barrier for a possible introduction, which is probably the most significant challenge, experienced in both areas. This barrier has to do with the resistance coming from public transport providers towards the concept of Mobility as a Service. Public transport providers might be afraid to loose invested interests: a certain position in the market, a vested brand and image, communication channels with customers and expectations of the future (Arby, 2016; Hietanen, 2016a). These transport providers are afraid that Mobility as a Service is just a layer on top of them, which makes them a cost base and possibly lowers their profits. In the area of Copenhagen, this mind-set of reluctance might be there too. Movia, with its newly set-up mobility department, is, in contrast to other public transport providers in Copenhagen, looking at the development of Mobility as a Service and consequently less reluctant towards its introduction. Even more, Movia’s approach could be seen as the opposite, where it is aiming at taking the lead in the process of the development of Mobility as a Service in Copenhagen. Even though that may sound good for MaaS’ development, it might just as well form a barrier for its introduction in the area. Both UbiGo and MaaS Finland state that in order for a mobility broker service to be successful and legitimate, it has to be offered by an independent third party (Arby, 2016; Hietanen, 2016a). When Movia would offer Mobility as a Service to customers, there is the risk that it would in some way always try to favour its own services. Furthermore, Mobility as a Service offered by Movia would not be able to scale and grow as fast as a private company could do that. Movia would always focus on offering the service within its own region, having no or few incentives to scale up and offer a nationwide service that includes as many transport services as possible. Furthermore, at this point Movia is not allowed to be a reseller of taxi services, rental cars or other commercial market activities (Enemark, 2016a). The wish of Movia to lead the development of Mobility as a Service in the Greater Copenhagen area could form a barrier for its introduction. From discussions with Movia, its focus seems to be on ‘keeping all options open’. Movia realises that it needs to be part of the MaaS development in order not to lose customers to other transport modes (Enemark, 2016a). Consequently, resistance from Movia for collaboration in a MaaS platform is not expected. On the other hand, public transport providers as DSB and Metroselskabet that are not looking into MaaS’
development, might be reluctant and difficult to get on board. Needless to say, this would also be a barrier for the introduction of MaaS in Copenhagen.

The second barrier that has been pointed out by both case studies is the legal challenge coming from the introduction of new mobility services. Where Mobility as a Service tries to include public subsidized services into a commercial model, legal issues are inevitable. Public transport in the Copenhagen area is subsidized, meaning that users do not pay the full price for these bus, train and metro services, but that the Danish government is partly paying for it too. A private Mobility as a Service company operating in Copenhagen has the aim to make profit from its services. The difficulty lies in the fact that such a company cannot make profit from tax money, while public transportation forms the backbone of its services. Danish authorities and possible MaaS operators in Copenhagen have to agree upon a certain profit margin or commission percentage concerned with the sales of public transportation services. This might form a serious barrier for the realisation of MaaS operations because Danish legislation does not allow the reselling of public transport tickets yet, let alone a commission percentage on these sales. Nevertheless, Movia states that the legal issue of reselling transport tickets does not have to be seen as a relevant barrier (Enemark, 2016a). Movia argues that in the past 7-Eleven convenience stores in Denmark also had the right to sell public transport tickets and at the same time were receiving a commission on these sales (Enemark, 2016a). Legal issues would be more seriously in the case of a public transport provider as a MaaS operator or as a rewarder of a MaaS concession, Movia thinks. So far, in Danish legislation, there is no legal basis on which a public transport provider as Movia has the right to do such activities (Enemark, 2016a).

On a technical level, both case studies have shown that barriers can be expected, but that these are not as significant as institutional and process challenges. One can see the realisation of the MaaS platform and mobile application, which takes time and effort. A bit more of challenge is the integration of travel information and ticketing systems and the realisation of open data and open APIs on the transport market. But as the case studies have shown, the knowledge and technology are there to make the introduction of Mobility as a Service possible. Most public transport providers in the Greater Copenhagen already have its travel information data openly available, with the APIs for ticketing on its way (Enemark, 2016a). Willingness (or non-willingness) from authorities and companies to invest in the development of these systems and platforms seems more of a barrier for its introduction than the technological factor.

Other barriers for the introduction of Mobility as a Service that have not been experienced in Gothenburg and Finland but might be significant for the Copenhagen area, will be discussed in this section. Firstly, the mind-set from the Danish government might slow down the development of Mobility as a Service here. The Danish ministry of transport is not looking into the topic of Mobility as a Service at the moment and furthermore it states that it expects higher direct profits from infrastructure investments than from investments in or commitment to the concept of Mobility as a Service (Skrumsager Hansen, 2016). In other words, the ministry sees more benefits from building an extra highway than from investing in Mobility as a Service. The mind-set of the Danish ministry of transport is in sharp contrast with the approach of its Finnish colleagues. In Finland, the ministry focusses fully on innovative forms of mobility and thus, Mobility as a Service is the core policy regarding transport at the moment. Such a mind-set within the government boosts the development of MaaS, while the opposite approach, as can be seen in Denmark, might seriously slow down its
introduction. Nevertheless, municipalities in Denmark have a large jurisdiction and self-autonomy (Enemark, 2016a). The commitment of and investments from the ministry are not necessarily needed to realize a viable MaaS product in the Greater Copenhagen area when the municipalities and the region are on board (Enemark, 2016a). For legal issues to be solved though, the support of the Ministry of Transport is still needed.

Furthermore problematic could be the lack of a strong regional authority in the Greater Copenhagen area. In the area of Gothenburg, the region of Västra Götaland and the regional transport authority Västtrafik have great power when it comes to the introduction of a mobility platform. Different from Gothenburg, the Capital Region of Denmark, in which Copenhagen is situated, has little authority regarding transport planning (Grell, 2015). Most responsibilities are within the cities or on a national level, at the Ministry of Transport. A service for MaaS that has to be operational on a regional level, in the Greater Copenhagen area, could face difficulties with its introduction. A potential company has to cooperate with different municipalities and the national government. Whenever a municipality, like the City of Copenhagen, decides to invest in the development of Mobility as a Service, it might be mostly focussed within its own city borders. Individual cooperation with other municipalities in the region is necessary to make Mobility as a Service work in the entire Greater Copenhagen area. This requires collaboration and coordination between different municipalities, different transport authorities and authorities on national level.

Another interesting point is the presence of relatively high car sales taxes in Denmark. Danish taxation on car sales can be considered very high and accounts up to 150% on top of the purchase price of a car (CPH Post, 2013). This high taxation level can form both a barrier and a facilitator for the introduction of Mobility as a Service in the Greater Copenhagen area. Because the purchase of a car is that expensive in Denmark, people that already own one, try to use it as much as possible (Yde, 2015). Usage of vehicles in Denmark is relatively cheap, especially compared to the purchase of the vehicle, so vehicle owners in Denmark might be difficult to seduce for a service in which they have to give up their personal vehicle. The fact that buying is expensive but using is cheap, could make the introduction of Mobility as a Service in Denmark more difficult. At the same time, people that do not own a car (yet) might be very much interested in Mobility as a Service here. Especially the younger generation in Denmark that does not own private vehicles yet and that is more open to new shared-mobility forms, could be the right target group for Mobility as a Service. Because of the high taxes on the purchase price of a car, a proper alternative to car ownership could make this group decide not to buy a car and use Mobility as a Service instead. For a potential MaaS operator in Denmark, this high taxation on cars and its consequences should be taken into account when designing its business plan.

The next part of this section discusses the time scale on which the previously described barriers are to be overcome. This discussion looks back on the layer model of Williamson that has been used in chapter 4. When combining Williamson’s layer model with the TIP-approach (distinction between technological, institutional and decision process barriers), an insightful overview can be presented of the embeddedness of issues and the time horizon on which they can be overcome (Bauer & Herder, 2009).
Table 3 – Layer model of barriers

<table>
<thead>
<tr>
<th>Layer</th>
<th>Technological</th>
<th>Institutional</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Transport habits</td>
<td>Legal issues</td>
<td>Government mind-set</td>
</tr>
<tr>
<td>3</td>
<td>Open data and APIs</td>
<td>Lack of strong regional authority</td>
<td>Resistance from public transport providers</td>
</tr>
<tr>
<td>2</td>
<td>Realisation of a MaaS platform and</td>
<td>High car taxation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

The overview shows the level of embeddedness of expected barriers for a possible introduction of Mobility as a Service to the Greater Copenhagen area. On a technical field, the standardization of openness of data and open APIs can be seen in the third layer. One layer down, comes the barrier of the technical realisation of a MaaS platform, application and integration of systems. The social subsystem shows us transport habits on the highest level of embeddedness, which are hard to change and deeply rooted in society. Mobility as a Service does not completely change the way we travel but it has the aim to decrease the importance of private vehicle ownership, going towards a more shared economy. The change in this institutional layer can take between 100 and 1000 years, according to Williamson (Williamson, 1998). Other institutional barriers for the Greater Copenhagen area are legal issues, the lack of a strong regional authority and the high taxation on car sale, which are on the third level and mostly deal with formal rules of the game. On the process side, the mind-set of the Danish government and the resistance from public transport providers are expected barriers on the second level. The latter two challenges are within governance and therefore easier to overcome, expected to be changeable on 1 to 10-year time period.

To conclude the chapter on Mobility as a Service in the Greater Copenhagen area, this section presents a recommended approach for Danish authorities in order to overcome expected barriers and to enable a possible realisation of Mobility as a Service. Both the case studies in Finland and Gothenburg show that an important step is to realize that the market should take the lead in the development of Mobility as a Service. The operator for MaaS should be a private third party and not the public transport provider. The right environment for Mobility as a Service can be created through a process of open cooperation between stakeholders. Enabling as a role for the ministry and the municipalities also includes early involvement of private MaaS operators and open discussions about the set-up of the market. Authorities that go into that process with an open mind-set are expected to be able to create the right environment for the introduction of Mobility as a Service. Just as in Finland, the Danish government should take a more pro-active approach in creating the right regulative context and shaping the landscape that gives private companies the opportunity to develop the best possible MaaS product for its users. When regulation and legislation is taken care of and when Danish authorities are open to new initiatives coming from the market, private MaaS operator could be attracted to start their businesses in the Copenhagen area. Again, in this approach the roles of different stakeholders can be characterized as ‘enabling’ for the government, ‘initiating and leading’ for the market and ‘cooperating’ for public transport providers.
8 INTEGRATION

In this chapter, results from the case study on Finland and Gothenburg are used to give a broader view on a possible introduction of Intelligent Mobility. With the case study, the concept of Mobility as a Service has been discussed intensively. Mobility as a Service has been analysed firstly by looking at its examples in Gothenburg and Finland, then the Greater Copenhagen area has been at point of discussion for MaaS’ possible implementation. Now, the broader concept of Intelligent Mobility will be brought back as the topic of interest. Previously in this research, Mobility as a Service has been defined as one of the developments within the broader context of Intelligent Mobility. This section aims at finding out to which extent the initiatives of Mobility as a Service cover the full scope of Intelligent Mobility. Afterwards, one can see what more is needed in order to realize Intelligent Mobility. In chapter 4, a table has been presented that shows the differences between Intelligent Mobility and mobility as organized now. This table will be used here to score the initiatives of UbiGo and MaaS on the list of characteristics of Intelligent Mobility. First, this table with the scoring of both initiatives will be presented. Below, a more detailed explanation of the scoring will be given.

