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Mobility as a Service
– A Proposal for Action for the Public Administration

Case Helsinki

Thesis submitted for examination for the degree of Master of Science in Technology.

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Abstract of master's thesis

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Abstract

The passenger transport sector is being affected by several major trends. These trends alter the requirements of the transport system, thus creating a challenge to the city development. However, it seems that the current organization of the public transport service provision in Helsinki fails to sufficiently respond to the challenge. Simultaneously, the objective of the national transport policy is to increase the share of sustainable travel modes. In addition to the altering requirements, modern technology, such as means of Intelligent Transport Systems (ITS), provide a spectrum of possibilities in the field. The deployment of ITS could contribute to more efficient utilization of resources, including infrastructure and fleet, improved fluidity of traffic due to real time information, and attractive provision of mobility services.

Having said this, it appears that the passenger transport sector in Helsinki needs to be transformed. In order to discover a possible form and course for the transformation, the Helsinki City Planning Department has procured this study. This study discovers a way to reorganize the passenger transport sector so that it would promote the concept of "Mobility as a Service" (MaaS), that is, convenient provision of a versatility of attractive mobility services. This study provides a suggestion of a transformed mobility sector. Furthermore, it provides a scheduled proposal for action for executing the transformation.

The study examined former transformations in four industries: telecommunications, energy, airline, and railroad industries. The author aimed to identify the most significant factors that contributed to the success of the transformations. These numerous factors were then formed into proposals for action and crystallized into seven most considerable ones. The seven proposed actions were then appointed to a time scale from 2015 to 2025, thus creating a road map for the transformation of the passenger transport sector in Helsinki. The results show that all stakeholders should cooperate in the transformation, and legislation as well as regulation should be revised. In addition, purchase and subsidization procedures, as well as mobility service provision should be reorganized, and transformed operations established. Additionally, pilots should be conducted from the beginning to gain practical experience.

Keywords mobility, public transport, service, operator

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Tiivistelmä

Useat yhteiskunnassa parhaillaan ilmenevät trendit muuttavat liikennejärjestelmään kohdistuvia vaatimuksia. Nykyinen julkisen liikenteen palvelutarjonta Helsingissä ei kuitenkaan pysty vastaamaan muuttuviin vaatimuksiin. Samaan aikaan kansallinen liikennepolitiikka tähtää kestävien liikkumismuotojen kulkumuoto-osuuden kasvattamiseen. Tämä ristiriita luo selvän tarpeen muuttaa nykyistä järjestelmää. Muutostarpeen lisäksi teknologian kehittyminen tarjoaa laajan kirjon mahdollisuuksia liikennejärjestelmän parantamiseen. Älyliikenteen (ITS) keinojen soveltaminen voisi johtaa resurssien, kuten infrastruktuurin ja kaluston, tehokkaampaan käyttöön, parantaa liikenteen sujuvuutta reaaliaikaisen tiedotuksen avulla ja mahdollistaa houkuttelevan liikkumispalvelutarjonnan luomisen.

Muutostarpeet ja toisaalta älyliikenteen luomat mahdollisuudet osoittavat, että henkilöliikenteen palvelutarjonta Helsingissä tulisi muuttaa perusteellisesti. Selvittääkseen muutosta ja sen kulkua Helsingin kaupunkisuunnitteluvirasto on teettänyt tämän tutkimuksen. Tutkimuksessa selvitetään miten henkilöliikenne tulisi uudelleen organisoida siten, että se tukisi ”Liikkuminen palveluna” (MaaS) -ajatusta eli monipuolisten, houkuttelevien liikkumisen palveluiden tarjoamista kätevästi. Työssä ehdotetaan millaiseksi liikkumisen palvelutarjonta voisi muuttua sekä minkälaisin toimenpitein ja millaisella aikataululla muutos voitaisiin toteuttaa.

Työssä tutkittiin aiempia muutoksia muilla aloilla, jotka olivat televiestintä, energia, lentoliikenne ja rautatieliikenne. Työssä tunnistettiin merkittäviä tekijöitä, jotka vaikuttivat muutosten onnistumiseen. Nämä tekijät muutettiin toimenpide-ehdotuksiksi ja sijoitettiin aikajanalla vuodesta 2015 vuoteen 2025, jolloin ne muodostavat tiekartan henkilöliikenteen muutoksen toteuttamiseen. Työn tulokset osoittavat, että muutos tulisi toteuttaa yhteistyössä kaikkien osallisten kesken, ja että lainsäädäntö ja sääntely tulisi tarkistaa nykyvaatimuksia vastaaviksi. Lisäksi kuntien käytännöt koskien liikenteen ostamista ja julkisen liikenteen tukemista tulisi muuttaa. Myös liikennepalveluiden tarjonta, kuten julkisen liikenteen lipunmyynti, tulisi järjestää uudelleen ja löytää toimijat uudenlaiselle markkinalle. Pilotteja tulisi toteuttaa jo alkuvaiheessa käytännön kokemuksen saamiseksi.

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Sonja Heikkilä

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Abbreviations

CCC	City Car Club
CEPT	the European Conference of Postal and Telecommunications Administrations
DaaS	Data as a Service
DB	Deutsche Bahn
DRT	Demand Responsive Transport
ELY Centers	Centers for Economic Development, Transport and the Environment (Fin. *Elinkeino-, liikenne- ja ympäristökeskukset*)
EU	the European Union
FaaS	Fleet as a Service
Ficora	the Finnish Communications Regulatory Authority (Fin. *Viestintävirasto*)
FTA	the Finnish Transport Agency (Fin. *Liikennevirasto*)
GSM	Groupe Spécial Mobile
HKL	the Helsinki City Transport (Fin. *Helsingin kaupungin liikenne)*
HKR	the Public Works Department of the City of Helsinki (Fin. *Helsingin kaupungin rakennusvirasto*)
HLJ	the Helsinki Region Transport System Plan (Fin. *Helsingin seudun liikennejärjestelmäsuunnitelma*)
HPY	the Local Telecommunication Company in Helsinki (Fin. *Helsingin Puhelinyhdistys*)
HSL	the Helsinki Regional Transport Authority (Fin. *Helsingin seudun liikenne*)
IaaS	Infrastructure as a Service
ICT	Information and Communications Technology
ITS	Intelligent Transport Systems
KSV	the City Planning Department of the City of Helsinki (Fin. *Helsingin kaupunkisuunnitteluvirasto*)
LCC	Low-Cost Carrier
LVM	the Ministry of Transport and Communications (Fin. *Liikenne- ja viestintäministeriö*)
MaaS	Mobility as a Service
NLC	Network Legacy Carrier
NMT	a common communications technology between the Nordic countries (Swe. *Nordiska Mobiltelefongruppen*)
NTP	National Telecom Policy
PKP	the Polish State Railways (Pol. *Polskie Koleje Panstwowe*)
TaaS	Transport as a Service
TOC	Train Operating Company
Trafi	the Finnish Transport Safety Agency (Fin. *Liikenteen turvallisuusvirasto*)

TRAI	Telecom Regulatory Authority of India
UK	the United Kingdom
US	the United States
VDV	The Association of German Transport Companies (De. *Verband Deutscher Verkehrsunternehmen*)
YTV	the Delegation of Collaboration in the Capital Area (Fin. *Pääkaupunkiseudun yhteistyövaltuuskunta*)

Definitions related to the Servicizing concept

Data as a Service (DaaS) a system, in which information (e.g., real time data of traffic) is collected and provided by companies, which sell the right to use the information to other companies (e.g., transport companies)

Fleet as a Service (FaaS) a system, in which fleets of vehicles are provided by companies, which rent or lease vehicles to other companies (e.g., transport companies)

