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Urban Mobility

Role of taxation in the adaptation of Mobility as a Service (MaaS) and tool for Policy Making

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The natural resources of this planet are finite and have been depleting over the past few decades at an exceptional rate. The sustainable use of these resources is not only beneficial to the future of our generation but for the generations to come. A big chunk of these resources is used by global transportation sector especially road transport in the form of fossil fuels and their by-products. Road transportation in cities and increased use of cars is causing congestion, pollution and other related externalities.

The purpose of this research was to understand Mobility as a Service which is increasingly being discussed in transportation market as the next big alternative to private car ownership. MaaS combines different service providers and IT systems in one stop shop offering the consumer travel by various modes of transport including first and last mile transport (e.g. bikes). MaaS builds on existing transport systems. The findings of this research prove that the business model has received positive feedback from residents of London, Gothenburg and Helsinki for the models implemented in these cities.

MaaS models rely a lot on co-operation from governmental authorities. The Whimpact study reviewed in this thesis clearly proved public transport to be the backbone of MaaS Helsinki (Whim app). The authorities use taxation as an important mitigation tool to promote or demote the use of certain products or services in an economy e.g. alcohol, tobacco. This thesis tries to identify the ideal scenarios where taxation could be used to demote the use of private cars and increase the use of MaaS simultaneously.

Keywords	Mobility as a Service, Road Transport, Policy, Taxation, MaaS

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1 Introduction

The 21st Century has provided us with immense technological advances and faster way of performing tasks, manufacturing products, growing crops, doing trade and faster mobility of people and of goods. Mobility is considered a vital part of economic growth indication of a country or region. The economic growth in almost all developed countries has resulted in a lifestyle based on car ownership. The increased car ownership has caused especially two key externalities i.e. congestion on roads and pollution in atmosphere, which are threatening the climate.

Other shortcomings like decrease in road capacity, deaths caused by pollution, deaths caused by road accidents, increased demand for parking spaces, and lack of reliable public transport are ongoing and long term consequences of aforementioned externalities which affect almost all the countries alike.

The Economist newspaper presents evidence that congestion results in high economic as well as emotional costs. The economic costs of congestion calculated based on GPS data from 300 million cars and devices across 1,360 cities in 38 countries, covered both direct costs like time and fuel wasted and indirect ones like high consumer prices caused by the elevated shipping prices, which result from congestion. These costs totalled $461bn or $975 per person in the year 2017 between Britain, Germany and the United States. (Economist, 2018)

Authorities, both in developed world and developing countries, are aware of this problem because it is a cost that mainly cities incur in the form of declining health of inhabitants, decreased road capacity and other mobility related issues. Over the past years, the city governments have implemented many solutions (e.g. congestion tax, road taxes, prohibition zones, zone based parking, alternate means of transport etc.) The purpose of all these endeavours has been to resolve the issues related to road transport and lessen the health hazards, which occur to a general public due to transport externalities.

The concept of “smart cities” is also taking precedence, which employs Internet of Things (IoT) technologies such as connected sensors, meters and lights to collect and analyse data to improve infrastructure and services. These IoT technologies are deployed for improving mobility, health and public safety (Intel, 2018). It is easier to integrate smarter

cities with MaaS solutions than it is to integrate the cities which lack the proper pre-infrastructure (both technological and physical).

This thesis explores the development of urban mobility in European Union (EU) in context of MaaS and policy implementation. The development in EU mobility is based on a roadmap to a Single European Transport Area implemented in 2011. A roadmap with 40 initiatives to increase the mobility, developing a competitive and sustainable transport system, growing transport, supporting mobility, removing barriers, increasing growth and smart funding while reducing the dependence on imported oil and cut carbon emissions from transport sector by 60% was approved by European Commission. In short, to prepare the European Transport Area for the future. (European Commission, 2018).

It is important to distinguish the premise of this thesis because most of the development in EU transport sector in the recent past results from the goals established by the European Commission earlier in 2011. This paper, in particular, explains the development and adaptation of Mobility as a Service (MaaS) in cities like London, Helsinki and Sweden.

MaaS has the potential to change the entire transportation sector through digitalization and combining of existing apps with existing transport. By offering one stop shop mobility services, MaaS is being marketed as an alternative to private car ownership and tries to solve the mobility issues by bringing different modes of transport together into a single mobile app. The single app includes everything from travel planning to payments, from journeys on-demand to subscription of an affordable monthly package. (MaaS global, 2016)

In this thesis, the arguments to resolve the urban mobility issues from perspective of authorities, consumers, and manufacturers are also analysed against the existing evidence to find out the types of policies, which have worked in the favour of authorities, and the type, which have not worked or have not brought any concrete results. Finally, an analyses for taxation as a policy tool to accelerate the promotion of MaaS will be conducted.

This research topic explores mainly the development in road transport since according to the Directorate General for Mobility and Transport of European Commission; the modal share of inland road transport modes is 72%. Growth in road haulage over long

distances (>300 km) is less than short and medium distances (up to 300km) which means that the passenger cars on roads have increased more than that of heavy vehicles. The road transport economic sector provides employment to 5 million people and a turnover of €470 billion. (European Commission, 2017)

1.1 Objectives & Research Questions

The main objective of this research is to analyse the urban mobility in the context of mobility as a service and how taxation could be used as a policy tool to promote certain sectors in road transport while demoting other sectors to sort of create a balanced shift. Urban mobility is facing many challenges due to an increase in car ownership mainly in cities. The city authorities face a dual problem of retaining the businesses (which depend on faster mobility as one of the growth factors) closer to cities while simultaneously trying to improve the general health of public and demoting the use of cars. Less private cars on the streets mean less congestion and pollution which results in efficient transport of goods and services. All of this is resulting in increased satisfaction of public and growth in economy.

The main research questions of this thesis are:

- **What is Mobility as a Service (MaaS) and why is it developing as a concept?**

This question tries to explain why it is necessary to understand and offer mobility as a service and slowly get away from conventional means of transport like owning a car all by oneself. The author also examines the relationship of IT industry and Transport industry which is resulting in a rapid evolution of MaaS.

- **How are MaaS business models working out commercially?**

This question analyses the argument presented by auto manufacturers, taxi operators and new players in the mobility market. It also uses examples of existing business models to derive results which are helpful in formulating the answer to the next research question.

- **How can governments use taxation as a policy tool to increase the adaptation of MaaS?**

Policies are a result of careful mitigation measures taken by authorities to solve a problem. To answer this question, the author analyses the premise on which policies are

made and then establishes a link on how right type of taxation can increase the adaptation of MaaS.

While answering these research questions, this paper also evaluates various subtopics which are part of the bigger picture. However, the final goal of the research is to make an informed opinion regarding aforementioned questions. The researcher of this thesis wants to investigate also the premises on which the transport policies are implemented from both historic and future perspectives. It is interesting to evaluate if taxation as a policy tool could help in the rapid adaptation of MaaS which is very likely the next alternate to conventional transport systems and services. MaaS is also being considered a long term solution to achieve the sustainable mobility framework by providing efficient and faster travelling, less emissions, more road space, less congestion and health improvements because of decreased pollution.

1.2 Methodology

In the introductory chapter 1, the roadmap to Single European Transport Area was mentioned. One of its 40 initiatives is the deregulation of market by removing barriers to accessing transport via internet systems. Following EU's lead the transport market was deregulated in Finland in 2018 after the introduction of Act on Transport Services (Communications, 2019). This act covers:

- Brokering and dispatch services
- Commercial road transport
- Integrated mobility services
- Mobility services
- Passengers and goods transport services
- Taxi and vehicle for hire services
- Transport services

Since MaaS is at an early stage of implementation in Finland after this deregulation, the concrete quantitative results have not been gathered or published yet. Olli-Pekka Rantala, Director General at Ministry of Transport and Communications in Finland, was sent an email query to comment on the impact of this new legislation of deregulation of transport market and the public response to whim App (MaaS platform providing services in Helsinki). The query was further redirected to Elina Immonen, Ministerial adviser (Markets Unit, Services Department in Ministry of Transport and Communications) who responded,

> As to the new legislation, I am afraid it is too early for concluding remarks on the impacts. We will report to the Parliament by the end of this year so more information is coming but unfortunately not available at the moment. (Immonen, 2018)

This email correspondence helped the researcher of thesis to narrow down the focus to qualitative data and to omit the quantitative data because of lack of availability. The existing literature on MaaS has a limited amount of quantitative data. Therefore, it was not sufficient to enable an informed opinion.

In order to make an informed opinion, this thesis was delayed a little while the researcher was waiting for the impact study of WhimApp in Helsinki. The study was released at the end of March 2019 and findings from Ramboll's analysis were in chapter 3.2.4 of this document.

The new value chain of Traffic markets defined by Trafi shows the increasing dependency of transport sector on technology where the market infrastructure are at cross roads with transport service market as differentiated by blue and purple colour in Figure 1. (Iqbal & Haapasalo, 2017, p. 7)

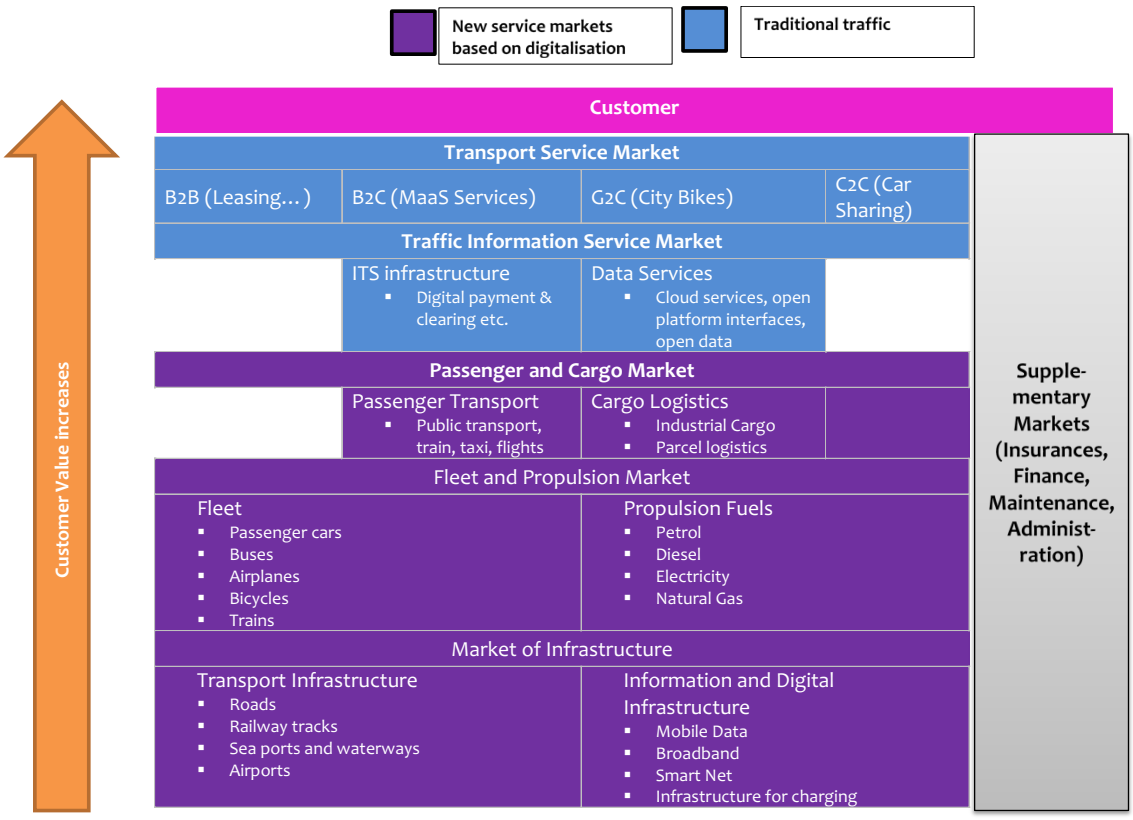


Figure 1: New Value Chain of Traffic Markets modified by (Iqbal & Haapasalo, 2017, p. 7)

This thesis has focused only on one subtopic (MaaS) of so called 'New Value Chain of Traffic markets'. MaaS covers the business to consumer (B2C) services and has been discussed in detail in chapter 2 of this document.

1.2.1 Data Collection Methods

The knowledge and data utilised in this research is secondary in nature. The reason for using secondary data is the descriptive nature of the topic and the notion that the primary data gathered from users will have too small of a sample size to validate the results. The MaaS providers or authorities gather and analyse samples on a much bigger scale and the results hold true for a larger population sample. There is a gap in knowledge around the thesis topic. In researcher's point of view, the research questions could be formulated in a way as to obtain primary data; but, the sample size will be too small resulting in low confidence and higher margin of error in quantitative findings.

However, quantitative data has not been ignored altogether. Certain quantitative data from established institutions (Eurostat, existing researches on MaaS prototypes and models etc.) and established authors has been used in the research to emphasize a particular point. Journals, eBooks, published books were given precedence over the sources from google. Special care has been taken in using a google-based source by verifying the authenticity of the source like newspaper article or blogs.

1.2.2 Data Analysis & Limitations

The data has been analysed in the context of research questions and compared against the case studies related to the policy effects of taxation on other products (like tobacco) deemed harmful for public health.

The first limitation, as mentioned earlier, is the non-availability of quantitative data and empirical evidence regarding the impacts of MaaS since most programs have been implemented in the near past and the results require time. As more and more countries start implementing or offering the MaaS platforms, the empirical evidence database will grow and it will become easier to predict what kind of a model will work for which kind of population based on samples

Secondly, the surface of qualitative data has only been skimmed to give a general idea which could be investigated more diligently. This would require studying the operating market and consumer sample at a very grass root level to derive results which will be in line with the location based policy.