Table 4 – Scoring of Mobility as a Service

<table>
<thead>
<tr>
<th></th>
<th>UbiGo in Gothenburg</th>
<th>MaaS in Finland</th>
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</thead>
<tbody>
<tr>
<td>On-demand</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Customer-centric</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Flexibility in routes</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Flexibility in time</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Flexible journey choices</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Personalised recommendation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Integrated</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Look at whole journey</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Blurring of boundaries</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Less commitment to one particular way of getting around</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sharing economy and access to mobility opportunities</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Both initiatives of UbiGo and MaaS Finland can be seen as highly flexible transport services or mobility services on-demand. Users can request its preferred mode of travel at any time and any place. Mobility as a Service offers users access to several transport options giving them flexibility in journey choices, routes and time. Although public transport with fixed routes, timetables and stops still exists, Mobility as a Service gives its users the possibility to travel by other means whenever preferred. Instead of the traditional ‘take it or leave it’ approach, UbiGo and MaaS Finland build its services around the customer, offering a flexible and changeable package or amount of travel minutes. In this sense, both services are customer-centric. MaaS Finland comes with a dedicated, multimodal travel planner that provides integrated and personalised travel recommendations to users. Within the mobile application, the whole trip can be planned and all necessary tickets for that trip can be acquired. UbiGo does not offer such an integrated and personalized travel planner. Users can book and get access to all transport options but for the actual planning of the trip an outside planner is needed. This leaves users of UbiGo to its own calculations in order to plot the whole door-to-door traveling. Looking at the whole journey, not leaving the ‘last mile’ outside the system, is at the essence of both MaaS initiatives. This whole-journey-approach comes for planning and for ticketing with the
service of MaaS Finland, only for ticketing or access to transport with UbiGo. With the service of UbiGo and MaaS Finland, boundaries between transport modes are blurring and separate planning of those belongs to the past.

Where mobility used to entail a clear, established range of transport modes, now Mobility as a Service makes transport users less committed to one particular way of getting around. Being able to use everything from public transport to rental cars, the choice for a certain transport mode is more flexible and can be retaken for every single trip. Both UbiGo and MaaS Finland build on the view of ‘access over ownership’, in which users are given access to mobility opportunities and no longer are committed to car ownership or long-term season tickets for public transport. Also, it stimulates the sharing economy by including car-sharing and bicycle-sharing into its offering and thus promoting the use of shared cars and bicycles.

Now, the question remains what more initiatives are needed besides Mobility as a Service to realize Intelligent Mobility. Intelligent Mobility is a concept that is never completely achieved. There are always ways to improve the way we travel and to make mobility even more intelligent. This section aims at giving an overview of what more initiatives are possible to reach a level of ‘intelligence’ in mobility that satisfies the current norms of Intelligent Mobility. Looking at the table drawn above and bringing back the meaning of Intelligent Mobility giving in chapter 4, it could be said that the development of Mobility as a Service does not completely satisfy on Intelligent Mobility’s pillars of ‘demand’ and ‘automation’.

The balancing of demand and supply of transport systems is not an aspect of Intelligent Mobility that is necessarily covered by Mobility as a Service. The offering of Mobility as a Service does help in reducing downtime of mobility assets with spare capacity by better listening to users’ demand and optimally matching transport supply. But, it does not focus on the actual changing of demand (yet). Developments that could be necessary to do so, are, for instance, the use of ITS and time-shifting of demand. These applications could be perfectly integrated with Mobility as a Service, by giving MaaS users personalized and intelligent travel information and by giving them off-peak discounts. In this way, Mobility as a Service can help in balancing demand and supply of transport for a region and make the transport system more efficient.

A second aspect of Intelligent Mobility that is not sufficiently covered by Mobility as a Service, is the concept of automation. Technological developments that range from increasingly sophisticated driver assist features to fully autonomous driving make transport in the era of Intelligent Mobility safer and easier. Again, Mobility as a Service offers a perfect opportunity to implement and realize these developments in automation, for instance by offering shared vehicles to MaaS’ users that are self-driving.

Then, as seen in the table above, an element of integration and personalization might be needed to realize the full range of Intelligent Mobility. Mobility as a Service could be implemented with a built-in multimodal travel planner that offers personalized and integrated transport options for users. With the choice for a UbiGo-like service, this will not be the case and here Mobility as a Service is limited to an integrated ticketing platform. The approach in Finland brings integrated ticketing and planning to transport users. Still, while bringing integration and personalization in planning and ticketing to users
of transport, the physical integration of transport systems is a separate task that has to be taken care of. Transport modes should be integrated better to make mobility more intelligent. Examples are enhanced indoor navigation and more dynamic platforming and timetabling, but also urban planning has an important role in this. Designing and building transport nodes that are more modular and ‘pluggable’ is an essential aspect of infrastructure planning of the future. Urban planning that builds on a hub-based system instead of a corridor-based system, is a prerequisite for a possible realisation of Intelligent Mobility in a region.

**CASE: GENERALISATION TO OTHER MARKETS**

This section looks at the generalisation of the findings to other markets. Findings from case studies are difficult to generalize and experts argue that case studies facilitate learning which involves naturalistic generalizations (Enemark, 2016b; Gomm, Hammersley, & Foster, 2000). In other words, case studies offer ‘working hypotheses’ and whenever generalisations to other cases are being made, the fit and similarities between both cases have to be compared (Gomm et al., 2000). For the subject of Intelligent Mobility this means that the findings from the case study in Copenhagen can only be used in other areas as guidelines and not as an indisputable theory. Furthermore, the ‘fit’ between the case of the Greater Copenhagen area and the other, to be researched area has to be made.

When the proposed governance structure for Intelligent Mobility in the Greater Copenhagen area is to be used in other countries or areas, some conditions and similarities with Copenhagen have to be met. The implementation of Mobility as a Service described in the previous chapter requires an open market for transport. This does not mean that train, bus and metro services have to be privatized and open to the market, but it should be possible for transport providers to start car rental, car-sharing or other transportation services. The country has to have a competitive market economy in which private companies can decide to start up transport service operations. In order for Mobility as a Service to be successful, the examined region or country has to have a well-functioning public transportation system. Because public transport forms the backbone of the MaaS service, these services have to be subsidized and attractive to a great public. Just as in the Scandinavian countries that have been part of this research, the level of smartphone penetration should be significantly high. There should be a starting or ongoing trend of digitalization in transport, making it possible for initiatives of Intelligent Mobility to develop. These new developments of Intelligent Mobility are highly dependent on the availability of data. This means that regions or countries that want to follow the approaches recommended for the Copenhagen area, should also have authorities that are focussing or working on the provision of transport data exchange and its security. Needless to say, the list of preconditions is non-exhaustive. When a country or region is examined and the findings for the implementation of Intelligent Mobility in the Greater Copenhagen area are to be used there, this should be done with great caution and consideration regarding the fit and the generalizability of it.
PART V: CONCLUSION & DISCUSSION
9 CONCLUSION AND RECOMMENDATIONS

Throughout the report the concept of Intelligent Mobility has been discussed and analysed in depth. Now, the findings of this research can help in answering the research questions as stated in the beginning of this report. Following the answering of the four subquestions, an answer can be given to the main research question. The conclusion of this research will be followed by recommendations for Danish authorities and recommendations for further research.

9.1 CONCLUSION

As explained, the four subquestions will be answered here, followed by the answering of the main research question.

SUBQUESTION 1: WHAT IS INTELLIGENT MOBILITY?

Intelligent Mobility has been defined as the provision of mobility in which “the user and their experience and requirements must be at the centre and in which the system must be integrated and focused on the outcome of providing a complete journey as easily and efficiently as possible for every user”. In the future of Intelligent Mobility, mobility is customer-centric and on-demand. The user can decide when, where and how to travel. Transportation for these requirements will be provided to them, whenever they want. Bringing a greater flexibility, the provision of transport is way more personalised. Instead of having to plan every single part of the journey separately, transport will be integrated and planning will look at a traveller’s whole journey. Users will have less commitment to one particular way of getting around and boundaries between transport modes will blur. Car ownership will decrease in the sharing economy where users prefer access to mobility opportunities and not necessarily need their own car or season ticket for public transport.

The concept of Mobility as a Service can be seen as a key trend within the Intelligent Mobility domain. Mobility as a Service (MaaS) is an interesting development that can change the way in which transportation is organised completely. With the concept of Mobility as a Service, users pay a month fee to their ‘mobility provider’. All different transport modes are included in this monthly package. The mobility provider offers users a certain combination of transport modes depending on the users’ actual travel needs. Weather conditions, traffic information and the preferences of the user can influence the advised travel itinerary. Users plan and book their trips using a mobile application. All planning, booking and payments are arranged by the mobility provider.

SUBQUESTION 2: HOW CAN INTELLIGENT MOBILITY TACKLE AND CREATE CHALLENGES IN TRANSPORT AND INFRASTRUCTURE?

Challenges have been identified for transport and infrastructure. These have been divided into challenges in transport and infrastructure for society and challenges for the transport sector. To sum up, the following impacts of Intelligent Mobility on societal challenges are expected:

• A higher effectiveness of the whole transport system: less congestion and a reduction of the burden on the car-dependent population;
• A more efficient allocation of resources: more efficient use of capacity (matching more demand with existing supply) including infrastructure, vehicles and parking capacity;
• Lower emissions by helping the urban population in reducing its transport footprint;
• Higher modal share of public transport
• Increasing employment and vitality generated by new businesses;
• Higher social inclusion and lower isolation of certain population groups.

Effects that Intelligent Mobility may have on challenges for the transport sector are the following:
• More seamless and well-functioning transport services that provide better multi-modal journeys: less complexity, more enhanced connectivity and improved speed and reliability;
• More developed, personalized and smart mobility services reflecting the users’ diverse needs and more actively engagement of users in journey planning and transport modal consideration;
• Easier access to mobility;
• Faster journeys and increased confidence in arrival time;
• Higher user experience and perceived value of public transport;
• More relevant, personalised and context-aware information;
• Profitable markets for new transport services and renewed opportunities for the traditional transport and infrastructure business sectors as part of innovative service concepts and cooperation.

But also new challenges can be expected with a possible realisation of Intelligent Mobility. Firstly, authorities need to find a way to stimulate initiatives of Intelligent Mobility. The market has to be ready and open towards changes coming from the implementation of Intelligent Mobility. The current providers of public transport, mostly public companies, face the challenge to get along with the developments around them. To keep up, also these public transport operators have to change their services and way of working. Furthermore, a key challenge for authorities will be the regulation of Intelligent Mobility. For several initiatives of Intelligent Mobility there is no regulation yet. National authorities or organisations in the area need to set up appropriate regulation and governance structures for redesigned transport systems. A mobility provider that integrates and offers all forms of transport to customers, needs to be regulated. The use of data by this mobility provider has to be regulated and rules need to be set up that ensure the privacy of users. Other challenges lie in terms of regulation of a shared-transport market such as issues for parking, taxation and insurance of shared vehicles. Furthermore, authorities have to find a proper balance between data sharing (open data) and privacy.

**SUBQUESTION 3: WHAT FACTORS POTENTIALLY BLOCK THE REALISATION OF INTELLIGENT MOBILITY?**

The cases of Mobility as a Service in Gothenburg and in Finland have shown important barriers for a possible MaaS introduction. With Mobility as a Service as one of the most important developments within the concept of Intelligent Mobility, these barriers are expected to block a potential realisation of Intelligent Mobility. The following barriers have been identified for a possible realisation of Intelligent Mobility:

• Resistance coming from public transport providers towards the concept of Mobility as a Service: public transport providers might be afraid to lose invested interests such as a certain position in the market, a vested brand and image, communication channels with customers
and expectations of the future. These transport providers are afraid that Mobility as a Service is just a layer on top of them, which makes them a cost base and possibly lower profits;

• The legal challenge coming from the introduction of new mobility services: Legislation might not allow the reselling of public transportation tickets yet, let alone a commission percentage on these sales for MaaS operators selling these services;

• Technical realisation of a MaaS platform, open data and APIs and the integration of ticketing systems: the knowledge and technology are there, but authorities and companies have to be willing to invest in its development.

Next, some barriers that are specific for the introduction of Intelligent Mobility in the Greater Copenhagen area have identified:

• The mind-set from the Danish government: the Danish Ministry of Transport is not looking into the topic of Intelligent Mobility at the moment and furthermore it states that it expects higher direct profits from infrastructure investments than from investments in or commitment to the concept of Intelligent Mobility or Mobility as a Service;

• The lack of a strong regional authority in the Greater Copenhagen area: the Capital Region of Denmark, in which Copenhagen is situated, has little authority regarding transport planning. A potential company has to cooperate with different municipalities and the national government;

• The presence of relatively high car sales taxes in Denmark: Danish taxation on car sales can be considered very high and accounts up to 150% on top of the purchase price of a car. Usage of vehicles in Denmark is relatively cheap, especially compared to the purchase of the vehicle, so vehicle owners in Denmark might be difficult to seduce for a service in which they have to give up their personal vehicle.