Infrastructure as a Service (IaaS)
a system, in which infrastructure is owned and maintained by companies, which sell the right to use the infrastructure to other companies (e.g., transport companies)

Intermodal retailer an existing example of servicizing in the freight transport sector, where a third party arranges all moves of a container and bills with one invoice

Mobility as a Service (MaaS)
a system, in which a comprehensive range of mobility services are provided to customers by mobility operators

Mobility Operator a company, which buys mobility services from service producers, combines them as a service supply and provides the services to customers

Mobility Service Ecosystem
a political and attitudinal environment or framework in the society which enables and promotes the generation of mobility services

Mobility Service a transport service (e.g., public transport, car sharing, taxi, bicycle and car hire) which is provided through a simple and convenient interface between a service operator and a customer

Mobility (traditional) realization of the needs of people to move themselves or transport something; affected by the availability of transport alternatives, personal attitudes and appreciations, personal attributes, and alternative manners to fulfill the needs

Servicizing a phenomenon in which the organizing and selection action is bought and performed by someone else, and customers receive merely the outcome of the actions

Transport as a Service (TaaS) a system, in which transport companies produce transport services (e.g., public transport, car sharing, taxi, bicycle and car hire) from service components (data, fleet, and infrastructure) and sell them to mobility operators

1 Introduction

The world is modernizing along with the development of technology, and several industries have witnessed a transformation to more efficient operations. However, passenger transportation has not:

> *Piritta calls, text-messages, and surfs on the Internet receiving an invoice once a month. When the expense seems not to be equivalent to her individual use, Piritta may invite companies to bid. The same applies to her energy charge. As Piritta desires a holiday in Shanghai, she uses a travel agent to find her the most affordable flights and travel occasion. Nevertheless, the flight is provided by a high-quality airline. Now imagine that Piritta boards a tram, alights from it a couple of stops later and hires a bicycle to travel to work. After work, she orders a car of demand responsive transport and travels to the sport hall, where her training equipment already waits for her. Finally after practice, she shares a ride in a shared car and travels home. Piritta uses all services through her personal mobility operator and the use of services is charged directly from her account.*

These examples seem ordinary everyday occasions. However, one of them is still only imagined - the case of urban passenger transportation. The story describes a situation that could be real after a transformation in transportation, which this thesis examines. Several drivers of change contribute to a transformation:

- a paradigm change,
- servicizing,
- scarcity of resources,
- poor satisfaction of some citizens with current urban passenger transport, and
- the development of technology.

Recent years have witnessed paradigm shift in the focus from movement to creation of access. The old-established design approach, in which the lack of infrastructure capacity was countered by expanding road network, has strongly contributed to car travel. However, this approach has a detrimental effect on the environment and safety, and the capacity cannot continue expanding at least in urban areas. In addition, there are ways to organize transportation more efficiently, conveniently and affordably. Thus, policy-making has increasingly adopted a novel multimodal approach, concentrating on creating access. (Litman 2013.) In addition, possessing a driving license and driving among youths have been decreasing (Frändberg et al. 2011). People are disengaging themselves from their routines and have begun increasingly open for alternatives. Indeed, it has been found that more people endeavor to use modes that are the most practical for each occasion. (VDV 2013.)

Upham, Kivimaa, and Virkamäki (2013) present that policy expectations and visions of innovations in transport are starting to accept transport demand reduction policies, even

though expectations and visions are still highly concentrated on the development of especially motor vehicle technology. The authors argue that technological development solely cannot respond to climate change and thus, such policies, referred to as social innovation, are decisive. They also highlight the need for research on how to support processes related to social innovation. According to Upman et al. social innovation contributes to a broader approach of system innovation, including means of decomposing environmentally adverse production and consumption structures. In the transport sector, this necessitates innovative combination of technologies and involving cross-sectoral processes. However, the authors find uncoordinated and even disconnected policies between and within regional and national governance levels as practical challenges. Having said this, Upman et al. expect a shift in transport policy towards reduction in mobility demand and innovation policy involving both technological and behavioral change. In addition to technological innovation:

- the need to travel has to be reduced by means of substitutive methods, such as telecommunications;
- there has to be a modal shift to transport modes that can reduce the use of private car;
- land use needs to contribute to reducing travel distances.

One solution to better satisfy customer needs is "servicizing". Servicizing refers to a phenomenon in which the organizing and selection action is bought and performed by someone else, and customers receive merely the outcome of the actions. Services are present around the society, of which examples are car maintenance, shoemakers, and restaurants. Travelling by a public transport means is a service, but the use of public transport services as an entirety is not. Servicizing has already been experienced in several industries, including freight transport and logistics, and is in close relation to the "sharing economy". Sharing economy refers to sharing of items and use of services, instead of owning all equipment by oneself. It succeeds because people are increasingly desiring to omit maintenance, storage, insurance, and other responsibility of ownership of items, and instead concentrate on the activity itself and profit from the outcome.

Servicizing and sharing economy are beneficial for the society, since they preserve natural resources. Furthermore, they are affordable to use, since capital costs are distributed to several users, and one can even turn a profit. Currently, sharing economy appears in urban passenger transportation in the form of car sharing, ride sharing, and bicycle sharing. However, these are still unfamiliar to the general public and have narrow clienteles. The current system fails to provide favorable circumstances for a comprehensive provision of mobility services. (Lahti & Selosmaa 2013.) In this thesis, mobility refers to the realization of the needs of people to move themselves or transport something. Mobility services, in turn, refer to individual transport services that are provided through convenient interfaces of mobility operators.

Another factor driving the transition towards servicizing is that states and municipalities face difficulties in the sufficiency of financial resources. Transportation accounts for a substantial portion of public financing and, thus, confronts pressures of intensification

of demand. At the same time, urbanization is moving people to cities. The City of Helsinki is experiencing a rapid increase in the population and is condensing along the new master plan being made. The scarcity of resources together with environmental issues places the focus on a more efficient exploitation of the existing infrastructure and transportation system rather than of extending it, which also the current transport policy promotes.

The current organization of public transport provision does not sufficiently contribute to a functional and convenient mobility service ecosystem. It needs to be renewed, in order to achieve efficiency gains and sustainability in the mobility sector. In order to be competitive with private car, for-hire and public transportation need to be able to fulfill the individual mobility needs of citizens. All uses of car cannot surely be replaced with the few alternative transport modes which are currently provided. The service provision needs to be contemplated with a number of additional multimodal services. Furthermore, services have to be provided conveniently through mobility service portals, which integrate and package services individually according to customers. These integrators should operate as interfaces between service producers and customers and manage the service supply and charging procedures. (Lahti & Selosmaa 2013.) Currently, there is a single public transport service planner, organizer and provider HSL, the Helsinki Regional Transport Authority, in the Helsinki metropolitan area. However, mobility service supply should be broadened and individualized by linking to additional privately organized services, and the use of services should be turned more convenient and accessible.

One reason for holding some degree of confidence that urban passenger mobility could be reorganized using servicizing concepts is that this transformation has to a large extent already occurred in the freight transport sector. Since the late 1980s, the industry has fast transformed into one providing a host of supply chain solutions customized for the needs of particular firms and particular products. As one can see by even a cursory reading of trade magazines, there are numerous third party logistics providers (3PLs) that perform studies for their clients and then set up supply chains optimized for the service levels required instead of a “plain vanilla” offering. As another example, there are intermodal retailers that provide a one-invoice loading door-to-loading door service for container shippers that may involve transfers between several modes at an agreed upon speed and reliability.