Thirdly, references to subtopics have been made to amplify or nullify a specific opinion within the context of this thesis. It does not mean that the conclusions drawn for one market will hold ground for the other because of differences in the market dynamics under question

2 Literature Review

The literature review mainly addresses the trends in transportation industry and transportation policy which are making mobility as a service possible. It also reviews some MaaS service combinations and some case studies from Finland.

2.1 Mobility as a Service (MaaS)

MaaS builds on the existing transportation systems instead of completely ruling them out of the equation or bringing entirely new systems in place. The idea is to integrate digital and transport services (both public and private) in such a way which benefits the end user as well as stakeholders involved e.g. transport operators, city authorities, digital innovators and tech firms. All these systems have been existing but operate individually in their own domains. For example, a description of existing mobility related services in greater Helsinki region of Finland is

1. A public transport company HSL is operating in the greater Helsinki Region which provides journeys on trains, trams, bicycles and buses and connects the cities of Espoo, Vantaa, Helsinki, Sipoo and Kirkkonummi (HSL, 2019)
2. Privately owned taxi firms like Helsinki Taksi are operating which provide private taxi journeys on an increased fare than that of public transport (TaksiHelsinki, 2019)
3. UBER Inc. was also recently allowed to operate which integrates digital technology and taxi service on one platform and requires private contractors to provide transportation to consumers on privately owned vehicles in return for a monetary compensation (Inc., 2019)

4. In addition to the above mentioned private car rentals are also operating in the region. (Hertz, 2019)

MaaS as a concept brings all these and other platforms on to one single platform to reap the maximum benefits of integration and multimodality. Sampo Hietanen's (CEO of MaaS Global) view of a Mobility as a Service is that of a new transport paradigm.

> Mobility as a Service (MaaS) is a mobility distribution model in which a customer's major transportation needs are met over one interface and are offered by a service provider. Typically, services are bundled in to a package – similar to mobile phone price-plan packages (Hietanen, 2014)

Growing pressure on urban passenger transport systems is asking for a new and innovative shift in transport to increase the efficiency of urban transport. Shared mobility services (car sharing, bike sharing etc.) in combination with traditional public transport have provided one approach to tackle this challenge. However, the interfaces that operate independently to provide these services through individual channels (e.g. customised apps for each mobility option) discourage people from taking advantage of them on a greater level. Integrating these transport modes to provide door-to-door seamless mobility is becoming a priority for transport authorities and decision makers. Mobility as a Service (MaaS) is a mobility concept that could assist in achieving seamless mobility. (Kamargianni, et al., 2016)

This type of revolution in mobility industry has also been compared to 'Netflix' of mobility. Before Netflix movies and entertainment were either rented or bought or watched through 3rd party satellite channels. These channels provided everything on an increased rate and usually consumers had to own some sort of console in order to access specific type of entertainment. In a similar way in mobility industry cyclists have to own a bicycle, car enthusiasts have to own a car and so on. As a result of increased car ownership, the public transport suffers from congestion. Building and expanding roads requires resources and it is not sustainable in the long run. MaaS developers want to provide seamless mobility to consumers in which all modes of transport are available without having the need to own any mode of transport or expand the existing transport infrastructure.

2.1.1 European MaaS roadmap 2025

The long-term solution being researched for mobility across European Union is through MAASiFiE project. Mobility as a Service for Linking Europe (MAASiFiE) investigated the prerequisites of providing a one-stop-shop mobility service for consumers. After comparing different definitions of MaaS, three components were identified to enable integrated mobility services to consumers. These components were:

1. Shared mobility
2. Booking/Ticketing information
3. Multimodal Traveller information. (Eckhardt, et al., 2017, p. 9)

Based on workshops conducted in countries like Sweden, Finland and Austria in which stakeholders from transport agencies, transport policy makers and academics were invited, a simplified roadmap (See Appendix I) with four functional perspectives was identified for European MaaS roadmap vision 2025. These four functional perspectives include:

1. Drivers - Policy and regulation is seen as a factor to push MaaS development. However, the deregulation cannot be too open-ended. The purpose should be guiding the development in transport sector towards using more sustainable mobility solutions.
2. Transport Market Sector - MaaS needs public-private-partnerships for development and regulatory support from policy makers. The consumer behaviour and MaaS acceptance will increase with MaaS awareness.
3. MaaS service development - The MaaS vision cannot be achieved without ICT development. Issues related to personal data and quality of open data need to be addressed.
4. Enablers - The policy and regulation sector is considered to be very important in enabling MaaS. The roadmap encourages the decision makers to provide new and innovative incentives and opportunities to support MaaS development and improve the general procurement process. (Eckhardt, et al., 2017, pp. 23,24).

The fourth functional perspective (Enablers) is what this thesis tries to examine in detail by comparing the existing evidence from the literature

2.1.2 MaaS Value Chain

The value chain is a simple framework depicting different value chains and is applied to compare different MaaS services. The main value chain links depict the stages of value creation, from data collection and information generation to service creation and provision (König, et al., 2017, p. 44).

The general value chains shown in Figure 2 is for the MaaS service provision (upper part) and the different roles and responsibilities (lower part) are identified by the MaaS ecosystem in Appendix II.

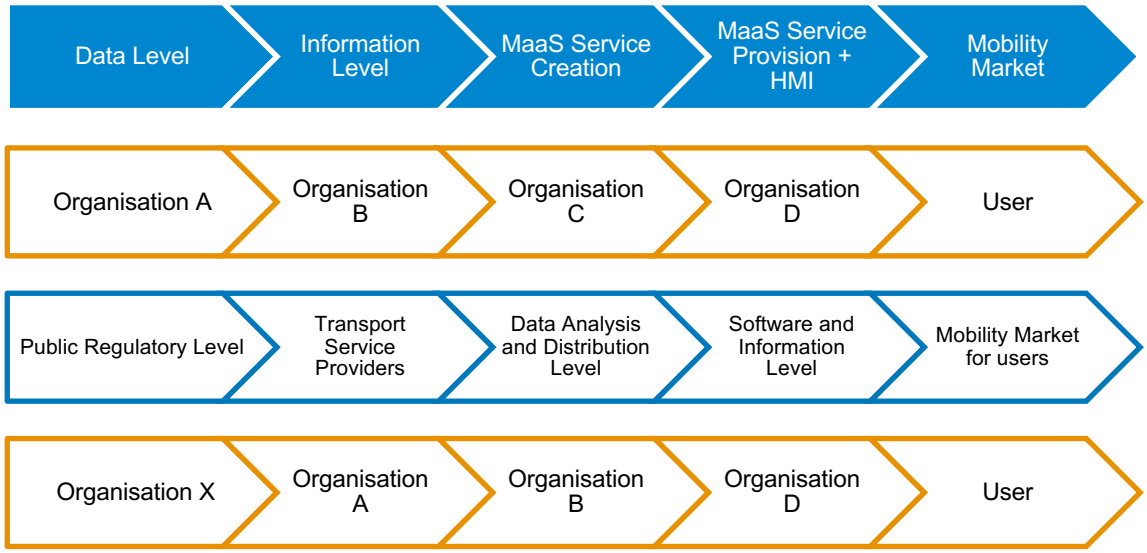


Figure 2: Adapted from MaaS value chain development (König, et al., 2017, p. 44)

The value chain is part of a larger ecosystem. The different levels of value chain do not necessarily have to be run by the same organisation. Different organisations specialising in different levels can become stakeholders as long as the end user is being served in return for the money being invested by the user. (König, et al. 2017)

Since it is important to provide proper understanding of MaaS before more complicated theory and this value chain concept might now be sufficient to do that so a case study from first MaaS service in Finland is described in the following chapter 2.1.3.

2.1.3 Case Study Kutsuplus & Sonera Reissu

Kutsuplus can be considered the world's first attempt to re-invent carpooling for digital age. The main reason for the project was for researchers to solve a major limitation of

Helsinki's mass transit system where most bus routes were operating from north to south and vice versa. Travelling from east to west was a real challenge for travelers so Kutsuplus developed a services for passengers who were heading in almost same directions in a minibus. The service cost was higher than that of a public transport but lower than the cost of taxi. (König, et al., 2017, p. 45)

The value chain of Kutsuplus project as shown in Figure 3, had Helsinki Regional Transport controlling 6 main levels of value chain. Only public regulatory level and MaaS service provision level (payment method) was controlled by other stakeholders.

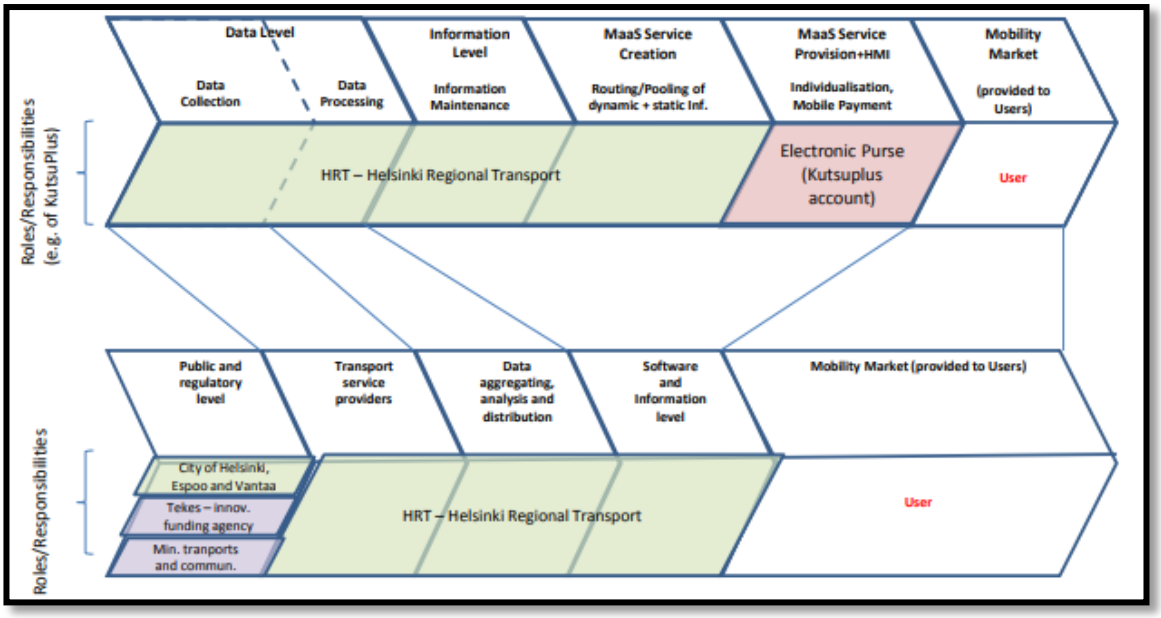


Figure 3: Identified Kutsuplus value chain (König, et al., 2017, pp. 45-47)

By comparing this with another MaaS pilot named as Sonera Reissu (Figure 4) which enabled traveller to combine taxi rides and train connections into one travel chain and pay at once, we can draw a conclusion that the New Value Chain is dynamic enough to be moulded into different types of services depending on the demand and availability of stakeholders or service providers.

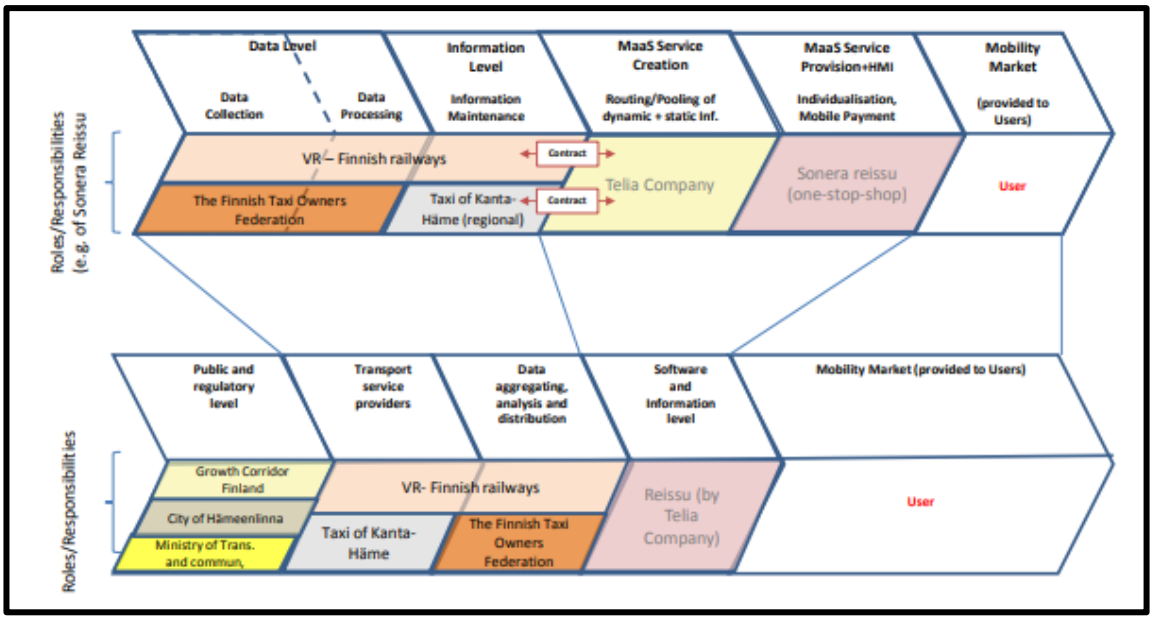


Figure 4: Sonera Reissu Value Chain (König, et al., 2017, p. 48)

Figure 4 also identifies that each level of the value chain has a different stakeholder. VR (Finnish railway) , Finnish taxi owner federation, taxi of Kanta Häme (at regional level), Telia company, Sonera reissu, Growth Corridor Finland, City of Hämeenlinna and Ministry of Transport and Communication.