**SUBQUESTION 4: WHAT CONDITIONS CAN FACILITATE A POSSIBLE INTRODUCTION OF INTELLIGENT MOBILITY?**

Certain conditions or approaches are expected to facilitate a possible introduction of Mobility as a Service and consequently the realisation of Intelligent Mobility. These so-called facilitators have been experienced in the case studies in Gothenburg and Finland and thus are presumed to stimulate a potential introduction of Intelligent Mobility. Three facilitators have been identified:

• An initiating and leading role for the market: giving private companies the opportunity to come up with initiatives of Intelligent Mobility will stimulate the introduction of Intelligent Mobility. Private companies have the expertise and abilities to make mobility more intelligent, whereas governments can support their initiatives with financial incentives. Governments that enable and let the market initiate, can expect a faster development of Intelligent Mobility in its region;

• Cooperation between public and private organisations: open discussions and the early involvement of the private sector will lead to a faster and more sophisticated introduction of Intelligent Mobility. In this way, public transport providers also realise that they can be part of the solution, but not own the solution;

• Openness of data and APIs: a last facilitator is open transport data and APIs. Sharing of transport data is of great importance in the era of Intelligent Mobility. Regions and countries that offer private companies access to data from public transport providers are expected to
see the change to Intelligent Mobility much faster than when public transport data is not openly available.

So far, answers have been given to the four subquestions of this research. Consequently, this will lead to a final conclusion with the answering of the main research question below.

**HOW CAN TRANSPORT MARKET GOVERNANCE BE ORGANISED TO MAKE MOBILITY MORE INTELLIGENT?**

This research has shown implications of mobility becoming more intelligent. The governance of the transport market plays an important role in this potential change. To answer the main research question, a description will be given of transport market governance that enables the realisation of Mobility as a Service. Mobility as a Service is being seen here as a key development for the realisation of Intelligent Mobility. To cover the whole scope of Intelligent Mobility, recommendations for additional elements will be given at the end of this section.

Governance for the transport market has been divided into three elements: the organisational structure of a Mobility as a Service company, the structure of the market and market regulation. Different possibilities exist for all three components of market governance. These options for market governance of Mobility as a Service will be explained below.

Regarding the structure of the organisation of a Mobility as a Service provider, there are three options: the company can be a privately owned firm, an institution being run by the government or being operated with a public-private partnership. Having a public organisation as the provider of Mobility as a Service gives three possibilities:

- A public transport provider as the MaaS operator;
- A public third party as the MaaS operator;
- A newly set-up public MaaS operator.

The opposite approach is to leave the provision of Mobility as a Service to the market, trying to attract a private company to take on the role of a Mobility as a Service provider. Here, a third-party, private company like UbiGo or MaaS Finland starts operations for mobility services in the area. It offers different subscriptions or packages to users and aims at making a profit, while potentially competing with other private MaaS operators. The hybrid form combines a publicly-developed and owned MaaS platform that integrates all transport APIs with private or public MaaS service providers offering these services to end-users.

Then when looking at the governance of the market for Mobility as a Service, this can be done in two ways, either by a public procurement with a concession or by an open market. A public procurement will tender out the right or concession to sell public transportation tickets on the behalf of public transport providers. When an open market for the reselling of tickets will be established, public transport providers are expected to open up their ticketing systems. Companies interested in offering tickets for public transport are allowed to do so, while taking care of the rules concerned with these activities. In the case of a public MaaS platform, the option between a concession and an open market also exists. Here the concession includes the right to use the MaaS platform and offer a service to end-users while using this system.
The previously described governance choices come with implications for regulation of the market and regulation of data. The choice for certain forms of organisation or governance structure has consequences for the degree and type of regulation that is needed. The allowance of private MaaS operators leads to a higher degree of regulation needed than when a public authority is organising Mobility as a Service itself. Structuring the market as open and competitive requires more regulation to prevent market failures and monopolies than when a concession for Mobility as a Service is being tendered out. It should be possible for new companies to enter the mobility market in a country, not being impeded by existing MaaS operators to commence services. Monopolies have to be avoided, both resulting from exclusivity between a MaaS operator and a monopolistic transport provider as well as from market failures that give a single MaaS operator an unfairly preferred market position. Public values have to be taken care of and this is done via regulation that includes guaranteeing of customer protection for end-users and non-exclusion of certain groups. Finally, market regulation has to ensure that MaaS operators’ behaviour and activities on a systematic level are geared to national policy goals as sustainability and safety. Furthermore, regulation should allow transport providers and MaaS operators to open up their APIs, but not force them to. Mobility as a Service operators should have a legal foundation to use the data from monopolistic transport providers and regulation might be necessary for this justification. The other side of data regulation for mobility services is about the safe keeping of users’ data and protection of customers’ privacy. Strict rules are necessary for the sharing of data with third parties, internal storage of data and data-exchange between providers and MaaS operators.

Finally, some other initiatives in addition to Mobility as a Service are needed in order to cover the full scope of Intelligent Mobility. As said before, Mobility as a Service is a key development within the Intelligent Mobility concept but does not cover it completely. Therefore, the following additional developments are recommended when authorities aim for making mobility more intelligent.

- Developments that balance demand and supply of transport systems more effectively such as Intelligent Transport Systems, intelligent route information, dynamic timetabling and routing of public transport and dynamic parking
- The promotion of or investments in automation in the Danish transport sector such as autonomous cars. A fleet of autonomous and shared vehicles could form a great backbone of a Mobility as a Service system and would significantly promote the development of both concepts.
- Physical integration of transport systems such as enhanced indoor navigation and more dynamic platforming and timetabling. Also urban planning plays an important role here. Urban planning that builds on a hub-based system instead of a corridor-based system, is a prerequisite for the realisation of Intelligent Mobility in a region.

9.2 RECOMMENDATIONS FOR DANISH AUTHORITIES

Together with a general conclusion of the research, a recommendation to Danish authorities for a possible introduction of Mobility as a Service will be given. When Danish authorities decide to aim for the realisation of Mobility as a Service in the Greater Copenhagen area, these recommendations can be used. Both the case studies in Finland and Gothenburg have shown that an important step is then to realize that the market should take the lead in the development of Mobility as a Service. The advice is that the operator for Mobility as a Service is a private third party and not the public transport
provider. The right environment for Mobility as a Service can be created through a process of open cooperation between stakeholders. Enabling as a role for the ministry and the municipalities also includes early involvement of private MaaS operators and open discussions about the set-up of the market. Authorities that go into that process with an open mind-set are expected to be able to create the right environment for the introduction of Mobility as a Service. A pro-active governmental approach is needed to create the right regulative context and shape the landscape that gives private companies the opportunity to develop the best possible MaaS product for its users. When regulation and legislation is taken care of and when Danish authorities are open to new initiatives coming from the market, private MaaS operators could be attracted to start their businesses in the Copenhagen area. Again, in this approach the roles of different stakeholders can be characterized as ‘enabling’ for the government, ‘initiating and leading’ for the market and ‘cooperating’ for public transport providers.

Furthermore, for a possible introduction of Mobility as a Service in the Greater Copenhagen area the following set-up or approach is recommended:

Regarding the organisation structure, a private company could be a right candidate to set up a Mobility as a Service offering. Both case studies in Finland and Gothenburg have shown strong arguments in favour of a market-oriented approach. The exact offering, business plan and pricing of packages should be left to this company to come up with. A prerequisite seems the integration of the Rejsekort into its system, so potential customers could use their existing travel cards to get access to the offered transport services. The expectation is that this MaaS operator will develop a multimodal travel planner that allows its users to plan and compare travel options. The existing, government-owned travel planner Rejseplanen is not geared for this purpose and might subsequently lose its function in the future. Meanwhile it could also be argued that Rejseplanen will keep its reason for existence since not all transport users are expected to switch to Mobility as a Service.

Next, the private MaaS operator should ideally include all transport providers that are operating in the Greater Copenhagen area into its system. Thus, a subscription to Mobility as a Service would give users access to transport services from Movia, DSB, Metroselskabet, DriveNow, LetsGo, GoMore, Snappcar, Bcyklen, taxi services, car rental companies, Uber and private bus companies. Although exclusivity could lead to lower prices for transport services offered to MaaS users, it doesn’t give users the same freedom of choice as when all Copenhagen’s transport options are available. Especially as a first MaaS operator in the region, exclusivity with transport providers might be best avoided.

Then when looking at the market and its governance structure, a consequential proposal for Copenhagen can be given. The market for Mobility as a Service is expected to be at its best when chosen for an open and competitive approach. Realizing the right regulatory environment will lead to a market in which multiple, competing MaaS operators create the best possible outcomes for transport users. In the Greater Copenhagen area, where there is no single legal entity for the provision of public transport, a procurement, as is being done in Gothenburg, will be difficult and time-consuming. Therefore, the creation of an open market seems to be the most promising government structure for Mobility as a Service here. At the same time, having an open market for Mobility as a Service requires the Danish government to come up with pro-active and comprehensive regulation. As described in the previous paragraph, proper regulation for an open market should result in the
prevention of harming monopolies, market failures and has to prescribe rules for cooperation between MaaS operators and transport providers, for cooperation between MaaS operators themselves and for the sharing and openness of data.

9.3 RECOMMENDATIONS FOR FUTURE RESEARCH

Apart from recommendations for Danish authorities for a possible realisation of Intelligent Mobility, this chapter also discusses some recommendations for further research on the topic of Intelligent Mobility. In this section, four recommendations for future research will be discussed.

A validation of the results by adding more case studies is recommended. In this research, the cases of UbiGo in Gothenburg and MaaS in Finland have been looked at, but more and more examples of Mobility as a Service are popping up. These initiatives such as Smile in Vienna and the Mobility Shop in Hannover could serve as case studies in a further research on the topic of Mobility as a Service. Adding more case studies is a necessary step in the validation of the results coming from this research.

A next recommendation for future research is to look more deeply into the governance of Intelligent Mobility as a whole. This research has been focussing on the concept of Mobility as a Service, especially when it comes to the answering of the main research question regarding transport market governance. Although Mobility as a Service forms an important part of Intelligent Mobility, it does not cover the concept completely. Therefore, additional research that looks into transport market governance of Intelligent Mobility might be useful.

The development of a business case for a Mobility as a Service provider in the Greater Copenhagen area could have a significant added value. This research has been looking into the societal feasibility and desirability of Mobility as a Service and has not been necessarily taking into account the profitability of such a service. Private (or public) companies that want to start up MaaS services in the Greater Copenhagen area need to know about the operational and financial feasibility of such a service. This research could include looking into the pricing scheme of different Mobility as a Service packages.

A final recommendation for further research into the topic of Intelligent Mobility is to look at travel behaviour and its consequences for Intelligent Mobility. Research needs to find out if travellers are willing to change their behaviour, for instance get rid of their private cars, in the future. Furthermore, it is necessary to find how authorities could effectively change travel habits and behaviour in order to accommodate the change to more intelligent mobility.
10 DISCUSSION

In the final part of this report, the focus will be on a discussion of the outcomes of this research and an evaluation of its scientific value. This chapter will first look at the outcomes and the context of these findings. Next, a discussion of the used methodology and the scope of this research will follow. Finally, this chapter provides a reflection on the process of this research.