This thesis aims to recommend the best practice to reorganize the mobility service provision in Helsinki. Particular emphasis lies on how the public governance is able to promote the transformation. The study comprises a literature survey and discourse with experts. In order to discover the most sufficient manner for the transformation, the thesis examines transformations in four other industries: telecommunications, energy, airline, and railroad industries. The revolution in telecommunications in the 1990s is examined in great detail, since it resulted in an extreme success in the industry, in its side industries, and in the national economy. The study identifies the drivers of the revolution and the crucial factors for the success. Furthermore, telecommunications industry is

an appropriate reference, since the current organization of the industry bears great resemblance to the contemplated one in urban passenger transportation. In addition, transformations in energy, airline, and railroad industries are explored to accumulate various perspectives and experiences. These transformations have not necessarily resulted in improved conditions, even proving disadvantageous to some parties. However, one can learn from those negative aspects as well as positive.

The study itemizes significant factors in the successes and failures of transformations in other sectors. These factors are then processed to be successfully adopted in the urban transportation industry. To support the adaptation, related research and experts in the field of transportation have been surveyed. The final outcome of the study is a proposal for action for the public governance to perform a transformation in the mobility service provision. The proposal for action is represented in the form of a road map, in order to define the order of importance of the actions and the approximate rate of the transformation. Research on such transformation is rather exiguous, whereas former transformations, especially the unsuccessful ones, have been widely studied. A comprehensive examination on some mostly unsuccessful cases has been left out due to their otherwise remote correspondence in the objectives and desired outcomes of the transformations.

Several studies are biased and conducted from a particular point of view. Moreover, as there are a number of ways to approach the subject, results vary greatly. This thesis attempts to cover previous research comprehensively.

This thesis addresses three research questions:

1. How could mobility be provided as an individual and flexible service?
2. How could the public governance contribute to the reorganization of the mobility service provision?
3. What are the risks, uncertainties, and possible implications of the reorganization?

This thesis has been produced as a commission to the City Planning Department of the City of Helsinki. It is a part of an extensive project at the City of Helsinki, where mobility organization is being developed and rethought, according to the concepts of smart city and Mobility as a Service. The thesis results will be exploited in the further development of the concepts, which will lead to practical measures. The work will continue with studies, pilots, and development plans. In addition, the thesis was accompanied by a consultant work by Movense Ltd, which is a company focusing on developing services, products and living environments with users in the central point. Movense contributed to the creation of the user cases in this thesis. Furthermore, Movense was the coordinator of a workshop that was organized on the topic “Mobility as a Service” in December 2013.

Considerable contributors to an improved service supply and provision are various means of Intelligent Transport Systems (ITS). ITS refer to the implementation of information and communications technology (ICT) in transportation. ITS exploit information

and communications technology, thus improving traffic flow, enhancing safety, decreasing environmental disadvantages, generating advantageous services for car drivers, and establishing increasingly convenient multimodal mobility service use. ITS strongly contributes to an increase in the efficiency of the system. (LVM 2014a.) The Finnish governance highly underlines the significance of ITS. The Prime Minister's Office reported in March 2014 that the government had discussed about the restructuring of transportation and found that future transport will be produced as a service (Prime Minister's Office 2014). In addition to this, the Ministry of Transport and Communications published the Second Generation Intelligent Strategy for Transport in 2013, being the first in the world. In the same year, the City of Helsinki released a report of implementing ITS (KSV 2013a).

The thesis examines the field of mobility and transportation in its entirety in light of ITS technologies and experiences with other fields where servicizing has been underway for some time. On account of the systemic approach of the thesis, travel modes and mobility services are not specifically examined in detail. The study examines the requirements and potential pitfalls involved in the establishment of a sufficient service ecosystem. The thesis does not examine the creation of certain services or service supplies. In addition, the study concentrates on exploring the reorganization of the provision of mobility services, but further research could extend to concern provision of other parts of mobility services, including infrastructure and vehicles. Freight transportation is already familiar with some service patterns, but they could be developed and intensified. The study provides a general framework, which can with minor adaptation be implemented in several transport systems in the world. Yet, the organization of the transport provision in Helsinki is examined in detail, in order to discover exact development areas.

The study divides into six chapters. Chapter 2 discusses the current organization of the passenger transport sector, transport policy, and the drivers of change in the sector. Chapter 3 explores the experiences with transformations in other industries, including telecommunications, energy, airline, railroad and other transport industries. Eventually, Chapter 4 illuminates the recent research related to the transformation of mobility. By exploiting the experiences with former transformations, it forms a plan of action. The plan of action is placed on a time scale from 2015 to 2025, since the target year for the accomplishment is 2025. Furthermore, Chapter 4 portrays the use of mobility services in 2025 in four user cases. This chapter also discusses the implications for public policies that may be disrupted and potential unforeseen consequences of the transformation. Chapter 5 concludes by discussing and evaluating the study, including potential pitfalls and policy implications from servicizing public transport, and addressing the need for further research.

2 Current Organization of the Passenger Transport Sector in Helsinki

This chapter describes the current organization of the passenger transport sector by presenting the relevant stakeholders and their duties. The organization of the sector is divided into four regimes: legislation, regulation, infrastructure, and service produce and provision. Infrastructure comprises design, construction and maintenance. Many countries confront issues with an ensilaged governance and even competition between separate mode-specific agencies, which was the case in Finland, as well. Nevertheless, the Finnish transport planning neared a uniform regime in 2010, as several mode-specific agencies were combined into fewer agencies, which are discussed later.

Additionally, this chapter introduces the current focus in transport policy and the ongoing progress. The current focus of the transport policy in Finland is in improving the efficiency of the transport system and increasing the modal share of sustainable travel modes. All national institutes plan their operations by formulating definitions of policy and target programs. This chapter presents some of the most relevant programs.

2.1 Legislation

The Ministry of Transport and Communications (Fin. *Liikenne- ja viestintäministeriö*) is set up by the Finnish government, and it is the highest governing body in the Finnish transport sector. The Ministry of Transport is in charge of the national transport legislation, whereas the Ministry of Communications is responsible for the legislation of communication networks, including issues concerning privacy and data protection, and information security. In addition, the Ministry of Communications is in charge of the national postal service, as well as policies concerning the information society. The Ministries prepare acts, decrees and decisions in cooperation with other European Union countries, Russia and other Nordic Countries. Additionally, the Ministries direct and supervise the operations of state agencies and are responsible for the ownership steering of state owned companies. Furthermore, the Ministries manage licensing and subsidization; however, the duties are partly assigned to regional and municipal levels. (LVM 2013a.)

The Ministry of Transport and Communications compiles the **Government Report on Transport Policy** (Fin. *Liikennepoliittinen selonteko*), which determines the principal guidelines for the national transport policy. The latest report from 2012 frames transport policy for the years 2012…2022. In addition, the report describes a vision and corresponding actions for the years 2030+. The report presents future funding in transport. (LVM 2014a, b.) The policy aims to safe and fluent everyday travel, competitiveness in economic life, and the mitigation of climate change (LVM 2013a), while the vision of the Ministry is to create well-being and competitiveness by well-functioning, safe, and affordable connections. Additionally, convenience of travel has an increasing importance. (LVM 2014c.) In addition to the transport policy, the Ministry of Transport and Communications sets the communications policy. This policy aims to ensure access

to high-grade, efficient and dependable communications networks and services with a reasonable price. (LVM 2013a.)

The current policy appoints funding in basic infrastructure management and light improving measures, instead of investing in large projects of new construction. Light measures, which nevertheless efficiently improve the mobility system, could be tools based on ITS. (LVM 2014a, b.) The Ministry of Transport states that the concept of ITS have a high importance in the growth and productivity of transportation. (LVM 2014a.) In addition, ITS would probably increase traffic safety and the efficiency of the transport system.