To sum up these case studies, it is worth noting that MaaS framework allows the flexibility needed to include as many stakeholders as required by demand in the market. The platform stays the same but services are built on each other and consumer gets the multimodal commute in a one stop shop process. This brings us to our next topic of how service combinations are made.

2.1.4 MaaS Service Combinations

MaaS is mainly being developed for urban areas but it does not abandon the rural areas although the service combination might differ according to customised rural needs. The availability and coverage of MaaS varies between geographical areas. The common features are

- One-stop-shop
- Mobile ticketing and payment. Mobile refers to ticketing and payment that can be done anywhere (via e.g. smart phone, tablet, smart card, PC…)

- Multimodal traveller information and routing are being adjusted in real-time if necessary.
- Perceiving individual preferences and priorities: time, sustainability, price, special needs and constraints (e.g., disability, special packages, child seat, etc.)
- Special offers and frequent customer programmes (König, et al., 2017, p. 55)

Based on these common features, the MaaS service combinations could be developed for urban areas, suburbs, and rural areas, national and even for an international level. Since the focus of this thesis is urban areas, Figure 5 illustrates the initial service combinations in cities and urban areas.

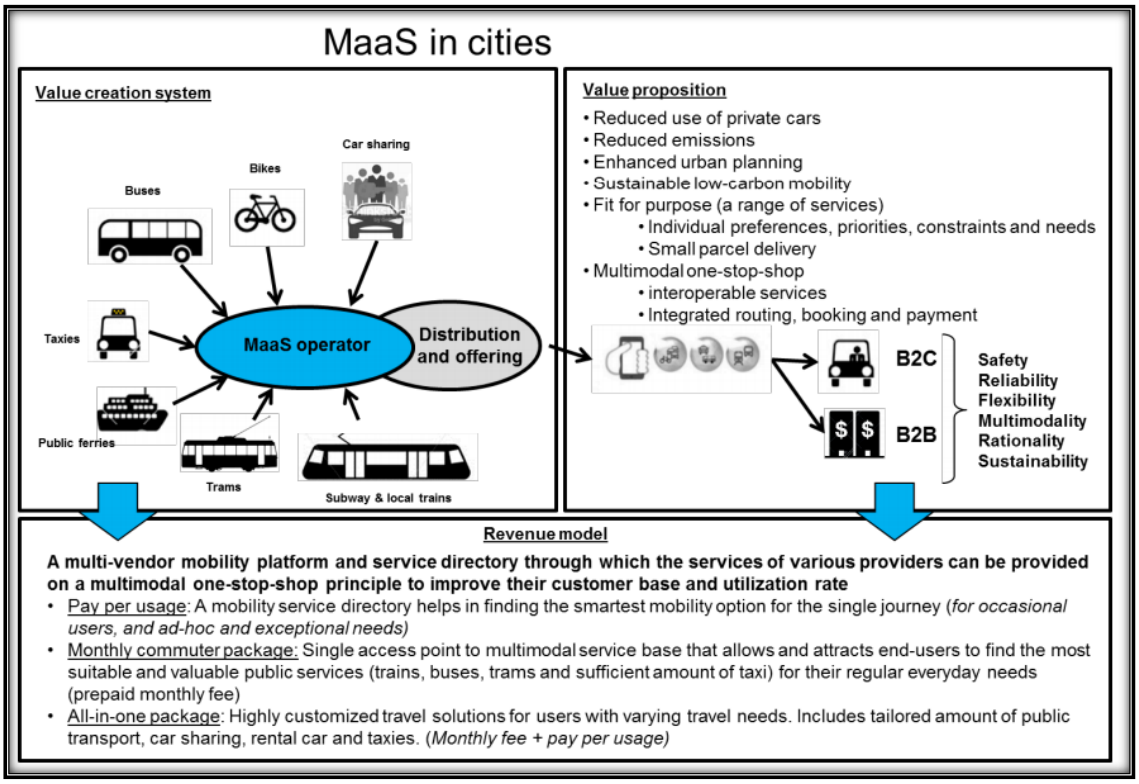


Figure 5: MaaS services in urban areas (König, et al., 2017, p. 55)

The payment packages can be customised based on the needs of a specific market demographics. There is a lack of generally available information on actual impacts of MaaS and the same is true for MaaS related services.

This impact assessment was formulated based on a web-survey to experts and stakeholders, and the knowledge and experience of the members of MAASiFiE project team.

The framework illustrated in Figure 6 consists of altogether 17 key performance indicators.

- 6 on an individual level
- 6 on a business level
- 5 on a societal level.

The issue with feasibility studies and the assessment of possible impacts is the lack of empirical evidence. The impacts mentioned in Figure 6 are, to a large extent, based on the informed assumptions and experts' opinions. (Karlson et al. 2017: 4)

Level	KPI	Impacts		
		Environmental	Economic	Social
Individual /user level	Total number of trips made	x		x
	Modal shift (from car to PT, to sharing, to ...)	x		
	Number of multimodal trips (combining different modes of transport)	x		
	Attitudes towards PT, sharing, etc.	x		
	Perceived accessibility to transport			x
	Total travel cost per individual/household		x	x
Business/ organisational level	Number of customers		x	
	Customer segments (men/women, young/old, ...)		x	x
	Collaboration/partnerships in value chain		x	
	Revenues/turnover		x	
	Data sharing		x	
	Organisational changes, changes in responsibilities		x	
Societal level	Emissions	x		
	Resource efficiency (roads, vehicles, land use, ...)	x	x	
	Citizens accessibility to transport services			x
	Modification of vehicle fleet (electrification, automation, etc.)	x		
	Legal and policy modifications	x	x	x

Overall positive increase/decrease
Both positive and negative increase/decrease
Overall negative increase/decrease
Not possible to assess

Figure 6: Overview of MaaS related impacts and key performance indicators (MariAnne K, et al., 2017, p. 57)

The key performance indicators (KPIs) are vital sources of information to determine the direction of policy making. The yellow colour coded cells in Figure 6 show that the impacts of those key performance indicators will either increase or decrease depending on the customers using the system.

2.1.5 Road pricing as part of MaaS

MaaS focuses on the reduction of total transport emissions and usage of non-private car and environmentally friendlier transport modes. Consequently, the polluter could potentially pay for externalities generated due to the own car use. (König, et al., 2017, p. 58) Identified the “polluter-pays” principle as a further measure to attract people to start using MaaS and related services. This principle will be discussed further while comparing cities in this document. Currently, there is no road pricing or congestion tax applied to car users on the Finnish roads. However, the Helsinki city officials are planning to cut back on private cars. Helsinki has already proposed a feasible road toll trial in 2020. Helsinki’s carbon dioxide emissions in 2016 were approximately 2700 kilotons. (Malmberg, n.d.) This type of system will help authorities in cutting down the private car trips which can be avoided or can be made in off peak hours. This will result in an efficient use of roads and only those travellers who have a necessity and are willing to pay for using the road during the congestion duration will pay for the externality caused by their trip on a private vehicle.

2.1.6 Technology for MaaS

The main requirements for the allocation of mobility services is provided by internet based technologies. They are integral part of the value chain (figure 2) starting from data generation up to the final end user service. Within the general modular chain there are 5 modular levels/functions that fulfil the specific technological requirements. These are

1. Data Level: This encircles the collection of all the statistical data (such as timetables and departure times) as well as dynamic raw data (weather, traffic and other similar data from sensors)
2. Information Level: Information level is based on processed data and crosslinking of statistical and dynamic data.
3. MaaS Service creation: Relates to the analysis and pooling of information to generate different MaaS service features e.g. routing capability, traffic forecasting.
4. MaaS Service provision: is about making the MaaS service available and accessible to the end user in a suitable form. e.g. availability of suitable Human-Machin/Machine- Machine interfaces
5. Mobility Market: describes the whole set of available mobility services to consumers. (König, et al., 2017, pp. 8-9)

3 Case Studies and Results

In this chapter the policy making approaches in relation to MaaS based on a benchmarking study of the Finnish Transport Safety Authority are discussed along with MaaS business models in London, Sweden and Helsinki. This chapter has also utilised the findings of Ramboll Whimpact study which is the study of whim app Helsinki (the first functional MaaS model).

3.1 Policy making approaches in relation to MaaS

In 2018, the researcher of this thesis worked as a project assistant for the National Transport Safety Agency of Finland. The aim of the research for Trafi was to benchmark the indicators of transport markets and compare them with the "status report of transport market" in Finland created by Trafi.
At that time, the transport market in Finland was highly regulated and controlled. Plans were underway to deregulate the market and increase the competition particularly in private transport sector so that the consumers could get a relief in fares of private transport providers and the delivery of services would increase according to demand.

It is still too early to predict if deregulation in transport market has helped the market or no but constant follow up of the market is always a better choice than no follow up. The follow up studies in Finland after deregulation of transport market have shown that the taxi fares initially dipped but rose again. There were also anomalies involved based on the region. For example, Statistics Finland reported that the average fare level was 7% higher than before the deregulation. In Helsinki region, this difference was 14%. Traficom data from last quarter of 2018 pointed out that October fares were 3.6% higher than national average. (YLE, 2019)

The study of transport markets in Finland, New Zealand, Sweden, California, Norway and Belgium; showed a difference in the approach of policy implementation by the authorities. All the aforementioned countries showed either top down approach (Government & Authorities taking an active role) to policy implementation or a hybrid approach (top down at central level, decentralised at regional level) but none implemented policy by bottom up approach. (Iqbal & Haapasalo, 2017, p. 50)

This study explored further the categorization of transport modes, transport indicators, categorization of transport services within different transport modes, transport service markets and MaaS. However there were differences in the implications of MaaS or resources allocated towards developing efficient MaaS systems. This is understandable because of the differences of the local market demand and supply. Therefore, an adaptive model has to be implemented rather than a homogenous MaaS model. (Iqbal & Haapasalo, 2017, pp. 53-54)

3.2 MaaS Business Models

Cities like London, Helsinki and Stockholm have already developed and implemented very comprehensive MaaS models. London and Helsinki have introduced whim App while Stockholm has introduced UbiGo after successful results of trial version run in the city of Gothenburg. This chapter analyses briefly these cities and their working models.

3.2.1 MaaS London - whim App UK

The economic and social characteristics of Londoners' transportation habits show that the current situation and trends in car ownership are the first steps to introduce the modal shift away from private cars towards new mobility services. London has been at the forefront of using car sharing, carpooling, ride hailing (peer to peer taxi), peer to peer car rental and bike sharing services. Many authorities in some European countries were challenged by the driver unions, transport providers and taxi operators in retaliation to the ride hailing services like Uber. (Kamargianni, et al., 2018)

Kamargianni, et al., (2018) identified some 'pain points' which hinder mobility, inter-modality (use of two or more transport modes in one trip), multimodality (use of different transport for different trip) and the choice of sustainable behaviours. These so called pain points in the case of Londoners are:

1. use of numerous tools in order to find information, purchase tickets and access transport
2. Wide variety of journey planning tools.
3. Lack of information on intermodal trips.
4. Different payment methods
5. Different ticket types to access each transport mode (Kamargianni, et al., 2018, p. 11)

The roadmap to a Single European Transport Area establishes the need for investment and overhauling in transport infrastructure because flawless mobility drives economic growth and job creation. Point 51 of aforementioned roadmap specifically notes:

> Despite EU enlargement, large divergences in terms of transport infrastructure remain between eastern and western parts of the EU, which need to be tackled. The European continent needs to be united also in terms of infrastructure. (Commission, 2011)

MaaS systems are not limited to cities only. If implemented properly, these systems can also cover rural areas and inter-city or even cross border transport problems. Figure 7 shows the current and future situation from a user's point of view.