10.1 DISCUSSION ON THE RELEVANCE AND CONTEXT OF THE FINDINGS

This research focussed upon the introduction of Intelligent Mobility in the Greater Copenhagen area. It has presented different options for transport market governance together with a recommended approach on how to overcome expected barriers for the introduction. The focus of this research has been mostly on the concept of Mobility as a Service, with an analysis part fully devoted to this topic. The question arises what the relevance is of these outcomes and in which degree conclusions for Mobility as a Service are representative for governance of Intelligent Mobility. Both the concepts of Intelligent Mobility and Mobility as a Service have to be put into their context for this discussion. Intelligent Mobility can be seen as an umbrella term, covering a lot of different developments in transportation. There is no single demarcation of the concept, neither can the exact outcome of these developments be predicted. The transport sector is being perceived relatively ‘old-fashioned’ and ‘ready for changes’. One has to keep in mind that the to-be-expected change in the transport sector is nothing more than a wide-spread assumption. The signs of market change are there, initiatives of Intelligent Mobility are popping up and other sectors like telecommunications and energy already experienced similar changes. But, the future could prove differently and the assumption that the transport sector is ripe for disruption might not hold. Whenever conclusions from this research are being interpreted, the underlying assumption concerning market change needs to be thought off. Having said this, the conclusions and findings from this research are still expected to hold, even in a future in which mobility is not as ‘intelligent’ as this research assumes. This brings us back to the putting-in-context of Mobility as a Service and Intelligent Mobility. Although Mobility as a Service might be just one of the many developments going on in the transport market, it is still an initiative that clearly and significantly is making its way to different cities around Europe. Outcomes from this research are expected to be relevant for many Intelligent Mobility developments and not only Mobility as a Service. Different Intelligent Mobility initiatives share their underlying approach and conclusions for market governance seem to hold also for other or new developments having similar characteristics. This research considers proposed governance structures for Mobility as a Service to be representative for other initiatives of Intelligent Mobility.

A further topic of discussion is the feasibility of the findings of this research. Governance approaches have been presented that could stimulate or facilitate the introduction of Intelligent Mobility in the Greater Copenhagen area. Problematic could be that the current Danish government does not seem to share the same beliefs as other governments in the Nordic countries. The feasibility of the research’ outcomes could be seriously threatened by a Danish government that is not so supportive to the development of Intelligent Mobility. On a local and regional level, commitment definitely seems to be there, but on a national level, the Danish government has its focus on other goals than making transport more intelligent. After a parliament change in June 2015, the governmental focus is less on sustainability on innovations goals, with the lowering of car sales taxes and lower investments in innovation. During this research’ interview with the transport ministry, its belief in ‘more direct
benefits from infrastructure investments than from Intelligent Mobility initiatives’ clearly shows a possible lack of support for the realisation of innovative mobility in Denmark. This lack of support and its consequences for the feasibility of this research’ outcomes have to be taken into account. Local authorities or private companies aiming at the development of Intelligent Mobility initiatives need to be aware of possibly inadequate support from the Danish national government.

Regarding the context of the findings of this research, a final note can be made. During the research, the scope has been on the Greater Copenhagen area. This demarcation had clear advantages: initiatives of Intelligent Mobility seem to be more relevant for urban areas and less likely to be realised in lower-populated regions. On the other hand, the case study of Mobility as a Service in Finland has shown that the scale of a region might be too small for a proper introduction of such a service. MaaS Finland stated that a MaaS offering should have a national or at least provincial coverage in order to be attractive for customers. The proposed governance structure for Mobility as a Service in this research is aimed on the level of the Greater Copenhagen area. Further research might be needed to find out whether a Mobility as a Service offering for this area might be viable for both a company and for customers or that a larger area has to be covered.

10.2 Discussion on methodology

The methodology for this research has been twofold: a case study on Intelligent Mobility in Copenhagen combined with a comparative case study on Mobility as a Service in Gothenburg and Finland. The input used for these case studies comes from interviews conducted with key stakeholders in all three regions. Both research methods know limitations, which will be reflected upon in this section.

When looking at the case study that has been conducted, one can see that the selection of cases has a major influence on the outcomes of the research. At the time of writing, the examples of Mobility as a Service in Gothenburg and Finland were the only two known initiatives of Mobility as a Service. Developments on the field of Mobility as a Service are going really fast and now other initiatives can be seen in countries like Austria, the Netherlands and Germany. These cases have not been looked upon in this research yet, since realisation of these only has been visible recently. The cases of UbiGo in Gothenburg and MaaS in Finland might have shown barriers that are not that relevant for future development of Mobility as a Service initiatives. The reason for this is that the described cases are pioneering and innovative developments requiring a lot of piloting and testing before proper implementation is possible. ‘Second-generation’ MaaS initiatives could have a learning advantage, possibly enabling them to skip pilot phases and experiencing fewer or different barriers. The criteria and the process of the selection of the cases in Gothenburg and Finland are clear and valid, but careful consideration nevertheless seems necessary regarding the influence of this selection on the outcomes of the research.

A second point of reflection that has to be made on the use of the methodology in this research comes from the conducting of interviews with major stakeholders. The information and input coming from these interviews largely determines the conclusions and outcomes of this research. Problematic here is that the information given in these interviews always reflects stakeholders’ opinions and interests. The findings from these interviews do not have to concern the objective truth, but are more likely to
show actors’ perspectives on the introduction of Intelligent Mobility. Although it might be difficult to scientifically use the information coming from these interviews, this research included measures to deal with the expected subjectivity. The most important measure taken is to conduct interviews with a broad scale of stakeholders, varying from local, governmental organisations to private and profit-driven MaaS initiators. By comparing the statements given by these different organisations more well-considered observations could have been presented. All cases have been looked at from the perspectives of different stakeholders and their answers in interviews have been compared to other available sources of information.

10.3 Reflection on the process

Finally, the process of this research will be reflected on in this section. When looking back at the research process, overall it can be described as a pleasant and enervating journey. Nonetheless, some difficulties can be pointed at that have been experienced throughout the process. The first one has to do with the novelty of the topic of this research. Intelligent Mobility and Mobility as a Service are both relatively new concepts and the scope for this research had not been made clear yet at the start of the project. The research has been a process of looking for the right direction, scope and purpose of it. Such an explorative and open approach is difficult and hard to grasp, but also gives interesting possibilities for iteration and development. Later towards the end of the research, the outcomes and scope of the project became more clear, making it easier to works towards a goal.

Another point of reflection on the process is the alignment of interests of the university and the hosting company for this research. The focus of the Delft University of Technology is mostly on the social and scientific relevance of the research, while COWI A/S aims for a more sellable, market-relevant outcome. Finding the right balance here has been proven difficult sometimes. The scope and the content of the research had to be clearly discussed with both parties in order to write a scientific relevant thesis that was also valuable to COWI. At the start of interviews with stakeholders, that are (potential) clients to COWI, a division of roles and a list of discussion topics had to be agreed upon. Also, the introduction between the supervisors from the university and from COWI during the kick-off meeting resulted in a common understanding of both parties’ interests and roles. During the research, the discussions with the supervisor at COWI about expectations from both parties were pleasant and valuable. Although the differences in expectations from both were visible, the alignment of those never resulted in problems or serious difficulties for the research.

The conducting of interviews should get a final thought of reflection for this research. Finding the right persons in the right organisations to talk to, has not always been easy. Coming from a different country, at first, it is difficult to find out where to look for the right interviewees. The help from COWI on this field has been of great value and highly appreciated. Whenever a potentially interesting interviewee had been selected, the real struggle started: getting the opportunity to talk to these people. All interviewees had a very busy schedule and it has been difficult convincing some of them to find time to participate in the interview. With some stakeholders that were on the list for an interview, no possibilities could be found for a meeting. Other interviews have been conducted in the end, but took a lot of time, effort and flexibility from my side in order to be planned. Eventually the people that has been spoken to, can be considered a highly valuable and interesting list of stakeholders relevant to the research.
References


A. TRANSPORT SYSTEM

In this chapter, the transport system in Copenhagen will be conceptualized from both a technical and an organisational perspective. This means that Copenhagen’s transport market will be discussed, presenting its characteristics and elements. Next, the actors in the transport system are presented, including their responsibilities, goals and incentives.

A.1. TECHNICAL VIEW OF THE TRANSPORT SYSTEM

Transport in Copenhagen has been improved enormously during the years and the Greater Copenhagen area now can rely on a well-established infrastructure. Thanks to its extensive road and rail network, but also because of the international airport, Copenhagen is considered as a major transport hub in Northern Europe. Copenhagen is a real bicycle city and its bicycle track network is extensive. Public transport in Copenhagen is well developed and the network consists of train, metro and bus lines and harbour busses. In the next part, most transport modes and infrastructure organisation will be explained in more detail.

Denmark’s road network is, when measured in kilometres, the country’s most extensive type of infrastructure. A big part of Denmark’s road infrastructure is located around Copenhagen, which is the only true metropolitan area in the country. Around 5 percent of all Danish roads are state roads, the remaining 95 percent are roads owned primarily by local municipalities (Ministry of Transport, 2012a).

An important element for Copenhagen’s road network is the Oresund bridge between Denmark and Sweden. The bridge, with a total length of almost 16 kilometres, provides both road and rail connections from Copenhagen to Malmo (Ministry of Transport, 2012a).

The Greater Copenhagen area offers public transport in the form of trains, S-trains, metros, busses and harbour busses (Ministry of Transport, 2012a). Regional trains are equally important for transport within the metropolitan area. Important lines are for instance to Helsingør, to Roskilde, to Copenhagen Airport and further to Sweden. The train line connecting Helsingør and Copenhagen with Malmö in Sweden is called Øresundståg and with trains running up to a 10-minute frequency this service is an important train connection in the area. The S-train network is a metro-like urban rapid transit system mainly serving the Greater Copenhagen area. Four main lines are connecting Copenhagen and its inner boroughs with the suburban areas. Trains are running frequently and the infrastructure is completely separated from all other traffic. On S-trains it is allowed and common for passengers to bring their bicycles. Copenhagen’s metro network is relatively new. Operations started in 2007 with two metro lines running from the north-west (Vanløse) to the south-east (Amager) of Copenhagen. A new circle line is being built and expected to be ready for operations in 2018 (Ministry of Transport, 2012a). The Copenhagen Metro is providing quick and reliable underground connections to the wider Copenhagen area by connecting the city centre to suburban areas and the airport. At the moment there are 22 metro stations and trains are running automatically without an on-board driver. To conclude, Copenhagen’s public transport system also includes busses and water busses.

Furthermore, Copenhageners use their bicycles a lot to travel from A to B. Copenhagen is famous for its biking culture and with more than 390 kilometres of designated bike lanes, everyone can...
understand why 95% of the Copenhageners owns a bicycle (Ministry of Transport, 2012a). In Copenhagen, 29 percent of all trips are being made on a bicycle, making it a popular mode of transport for a lot of purposes.

**A.2. ORGANISATIONAL VIEW OF THE TRANSPORT SYSTEM**

This section contains an overview of stakeholders to the transport system in the Greater Copenhagen area. This analysis shows their interests and responsibilities and the way in which stakeholders interact with each other.

Stakeholders to the transport system in the Greater Copenhagen area can be categorized in the following groups:

- Authorities
- Transport service providers
- Service/data providers
- End users
- R&D actors

The next sections describe the relevant stakeholders for each group.

**A.2.1. AUTHORITIES**

The European Commission (EC) is the executive body of the European Union and is responsible for European legislation. Denmark, as one of the EU member states, has to implement European regulation. The European Commission represents the general interest of the EU and is the driving force implementing regulation concerning mobility in Europe (European Union, 2016).

The Ministry of Transport and Building (TRM, Danish: Transport- og Bygningsministeriet) is set up by the Danish government and is the highest governing body for the Danish transport sector (Ministry of Transport, 2011). National legislation concerning transport is the main responsibility of the ministry. Its responsibility is within the areas of roads, vehicles, railways, fixed links, harbours, ferry operations, aviation, airports and postal services. The ministry has the task to implement policy from the government within its areas.

The Danish Transport and Construction Agency (Danish: Trafik- og Byggestyrelsen) is an agency within the Ministry of Transport and Building. The agency's main responsibility is the regulation on all forms of transport in Denmark (Trafik- og Byggestyrelsen, 2015). It includes the railway authority, aviation authority and road authority. Also the agency advises the ministry on matters relating to transport policy. The Danish Transport Agency is involved in the planning, coordination and regulation of public transport.