In order to implement approaches of ITS, the Ministry has produced an **intelligent transport vision for the year 2020**, which aims to:

- improvement in the fluidity of traffic, friendliness to the environment, and safety of transport;
- gathering real-time information on traffic;
- more efficient use of the infrastructure;
- more efficient logistics to improve competitiveness; and
- place Finland in a significant role in the global ITS market. (LVM 2014a.)

A vision needs a strategy to be enforced. Thus, the Ministry of Transport and Communications issued the **Finland's Second Generation Intelligent Strategy for Transport** (Fin. *Toisen sukupolven älystrategia liikenteelle*) in 2013. The previous Strategy of National Intelligent Transportation (Fin. *Kansallinen älyliikenteen strategia*) was launched in 2009 being the first strategy of intelligent transportation in the world. The strategies aim to integrate tool of ITS into all transport modes, which is why the Ministry promotes innovation in information and communication technologies.

In addition to the benefits in the transport system, ITS offers considerable business opportunities and could thus create export and improve the national and international economies. The main message is that improvement in transportation services is not anymore about doing more, but doing things wisely. (LVM 2013b, 2014d.)

In 2011, the Ministry of Transport and Communications completed a publication called the **Transport Revolution** (Fin. *Liikennerevoluutio*). The Transport Revolution was conducted together with numerous stakeholders, including the Ministry of Finance, the Ministry of Employment and the Economy, and the Ministry of Environment. In addition, public agencies, municipalities, and companies were involved. As in reference to its name, the Transport Revolution suggests radical rearrangement in transportation. The objective of the rearrangement is to gain efficiency, that is, to produce more and better with fewer resources. The desired society would be anthropocentric and sustainable, in which infrastructure, mobility and logistics are perceived as services and sources of well-being. The Revolution appoints the following to be essential in a service-centered society:

- the significance of non-material and mental growth;
- individuality;
- networking;
- service thinking, and
- active participation of individuals, communities, and enterprises.

The Revolution promotes generating new, modern solutions and exploitation of arising business opportunities. The Revolution states that essential in this process are test initiatives, enterprise-originated research programs, right viewpoint and faith. The modern mindset needs to be adopted in each level: the Ministries, agencies, regional institutions, municipalities, enterprises, and citizens. (Kostiainen & Linkama 2011.)

2.2 Regulation

The Helsinki Regional Transport Authority (HSL, Fin. *Helsingin seudun liikenne*) is a common local authority for seven municipalities in the metropolitan area of Helsinki. These municipalities are Helsinki, Espoo, Vantaa, Kauniainen, Kerava, Kirkkonummi, and Sipoo, which also compose the HSL area (HSL 2013a). There area may be extended in the future to concern seven municipalities more: Järvenpää, Nurmijärvi, Tuusula, Mäntsälä, Pornainen, Hyvinkää and Vihti. HSL was established through the integration of the Delegation of Collaboration in the Capital Area (YTV, Fin. *Pääkaupunkiseudun yhteistyövaltuuskunta*) and a part of the Helsinki City Transport (HKL, Fin. *Helsingin kaupungin liikenne*) in 2010. (Granberg 2011.) HSL covers its expenses approximately half-and-half with the ticket income and with municipal funding. The municipalities pay HSL according to the service operated in their area.

Such regional planning and organization of public transport aims to support functionality throughout the metropolitan area. (HSL 2013b.) HSL aims to smoothen traffic by increasing the modal share of public transport and light transport, such as cycling and walking. Thus, it aims to provide extensive, fast, reliable, and economic public transport service supply. (HSL 2014.)

The regional authority HSL is in charge of the planning and organization of public transport in the HSL area. Thus, HSL acquires and provides bus, tram, subway, ferry, and commuter train services. In addition, HSL approves the public transport fare and ticketing system, and organizes ticket sales and inspections. Furthermore, HSL is responsible for marketing and passenger information. (Granberg 2011.) Concerning design, HSL prepares the Helsinki Region Transport System Plan (HLJ, Fin. *Helsingin liikennejärjestelmäsuunnitelma*) for all the 14 aforementioned municipalities in the Helsinki metropolitan region every few years. The plan indicates the stress of the current regional development. At the moment, HSL prepares the Transport System Plan 2015. The previous HLJ, which was launched in 2011, aimed to improve economic efficiency, the competitiveness of public transport with private car, accessibility, and remain affordable public transport. According to the HLJ, significant characters in attractive public transport include a clear route network, an inviting supply of services, functioning high-quality trip chains, comprehensive real-time information, a ticket system and pric-

ing that is suitable for individual needs, and a modern and cost-efficiently used fleet. The HLJ also concludes that light measures, such as informing, encouraging, and marketing, are effortless and inexpensive to implement but may greatly contribute to an improved system. (HSL 2011.)

The Finnish Transport Safety Agency (Trafi, Fin. *Liikenteen turvallisuusvirasto*) is in charge of the regulatory duties concerning safety in transport. Trafi covers examinations, registrations, safety regulations, and permits, such as safety clearances to new operators (Rautatiemarkkinoille.fi 2013; Trafi 2013a). Trafi was also established in 2010 through the merge of transport mode specific agencies. (Trafi 2013a.)

2.3 Infrastructure

The Finnish Transport Agency (FTA, Fin. *Liikennevirasto*) is a state agency under the Ministry of Transport and Communications. Also the FTA was established in 2010, combining formerly separate travel mode specific agencies. This amalgamation ensures coordinated long-term planning, as well as complete and consistent execution of major infrastructure projects. The FTA executes the majority of the largest infrastructure projects in Finland, through the purchase of design, construction and maintenance services (FTA 2013a, b). The FTA directs the development of the transport system nationwide, and by allocating national funding it aims to enhance economic development and to improve transport conditions as well as the state of the environment. In addition, the FTA is responsible for traffic control and passenger information on its premises, which are the main roads, railroads and watercourses. The FTA is also responsible for their condition. (FTA 2013a.)

In addition to the nationwide transport agency FTA, Finland has 15 regional **Centers for Economic Development, Transport and the Environment** (ELY centers, Fin. *Elinkeino-, liikenne- ja ympäristökeskus*). The ELY centers cover three fields: regional competitiveness, well-being and sustainable development. (ELY 2013a.) The ELY centers are in charge of the regional development and the execution of national principles in their regions and reconciling them with the regional objectives (ELY 2013a, b). They cooperate with the municipalities and counties in their regions (ELY 2013b). The ELY centers concern the procurement, license management, and planning of the regional public transportation. In addition, the ELYs finance public transport tickets and grant government subsidies. (ELY 2013c.) Furthermore, the ELY centers possess regional roads and are responsible for their condition (FTA 2013a). However, some roads are owned by municipalities. The ELY center Uusimaa concerns the development of the Helsinki metropolitan area (ELY 2013d).

The Public Works Department of the City of Helsinki (HKR, Fin. *Helsingin kaupungin rakennusvirasto*) is responsible for the design, construction and maintenance of the streets and green areas in Helsinki. The HKR purchases construction and maintenance from the city-owned company Stara or from private contractors. In addition, HKR organizes parking control in the city. (HKR 2013.)

The City Planning Department of the City of Helsinki (KSV, Fin. *Helsingin kaupunkisuunnitteluvirasto*) manages the comprehensive transport planning in Helsinki. The KSV comprises three divisions: the Strategic Urban Planning Division, the Town Planning Division and the Transportation and Traffic Planning Division (KSV 2014). The divisions prepare designs for the City Planning Board to approve. (KSV 2013b.) The department develops the regional transport system and additionally is in charge of traffic lights and telematics (KSV 2013c). The City Planning Department focuses on improving the fluidity and the level of service of public transport in Helsinki (KSV 2013b).