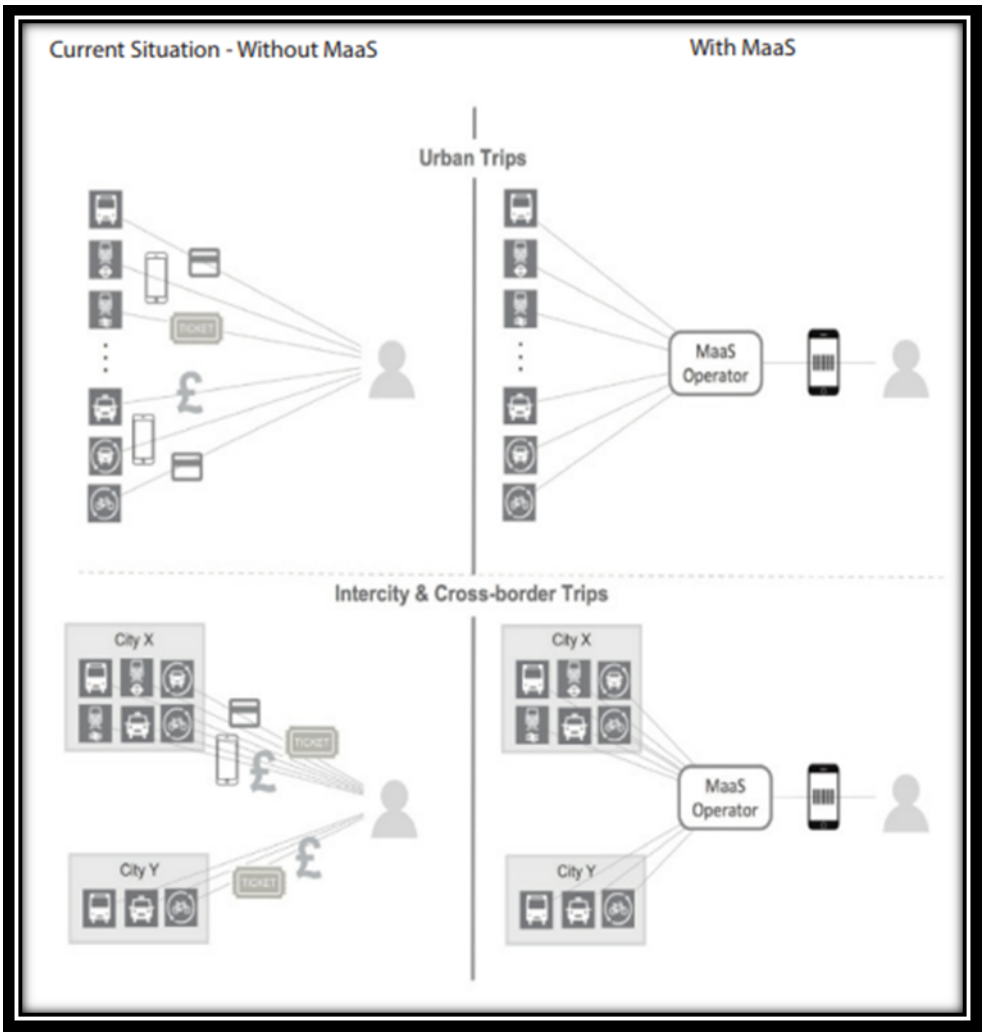
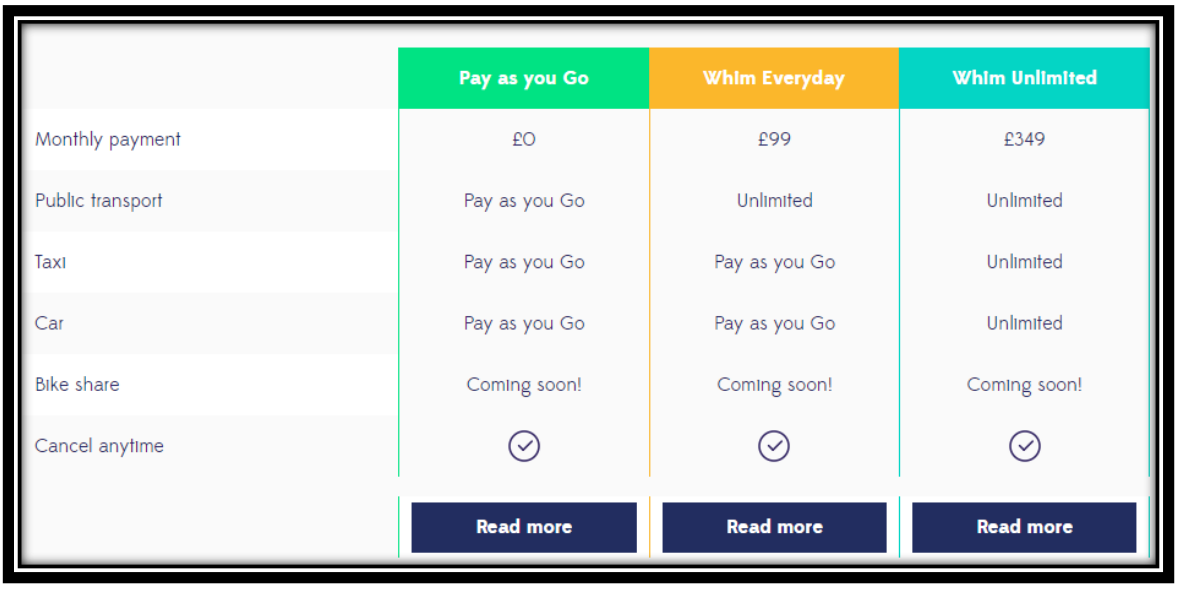


Figure 7: Without and With MaaS from travellers' point of view (Kamargianni, et al., 2018, p. 12)

The process and end information becomes simpler and easily accessible for the end user when a MaaS service acts as intermediary between the customer and the service providers. Whim app is already a working model of a comprehensive MaaS system. The app is working in London as well as in Helsinki. The app provides its customers with all the journeys on public transport, taxi, car and bike sharing. There are currently three paying plans as shown in Figure 8.



	Pay as you Go	Whim Everyday	Whim Unlimited
Monthly payment	£0	£99	£349
Public transport	Pay as you Go	Unlimited	Unlimited
Taxi	Pay as you Go	Pay as you Go	Unlimited
Car	Pay as you Go	Pay as you Go	Unlimited
Bike share	Coming soon!	Coming soon!	Coming soon!
Cancel anytime	✓	✓	✓
	Read more	Read more	Read more

Figure 8: whim app London Payment Plans (Global, 2018)

Since the whim app model is in its trial stages, the amount of transport modes is limited to only public transport, taxi, car and bike-share. These modes cover the needs of any city. But as the system grows and acceptance will increase, other modes of transport can also be added like plane, ship, boat etc. For instance, New Zealand's MaaS system Satori Beta also has the option to use ferries and helicopter. Good examples of this kind of services are Choice App New Zealand and Satori Live (Iqbal & Haapasalo, 2017, pp. 22,23)

3.2.2 MaaS Sweden - UbiGo Gothenburg

(Smith, et al., 2017) Identified a set of general implications for MaaS policymakers by analysing similarities, differences and MaaS related developments between Finnish and Swedish cases. The developments have advanced along different trajectories. Key events in the development of MaaS in Finland and Sweden are included in Appendix III

In Sweden, the multimodal mobility package was initially proposed within an R&D project titled “The flexible Traveller” *(Den flexible trafikanten)*. The business concept was developed between 2011 and 2014 in two phases.

- Go Smart
- UbiGo (Smith, et al., 2017)

UbiGo has now been launched in Stockholm after completing its pilot version in Gothenburg, Sweden. Contrary to fixed packages as in the case of whim App, the packages in UbiGo are customised and depend on the travelling habits of household members. Table 1 highlights the main package deals for a household with two working adults and two children.

Table 1: Adapted and translated from UbiGo pilot studies (Arby, 2018)

UbiGo for two working adults and two school children		
Public transport	40 days	1400 SEK (134 euro)
Car (rent, pool)	18 hours	1200 SEK(114 euro)
Cykel	unlimited	25 SEK (2.3 euro)
Estimated extra services		
Taxi	3 trips	850 SEK (81.44 euro)
Rental car with no limit		110 SEK (10.53 euro)
Purchased hours car	3 hours	200 SEK (19.16 euro)

On the other hand, an average leased car with all its liabilities, maintenance and other costs, sum up to around 6160 SEK per month if driven 1500 miles. UbiGo package costs around 3785 SEK and the bigger savings come in the form of long-term preservation of resources and environment. (Arby, 2018)

Karlsson, et al. (2016) studied the UbiGo service trial in detail and analysed that it appears a promising model when changes in attitude of people towards mobility are calculated. However, designing and implementing an actual service requires a lot of structural changes regarding target group, marketing strategy, pricing model and other support functions.

The concept of multimodality allows a user to choose between different options available contrary to purchasing a travel pass or car, where a customer can feel being locked in choosing between those modes of transport even if the trip conditions or practicalities are changing. Another critical aspect for the perception of increased accessibility was the distance between customer and car sharing service.

3.2.3 MaaS Helsinki - whim App Heksinki

The city of Helsinki is adjoined by two other cities Espoo and Vantaa and several smaller municipalities like Tuusula, Kirkkonumi, Sipoo. The greater Uusimaa regions has a population of estimated 1, 65 million people as of 31.12.2017. (StatisticsFinland, 2018). The public transportation is provided by the Helsinki Region Transport System (HSL) with the help of several partner companies like Nobina, Pohjola, and Veolia etc. Some 370 million journeys are made on HSL's transport services annually. (HSL, 2018)

The Helsinki Regional Transport Service authority released the new zone system for Capital region where the cities have been divided into zones as shown in Figure 9. The aim is to provide smoother transport for a growing number of inhabitants and to respond to people's need to use public transport. The ticket price according to the new system will be based on the distance travelled. (HSL, 2018)

Figure 9: Zone Division by HSL (HSL, 2018)

Helsinki launched whim App in 2016 and after its commercial launch in 2018 it had 70,000 users. The packages address the needs of travellers within the city by providing

bike, public transport, taxi packages and car rental, taxi, carpooling for the commuters who need to travel longer journeys. The services of the app cater more to the needs of Helsinki residents because of the availability of all the modes of transport at close proximity resulting in a better data set.

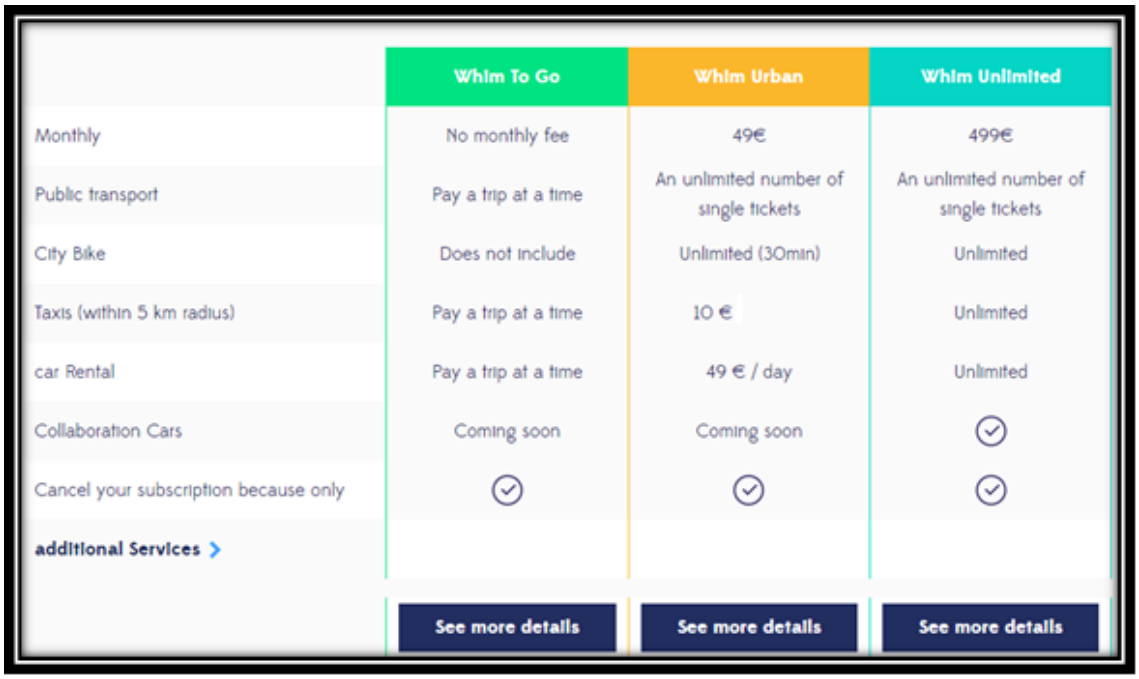


Figure 10: whim App Helsinki Payment Plans (Global, 2018)

Figure 10 shows that there exists a slight difference when compared with Figure 8: whim app London Payment PlansThe whim app in Helsinki offers 10€ worth of credit on taxi rides within 5 km of radius. One may question the value being added by zero euro (pay as you go) packages. Such packages provide one stop shop for a range of services. Some customers do not necessarily travel on daily basis like pensioners or patients. For them the service is customised on demand and they pay for the service they choose to use via single platform.

3.2.4 Whimpact Study

The Whimpact study is the insight report published in late May 2019 after analysing one full operational year of data from whim app Helsinki. The results of the report show already remarkable results but those results are prone to some limitations of available data set. These limitations are due to the high growth rate of user data and skewness of results to early adopters. Also, adding new services during the period of data gathering

made the normalisation of the data a bit harder. Nonetheless, the report provides good initial insights into the nature of MaaS and MaaS users. MaaS users are found to have been excelling in multimodality and the MaaS platform is potentially facilitating first/last mile choices that lead to greater access to public transport. (Ramboll, 2019, p. 3)

Out of 6 aims of the study (Ramboll, 2019, p. 7), three of them are deemed beneficial for this thesis. Understanding these questions helped to draw conclusions of this thesis research. Let us now look at the results of Ramboll study and analyse what they have to offer us in order to understand MaaS up to this point.

I. Does MaaS have an impact on travel behaviour?

MaaS has been found to positively impact the travel behaviour by enabling riders avail multimodality. Whim users were found to be using taxis 3 times more often with public transport compared to typical Helsinki resident. Similarly, as ´Figure 11 shows, the public transport modal share of a Whim user is considerably more than that of an average Helsinki resident. (Ramboll, 2019, pp. 14-15)

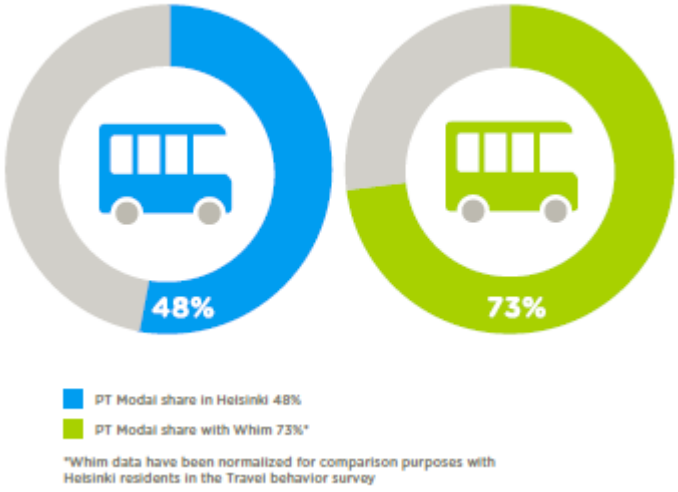


Figure 11: Modal share of Helsinki Resident vs Whim User (Ramboll, 2019, p. 14)

II. Does MaaS encourage a car dependent city?

The total number of car rental trips in data set are comparatively small but increasing numbers of users are including car rentals in their trip planning. MaaS users are open to the idea of using car rentals and are finding the options as an alternative solution to

owning a car. (Ramboll, 2019, p. 24). Figure 12 shows the number of trips made by rental cars using whim app.