The Capital Region of Denmark (Danish: Region Hovedstaden) is one the five regions in Denmark. Every region has the primary responsibility for the overall health service, but together with the municipalities and various organisations, the regions are also in charge of ensuring development and growth within the areas of business, education, climate and transport. The Capital Region of Denmark,
with 1.7 million residents is the most populated region in Denmark (Region Hovedstaden, 2015a). Together with Region Zealand and 45 municipalities, the Capital Region of Denmark finances the transport company Movia. The Capital Region also finances local train lines and regional routes. A regional transport agreement has been set up in 2011, together with the municipalities. In this agreement, investments in the future that are considered necessary for the region’s accessibility have been established.

The City of Copenhagen (Danish: Københavns Kommune) is the largest municipality in the Greater Copenhagen area. The City of Copenhagen is in charge of local legislation for Copenhagen. The City of Copenhagen has seven administrations, of which one is called the Technical and Environmental Administration (City of Copenhagen, 2015a). This department of the municipality is responsible for most transport issues in Copenhagen. Public transport, roads, parking and cycling routes can be seen as important topics for the municipality.

A.2.2. TRANSPORT SERVICE PROVIDERS

The Danish State Railways (DSB, Danish: Danske Statsbaner) is the largest train operating company in Denmark (DSB, 2015a). Although owned fully by the Danish Ministry of Transport, DSB is an independent public corporation. Its responsibilities are the passenger train transportations on most of the Danish railways, so freight transport is not part of their tasks. DSB doesn’t own railway infrastructure and is not responsible for the construction and maintenance of the tracks. The S-train system, as described before, is operated by DSB, as is the Øresundståg that runs to Sweden.

Metroselskabet is a public owned company that is responsible for all metro transport in Copenhagen (Metroselskabet, 2015b). Furthermore, it has the overall responsibility to establish the City Ring line. Metroselskabet is a partnership, owned jointly by the City of Copenhagen (50%), the Danish Government (41.7%) and the City of Frederiksberg (8.3%). Metroselskabet has been founded in 2007 when operations on the metro lines started. In 2010, through an EU tendering process metro operations have been awarded to an operating company. These operations are contracted out to Ansaldo STS, an Italian transportation company. Ansaldo STS has subcontracted its Copenhagen metro operations again to Metro Service A/S. Metro Service is a privately owned company that handles the operation and maintenance of the metro. It has been awarded metro operation and maintenance until 2019 (Metroselskabet, 2015a).

Movia is Denmark’s largest transport company with around 220 million passengers per year (Movia, 2015b). Movia is responsible for bus transport in the Capital Region of Denmark and the Region Zealand, but also for certain local railways and water busses. Movia is a public company and is owned and financed by the two regions and 45 municipalities. The Capital Region of Denmark and municipalities decide which bus lines have to be established and what their frequency should be. Then, Movia plans and coordinates the overall bus services across municipal and regional boundaries, so it can provide the best possible service, which is also connected to train- and metro services. Movia doesn’t operate these bus services itself, neither does it own any vehicles. All operations have been put out to tender and awarded to subcontractors.
Arriva is the largest subcontractor for bus operations of Movia with more than 140 bus lines in the Greater Copenhagen area (Arriva, 2015a). Arriva Denmark is part of the Arriva Group, one of the biggest transport companies in Europe. Arriva Group is owned by Deutsche Bahn since 2010, when the German train company acquired it. Arriva Denmark is responsible for bus operations, including the training and scheduling of drivers, purchasing and maintenance of vehicles and sales of tickets. Furthermore, Arriva is responsible for operations on the three harbour busses (Danish: havnebusserne) in Copenhagen. The car-sharing system DriveNow is operated by Arriva in the Greater Copenhagen area.

Private taxi companies provide taxi transport in Copenhagen. Most companies are united in a taxi association called Dansk Taxi Råd (Dansk Taxi Råd, 2015). Taxi entrepreneurs need an operation license that is being granted by the taxi regulatory body Taxinævnet. Taxinævnet is a joint authority for 28 municipalities in the Capital Region of Denmark. Its main responsibility is ensuring quality of taxi services by controlling rates and providing licenses. The largest taxi companies in Copenhagen are Taxa 4x35 and DanTaxi.

Several new mobility initiatives in Copenhagen will be described in appendix C. Some of these are transport service providers, which makes them stakeholders in Copenhagen’s transport market. These are Uber, DriveNow, LetsGo, Car2Go, MinbilDinbil, GoMore and Bycyklen. All are private companies, except for Bycyklen. The Bycyklen system is owned by the cities of Copenhagen and Frederiksberg and DSB. but the realisation and operation of the bike system is contracted to GoBike.

A.2.3. SERVICE/DATA PROVIDERS

Rejsekort A/S is the organization in charge of the Rejsekort, Denmark’s electronic ticketing system for public transport (Rejsekort, 2015). The shareholders of Rejsekort are several transport companies in Denmark. For the Greater Copenhagen area these are DSB, Movia and Metroselskabet. The Rejsekort system will be described in appendix C.

Rejseplanen (English: Travel planner) is Denmark’s largest public internet service, providing more than 20 million itineraries a month through the website and mobile application (Rejseplanen, 2015b). Founded in 2003, the company is owned by the regional and local transport companies including DSB, Movia and Metroselskabet. These transport companies are also providing Rejseplanen with real-time transport data. Users can plan their entire journey with public transport throughout whole Denmark. Travel information found on its website rejseplanen.dk and its mobile application is real-time and always providing travellers with the latest travel updates.

Din Offentlige Transport (DOT, English: Your Public Transport) is a cooperation between DSB, Movia and Metroselskabet to make public transport in Zealand better and more coherent (DOT, 2015). DOT serves as a single access point for information on public transport throughout Zealand. All customer service, traffic information, prices and tickets, communication and marketing have been combined in this platform.

A.2.4. END USERS
End users here are the residents of the Greater Copenhagen area: the users of transport and infrastructure in the region. These include cyclists, car owners and sharers, passengers on public and private transport. One can see differences in usage and preferences by different groups, for example students, commuters or elderly people.

A.2.5. R&D ACTORS

Realdania is a “member-based philanthropic organization that supports projects in the built environment: cities, buildings, and built heritage” (Realdania, 2015). Realdania works together with researchers and local enthusiasts, also on topics concerning mobility in Copenhagen, and aims at strategically advising decision-makers. Its legal structure is that of a private association operating as a business.

Copenhagen Solutions Lab is an incubator for smart city initiatives and part of the City of Copenhagen (Copenhagen Solutions Lab, 2015). Working together with the City’s administration, local and international companies and institutions, Copenhagen Solutions Lab aims at creating new ideas, technologies and solutions for urban challenges. Part of its activities are focussed on intelligent transport solutions for Copenhagen to make mobility better.

Copenhagen Capacity is an organisation for investment promotion and economic development in the Greater Copenhagen area (Copenhagen Capacity, 2015). Also on the field of transport and infrastructure it aims at attracting foreign-owned businesses. Copenhagen Capacity is mostly funded by the Capital Region of Denmark and has close links to other governmental bodies.

Technical University of Denmark (DTU, Danish: Danmarks Tekniske Universitet) is a public university located in Lyngby, 15 km north of Copenhagen. DTU is ranked among Europe’s leading engineering institutions and seen as one of the best universities in Scandinavia (DTU, 2015). Also on the field of mobility research DTU plays an important role. It has been part of the Copenhagen Research Forum 2012, contributing to several societal challenges such as urban transport (Copenhagen Research Forum, 2012).

Formel M is a public-private innovation initiative carried out between public institutions, private companies and universities (Formel M, 2015). Formel M has the aim to reduce the single-use of cars and promote bike, public transport and car-sharing. Most of its funding is coming from the Danish Transport Agency and the Capital Region of Denmark.
B. TRENDS AND CHALLENGES

Mobility in Copenhagen might look different in the future. Important to see is what challenges in mobility there are, now and in the future. Issues that are important for transport and infrastructure planning will be discussed. Furthermore, possible trends in transport and infrastructure will be explored.

B.1. TRENDS

The transport sector in Copenhagen has been changing gradually throughout the years. Roads have been built and public transport has been improved, always trying to satisfy users’ needs. Societal, technical and environmental trends in Copenhagen might bring new challenges for its transport sector. Identifying trends is an important step in determining transport policy’s effectiveness. In the Greater Copenhagen area, some major trends can be seen. Trends can be seen on a larger geographical scale and are not only at importance for Copenhagen. Yet, knowledge of the implications for the Greater Copenhagen area are necessary to be able to provide useful conclusions. To do so, in this section global or national trends will be discussed, while the next section aims at identifying challenges for mobility in Copenhagen following from these trends. Four major trends can be seen, that are of importance to Copenhagen’s transport system. These trends are urbanisation, climate change and sustainability, trends in demographics and technological development.

B.1.1. Urbanisation

The trend of urbanisation can be seen all around the globe. From 1950 to 2015, the population living in cities increased from 30% to 54% worldwide. In Europe, this proportion changed from 52% to 74%. Denmark, one of the most urbanised countries in the world, saw increased numbers from 68% to 88%. By 2050, it is expected that almost 92% of the population in Denmark is living in urban areas (United Nations, 2014). The increase in proportion urban citizens can be seen in the figure below. With Copenhagen being Denmark’s largest city, most population is consequently living here. The Greater Copenhagen region has a population of nearly 1.3 million, almost one-fourth of everyone living in Denmark (Statistics Denmark, 2015a). This number is expected to grow in the coming years. With already 88% of Denmark’s population living in urban areas, the era of urbanisation in Denmark may have come to an end, urban growth has not. More and more urban land is being used per capita at an increasing pace. Every year, around 15 km² is transformed from natural to urban area in Denmark (Fertner, 2012). The metropolitan area of Copenhagen is expanding, integrating parts of rural areas into the urban. For the coming years, the percentage of urban area in the Greater Copenhagen region has a steady grow projection.
B.1.2. CLIMATE CHANGE AND SUSTAINABILITY

Changing of climate is probably the most influential environmental trend for the world. Key natural and human living conditions are being influenced by climate change, which forms the basis for social and economic development. These days, a great focus is on sustainable development, on climate policies and emissions control in order to prevent the cause of climate change and its vulnerability. Sustainability is a key word in almost every policy plan. Wisely exploiting of natural resources and minimizing of contamination are important elements. Sustainability strongly relates to transport, be it the transport sector largely affecting the environment.

B.1.3. DEMOGRAPHIC TRENDS

Several demographic trends can be seen. Population growth is a common fact worldwide, although maybe not significantly for developed countries, such as Denmark. Still, Denmark’s population is expected to continue growing for the coming years. Population growth obviously comes from a positive birth rate. But of much of the growth also stems from immigration, partly from other parts of Denmark, but also from outside Denmark. The Capital Region of Denmark, with a population of almost 1.77 million in 2015, is expected to have around 2.08 million residents in 2040 (Statistics Denmark, 2015c). The expected growth in population for the Capital Region of Denmark can be seen in the figure below. The City of Copenhagen has to deal with the largest share of this population growth. While the whole region expects an increase in population of 18% by 2040, in Copenhagen alone projections until 2040 show a 29% growth (Statistics Denmark, 2015c).
In addition to population growth, another interesting demographic trend can be seen in developed countries: the ageing of the population. Life expectancy is rising and being on average 80.6 years now for new born babies in Denmark (Statistics Denmark, 2015d). Consequently, the share of elderly people in the total population of Denmark is increasing. While in 2015 around 12% of Denmark’s population has the age of 70 or older, this share is expected to be 20% in 2040 (Statistics Denmark, 2015b). This means relatively less young people have to take care of relatively more older people in the years to come.

Maybe the most promising trend in demographics is the social change brought by the generation of the Millennials. This generation is born in the years ranging from the 1980s to the early 2000s. Millennials are considered ambitious, self-confident and full of high expectations in life (Heikkila, 2014). Growing up in a world of technological progression, these ‘digital natives’ take information and communications technology and mobile connectedness as given. Millennials travel more than ever and are socially aware with their globally oriented mind-set. An interesting paradigm shift brought by this generation is trend of servicing and sharing. Many refer to this trend as the rise of ‘the sharing economy’ and ‘access over ownership’. Both concepts will be examined more precisely now.