The City of Helsinki released its Strategy Program in 2013. The strategy concerns the years 2013 - 2016. The strategy supports the execution of the City's vision, which aims to develop the city into a communal residence and a capital with well-functioning services and open decision-making. Helsinki aims to be the center of the world for business and innovation, so that its wealth would benefit the well-being of the citizens in Helsinki and in whole Finland. According to the strategy, one step towards the vision is to generate convenient and integrated services to citizens. Initiatives that aim to increase the modal share of light transport and public transport are prioritized, and the functionality of the mobility in the downtown will be ensured. The strategy states that user focused service design should be practiced more and there should be a number of service options to fulfill customers' individual needs. (City of Helsinki 2013.)

The strategy also encourages citizens to participate in the planning process of their residential environment. In order to do this, the City will create channels for interplay and utilize Internet services. The City is strongly devoted to the development of virtual and electrical communications. In addition, the City is promotes the opening of information databases. (City of Helsinki 2013.)

The City is extremely active in developing the transport, as in 2013, it released two more reports. The first concentrates on implementing ITS in the City's transport system, by proposing direct actions and even schedules for their execution (KSV 2013a). The other is the Helsinki's Mobility Development Plan (Fin. *Helsingin liikkumisen kehittämisohjelma*), which covers all mobility. It discusses the objectives and policies concerning transport, the current situation and trends, as well as principles in transport planning, which may expand or restrict the scope for action of transport planning. The Plan embodies three main objectives:

1. The transportation system has to be functional, dependable, accessible, and safe in order to support everyday routines;
2. Vitality needs to be promoted by enhancing economic competitiveness and attractiveness;
3. Space, money, and natural resources have to be used efficiently and wisely.

The Plan also emphasizes health benefits that could be achieved by promoting bicycling and walking. (KSV 2013d.)

2.4 Service Production and Provision

Several transport companies produce public transport services in Helsinki. However, only one institution organizes the services and offers them to customers.

The Helsinki City Transport (HKL, Fin. *Helsingin kaupungin liikenne*) is a city-owned company, which produces tram, subway and waterway services. The HKL owns the subway and tram infrastructures including stations. In addition, it hires its own staff, it controls traffic, maintains infrastructure and equipment, and plans and executes infrastructure projects. (HKL 2013.)

The VR is a state-owned company, which produces all passenger railroad services in Finland. Furthermore, the VR designs, constructs, and maintains infrastructure and operates in rail and road freight transport. Freight transport has already been put out to tender; however, no competition has emerged in the market to date (VR Group 2013). Passenger railroad transport will be put out to tender in 2017, as the valid contract expires in 2018 and legislation will allow competition. The EU Commission proposed that all passenger traffic should be put out to tender at latest in 2023. However, currently there are barriers that hinder competition in practice. Such barriers include the organization of the use of depots, the training of personnel, and the availability of stock. These have to be removed before introducing competition. Moreover, traffic control and management needs to be rethought. (Remes 2013.) The VR sells tickets to long-haul train services, but commuter train tickets are sold by the HSL, while commuter train services pertain to the public transport service supply, which HSL alone otherwise provides.

Contrary to railroad transport, there are several **private bus transport service producers**. The following four companies produce 95 % of the services in the HSL area: Nobina, Helsingin Bussiliikenne Oy, Veolia Transport, and Pohjolan Liikenne. The HSL purchases services from service producers through tendering. (Kuukankorpi 2013.)

The Finnish Taxi Union (Fin. *Suomen Taksiliitto*) organizes taxi services nationwide. In Finland, taxi entrepreneurs need an operation license, which the regional ELY centers grant (Taksiliitto 2014a). The Taxi Union aims to improve the operational conditions of taxi entrepreneurs (Taksiliitto 2014b). Customers buy taxi services directly from entrepreneurs.

Additionally to the traditional public transport modes, HSL has introduced a new public transport service called **Kutsuplus**. Kutsuplus is a demand responsive transport (DRT) service, which combines the characteristics of bus and taxi services. The service is ordered by a customer similarly to taxi, but instead of a taxi car, a minibus conveys one or more customers at the time. The service is more flexible than traditional public transport means but more affordable compared to taxi service. Kutsuplus begun its operation in spring 2013. The present operation area is rather restricted, as the service is still being tested. Moreover, the service operates only from a bus stop to another, not from door to door. Nevertheless, there are plans to extend and improve the service. (Kutsuplus 2013.)

In addition to Kutsuplus, there are services related to the use, rent or leasing of a vehicle. Currently probably renting and leasing a car or bicycle are the most common of these services. However, the use of a vehicle is still uncommon but gaining popularity. Such services are car sharing, ride sharing, and bicycle sharing. These services naturally need service platforms to be used. These platforms are provided by a few companies, and for example, work places may join a platform and establish a group for the employees of a certain office to share rides. One company in Helsinki that provides a car sharing platform is **the City Car Club** (CCC). The CCC has 3 600 customers in the capital area (CityCarClub.net 2014). The city of Helsinki supports the business by providing the CCC parking places for a low price and free advertisement space. In addition, the HSL financially supports the CCC, and the CCC grants discount to HSL users. (Wikipedia 2014.)

The Helsinki Regional Transport Authority (HSL) was already introduced as a regulator in the transport sector. In addition, HSL is responsible for the planning and organization of the public transport in the HSL area, and it is also the only organization responsible to provide the services. HSL purchases the services from transport companies, some of which were introduced above. However, the HSL's service supply does not include all the aforementioned for-hire services, as the HSL does not offer car, bicycle, or ride sharing platforms, taxi services, or other vehicle renting. The HSL's service supply and pricing strongly determine the appearance of public transport in the Helsinki region, as it is the single public transport service provider. Of course, its sponsors, the corresponding municipalities, affect the decision-making. However, the lack of competition in mobility service provision retards innovation and the implementation of newest technology.

The current organization of the transport sector in Helsinki is illustrated in Figure 1. The figure shows that transport itself is the highest level in the organization. Transport includes public transport, other mobility services, and several types of private transport. Other separate mobility services refer to the aforementioned mobility services, which are still unknown to the general public. Transport, in turn, constitutes of transport components, which are infrastructure and fleet. Infrastructure is owned, planned, constructed and maintained by the national or municipal institutes, which were presented earlier. Fleet includes all vehicles. Vehicles may be privately owned by people or transport companies. Transport companies refer to companies that produce transport services, such as bus companies in Helsinki. Vehicles may also be owned by producing units of municipals, such as the HKL. In addition, vehicles can be rented or leased, for example, via workplaces.

In the current organization of the transport sector, municipalities purchase certain required services, such as transport for students, elderly, or disabled, directly from transport service producers through contracts. Thus, these services are accessible only for the appointed users, and they cannot be sold to others, even if the utilization rate of the service was poor. In addition, the subsidization of public transport goes directly to

the HSL. However, some subsidization goes to the CCC. Figure 1 illustrates also the direction of purchase and subsidization.