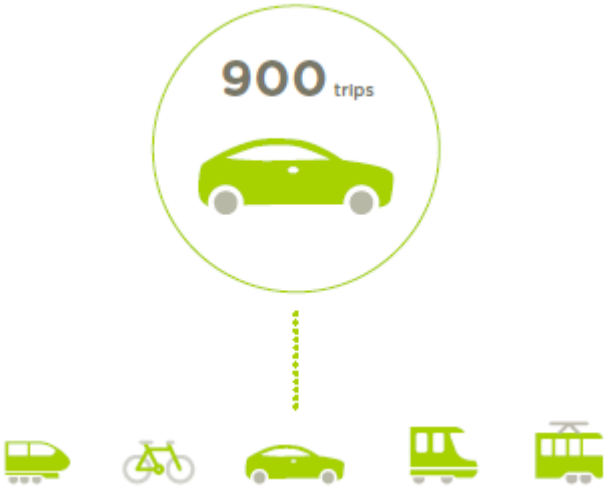


Figure 12: Rental Cars are part of MaaS daily trips (Ramboll, 2019, p. 24)

The early adapters of MaaS have shown a high preference for multimodal transport. Areas with higher accessibility to bicycle points tend to show a higher usage of Whim. This restriction can be eliminated by introduction of new multimodal options like E-bikes. Figure 13 illustrates the hotspots of accessibility which correspond to the availability of bicycle in those areas.

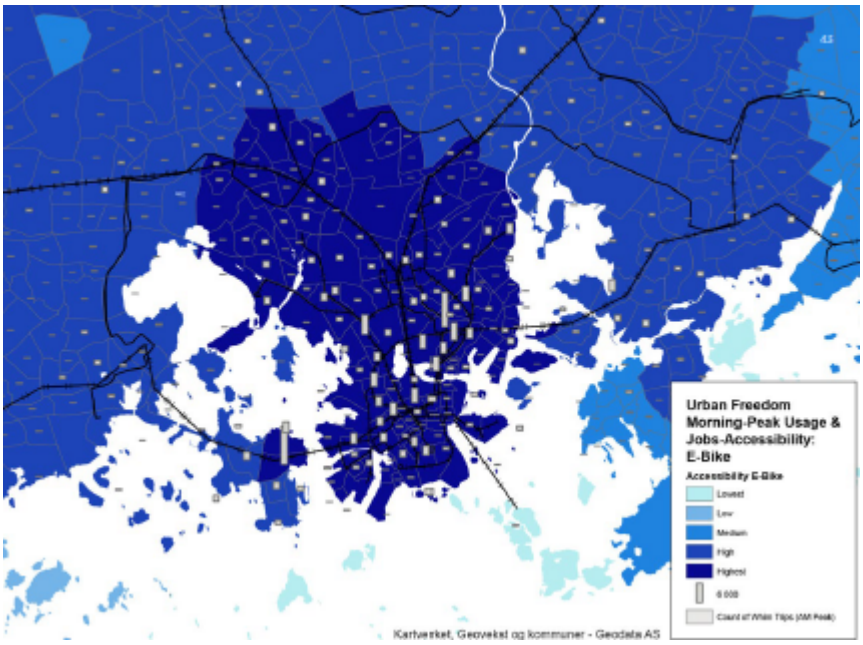


Figure 13: Urban Freedom - Morning peak usage (Ramboll. 2019, p. 22)

Although average daily trips of MaaS users and typical Helsinki residents have stayed the same, the important thing to note in Figure 14 is the reduction in car trips from 7.3% (average resident) to 3.4% (MaaS user). This reduction would surely have resulted in less cars on the roads but still not significant enough because of the smaller number of people using Whim as opposed to the number of people owning cars. Once Whim will end up owning a larger share of transport, these numbers will fluctuate at a different rate and the effects will be visible on the roads in terms of increased space and decreased private cars. (Ramboll, 2019)

Whim-trips avg per person	No. Of trips	Modal share %
Public transportation	2.15	73.1%
Taxi (from Whim data)	0.07	2.4%
Car (Trips added, Travel behavior survey)	0.2	3.4%
Bicycle + Walking (Trips added, Travel behavior survey)	1.0	20.4%
Total	**3.4**	

Control group avg per person (From HSL Data)	No. Of trips	Modal share %
Public transportation	1.6	47.6%
Taxi	0.03	1.0%
Car	0.2	7.3%
Bicycle + Walking	1.4	43.6%
Total	**3.3**	

Trip numbers and modal share among control group in Helsinki metropolitan area vs. Whim-users. 2.24 trips are made with Whim per day per user, but the missing modal shares are added from the corresponding control group.

Helsinki metropolitan area

Whim-users

Figure 14: Average Daily Trips of MaaS Users & Typical Helsinki Residents ((Ramboll. 2019, p. 19)

III. Does MaaS steal ridership from public transport?

Public Transportation is the backbone of MaaS. In preliminary findings of Whimpact as shown in Figure 15, it was discovered that public transport accounts for 95.2% of modal share among whim users. This further clarifies the concept that existing modes of transport are the foundations for effective MaaS models and that the system is dependent more on existing modes of transport than replacing them. 68% of all the Whim trips were found occurring in areas with highest public transport access. (Ramboll, 2019, pp. 20-21)

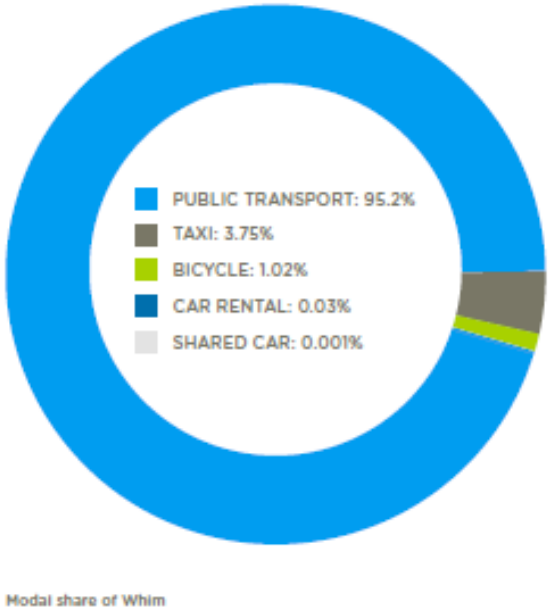


Figure 15: Public Transportation Modal Share of Whim (Ramboll, 2019)

3.3 Key learnings

Based on the review by Kamargianni, et al., 2016), the new mobility services which have come into existence because of the increased demand for mobility. Decision makers and transport authorities are increasingly adapting systems which provide seamless door to door mobility by integrating transport modes.

In earlier chapter 2.1.5 of this document a reference to “polluter-pays” principle was mentioned based on König et al. (2016: 58). By deregulating the market, Finland has made it possible for car pool services and ride hailing services to become available for the consumers. Such services should, in theory, reduce the congestion by providing alternative to people to use the service instead of bringing own car to the city. Each car entering the city in the morning rush hour results in creating the same rush loop during the evening rush hour. If, after the deregulation, these services are not being used by commuters then taxing the road use or car use is justified because personal cars not only result in congestion of their lanes but also the public transport lanes.

When the price tag of “whim Unlimited” is compared with the cost of car ownership in Finland, the annual cost of keeping a basic car is between 6,000 to 7,000 euros according to (YLE, 2018). Calculation includes basic vehicle tax, an extra tax applied on cars that do not run on petrol, fuel costs, insurance, parking and maintenance expenses 6,000 euros annually means 500 euros monthly. The price of whim Unlimited in Helsinki is 499 euros. At this price whim is offering access to cars, bicycles, public transportation, carpooling and other services. Public transportation and bicycles use are unlimited while other services have some constraints. Based on this comparison it will be justified to argue that whim model is indeed a very competitive model.

The markets are moving towards solutions which put less strain on roads and resources of the planet earth. Information technology systems are helping the markets to utilise transportation in most effective ways possible. The determination of authorities to provide such services is clearly visible. Though, more advertisement and general awareness of public is needed to make this shift possible at a faster pace. If a MaaS platform is costing more than owning a car then either the MaaS platform’s prices need to be restructured or benefits of using the platform need to overshadow the public perception of ‘owning the car’.

4 Policy and Taxation

In chapter 2.1.1, policy formers and regulators were identified as important stakeholder for enabling MaaS. The EU roadmap for MaaS 2025 encourages the decision makers to incentivise and support MaaS development. Appendix IV highlights how “enablers” can achieve these goals in short term, medium term and long term. Policy making and Regulation will be the theme of this chapter.

Taxation is considered an essential tool for Government in terms of revenue collection or sometimes mitigation procedures. However, from a consumer point of view, taxation has its downsides especially when used as a mitigation tool. In the case of cars, many governments are using their authority to ban diesel cars or tax them more than other cars because of higher polluting power in diesel cars. In Finland, the Government relies heavily on the taxation system as a revenue stream. Let us go through some cases of taxation where the Finnish government tried to control the negative externalities of a product by increasing taxes and demoting the sales of that product.

4.1 Effects of Taxation on Tobacco

Finland has introduced Tobacco Act to end the use of tobacco and other nicotine products by the year 2030. The history of smoking in Finland dates back to 1920s when Finland was consuming more cigarettes per capita than anywhere else in the world. In 1940s, the ration cigarettes distributed among soldiers turned many into smokers and after the war some 76% men and 13% women stayed smokers. Afterwards came the research on use of cigarettes and lung cancer. In 1960, Finnish Medical Association announced that smoking is hazardous to health. (ASH Finland, n.d.)

During the same year 58% of men and 14% of women were smokers. From 1961 to 1980, many initiatives on national and regional level demoted the use of tobacco by putting a ban on tobacco advertising, prohibition of sale of tobacco to minors and smoking ban in public. In 1990, only 33% of Finnish men and 20% of women were smokers. Use of bans, prohibitions and tax hikes continues and the latest statistics from 2015 show that only 16% Finnish men and 12% women are smokers. (ASH Finland, n.d.)

Another interesting statistic is the increase in the revenue of the Finnish Government resulting from tobacco tax. In 2016, tobacco tax revenue of 975 million euros was collected despite the decline of smoking throughout 2000s.The tobacco tax is raised regularly. It was raised twice a year in 2016 and 2017 and the trend continued in 2018. (ASH Finland, n.d.)

An important point to be noted here is that taxation alone is not the solution. It works best when alternatives are provided and prohibition tactics are implemented.

4.2 Effects of Taxation on Alcohol Consumption

Elder, et al., (2010) have reviewed an extensive amount of literature to assess the reduction in alcohol consumption based on the effectiveness of alcohol tax policy interventions. Nearly all studies found that there is an inverse relationship between the tax or price of alcohol and consumption of alcohol. The authors have referred to the Law of Demand, which is considered one of the fundamental laws of economics and implies that quantity of demanded product is inversely related to the price of the product. Figure 16 conceptualizes the law of demand

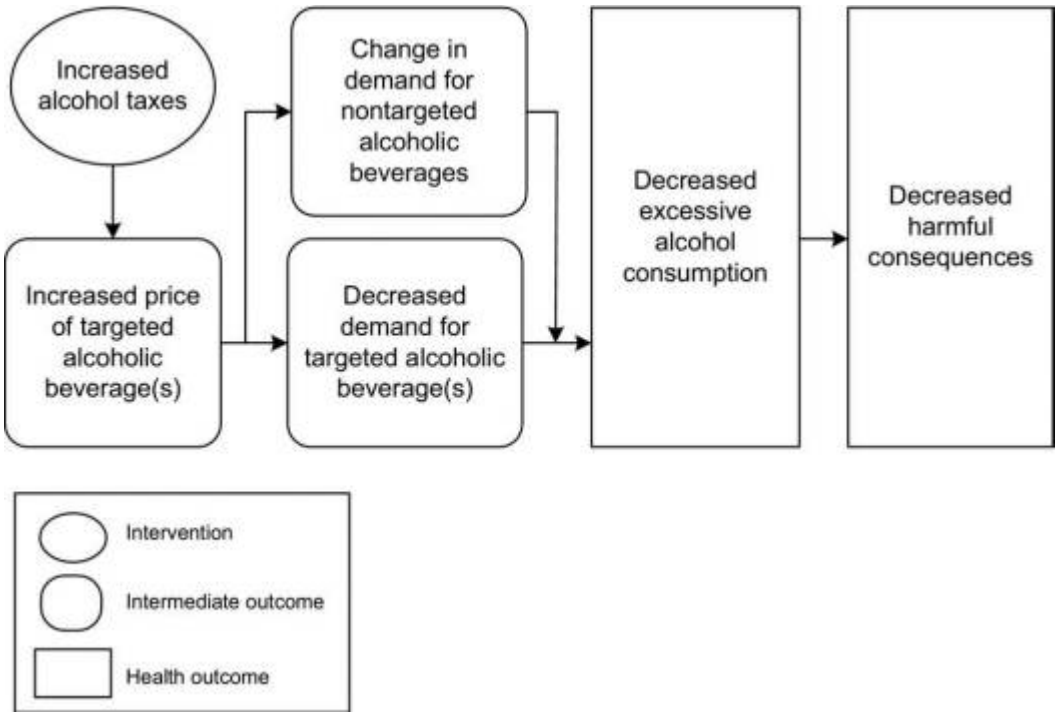


Figure 16: Conceptual model for the causal relationship between increased alcohol taxes and decreased excessive alcohol consumption and related harms (Elder et al., 2010)

4.3 Effects of Taxation on Diesel Engines

A report by European Environment Agency (EEA) examined the CO2 emissions in all EU member states and compared them against the taxes and incentives being offered to promote the use of lower emitting vehicles. The case studies to analyse the different approaches used for taxation and incentives in France, Germany, Greece, Ireland, the Netherlands, and Poland revealed that consumers purchased the lower emitting cars where large and targeted taxes and incentives were available. (Agency, 2018). Figure 17 show the average CO2 emissions in EU-28 member states and Norway, Iceland and Switzerland. Finland lies in the middle of the colour spectrum while Norway shows the most compliance in keeping the CO2 levels low.