The sharing economy is booming. Technology has reduced transaction costs and the sharing of assets is easier and cheaper than ever. Everyone with access to the internet has the possibility to share its goods. New platforms match up owners and renters and businesses have jumped into that gap. The most well-known is of course Airbnb, the website that allows you to rent out your apartment, but also other platforms provide collaborative consumption: car-sharing and peer-to-peer lending are just two examples. With the rise of the sharing economy, also the concept of access over ownership has gained increasing (The Economist, 2013). According to a study by the Future Foundation, fuelled by the Millennial generation’s post-recession cost-consciousness, many seek more control over the way they consume (Earley, 2014). Owning products is expensive and inefficient when it is only used sporadically. More important it is, for Millennials, to have access to the service or product they need. Examples are
Spotify (for music), DriveNow and Snappcar (for cars) and Netflix (for movies). Both markets for sharing and servicizing (providing access or the service to a good) are growing (Earley, 2014).

B.1.4. TECHNOLOGICAL DEVELOPMENT

So far, social, demographical and economic trends have been discussed. Just as noteworthy are trends in the technical domain. Technological developments have great influence on the life of people and on the way society functions. Technological trends that can be seen in the field of transport are personalisation and more on-demand developments. Both developments shall be explained. With personalisation of services the trend is meant that deals with directly meeting evolving needs of customers. Governments and businesses move from “large-scale, standardized solutions” to “more intelligent, interactive solutions that focus on individual user needs” (Service Futures, 2015). When these solutions are offered to the customer when the latter asks for it, the concept of on-demand comes in. Several technologies are helping in making products and services more personalized and on-demand these days. Transport services are seeing this change too. A bulk supply of homogenised mobility opportunities (seating capacity on public transport, road capacity) is changing into a seamless integration of traditional modes of transport with new opportunities and services being created as well as new method of purchasing mobility.

One of the drivers for enabling personalization and on-demand solutions, is the increasing penetration of smartphones. The rise of the smartphone in our daily life can be seen everywhere worldwide and already for a longer time in developed countries. Denmark is experiencing a remarkable growth in the use of smartphones in recent years. By 2017, it is expected that nearly 83% of the total Danish population will be using a smartphone, making Denmark one of the worldwide leaders in smartphone penetration (eMarketer, 2014). Mobile devices allow users to get access to information, to connect with others and to use practical applications always and everywhere. For transport, there is great potential in the implementation of the smartphone, both in sharing and gathering information.

Other technological developments in transport can be found in the automotive industry. These are the concepts of ‘self-driving cars’ and ‘electric cars’. Electric vehicles (EVs) are the furthest developed concept of the two. They can be seen regularly on the roads in most developed countries these days. An electric car runs on electricity only and its motor is powered by a rechargeable battery pack (U.S. Department of Energy, 2015). Self-driving cars are still under development and several companies are intensively testing these vehicles on the roads. The concept is simple: the self-driving car can drive autonomous, so without a driver. The development of this next generation of cars has huge potentials for the transport sector (Hepler, 2015). Think of the idea of self-controlled, clean energy-powered cars that pick up drivers on demand. While this vision is maybe still far away, the development of these cars can represent a turning point for the predominant model of personal car ownership and the impacts on environment that it comes with. Electric cars are becoming more widespread in Denmark with more than 1500 electric cars being sold in 2014 and already more than that number in the first 8 months of 2015 (Dansk Elbil Alliance, 2016).

B.2. CHALLENGES IN TRANSPORT AND INFRASTRUCTURE

Similar to every big city, Copenhagen faces major challenges in mobility. In this section present and future challenges in transport and infrastructure for the Greater Copenhagen area will be looked at.
Trends, as presented in the previous section, will be translated into challenges and specific consequences for Copenhagen.

### B.2.1. Congestion and Demand for New Infrastructure

As seen before, the Greater Copenhagen area faces a trend of both urbanisation and population growth. Already over the next 10 years, the City of Copenhagen is expecting 20% more citizens (Statistics Denmark, 2015c). This will have a large effect on the current provision of infrastructure in the region. The current growth of population will put a huge pressure on transport networks and its capacity. Increasing mobility is associated with increasing traffic in the Greater Copenhagen area. More congestion can be expected due to the overexploitation of the system’s capacity (Copenhagen Research Forum, 2012). Data from TomTom shows an average congestion level of 21% in Copenhagen, meaning 21% additional travel time compared to normal traffic can be expected on average in Copenhagen (TomTom International, 2015). During morning peak hours, the congestion level is around 45%, during evening peak around 37%. Different areas face different congestion problems.

The urban core of the Greater Copenhagen area has a high population density and has severe congestion problems in the limited urban space. The ring city (Danish: Ringbyen) has a lower population density and consequently facing less congestion. The area’s main transport corridors have serious congestion problems during rush hours. In the period between 2012 and 2025 an increase of 10% in the amount of daily car trips is expected for the Greater Copenhagen area (Trængselskommissionen, 2013). Consequently, more congestion can be expected. The delay time calculated in vehicle hours for car traffic will increase with 96% between the years of 2012 and 2025 (Trængselskommissionen, 2013).

<table>
<thead>
<tr>
<th>Transport mode</th>
<th>2012</th>
<th>2025</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>3.533.000</td>
<td>3.879.000</td>
<td>10%</td>
</tr>
<tr>
<td>Public transport</td>
<td>959.000</td>
<td>1.100.000</td>
<td>15%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>1.192.000</td>
<td>1.222.000</td>
<td>3%</td>
</tr>
<tr>
<td>Foot</td>
<td>1.049.000</td>
<td>1.082.000</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6.733.000</td>
<td>7.283.000</td>
<td>8%</td>
</tr>
</tbody>
</table>

Also Movia and the City of Copenhagen are highlighting the challenge of congestion here. Movia experiences the issue of congestion directly with busses having longer trip times. The City of Copenhagen states that there might be not so much congestion yet in the city, but their expectation is that this will increase significantly in the near future. National roads, not the city’s responsibility but the state’s, are already suffering a lot from congestion during peak hours.

As a response to increasing congestion, there will be a growing demand for new infrastructure in Copenhagen. The challenge of this demand for new infrastructure stems again from urbanisation and population growth. There will be an investment requirement for authorities in the coming years. Investments in transport and infrastructure have to be made in order to keep pace with the rapidly growing demands on the transport network (Siemens AG, 2014). Existing infrastructure needs to be upgraded and supplemented to meet modern requirements (Siemens AG, 2014). Furthermore, Copenhagen faces a major challenge in the integration of its transport system, which is currently
modally divided and vulnerable (Copenhagen Research Forum, 2012). Copenhagen’s solutions for a growing demand for new infrastructure gets even more challenged by the city’s aim of securing most of the increasing travel demand by public transport and soft modes of transport (Krogsgaard Niss, 2016). Authorities need to find the right balance between infrastructure investment, congestion management and the improvement of public transport.

Due to urbanisation and population growth in Copenhagen, markets and habits are changing. Car ownership in urban areas is usually lower and there is greater reliance on public transport and active modes of transportation (cycling and walking). Decreasing use of cars can be expected from the ongoing urbanisation in Denmark (Haustein et al., 2014). For people living in large urban areas like the Greater Copenhagen area, car usage appears to be lower than for people outside these urban areas, even when car ownership is controlled for. Research shows that when the Copenhagen area becomes more urbanized, offering better transport alternatives to a car, there seems to be less need for the possibility to drive for young and middle aged people. For older people, this compensation seems to be less significant and thus better access to alternative transport modes cannot sufficiently replace older people’s need for a car (Haustein et al., 2014). With a growing population in a growing urban area of Copenhagen, an increase in ridership on public transport can be expected and also more new and innovative mobility services are expected to emerge here. The City of Copenhagen also states an increase in usage of public transport in the past years and the city expects it to hold for the future too: It is a trend that will continue because the city is building more and better public transport.

B.2.2. Sustainability challenges

The trend of sustainability brings in many considerations for transport planning in Copenhagen. Due to climate change some consequences have to be taken into account. The transport sector faces several challenges in the field of sustainability. The transport sector is heavily dependent on oil and emitting a large share of the greenhouse gasses (Copenhagen Research Forum, 2012). It is the transport sector that is responsible for more than 30 percent of CO2 emissions in Denmark (World Bank, 2015). Air quality is an important issue for authorities in the Greater Copenhagen area. The City of Copenhagen states an environment goal of becoming carbon neutral by 2025 (City of Copenhagen, 2012a). This aim puts a huge pressure on transport in the region. Mobility has to become ‘green’, meaning emission-free forms of transportation have to be used and the traffic flow has to become more sustainable, according to the City’s plans. Together with the focus on lower emissions and a higher air quality in Copenhagen, the problem of resource depletion comes in. The transport sector accounts for two-thirds of all oil used in Denmark (International Energy Agency, 2014). Fuel efficiency is an important term for improving air quality and reducing the transport’s dependency on oil. Making vehicles more fuel efficient in order to emit less pollutants is a requirement for future improvements.

There is a huge challenge for regulatory action in Denmark and Copenhagen. Authorities face this challenge in regulation to limit pollution and/or incentivise new technologies. Finding a right balance between negatively charging (by taxation) and positively rewarding (by subsidizing) can be troublesome. Some regulation measures can be more effective in limiting pollution than others. The recent debate on the abolishment of the tax break on electric vehicles in Denmark gives a clear illustration of the challenge in regulatory action for sustainable transport (CPH Post, 2013). Sales tax on cars in Denmark accounts for 150%, but electric vehicles have been exempted from this taxation
so far to stimulate the use of electric cars in Denmark. Although the sales of electric cars in Denmark are high due to this tax exemption, the Danish government recently decided to phase out this system in order to increase tax incomes (Ørum Klinke, 2015). Governmental planning requires considerations to be made between economic and environmental values, making the challenge of proper regulatory action difficult.

But there is not only the technological innovation that will save our environment. A change in mobility behaviour is also necessary. This behavioural change can be seen in the Greater Copenhagen area too. Where people 15 years ago expected that technological innovation will save our environment, reality now has proved differently, according to the City of Copenhagen. Vehicles did not get as clean as we had hoped them to be. For this reason, now more and more focus is on sustainability and environmental protection. Municipalities in the area and the Capital Region put great emphasis on sustainability goals and the reduction of car traffic in the region. Cycling and public transport are being promoted, while the use of private vehicles has to decrease. Also users find sustainability important and expect transport to become greener. Transport operators feel the pressure from the public opinion and are forced to change.

B.2.3. Social changes

As shown in the previous section, the population of Denmark is ageing. The ageing of the Danish population brings in several challenges for transport. Older people are healthier and more active in general than ever before, making them also more mobile. This will increase the demand for transport as the population grows and ages. Besides that, urban environments like the Greater Copenhagen area put elderly at a greater risk of social isolation and loneliness. While Danish authorities are putting emphasis on active ageing neighbourhoods, also the accessibility to transport possibilities should be an important point on the agenda. Mobility of elderly and the accessibility to transport form crucial factors in mitigating the risk of isolation (The Knowledge Exchange, 2014). Since older people normally have less financial means, a lack of funding to support more services from the public purse, can consequently mean a decrease in mobility for this group. As a study in Denmark states it: “providing satisfactory opportunities for independent travel and mobility will support the older population in independent living and well-being, which in turn has positive implications on societal level” (Haustein & Siren, 2012). Another challenge is to ensure a satisfactory level of quality for transport. Older people have a specific set of requirements for transport. The ease of use and convenience, high safety and clear information and communication are important for this group (The Knowledge Exchange, 2014).