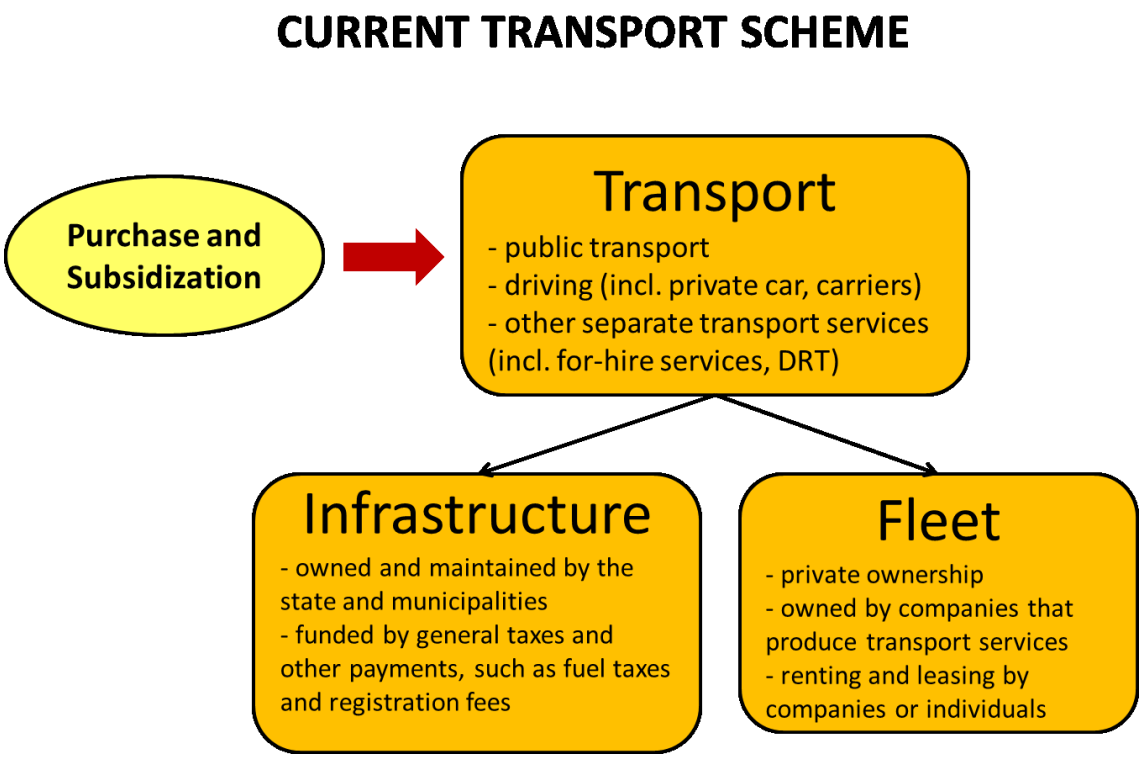

Figure 1. The current organization of the transport sector in Helsinki (Source: author).

3 Drivers of Change

This chapter introduces trends and development that strongly appear and affect the field of transportation and mobility. Most of them affect the society in general; however, this chapter examines their impact especially to the transport sector. Many of the trends are related to people's mindset, and thus affect personal evaluation and thereby personal mobility. To clarify terms, mobility refers to the realization of the needs of people to move themselves or transport something. Mobility is affected by the availability of transport alternatives, personal attitudes and appreciations, other personal attributes, and available alternative manners to fulfill the needs.

The current organization of the transport sector does not promote the discovered trends. However, these trends and the alteration of the society are inevitable, and they set substantial requirements to the future transport. While minor improvements in the current transportation system are not likely to suffice, a greater transformation should occur. Later on, this thesis suggests a transformation of the mobility sector. Hence, the trends presented in this chapter could be referred to as the drivers of change of a transformation of mobility (Figure 2).

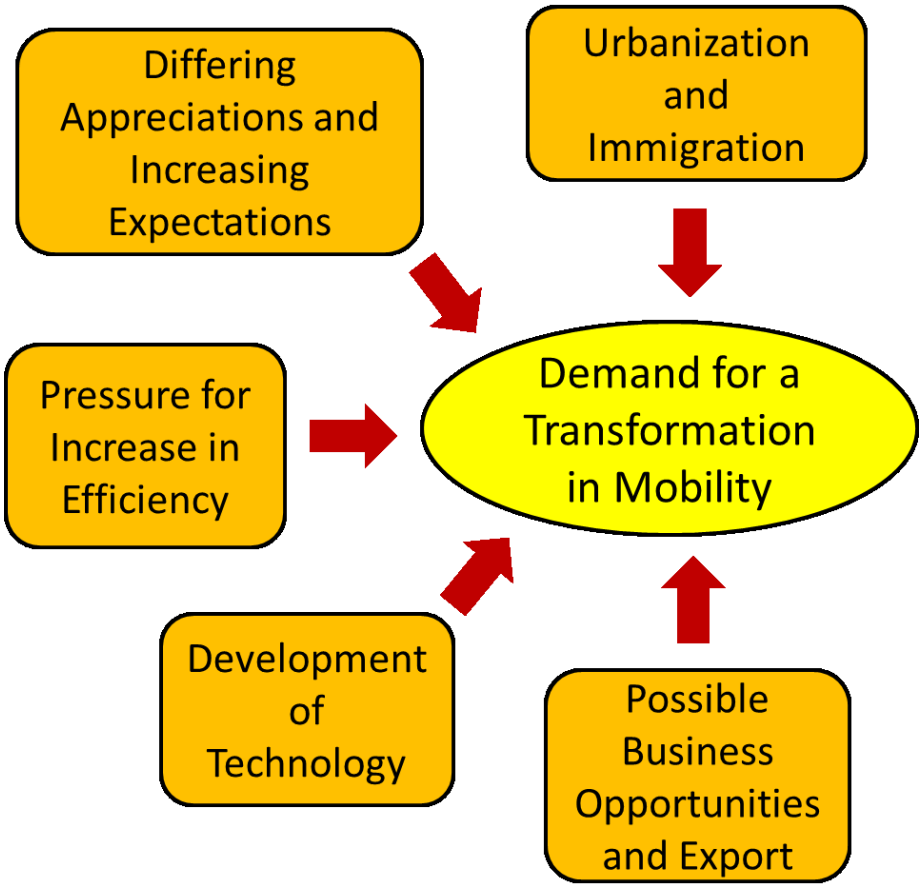

Figure 2. These drivers of change contribute to the transformation of mobility (Source: author).

3.1 Social Change

In this context, social change refers to the change in the characteristics of people. These characteristics, such as mindset and behavior, often reflect to personal experiences. Personal experiences, in turn, are affected by the environment. Thus, people who have grown up and lived in similar environments tend to act similarly. Environments, in turn, reflect the present time and world situation. As a result, people may be divided into cohorts according to their time of childhood. These cohorts are called social generations.

Social generations depict the personalities and the world view of people born in particular time periods. Representatives of each generation tend to think and act similarly and have same kind of expectations and ambitions in life. These characteristics originate from the way they have been raised and especially reflect the episodes that they have experienced in the childhood and young adulthood. (Pilcher 1994.)

A number of generations have been discovered, but the time periods related to the generations vary according to sources. People naturally cannot be strictly divided into certain cohorts, and the characteristics of the generations are generalizations. However, as the world is rapidly developing, especially through the impact of technological advance, the youngest generation might considerably differ from the earlier ones. In general, there are four generations: baby boomers, generations X and Y, and the Millennials. This subchapter discusses the general characteristics of these generations. The section concentrates on describing the younger generations, as they will shape the future society.

Baby boomers are born during 1946 - 1964. The name refers to the numerous children that were born after the World War II. (US Census Bureau 2011.) At the moment, baby boomers are starting to retire, or work in a company often as experienced professionals or in leading positions. Soon the rest of baby boomers are going to retire, which leads to a troubled ratio of resources, as there are more elderly in comparison with the working labor. Baby boomers are conscientious and obedient, and they perform the work they are assigned, even if it was not exactly of their interest. They are also aware of the impermanence of resources and appreciate what they are given. (Elite Daily 2013.)