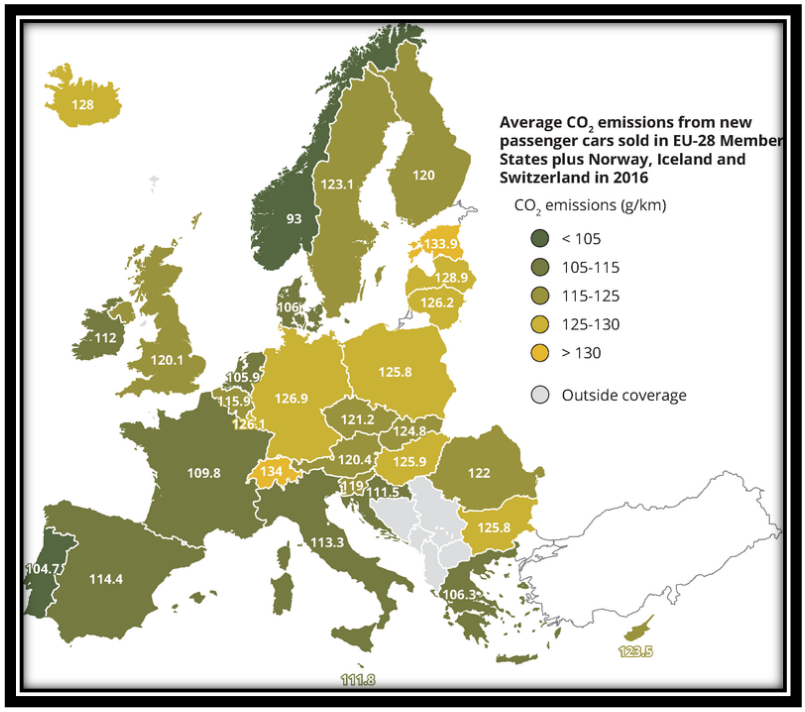


Figure 17: Average CO2 emission from new passenger cars sold in EU-28 Member States plus Norway, Iceland, and Switzerland in 2016 (Agency, 2018)

Cash for clunker's campaign by the Finnish Government ended in August of 2018. The campaign was aimed at taking higher emitting vehicles off the road. The idea was to give a rebate of 1500-2500 euros to the owner of a highly polluting vehicle that is at least 10 years old. The vehicles were junked. By the end of the campaign 6600 new cars had been purchased. (YLE, 2018)

Organisation for Economic Co-operation and Development (OECD) & International Energy Agency (IEA) compared the policies of Nordic countries and compared them against the evidence of existing electric vehicles or alternate fuels in the market and decline of high polluting vehicles particularly diesel (OECD/IEA, 2018). The report also considers policy support as mandatory to enable market growth. Figure 18 shows the overview of support policies for electric cars in the Nordic region.

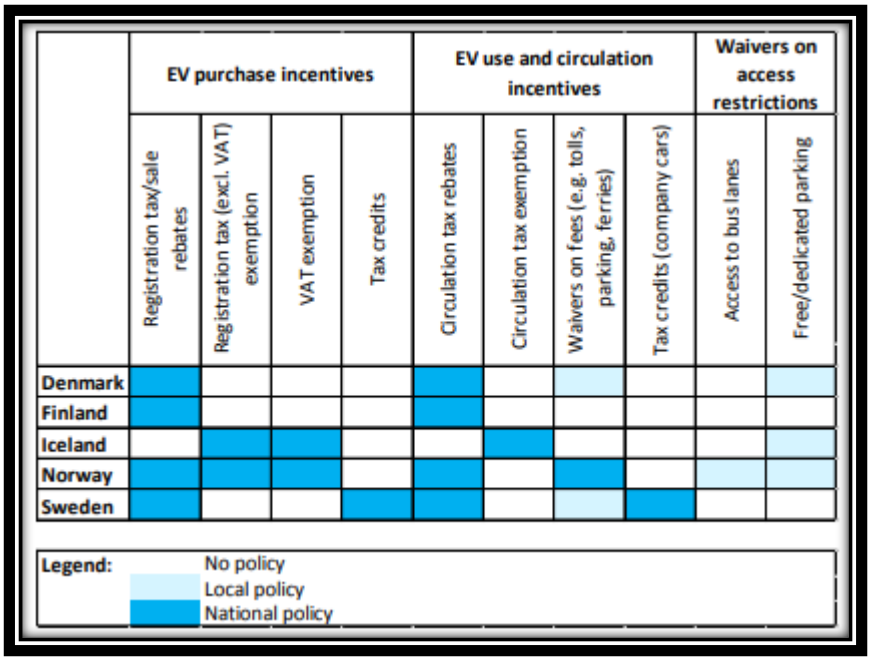


Figure 18: Overview of Support policies for electric cars in the Nordic Region in 2017 (OECD/IEA, 2018)

Norway has maximum policy incentives and waivers on access restriction both on national and local level and as a result ranks as being the highest in the adaptation of electric vehicles. Finland is lagging behind in many areas compared to its Nordic neighbours and as a result the trend of moving towards less polluting vehicles is slower. Electric cars are a part of bigger picture to curb emissions and meet the international and EU targets to limit CO_2 under a certain level. The MaaS schemes being implemented could be a good starting point to make electric cars available for customers to use. This will result in two outcomes.

- people will get to know the performance of electric vehicles and market reluctance to buy EVs will be adressed
- More people using EVs instead of petrol or diesel cars will reduce the CO_2 emissions.

4.4 Diesel Ban and Car Manufacturers Stance

In a review by Hooftman, et al., (2018) about the European passenger car regulations - real driving emissions vs local air quality it was argued that Europe's passenger car emission regulations have been proven failed. The authors argue that favouring diesel technology on policy level lead to Europe becoming a diesel island and as a result every European citizen is breathing harmful air. The paper effectively takes both sides of the equation under consideration and claims that an update to the European regulatory framework regarding automotive emissions is needed and post 2021 emission targets should be set if Europe does not want its automotive industry to lose competitive position in the global market.

Environmentalists in the European Union have been pushing for an all-out ban on diesel automotive but an all-out ban cannot serve its purpose if as a result of that ban the economic market comes to a halt. However, legal institutions have started taking public health complaints seriously and in 2018 the news of German courts banning diesel cars in some cities made waves all across the Europe. Many cities in other countries followed in the footsteps of Germany and many other started thinking in that direction. Diesel car sales in Germany dropped to 31.1% of the total in the first half of 2018 from 41.3% in the year before. The EUs sale as a whole declined by around 16%. Some famous cities introducing court-induced diesel bans were Cologne, Bonn, Essen, Gelsenkirchen, Mainz, Stuttgart, Aachen, Frankfurt, Berlin, Munich, Dusseldorf, Darmstadt and Wiesbaden. (Reuters, 2018).

Volkswagen (VW) emission cheating scandal has already costed the company nearly $33 billion after it admitted to cheating on clear air rules with software that made emissions look less toxic than they actually were. VW is still facing a number of lawsuits. (Kottasova, 2018). Though car manufacturers have been claiming to invest in greener technology and reducing the dependency of highly polluting fossil fuels but in the most recent turn of events, the European Commission has charged three auto industry giants BMW, Daimler and Volkswagen with colluding to limit the introduction of clean emission technology in preliminary findings of an antitrust investigation. If the car manufacturers fail to give reasonable explanations, they could face fines of billions of euros - up to 10% of their global turnover. (Neslen, 2019)

5 Conclusions

By comparing the MaaS Business Models (Chapter 6), the notion that MaaS is indeed a competitive business model is authentic and justifies that there are more advantages of offering mobility services in one stop shop. The infrastructure is the key to developing competitive MaaS business models. Infrastructure not only includes the roads but also the IT infrastructure, transport service infrastructure, payment systems all are part of the MaaS ecosystem and all have to operate in harmony to provide seamless mobility. The general acceptance to MaaS services among the people of London, Gothenburg and Helsinki is very positive.

Authorities play a crucial role in implementing policy and making way for the systems to operate as efficiently as possible e.g. deregulation of transportation in Finland resulted in increased taxi providers which led to availability of more options to choose from for the consumer. Also these services are now co-operating with other mobility providers as part of a greater service delivery than focusing on their own specific niche. Federal governments, could further trickle down the decision making power to cities so cities can develop and invest in solutions for location-based problems.

Value chains of MaaS systems are dynamic enough to accommodate not only cities but their suburbs or even remote areas where the demand of public transport is not as much. However, there is a demand on specific times. By integrating the services on demand in the MaaS ecosystem, the supply of services can be customised which would not only save resources but also provide good customer experience to suburban customer which usually complains about the lack of service or poor quality of service compared to the cities.

Mobility providers such as taxi operators, public transport operators or rental car/bike operators or sellers are benefitting from the increased use of their services as a whole. Improved financial gains as well as maximum return on investments is further motivating service providers to be a part of something bigger instead of tirelessly burning resources in their own individual specific niche. A positive feedback from mobility providers and cooperation has also made it possible for MaaS to operate.

According to simplified European MaaS roadmap 2025 enablers (authorities) should invest in research and development and implement roadmaps and strategies on national and international networks. One of the short and medium term goal is to incentivise people for using MaaS and change their perception of mobility. Availability of MaaS and marketing or advertisement alone can help to a certain extent in achieving these goals (Eckhardt et al. 2017),

The real progressive results will come when the policy is tightened for private car owners. Car owners have been charged differently in different parts of the world. In Sweden congestion tax is used for areas closer to city centre of Stockholm and automatic systems take the picture of number plates of car which choose to enter a heavily congested area during peak hours and charges them for the time they spend in those areas (Iqbal & Haapasalo, 2017). Likewise London uses congestion tax not only to demote the use of cars but also to control the pollution caused by vehicles. In Germany, cities are putting ban on the entry of heavily polluting diesel cars to save the health of their inhabitants.

These type of counter measures prove effective only to a certain extent. For example, in areas charged with congestion tax, people will wait until the congestion tax timings are over and still use their cars to enter. Consumers will switch to hybrid or petrol cars to avoid the ruling against the 'ban' of diesel cars. The real need for the authorities is to make sure that when they charge or ban something, the consumer should use a more sustainable, greener and efficient system instead of switching to a system which starts causing other type of pollution.

After all said and done, if taxation has to be used as policy approach to demote the use of cars, it should be used in such a way that it won't end up creating externalities in another form i.e. the externalities will stay constant, only their form will change from one to another. The Whimpact study has given key insights to the future of MaaS in Helsinki. The study, therefore, was prone to some limitations due to the high growth of service, addition of services during the data collection period and early adapters using it. Whim Helsinki has proved to be a good model for Helsinki residents according to Whimpact study. It not only provided services to all the age groups but also made it possible for all the service providers to operate seamlessly.

Since, this study aims at using a policy instrument (taxation) to set out the demand and supply curve of road transport sector, it is important to mention the Taxonomy of Policy

Components based on Cashmore and Howlett (2009) as outlined in It provides the main themes to be considered both in terms of 'Policy Goals' and 'Policy Tools'. Both rely on each other in order to create a balanced policy focus.

Table 2. Understanding this taxonomy of policy components can help target the policy in a way that it will be beneficial for all the stakeholders involved. It provides the main themes to be considered both in terms of 'Policy Goals' and 'Policy Tools'. Both rely on each other in order to create a balanced policy focus.

Table 2: A modified taxonomy of policy components. Cells contain example of each measure. Modified from Cashmore and Howlett 2009

		High Level Abstraction	Program Level Operationalization	Specific on the Ground measures
Policy Content	*Policy Ends or Aims*	**Goals** *What general types of ideas govern policy development?* (e.g. congestion reduction)	**Objectives** *What does policy formally aim to address?* (e.g. minimizing influx of private vehicles into the city while providing good mobility to consumers)	**Settings** *What are the specific on the ground requirements of policy?* (e.g. %age reduction in the car inflow in the city)
Policy Focus		**Instrument Logic**	**Mechanisms**	**Calibrations**
	Policy means or tools	*What general norms guide implementation preferences?* (e.g. carrots and sticks paradigm)	*What specific types of instruments are utilized?* (e.g., vehicle ownership tax, fuel tax, congestion charge or cheaper alternate services etc.)	*What are the specific ways in which the instrument is used?* (e.g., targeting particular type of vehicles, alternative timings for entry to city for vehicles etc.)