Other consequences for transport come from the social changes brought by the Millennial generation. The rise of the sharing economy and the trend of access over ownership are two developments that can also be seen in Denmark. In most developed countries recent years show a decrease in car ownership. Less cars are being sold and owning a vehicle is not as important anymore as it used to be before. The decline in car ownership cannot be seen in Denmark. On the contrary, according to the City of Copenhagen car ownership in Copenhagen is increasing fast (Krogsgaard Niss, 2016). Denmark has a tradition of extremely high taxation on the sales of tax and for this reason Denmark still has 500.000 fewer cars on the roads compared to similar wealthy European countries and relative to its population (CPH Post, 2013). The registration tax for cars in Denmark is 105% for the first 81.700 Danish kroner (around 11.000 euro) of the car’s value and 150% for the amount above that threshold
(Ørum Klinke, 2015). The upper tax percentage used to be 180% for the last decennia, but has been recently changed to 150%. The sales tax that has to be paid, gets also higher when cars are more pollutant and lower when these are more fuel efficient. The substantially lower tax rate for cheaper cars (under 81,700 kroner) and the discount for fuel efficient vehicles have resulted in an increase in the sales of small, cheaper cars (CPH Post, 2013). The increasing sales of these small cars can explain the growth in car ownership in Denmark (Krogsgaard Niss, 2016).

Although the ownership of cars in Denmark is still growing, car-sharing is also seeing a positive trend here. Car-sharing services in Copenhagen are emerging and attracting more members every year (Krogsgaard Niss, 2016). GoMore, for example, had 330,000 members by August 2015 and was growing with 20,000 members monthly (Faergeman, 2015). With the introduction of DriveNow and Car2Go in Copenhagen, another 600 sharing cars have been placed in the capital’s streets. Precise figures about shared-mobility users in the Greater Copenhagen area are not available, but this number is expected to grow rapidly in the coming years, making car-sharing a serious form of transport in Copenhagen.

These developments bring in challenges for authorities in Denmark because regulation has to be there that properly guides the usage of shared vehicles. These developments in shared mobility are considered part of the change towards more intelligent mobility. A more in-depth discussion of challenges for regulatory action on the field of Intelligent Mobility (and thus, shared mobility) is discussed in chapter 4.

B.2.4. Technological development

The increasing penetration of smartphones in Denmark has huge consequences for transport. People, now constantly being connected to everyone and everything in the world, expect more real-time information on the road and while using public transport. Planning and booking of trips have to be made easy and convenient for the new generation. Smartphones users expect transport operators to provide up-to-date travel information and easy-to-use planning directly on their portable devices. While travelling, the smartphone generation wants to stay connected, so accessibility to WIFI or mobile data networks need to be ensured in order to satisfy travellers’ needs.

Now Denmark is close to 83 percent of its population using smartphones, the information coming from these devices is extremely useful (International Transport Forum, 2015). Data analytics in transport will become increasingly important. Several challenges can be seen regarding the use of data analytics in mobility (Parliamentary Office of Science & Technology, 2014). To open up the data for developers and transport companies, data needs to be archived and made available in a usable and standardised format. Accessibility and standardization of data is something in which Danish authorities have to play a role. Investments in new technologies seem necessary to solve problems with data analytics in transport like incomplete, inaccurate or unreliable information. Because there are so many transport operators and authorities, information can be fragmented and inconsistent. This can make it difficult to share data and information provided to travellers can turn out to be incorrect. A last important governmental issue for data analytics in transport is privacy. Effective regulation on the protection of user data seems necessary, but when privacy protection becomes too severe, the collection and sharing of information becomes difficult. Danish authorities should find a
The development of electric cars involves challenges including the roll-out and design of infrastructure, market penetration and the consequences for the population’s transport patterns and the total traffic load. Charging infrastructure is needed to provide these vehicles with the necessary energy. The availability of charging stations in the public area is important to promote the use of electric vehicles. The City of Copenhagen already states a goal of reserving 500 parking spaces in Copenhagen for providers to set up and operate charging stations for a period of ten years. To date, 106 charging points and 218 parking spaces have been made available (City of Copenhagen, 2015b). The City of Copenhagen states around 600 public charging stations for electric vehicles have been made available in the last couple of years. Relevant standards and legislation have to be made ready for the large-scale introduction of electric vehicles in Copenhagen. Because of national legislation, the City of Copenhagen is not allowed to treat electric vehicles differently from ordinary cars (Krogsgaard Niss, 2016). This makes it difficult for them to offer free or cheaper parking places to electric vehicles owners. Furthermore, the market penetration of electric vehicles in Denmark has to be stimulated. As described before, the removal of the exemption of car sales tax on electric vehicles won’t stimulate future sales of these cars. Authorities in Denmark face the challenge on how to best promote the use of electric cars. The implementation of electric vehicles will bring changes to Danish society. Transport patterns could look different when the charging of vehicles has to be taken into account. More knowledge is needed about possible changes in population’s transport patterns after the large-scale implementation of electric vehicles. Dealing with these changes and anticipating on differences in the total traffic load is a major challenge for transport planning in the future.

For automated cars still a lot of research is needed. Research projects done by universities and other organizations are heavily dependent on financial contributions from the government. Danish authorities have to think about investments in these technological developments. The realisation of automated vehicles on the Danish roads will require specific regulation. Regulation of driverless traffic is still to be considered and legislation and insurance regarding automated vehicles are important issues.
C. INTELLIGENT MOBILITY INITIATIVES IN COPENHAGEN

Now that the concept of Intelligent Mobility has been defined for this research and the transport system has been described, it seems interesting to have a look at some different Intelligent Mobility initiatives popping up in Copenhagen. Five different categories of platforms can be seen. These are car-sharing, on-demand ride services, ride-sharing, integrated ticketing and bicycle sharing schemes.

C.1. CAR-SHARING

Car-sharing is receiving increased popularity in Copenhagen. People that are in need of a car and don’t have their own, can use these shared cars. It gives users access to mobility opportunities instead of the actual possession of a vehicle. With the so-called sharing-economy booming, many households prefer having access to cars instead of buying one (The Economist, 2013). Last years, several car-sharing schemes have been realised in Copenhagen.

Car2Go is a car-sharing scheme introduced by Daimler, a German car manufacturer most-famous for its Mercedes brand (Car2Go, 2016). Daimler released Car2Go in Copenhagen in September 2014 and 200 Smart Fortwo vehicles were placed in the streets. Car2Go is a so-called free-floating car share service, which means that cars can be parked everywhere on public, legal parking spaces and do not have to be brought back to a designated Car2Go parking spot. So Car2Go is offering one-way point-to-point car rentals. Users are charged by the minute, but also hourly and daily rates are available. Vehicles can be accessed with a membership card and users can find online or in a smartphone app where available cars are located. Car2Go announced in January 2016 that after one and a half year of offering free-floating shared cars it will stop its services in Copenhagen at February 15th (Car2Go, 2016). All 200 Smart vehicles will disappear from Copenhagen’s streets and memberships in Copenhagen will be cancelled.

DriveNow has a similar system to Car2Go in Copenhagen (DriveNow, 2016). Launched in September 2015 by Arriva, 400 electrical BMW i3s have been placed in the streets of Copenhagen. DriveNow is a German joint venture between car manufacturer BMW and car rental company Sixt. In Denmark, British public transport company Arriva is operating the DriveNow car-sharing system. The business model is similar to Car2Go with the main difference that DriveNow is fully electrical with a fleet of electrical BMW’s. Also here, people can pick up their car and return anywhere within the area of operation, which currently covers Copenhagen, Frederiksberg, Tårnby, Hvidovre and Lyngby. The average distance between cars is 300 meters, which is comparable to the distance between bus stops in Copenhagen, according to Arriva (Arriva, 2015b). Furthermore, DriveNow offers users the possibility of accessing vehicles with a Rejsekort, the public transport travel card in Copenhagen.

LetsGo is another car-sharing scheme in Copenhagen (LetsGo, 2016). In comparison to DriveNow and Car2Go, LetsGo is a non-profit organisation, based in Denmark. With around 100 cars in the Copenhagen area, LetsGo is relatively small compared to Car2Go and DriveNow. LetsGo offers 10 different vehicle types, varying from Volkswagen UP cars to Ford Transit vans. Different from the other car-sharing schema, LetsGo is not necessarily focussed on short, local rides. Vehicles can be used to go away for the weekend and also driving abroad is allowed. Whereas members of DriveNow and Car2Go only pay a certain amount per minute, LetsGo users pay per minute and kilometre they drive and a monthly membership fee.
MinbilDinbil, which means ‘my car your car’, is a Danish car-sharing system that has another business model. MinbilDinbil has recently been acquired by the Dutch car-sharing platform Snappcar, which wants to become the largest company in their field in Europe (SnappCar, 2015a). Instead of owning a lot of vehicles and placing these in the streets, MinbilDinbil connects car-owners and car-users in Copenhagen. Copenhageners that own a vehicle and would like to rent it out to others, can advertise their car on the website. Others that are looking for a car to use, can reserve a car from the website. All communication and payments are being done through the website and insurance and road assistance are included in the rental price. MinbilDinbil has 20000 users in Denmark, and 2500 cars (SnappCar, 2015b).

**C.2. On-demand ride services**

Uber is a worldwide well-known example of an innovative mobility service. Uber offers taxi services in Copenhagen and around (Uber, 2016b). Different from conventional taxis that has to be hailed on the street, Uber customer can request a nearby taxi in a mobile application. Besides booking, this app shows more relevant information about the vehicle and driver and the estimated time of arrival. Payment is also being done through the application. There are different forms of Uber services. In Copenhagen, currently, only UberBLACK is available. UberBLACK is the most conventional taxi service: a licensed on-demand private driver picks you up with a luxury vehicle. The less conventional and more controversial form of Uber, UberPOP, has been available in Copenhagen to a select group of users for 6 months. With UberPOP everyone with a driver’s license can, after a screening by Uber, offer on-demand. This version of Uber is not operational anymore in Copenhagen.

Flextrafik collects and coordinates all rides for citizens in Denmark who are unable to use other forms of public transport (Movia, 2015a). Flextrafik is demand-driven, meaning that rides are planned according to customers’ demand and do not follow a prescheduled route. Flextrafik is partly paid by public means and mainly used for elderly and disabled people to travel to and from hospital appointments, revalidation, family or school.

**C.3. Integrated ticketing**

Rejsekort means ‘travel card’ in Danish and works as an electronic ticketing system for travelling by train, bus and metro in most of the country (Rejsekort, 2015). Rejsekort brings transport operators, travel zones, ticketing- and discount schemes together into an integrated system. The system has been operational in the Greater Copenhagen area since 2010. The intention of realising the Rejsekort system is to make the use of public transport in Denmark easier for passengers. Passengers can load money on their travel card, check in when starting a journey and check out when their trip ends. The system then automatically calculates the fare and whether the user is eligible for any discount. Passengers can choose from three different types of cards: a personal, flexible or anonymous one. All cards have their own pricing and characteristics.

**C.4. Bicycle sharing**

Bycyklen is Copenhagen’s bicycle share scheme. Consisting of 90 bike stations and 1860 city bikes, Bycyklen bikes can be found everywhere in Copenhagen and Frederiksberg (Bycyklen, 2015).
system is still in its test phase and 15 more stations have to be opened yet, but bicycles can already be rented by users since April 2015. Bycyklen bikes can be unlocked from a docking station and handed in at any other station in Copenhagen or Frederiksberg. Users can choose from a daily pass or a monthly subscription with different price schemes. The bicycles are equipped with an electric motor and built-in touch screen tablet that is water resistant and includes a navigation system.

C.5. RIDE-SHARING

GoMore is a ride sharing platform founded in 2005 in Denmark (GoMore, 2015). The service offers drivers the possibility of filling empty seats while sharing expenses. Drivers can publish their planned rides on the website so others can request to ride with them. All communication and payments are done through GoMore’s website or mobile application. Both drivers and riders can review each other afterwards. Most rides end or originate in the Greater Copenhagen area, but GoMore is normally not used for travelling inside Copenhagen.

As can be seen, several initiatives of Intelligent Mobility are emerging in Copenhagen. These initiatives have in common to be more customer-centric and demand-orientated than the conventional provision of transport. But it has to be stated that of these initiatives solely the Rejsekort system takes a real integrated approach of transport. The other described platforms, while surely being innovative and more intelligent, are still separate systems and do not cover the complete definition of Intelligent Mobility. This section brings forward that well-integrated, demand-driven transport systems are not yet developed in Copenhagen.
D. STAKEHOLDERS’ VIEWS ON INTELLIGENT MOBILITY

Interviews were carried out to find out about stakeholders’ interests and perspectives. Firstly, an overview of stakeholders’ views regarding Intelligent Mobility will be given. Then, a categorisation has been made of relevant stakeholders.