Generation X was born between 1965 and the beginning of 1980s. Generation X is still active in working life and often successful. They prefer to spend on living, hobbies, and leisure time. (CNN 2011; Wikipedia 2013.) Generation X is said to acknowledge and embrace social diversity. They are presumably highly educated, active, balanced, and family-oriented. (Population Bulletin 2013.)

Generations Y and Z, and the Millennial Generation were born between 1980 and 2005, in the respective order. These generations are examined in the sources separately. However, due to overlapping and the strong impact of all these generations on the society in the future, the author prefers to examine them together. Let us refer to them all as

Millennials. What follows is a general description of their characteristics from a variety of sources.

As a group, Millennials are ambitious, self-confident, and have high expectations in every field of life. They also appreciate the importance of work or whatever they do. Thus, instead of earning money, they desire to work for something meaningful, which motivates them. (English Online 2013.) Millennials require flexibility in work; they want the freedom to work from home and at flexible hours. In addition, they appreciate leisure time and are not willing to overwork. They want time for themselves, for leisure activities, and to spend with their families. (The Sydney Morning Herald 2013; Howstuffworks 2013.) Millennials are independent, self-directed, and oriented to problem solving (Essential Kids 2013; Elite Daily 2013). The orientation to problem solving might also appear as greater innovation. Additionally, Millennials desire to search for solutions by themselves, rather than comply with directives. Thus, they might have issues in respecting authority. (Elite Daily 2013; English Online 2013.)

Millennials are used to consuming more than their parents; however, they prefer to consume on experiences and services, such as travelling, and eating out, rather than on possessions (Essential Kids 2013; Elite Daily 2013). In fact, Millennials are moving to urban areas driven by urban lifestyle and work. (Elite Daily 2013.)

The Generation of Millennials is born to the mobile world, thus, they can be referred to as "digital natives". This means that the Internet has existed during all their lives, and they take information and communications technology as well as mobile technologies as given. (Howstuffworks 2013; JWT 2013; Essential Kids 2013.) Millennials are eager to acquire the newest devices, in order to be trendy and aware of the newest development. They also want to stay connected with their friends and the rest of the world, and can even be addicted to it. (Elite Daily 2013; JWT 2013.) Millennials are technologically savvy (JWT 2013; Forbes 2013a; APTA 2013).

Millennials are socially aware (Essential Kids 2013). Since their birth, Millennials acquire a multicultural and globally oriented mindset. Often even Millennial children have connections around the world. Hence, they learn different cultures, grow up open-minded, and are confident in communicating in a foreign language. (JWT 2013.) They are tolerant, since they are familiar with disparity through the globalized world of their time. Millennials are willing to cooperate and share, in order to evolve something even greater than they would achieve by themselves. (Forbes 2013b; Elite Daily 2013; Howstuffworks 2013.)

Baby boomers and the generation X pursued freedom through driving cars, but Millennials find freedom through the Internet and other information and communication devices. Such technologies enable experiencing everything while going nowhere. (Forbes 2013a.) This may lead to reduced demand for transport or wiser trip planning and making, as all information can be accessed through the Internet. Moreover, the instantly interactive world of the Internet has led Millennials to demand constant and immediate

response (Howstuffworks 2013). Thus, they may be impatient to comply with poorly functioning or slow systems.

An American Public Transportation Association (APTA) report, which studies the mobility choices of Millennials living in city centers or suburbs, shows that Millennials are multimodal; they choose the most convenient transportation mode each time. However, not all city and transport systems support multimodality. Indeed, the study reveals that communities which have devoted to multimodality are especially popular among young. Furthermore, Millennials exhibit increasing interest in being communal. The study showed that Millennials living in city centers or suburbs praise the ease of getting around, the availability of public transport, proximity to work and other activities, and city culture. (APTA 2013.)

According to the study, Millennials value affordability, environment-friendliness, exercising possibilities, possibility of being spontaneous and flexible, and personal space. Reasons for using public transport often lie on money saving and convenience, and in some communities, it is simply sensible to use public transport. In addition, the study reveals that public transport is favored due to the possibility of socializing and working while travelling. This trend might reduce the pressure of diminishing travel time, which is at the moment one of the most considerable indicators of the level of service. (APTA 2013.)

However, the young propose improvements. According to the study, Millennials would appreciate increase in reliability, real-time information, and Wi-Fi or 3G/4G connections. By better exploiting technology, public transport would allow users to act more spontaneously. Furthermore, Millennials would appreciate a more individual and user-friendly travel experience. As a result, Millennials would desire public transportation with more similar characteristics to car travel, and this could be achieved by exploiting the rapidly developing technology. (APTA 2013.)

Based on the findings, the APTA study recommends the following in order to attract Millennials to public transport:

- Ensure that Millennials can remain connected while travelling.
- Provide mobile real-time tools to compensate unreliability and inconsistency.
- Assist Millennials to optimize their experience by considering both their mobility needs and minds.
- Internalize Millennials' interests and integrate them into operations.
- Be aware of Millennials' continuous search for possibilities to save money.
- Expand the substance of public transport from its fundamental purpose to an enjoyable experience. (APTA 2013.)

Several countries have been witnessing differentiation between the mobility of different age groups. The young generations have challenged car use by a countertrend towards diminished car use. It has been noted that the young drive by car, possess a driving license or a car more rarely than their parents do. The share of the young possessing a

driving license has decreased since the early 1990s. Yet, research shows that the number of driving licenses increases as people become older. However, the number does not rise to the same level or at the same rate as among older generations. Results from Britain, Denmark, Norway, and Sweden show that middle-aged travel the most. They also maintain their habit to use car into old age. In addition, after retirement, when commuting and work-related trips decrease, leisure time trips are performed until a high age. (Frändberg et al. 2011.) This might partly result from the good health and increased activity among seniors.

As stated, mobility trends feature continual reduction in the dependence on and use of car, as well as delay or renouncement of acquiring a driving license. Especially Sweden and Stockholm have witnessed significant decrease in the possession of a driving license among the young. Namely, only 9 % of the 18-year-olds in Stockholm acquire a driving license (Yle Uutiset 2013). In the entire Sweden, the corresponding share is 25 % (Taloussanomat 2012). Although the trend is reaching Finland and Helsinki as well, still approximately 40 % in Helsinki and 60 % in the rest of Finland acquire a driving license at the age of 18 (Yle Uutiset 2013). In Finnish cities in general, the corresponding number was 56 % in 2012 (Trafi 2013b). Finland has explicitly been behind in the development already some time, as in 2001 in Sweden, 57 % of the 18-24-year-olds acquired a license and 82 % in Finland (VTT 2003). In 2000, 71 % of the Norwegian 18-24-year-olds acquired a license and 80 % in 2000 (VTT 2003). Additionally, in each country, there is a great difference in the possession of a driving license between the young living in urban areas and the young living in rural areas (Taloussanomat 2012). Among those living in rural areas, it is much more common to acquire a driving license (Trafi 2013b). Nonetheless, as stated earlier and will be shortly discussed, the young are increasingly moving to urban areas. (Frändberg et al. 2011.)

3.2 Urbanization and Globalization

Globalization refers to the increasing geographical scale of economic, political, social, and cultural interactions. It can be partially explained by economic shifts that have resulted from world-wide deregulation, followed by removal of trade barriers and increase in competition. (Goetz 2004.)

Due to the fastness and convenience of modern transport, moving from a country or a continent to another has become ordinary. People travel and work abroad, and students are increasingly attracted to study abroad to learn cultures and languages. Simultaneously, the number of international connections of universities is rising. Furthermore, migration between nations is abundant.