5.1 Key Learnings

Almost all developed countries invest heavily into their infrastructure and its maintenance. Despite that, the roads keep getting more crowded with each passing year and operate on maximum capacity particularly during the peak hours. This results in delays, pollution and other externalities. Countries with limited land cannot increase road capacity infinitely and the countries with relatively unlimited land (less population per square kilometre) cannot afford to become unsustainable in the long run by just increasing roads in the system. What is needed now is a smarter approach to use the existing infrastructure and if that falls short then investments could be made into new infrastructure.

Chapter 4.1 and 4.2, effectively justified that if policy makers wish to target the use of a specific product, they can do so by increasing the price which results in the decreased use of that product. When it comes to measures like tax increase, the impact of potential tax increase is expected to be proportional to its magnitude and to be modified by factors such as disposable income and the demand elasticity among various population groups. (Elder et al., 2010)

It could be argued that alcohol and tobacco taxation policies are entirely different from diesel or vehicle or road usage taxation because they target different market segments. That is true. The market segments are entirely different, however, the policy in both cases tends to favour the public health and improves the living standard of people in general. Alcohol consumption causes deaths just like breathing in heavily polluted air could cause premature deaths.

Sean O'Grady, Deputy Managing Editor and former Economics editor of the Independent (newspaper), talks about the next transport revolution which will likely come in the form of electric vehicles on roads and puts a rather unique rationale as an economist.

> "Well there is no better method of rationing than by price, though I admit that busy times and roads will become more the preserve of the wealthy in such a set-up. Road pricing is, then, a bit regressive but it is probably the fairest way to regulate road use. In a world where electrification also threatens traditional sources of government revenue, it needs to be brought in to protect the funding of public services, including investment in roads and public transport, because all those duties on petrol and diesel will start to decline sharply. Payment by the mile is one easy way to do it." (O'Grady, 2017)

This type of system is also being developed in Belgium where the Flemish regional government has plans to introduce a smart kilometre tax. The goal is to replace the current system with a budget neutral tax system that will result in the reduction of number of

kilometres driven every year. Drivers who choose to drive during rush hours will be expected to pay more than those who drive in off peak hours. (Uyttebroeck, 2018)

MaaS is not a result of an overnight discussion between consumers and authorities. For birth of any idea, some preconditions or problems are needed to get someone to think or innovate the solution. The scientific community has widely agreed on the fact that greenhouse gas emissions are the root cause of climate change. With recent efforts at global level particularly Paris Agreement (Climate Change, 2016), the focus of the international community is to accelerate and intensify the actions and investments towards a low carbon future.

A low carbon future not only requires the efficient use of existing resources but also requires that the maximum output should be achieved by investing or utilising minimum natural resources which are in finite supply. Taxing diesel vehicles has resulted in the shift from diesel to petrol engines. Using petrol has its own consequences. It is cleaner than diesel but still harmful than greener technology i.e. electric vehicles. The electric vehicles on the other hand are too expensive for an average consumer to make that huge leap of faith and pay for a product that has not been highly tested yet and there is only a handful of companies providing electric cars.

The diesel emissions scandal and the heavy fines imposed by the US on VW has given out a clear message that the policy makers are moving on the side of the public because the future of next generations depends on the decisions being made today. Car manufacturers are right in claiming that the shift to electric engines is not going to be an overnight change. It requires heavy investment in research & development which is not possible if the existing sales revenues and profit streams will be blocked systematically.

The threat of global warming and climate change, on the other hand, is forcing authorities to take radical actions in order to save the future. Ryley & Chapman (2012) examined the relation between transport and climate change based on the studies of various researchers. The focus of their work is on mitigation tools available to transport stakeholders along with the effects of carrot and stick approach.

5.2 Critical Appraisal

The research process was complicated because a lot of primary data from active MaaS business models has not been openly released yet. The outcomes of deregulation of transport in Finland are still being studied and the preliminary investigations have been included in this research document. The investigations regarding increase and decreases in fare in different parts of the country and the applications for new commercial driving licenses is readily available. However, the information as to how this deregulation is assisting MaaS is still under scrutiny by stakeholders.

The results of this research are dependent on secondary data from other researchers. This research has tried to introduce the idea of using effective taxation to accelerate the use of MaaS platforms The research data was limited to existing literature including books, journals and online sources. The selected data collection and analysing methods were suitable for the objectives of the research taken into consideration the time and sources available.

5.3 Recommendations

From the point of view of researcher, authorities are not in complete sync with MaaS providers in such a way that would accelerate the adaptation of MaaS. The focus is more on letting the market take control and trusting people that they would choose the alternatives just by having information that the alternatives are better. If that had been the case then world would have already shifted to solar panels and would have abandoned the higher polluting forms of energy production like nuclear and coal. The sticks and carrots approach from the policy holders is mandatory to fast track the process. Only sticks or only carrots approach will result in a more relaxed and laid back attitude from most consumers which in the long run will not benefit the system as a whole.

5.4 Suggestions for Further Research

An important thing noticed during the research was the lack of extensive country specific or market specific researches for MaaS platforms. Every mobility market has its own needs and demands. The sooner the authorities or MaaS providers realise and document their market needs, the better it will be for the service development sector to customise the packages.

For example, a market with a very high percentage of older people will likely have to make more taxi services available via their platform compared to a market with very young people who cannot afford cars and taxis and will likely rely on bicycling and public transport.

Thus, the countries which are actively promoting MaaS can also invest in research for the market specific needs so that there will be enough market specific data by the time MaaS business models get started. This will help making smarter investments in the areas which need them the most thereby making efficient use of resources.

References

Agency, E. E., 2018. *Tax breaks and incentives make Europeans buy cleaner cars.* [Online] Available at: https://www.eea.europa.eu/highlights/tax-breaks-and-incentives-make [Accessed 08 08 2018].

Arby, H., 2018. *What does it cost?.* [Online] Available at: http://www.ubigo.nu/vad-kostar-det/ [Accessed 05 10 2018].

ASH Finland, n.d. *Tobacco Free Finland 2030 Timeline.* [Online] Available at: https://savutonsuomi.fi/en/towards-tobacco-free-finland/timeline/ [Accessed 6 10 2018].

ASH Finland, n.d. *Tobacco Taxation.* [Online] Available at: https://suomenash.fi/en/tobacco-policy/tobacco-taxation/ [Accessed 07 10 2018].

Climate Change, U. N., 2016. *What is the Paris Agreement?.* [Online] Available at: https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement [Accessed 16 October 2018].

Commission, E., 2011. *EUR-Lex.* [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52011DC0144 [Accessed 01 10 2018].

Communications, M. o. T. a., 2019. *Act on Transport Services.* [Online] Available at: https://www.lvm.fi/lvm-site62-mahti-portlet/download?did=246709

Eckhardt, J. et al., 2017. *Deliverable Nr 2 – European MaaS Roadmap 2025,* s.l.: MAASiFiE.

Economist, T., 2018. *The hidden cost of congestion.* [Online] Available at: https://www.economist.com/blogs/graphicdetail/2018/02/daily-chart-20 [Accessed 05 05 2018].

Elder, R. W., Lawrence, B., Ferguson, A. & Naimi, S. T., 2010. The Effectiveness of Tax Policy Interventions for Reducing Excessive Alcohol Consumption and Related Harms. *American Journal of Preventive Medicine,* 38(2), pp. 217-229.

European Commission, 2017. *An Overview of the EU Road Transport Market in 2015,* s.l.: European Commission. European Commission, 2018. *Sustainable Urban Mobility Plans.* [Online] Available at: https://ec.europa.eu/transport/themes/urban/urban_mobility/urban_mobility_actions/sump_en [Accessed 2018].

Global, M., 2018. *whim - kulje fiksummin..* [Online] Available at: https://whimapp.com/fi/ [Accessed 01 10 2018].

Global, M., 2018. *whim - Travel Smarket.* [Online]
Available at: https://whimapp.com/uk/#about
[Accessed 01 10 2018].

Hertz, 2019. *Auton Vuokraus Helsingin Kekskusta.* [Online]
Available at: https://www.hertz.fi/p/vuokra-autot/suomi/helsingissae/helsinki-city-central
[Accessed 01 04 2019].

Hietanen, S., 2014. *EuroTransport.* [Online]
Available at: https://www.intelligenttransport.com/digital/et-issue-2-2014/index.html
[Accessed 04 03 2018].

Hooftman, N., Messagie, M., Mierlo, J. V. & Coosemans, T., 2018. A review of the European passenger car regulations – Real driving emissions vs local air quality. *Renewable and Sustainable Energy Reviews,* pp. 1-21.

HSL, 2018. *Helsinki Regional Transport Authority.* [Online]
Available at: https://www.hsl.fi/en/helsinki-regional-transport-authority
[Accessed 5 10 2018].

HSL, 2018. *New Zones.* [Online]
Available at: https://www.hsl.fi/en/newzones [Accessed 01 11 2018].

HSL, 2019. *Transport Services.* [Online]
Available at: https://www.hsl.fi/en [Accessed 01 04 2019].

Immonen, E., 2018. *To gain some insights from you on MaaS for my thesis / Former Researcher at Trafi and Helsinki Metropolia,* Helsinki: s.n.

Inc., U., 2019. *Uber moves Helsinki.* [Online]
Available at: https://www.uber.com/en-FI/cities/helsinki/ [Accessed 01 04 2019].

Intel, 2018. *Smart Cities Technologies Give Back 125 Hours to Citizens Every Year.* [Online]
Available at: https://newsroom.intel.com/news/smart-cities-iot-research-125-hours/
[Accessed 06 06 2018].

Iqbal, T. & Haapasalo, K., 2017. *International reporting mechanisms of Transport Markets,* Helsinki: Trafi Publications.

Kamargianni, M., Li, W., Matyas, M. & Schäfer, A., 2016. A Critical Review of New Mobility Services for Urban Transport. *Transportation Research Procedia,* Volume 14, pp. 3294-3303.

Kamargianni, M., Matyas, M., Li, W. & Muscat Jakub, 2018. *Londoners' attitudes towards car-ownership and Mobility-as-a-Service: Impact assessment and opportunities that lie ahead,* London: UCL Energy Institute Report.

Karlsson, M., Sochor, J. & Strömberg, H., 2016. Developing the 'Service' in Mobility as a Service: experiences from a field trial of an innovative travel brokerage. *Transport Research Procedia,* Issue 2016, pp. 18-21.

Kottasova, I., 2018. *Volkswagen's diesel scandal costs hit $33 billion with new Audi penalty.* [Online]
Available at: https://edition.cnn.com/2018/10/16/business/volkswagen-audi-diesel-fine/index.html [Accessed 01 04 2019].

König, D. et al., 2017. *Deliverable Nr 5 – Technology for MaaS.* [Online]
Available at:
https://www.vtt.fi/sites/maasifie/PublishingImages/results/cedr_mobility_MAASiFiE_deliverable_5_revised_final.pdf [Accessed 05 10 2018].

König, D. et al., 2017. *Deliverable Nr 3 – Business and operator models for MaaS,* s.l.: MAASiFiE.

MaaS global, 2016. *What is Mobility as a Service ?.* [Online]
Available at: https://maas.global/what-is-mobility-as-a-service-maas/ [Accessed 2018].

Malmberg, L., n.d. *Helsinki varautuu kurittamaan yksityisautoilijoita rajusti: tietullit ja kaksinkertaiset pysäköintimaksut tehokkaita keinoja hillitä saasteita.* [Online]
Available at: https://www.hs.fi/kaupunki/art-2000005610231.html [Accessed 06 06 2018].

MariAnne K, K. et al., 2017. *Deliverable Nr 4 – Impact Assessment,* s.l.: MAASiFiE.

Neslen, A., 2019. *BMW, Daimler and VW charged with collusion over emissions.* [Online]
Available at: https://www.theguardian.com/business/2019/apr/05/bmw-daimler-and-vw-charged-collusion-clean-emissions-tech [Accessed 05 04 2019].

OECD/IEA, 2018. *Nordic EV Outlook 2018.* [Online]
Available at:
https://www.iea.org/publications/freepublications/publication/NordicEVOutlook2018.pdf
[Accessed 15 10 2018].

O'Grady, S., 2017. *As a driver, I would support pay-per-mile road pricing.* [Online]
Available at: https://www.independent.co.uk/voices/chris-grayling-transport-cars-drivers-road-tax-pay-per-mile-a8127331.html
[Accessed 06 10 2018].

Ramboll, 2019. *Whimpact.* [Online]
Available at: https://whimapp.com/rambolls-whimpact-study-reveals-that-public-transportation-is-the-backbone-of-mobility-as-a-service/ [Accessed 10 04 2019].

Reuters, 2018. *Factbox: German cities ban older diesel cars.* [Online]
Available at: https://www.reuters.com/article/us-germany-emissions-factbox/factbox-german-cities-ban-older-diesel-cars-idUSKCN1NK28L

Ryley, T. & Chapman, L., 2012. *Transport and Climate Change.* Bingley: Emerald Publishing Limited.

Smith, G., Sochor, J. & Sarasini, S., 2017. *Mobility as a Service: Comparing Developments in Sweden and,* s.l.: ICoMaaS 2017.

StatisticsFinland, 2018. *Population.* [Online]
Available at: https://www.stat.fi/tup/suoluk/suoluk_vaesto_en.html#populationbyregion [Accessed 03 10 2018].

TaksiHelsinki, 2019. *TaksiHelsinki.* [Online]
Available at: https://taksihelsinki.fi/?gclid=EAIaIQobChMIsIXijpmx4QIVR8-yCh2PjQLBEAAYAiAAEgJ6APD_BwE [Accessed 01 04 2019].

Teivainen, A., 2017. *Finland to raise excise duties on alcoholic beverages.* [Online]
Available at: http://www.helsinkitimes.fi/finland/finland-news/domestic/15118-finland-to-raise-excise-duties-on-alcoholic-beverages.html [Accessed 06 06 2018].