D.1. STAKEHOLDERS’ VIEWS

In the next section the views of relevant stakeholders concerning Intelligent Mobility in the Greater Copenhagen area will be discussed. The views of the City of Copenhagen and other authorities regarding Intelligent Mobility are described in paragraph D.1.1. Transport service providers, public and private, are looked at and their perceptions shown in paragraph D.1.2. Also the views of other stakeholders are described and shown. The input for this analysis comes from interviews that will be conducted with major stakeholders and from extensive desk research. The stakeholders that will be spoken to, are from governmental organisations. The following persons in Copenhagen have been interviewed:

- Anette Enemark, Head of Mobility, Movia, Valby, Denmark;
- Mikkel Krogsaard Niss, Head of Section, Finance Department, Center for Urban Development, City of Copenhagen, Copenhagen, Denmark;
- Per Skrumsager Hansen, Senior Advisor, Ministry of Transport and Building, Copenhagen, Denmark.

D.1.1. AUTHORITIES’ VIEW

Authority on mobility in the Greater Copenhagen area consists of governmental bodies on several levels. The lower the level, the more specific authorities’ goals and interests are. On a higher level, objectives of governmental bodies seem to be aligned when it comes to transportation. Looking at Intelligent Mobility, authorities seem to have a positive attitude, but are not necessarily involved or actively participating in it.

Objectives of the European Union on transport are:

- Smart, green and integrated transport;
- Competitive transport system;
- CO2-free city mobility in major urban centres by 2030.

The European Commission writes in its leading White Paper from 2011 about integrated mobility: “This could include a legislative proposal to ensure access of private service providers to travel and real time traffic information” (European Commission, 2011).

The Ministry of Transport expressed its goals in A Greener Transport System in Denmark: “The development of a greener transport system in Denmark combines growth and a high level of mobility, thereby ensuring both a well-integrated transport system and less noise and pollution” (Ministry of Transport, 2012b). The Danish Transport Agency has the main aim “to increase safety in all modes of transport” (Ministry of Transport, 2011). Objectives of the Capital Region of Denmark are a high availability and easy passability of the region and green transport.
The Ministry of Transport states that these days it is looking less at the Greater Copenhagen area, because in the past there have been a lot of investments in transport here and the ministry aims to focus more on the regions outside the capital now (Skrumsager Hansen, 2016). The ministry states that its focus now is on infrastructure investments, more than on the investment in public transport. Furthermore, it looks into the optimizing of current infrastructure and the development of more intelligent mobility, but at the same time the ministry sees that its financial support for these kinds of developments is relatively small and municipalities have to finance initiatives themselves. The Ministry of Transport sees the initiative of Mobility as a Service as a part of the transport system of the future, together with shared cars and self-driving vehicles, but it states that “the current thinking about infrastructure should not be changed at this moment” (Skrumsager Hansen, 2016). It states that the thinking in mobility and not only in separate modality silos is definitely at presence within the ministry, but at the same time the ministry sees more benefits coming from the investment in roads and infrastructure than from the development of Intelligent Mobility (Skrumsager Hansen, 2016). Consequently, it seems difficult to get political support in Denmark for new approaches to mobility planning that differ from the current way of thinking in infrastructure investments.

The City of Copenhagen states in its ‘Green Mobility’ report that “mobility in Copenhagen must be greener and more efficient in order to stimulate growth, contribute to a carbon-neutral city and to a good life for Copenhageners” (City of Copenhagen, 2012b). Goals of the City of Copenhagen are:

- 2005 – 2015: CO2 emissions from transport to be reduced by 10%;
- Copenhagen to be CO2-neutral by 2025;
- By 2025: 75% of all trips in Copenhagen to be by bike, by public transport or on foot (City of Copenhagen, 2012a).

The last goal has been changed later to: “at least 1/3 of trips are to be made by public transport, at least 1/3 by bike, and at most 1/3 by car” (City of Copenhagen, 2014a).

The focus of the City of Copenhagen is on public transport and alternative fuels for transport. The stimulation of electrical vehicles receives great attention by the municipality. Emissions have to go down and more people need to use public transport so congestion will not increase. The city does not expect a radically different future and the view is that in 10 or 15 years from now, we will still travel in the way we do now. Shared cars will become a serious component of our transport system with hopefully a 5 percent share (Krogsgaard Niss, 2016). The role of the city is to promote the use of electric vehicles and public transport. The City of Copenhagen wants to become the first carbon neutral capital in the world and with such an ambitious plan, the city thinks it is not behind other European cities in realising future mobility. Seeing the emergence of new, intelligent mobility services in Copenhagen, the city is supporting these initiatives, but not directly taking specific measures or actions to realise them (Krogsgaard Niss, 2016).

One can see that authorities share the objective to improve mobility and make transportation in Copenhagen greener. At the same time, local authorities don’t seem to be actively exploring Intelligent Mobility. Reducing congestion, improving public transport and making transport greener are seen as important measures, but more radical changes towards more intelligent mobility are not (yet) being made. Regardless of what Intelligent Mobility is precisely going to look like in Copenhagen, authorities find the safeguarding of public interests important. Mobility is important for daily life in Copenhagen and all citizen should have access to mobility means. The City of Copenhagen feels slowed
down by higher, national governmental institutions (Krogsgaard Niss, 2016). Governmental regulation makes it difficult to stimulate more intelligent mobility and the national government is not as concerned with greener mobility as the city is.

D.1.2. TRANSPORT PROVIDERS’ VIEW

Providers of transport services might have different objectives than authorities. Especially private operators, not having a public responsibility, might be more concerned with profitability and customer-satisfaction. Public transport providers have these goals too, but at the same time share objectives with authorities, which are eventually their principals. Goals of Movia are:

- More passengers in public transport;
- Higher satisfaction amongst customers;
- Greener public transport;
- Better Flextrafik;
- Well-functioning public transport market (Movia, 2014).

Goals of DSB are:
- Transport time must be quality time;
- Public transport must be as personal as possible (DSB, 2015b).

But, in contrary to the other public transport providers, Movia is also concerned with the future of mobility: “users must have integrated solutions irrespective whether they travel by, train or subway. To fulfil mobility demands, we need to combine public transport with, for example, car-sharing, bicycling, Flextrafik and ride-sharing. So it’s not only about how our passengers use busses and trains, but also how they get to the bus stop or train station” (Nøhr Pedersen, 2014).

Movia seems to take a different approach than other public transport providers do. It created a mobility department within the company. This department has the aim to look beyond the traditional role of a public transport company and is concerned with mobility planning and development and not just the provision of bus transport. This department of Movia is looking at trends in mobility worldwide and in Denmark and helps Movia in keeping up with these developments. Movia is having a positive attitude towards the introduction of Intelligent Mobility (Enemark, 2016b). The company is expecting these changes for transport in Copenhagen and is planning on how to engage. Movia states it is not afraid of cooperation with other transport modes and it doesn’t see these new forms of mobility as competitors for bus transport in Copenhagen. Movia sees a role for public organisations to step in and to proactively work towards more intelligent transport in the area. Waiting for a private third party to enter the market and take on the role of a mobility integrator might not be a good development according to Movia. A Mobility as a Service platform needs public funding, since there is no viable business case and the process will be happier and better-resulted when public actors together get to decide (Enemark, 2016b).

Newer alternatives in car-sharing and ride-sharing are open to Intelligent Mobility. Making mobility more efficient and customer-friendly is in their future image of mobility. Car-sharing company DriveNow says about its competition with public transport: “We are not rivals, but cooperating with Arriva as a provider of public transport to enable customer-oriented and sustainable mobility in the
future” (Blättel, 2015). Also car-sharing company Snappcar (owner of MinbilDinbil) aims at a more efficient transport system with its goal of “one percent less cars in Europe by 2018” (SnappCar, 2016).

D.1.3. Users’ view

End users of mobility in Copenhagen are probably not really aware of Intelligent Mobility. Most are using means of transport which are best and cheapest for them. Transportation is normally a habit and not necessarily a day-to-day calculation. Of course the group of end users varies enormously, which makes it hard to generalize users’ views on Intelligent Mobility. Probably there will be a share that is highly interested in Intelligent Mobility, for instance in Mobility as a Service. Other users might be reluctant and would prefer to travel in the way they are used to.

D.1.4. Service providers’ view

Most service or data providers are owned by transport operators and authorities. They don’t necessarily have their own goals and perceptions when it comes to Intelligent Mobility. The vision of Rejseplanen is that “travelling by public transport has to be easy. Travel information must be easily accessible, simple and understandable. Information should be relevant to the individual user and based on the user’s situation and means of travel that he or she wants to use” (Rejseplanen, 2015a). The introduction of Mobility as a Service can bring new opportunities for service or data providers. Service providers could feel threatened by newcomers in the market, while others might be interested in these new opportunities, that can of course generate new revenues. Rejseplanen, currently Denmark’s most important travel planner, has been pointed at by both Movia and the City of Copenhagen to be the preferable platform for a possible introduction of Mobility as a Service.

D.1.5. R&D actors’ view

Intelligent Mobility is perceived as an interesting topic amongst research institutions. These organisations aim at developing and increasing knowledge about mobility challenges. Research & Development actors usually have a scientific approach in research on Intelligent Mobility. These are neither in favour nor against the realisation of Intelligent Mobility. Research by these institutes is highly valuable for the expending of knowledge about the future of mobility and for policy recommendations.

D.2. Categorisation

Stakeholders’ interests can be categorised. This makes it easier to see whether interests are aligned or conflicting. Furthermore, some stakeholders might have more power or a more positive attitude towards Intelligent Mobility in Copenhagen. A useful categorisation can be made using Murray-Webster and Simon (Murray-Webster & Simon, 2006). Stakeholders are, based on their interests, power and attitude, categorised in different groups. When using this categorisation, suggestions can be given on the optimum approach to manage different kinds of stakeholders. In order to categorize the previously described stakeholders, it is necessary to determine each’s interest, power and attitude towards the realisation of Intelligent Mobility in Copenhagen.
First, governmental organisations and authorities are expected to have a positive attitude towards Intelligent Mobility, much power but maybe not always a great interest. For instance, the municipality of Copenhagen is realizing relatively small initiatives that make mobility more intelligent. Mainly, the city is following the developments but not necessarily actively promoting or stimulating them (Krogsgaard Niss, 2016). The Ministry of Transport is supportive to Intelligent Mobility initiatives, but does not see guaranteed benefits from these and thus is not focussing on such developments (Skrumsager Hansen, 2016). For transport providers a distinction has to be made, between ‘traditional’ transport providers and providers of new mobility services. The traditional transport providers have great power and also a sharp interest in the development of more intelligent mobility. At the same time, these companies do not always have a positive attitude towards it. Movia for instance, is thinking about integrating more with new modalities as last-mile transport, but keeps seeing itself as the main provider of public transport (Enemark, 2016b). Movia is not afraid of new entrants to the market for mobility and in this sense Movia should not be considered as a ‘traditional’ transport provider. Taxi companies have a more negative attitude towards working together with new mobility services that will change the current way of doing business. Providers of new mobility services have power, positive attitudes and great interest in Intelligent Mobility.

Mobility users in the Greater Copenhagen do not have much power regarding the development of transport. Their attitude towards Intelligent Mobility is probably mostly positive, since it will increase the ease and quality of transport. Interests are low and users just wait until something changes in the way they travel. Lastly, service or data providers will become increasingly important in the future of mobility. To this development, data providers will have a positive attitude and great interest. To date, most of these providers like Rejseplanen or Rejsekort do not really have much power. Partly or completely owned by transport operators, data providers just gather data and provide information to the customer. Their degree of power might change rapidly in the future, when transport becomes more intelligent and the ownership of the data concerned with it becomes highly valuable.

With the description of each stakeholder’s interest, power and attitude, a categorisation following Murray-Webster and Simon can be made (Murray-Webster & Simon, 2006). Doing so, results in a graphical representation of stakeholders’ positions. The figure showing this mapping can be seen below.
Figure 14 – Categorisation of stakeholders