Teivainen, A., 2018. *Helsinki Times.* [Online]
Available at: http://www.helsinkitimes.fi/finland/finland-news/domestic/15685-survey-most-finns-say-alcohol-act-reform-has-not-had-a-major-impact.html [Accessed 08 10 2018].

Uyttebroeck, B., 2018. *Belgian Flemish region might introduce smart kilometre tax - eventually.* [Online]
Available at: https://www.fleeteurope.com/en/taxation-and-legislation/belgium/news/belgian-flemish-region-might-introduce-smart-kilometre-tax [Accessed 08 09 2018].

YLE, 2018. *Cash-for-clunkers scheme ends, declated a success.* [Online]
Available at: https://yle.fi/uutiset/osasto/news/cash-for-clunkers_scheme_ends_declared_a_success/10381152 [Accessed 15 10 2018].

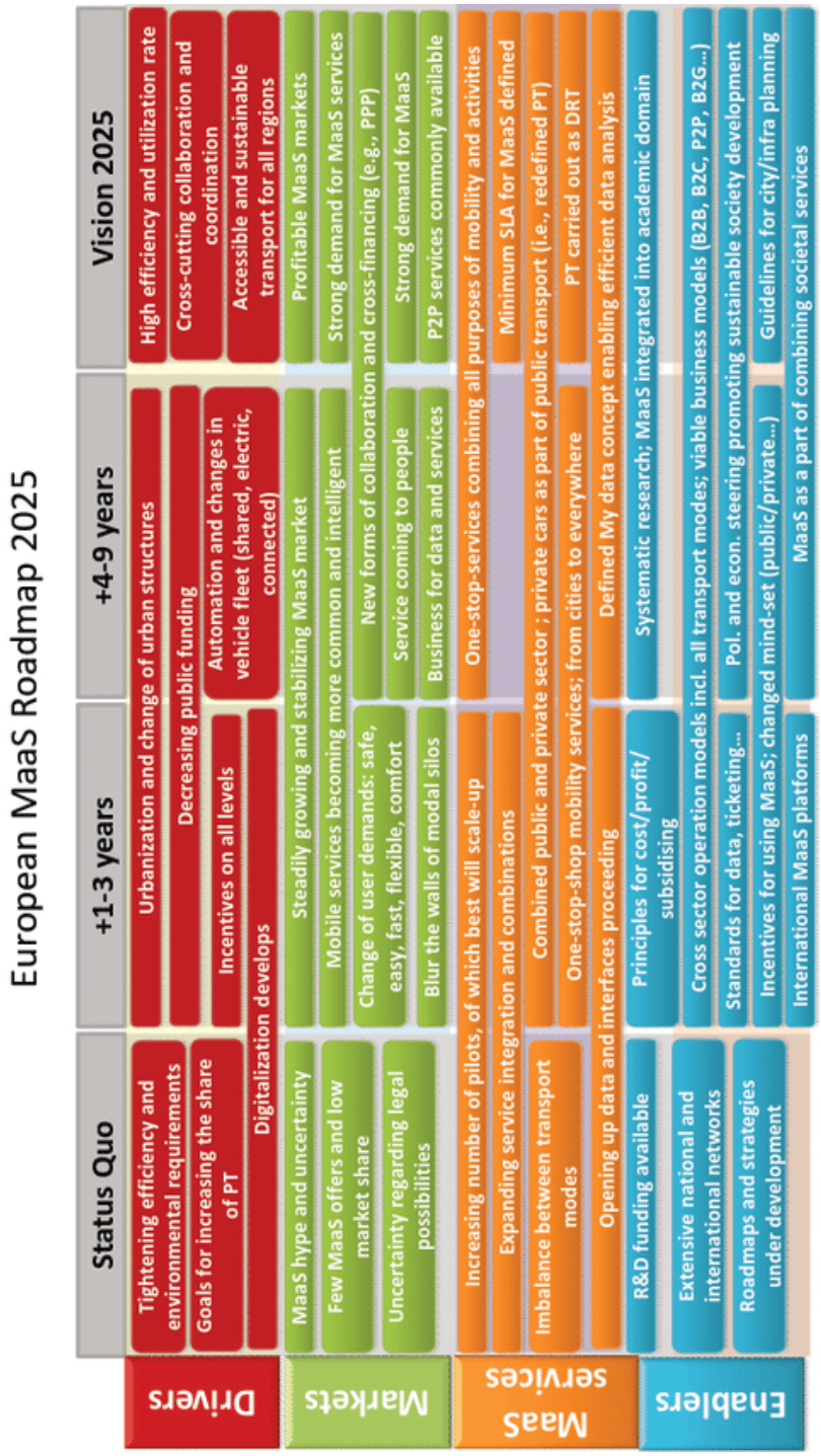
YLE, 2018. *How much does it cost to own a new car in Finland?.* [Online]
Available at: https://yle.fi/uutiset/osasto/news/how_much_does_it_cost_to_own_a_new_car_in_finland/10044668 [Accessed 15 06 2018].

YLE, 2018. *Uutiseet.* [Online]
Available at: https://yle.fi/uutiset/osasto/news/hsl_rejigs_fare_zones_changes_prices_pushes_passengers_to_use_app/10483387 [Accessed 31 10 2018].

YLE, 2019. *Survey: Some taxi customers feel less safe since deregulation.* [Online]
Available at: https://yle.fi/uutiset/osasto/news/survey_some_taxi_customers_feel_less_safe_since_deregulation/10700745 [Accessed 01 04 2019].

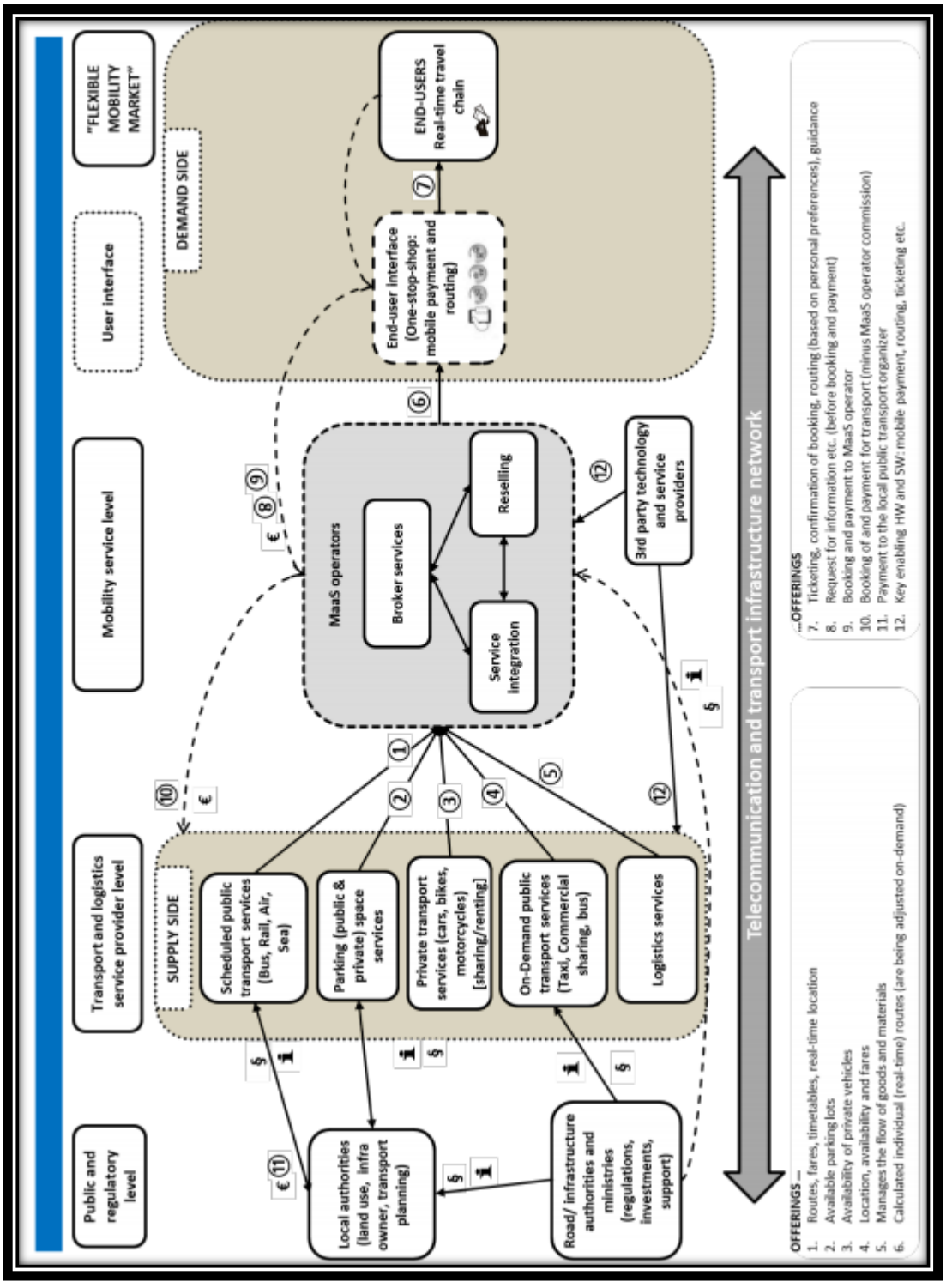
Appendix I European MaaS Roadmap 2025

(Eckhardt et al. 2017: 25)



Appendix II Overview of MaaS ecosystem

(Aapaoja, A., Sochor, J., König, D. & Eckhardt, J. 2016)



Appendix III Key events in the development of MaaS in Finland and Sweden

(Smith, et al., 2017, p. 230)

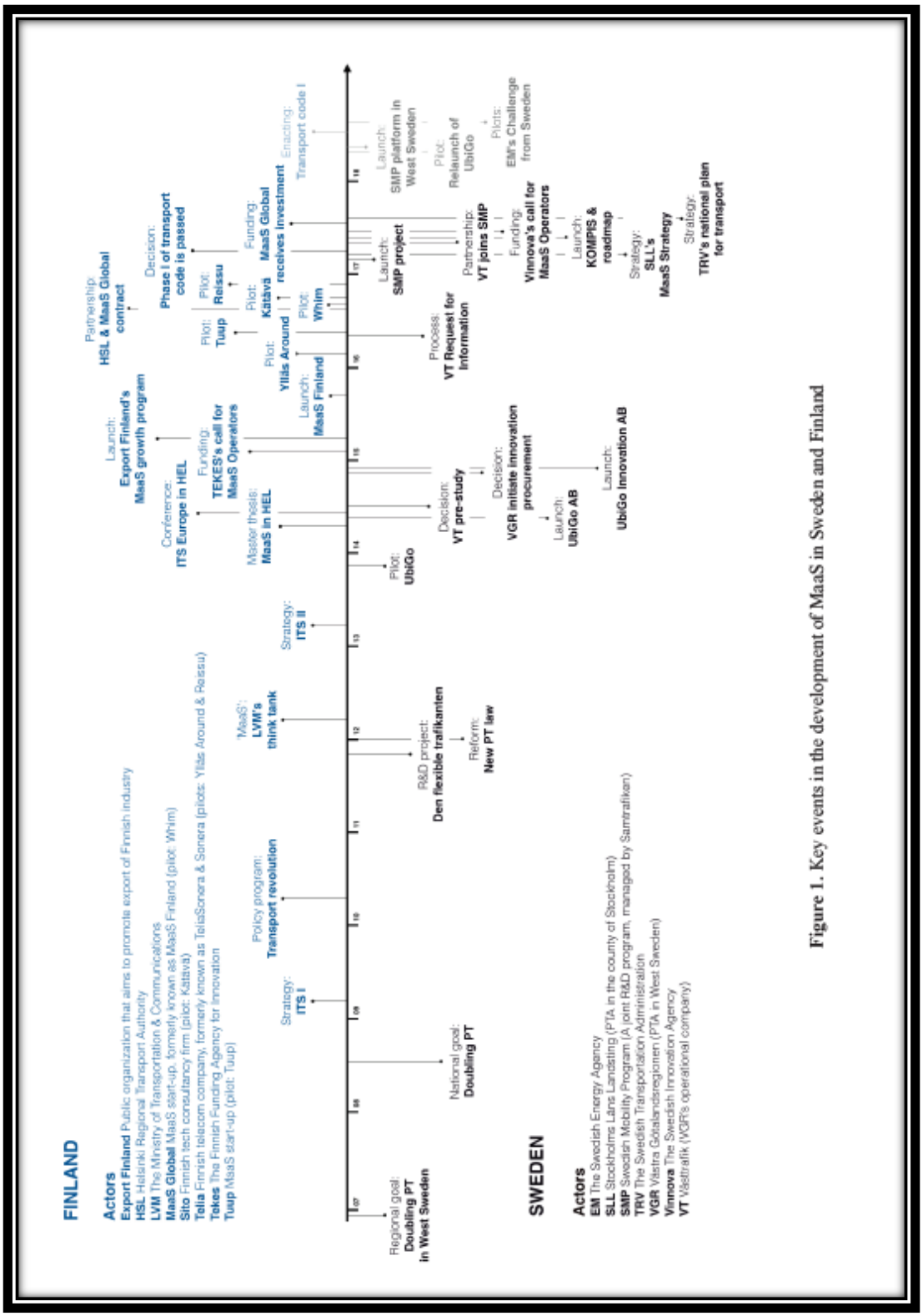


Figure 1. Key events in the development of MaaS in Sweden and Finland

Appendix IV European MaaS Roadmap 2025

(Eckhardt, et al., 2017, p. 42)