In addition to modern transport, the Internet greatly contributes to globalization. It allows information to be simultaneously available around the world. It has overall facilitated access to information. Thus, people are well aware of occurrences around the world, and they can easily find information concerning nearly anything. In addition, virtual communications enable companies, customers, and interest groups interconnect and operate without physically meeting.

Travelling, easy access to information, and connections with foreigners in home country and virtually uniform the world. People become familiar with cultures and adopt conventions. Examples of the influence of globalization to the Finnish culture might be the adoption of urban lifestyle, increased openness, interest in local societies and cultural activities, as well as utilization of services. Such trends need to be taken into consideration when planning future societies. In addition, the transport system needs to meet the requirements arising from cultural differences, as well as differing premises and expectations.

Urbanization prevails in most parts of the world; it is also an objective of many governmental policies. Urbanization means that the occupation of population concentrates in dense living environments, that is, urban areas. Dense housing is in general more ecological than sparse housing, on account of energy consumption and other costs related to housing. This is why several cities and governances support urbanization. In addition, public and other services are generally more profitable to organize in cities, as the clientele is greater. The same applies to transportation. Public transport has a more profitable prospect and it can be arranged more affordably in dense areas, due to the economies of scale. On account of the rather small population of Helsinki and the whole Finland, urbanization could facilitate the organizing of public transportation. Urbanization is only just beginning in Finland (KSV 2013d).

The City of Helsinki needs to prepare to the growth of the population. Hence, the City prepares a new master plan at the moment. The plan is based on an estimation of a rapid population growth, which suggests a population growth of 376 000, that is 27,5 %, by the year 2035 in the metropolitan area of Helsinki. The basic estimation suggests a growth of 312 000, that is 22,8 %. The basic estimation is slightly decelerating compared to the occurred development. At the moment, the total population of the metropolitan area is 1 366 000. (KSV 2012.) The actual growth might be something between of the two estimates. However, rapid population growth could improve the preconditions of the transport system, as stated previously.

The population growth will mostly stem from immigration from other parts of Finland and Europe. The immigration will mainly comprise of young adults, which will also result in natural population growth (KSV 2013d). To support the assertion of urbanization, the county of Uusimaa, which includes the Helsinki metropolitan area and is the most dense area in Finland, experienced the greatest internal immigration in 2012. It gained 3 120 citizens of the total population of 5 426 674. Six of the 20 counties in Finland experienced immigration. (Statistics Finland 2014a.)

3.3 Servicizing and Sharing

Considerable trends appearing in the society are servicizing and the associated sharing economy. Servicizing refers to a phenomenon where the action is bought and performed by someone else, and customers receive merely the outcome of the action. Sharing economy, also termed collaborative consumption, refers to sharing of items and ser-

vices, instead of owning all equipment by oneself. People are willing to forsake the maintenance, storage, and responsibility of items to others, and instead, merely perform the actual activity, usage of the item. Items may be lent and borrowed and even services may be exchanged. (Lahti & Selosmaa 2013.)

In fact, people have been sharing a long time ago, but the importance of sharing has declined in the modern, commercial world. At least five dynamics are considered to actuate a sharing economy: cultural change, technological development, threat of environmental crisis, economic crisis, and business opportunities in sharing economy. Sharing economy is rearing its head in many industries and thrives especially in California, the United States, where the modern sharing economy also started. One can stay the night on someone's couch, exchange tools, cleaning services, or cars. Companies in sharing economy are becoming increasingly organized. They may have begun sharing within neighborhoods, but currently, some even receive substantial investments and return a profit. Servicizing has a good prospect in places where there are many possibly interested people, but yet few service providers. (Lahti & Selosmaa 2013.)

Servicizing and the associated sharing economy preserves natural resources and is more affordable, since fixed costs are distributed to multiple users. In transport, sharing economy appears as sharing cars and other vehicles, equipment and rides. Increased car and ride sharing would result in a higher utilization rate of cars and respectively decrease in car possession. Eventually, the outcome would appear as diminished congestion, decreased need for parking and other space, and diminution of emissions. More extensive servicizing could appear in transportation as an increase in the use of mobility services.

However, the current system fails to provide appropriate circumstances for a comprehensive service provision. In order to be competitive with private car, public transport needs to be able to fulfill the individual mobility needs of citizens. The applications of car cannot surely be replaced with a few main public transport modes, such as bus and subway. They need to be complemented with a number of additional multimodal services. Moreover, in order to be convenient to use, these services must be provided as an entirety through a single mobility service provision portal, which integrates services and operates as an interface between service producers and customers. This integrator or operator manages the service supply and charging. There could naturally be several service operators, thus creating competition in the market. As will be shown in a later chapter, experiences have witnessed competition to result in improvement of services, and lowering of pricing. Furthermore, several aspects justify the private sector to excel in such a service provision. To set the stage, a renewed organizational framework contributing to service ecosystem is essential in order to reach efficiency gains and sustainability in mobility. (Lahti & Selosmaa 2013.)

3.4 Scarcity of Resources

Due to the protracted slump in economic development, funds of states and municipalities have been continuously declining (LVM 2012). The poor availability of funding requires increase in the efficiency of operations. Gaining efficiency and productivity

might, in turn, require innovation. The productivity development in Europe is slow in comparison with the BRIC countries (Brazil, Russia, India, and China). As productivity growth devolves on the BRICs, the Occident needs to establish novel export. According to Linturi, such export could be knowledge in ITS. (Linturi 2012.)

Another substantial phenomenon in the society in the developed countries is aging. The life expectancy rises, being 83.4 for a female child born in Finland in 2012 (Statistics Finland 2014b). Thus, the special needs of the elderly need to be taken into consideration in the design and operation of public services. Indeed, aging population could raise the need for individual services. Additionally, they require the ease of use, convenience, and extravagance (Rönkä 2008). Moreover, as elderly need to move and run errands independently at an increasingly high age, the quality of transport services should be high (KSV 2013d). In addition, when elderly are in a good physical and mental condition, they wish for a greater activity. The increasing share of elderly and their greater activity lead to a rising total mobility of elderly. However, a sufficient amount of physical movement and exercise among the elderly also needs to be ensured. Therefore, individual transport services should not fulfill all mobility needs of the elderly.

In addition to scarcity in funding and aging, the environmental impact of the transport system needs to be taken into account. Natural resources have to be wisely exploited, and contamination minimized. There are high global and national targets concerning the conservation of the environment, which put pressure on development. Environmental targets strongly relate to transport, as transport considerably affects the environment – for example, as a contributor to climate change.

Transportation consumes 20 % of the total energy spent in Finland and 40 % of the energy produced from oil (Motiva 2014). In addition, transport induces emissions, such as greenhouse gases. Transport induced 26 % of the global CO_2 emissions in 2007 and 27 % of the greenhouse gases in Finland in 2012 (Statistics Finland 2014c). Vehicle emissions per unit are decreasing, but the increasing amount of vehicles evens the reduction out (Motiva 2014). Moreover, transport causes noise pollution, unties particles from road surfaces, and adversely affects the nature. In urban passenger transport, private car naturally causes relatively much emission. However, a substantial part of the emissions and use of resources are related to the manufacture and keeping of cars, as the utilization rate of cars is extremely low, approximately only 5 % (Tekniikka&Talous 2014). Hence, increasing the utilization rate of cars would be beneficial. Additionally, congestion raises emission levels. Thus, actions towards the fluidity of traffic positively affect the environmental impact of traffic. Certainly, the matter has the reverse rebound effect; increased fluidity could attract more drivers. However, with correct arrangements, such issues might be solved.

In order to inhibit climate change, energy needs to be exploited efficiently. Moreover, the decreasing delivery reliability of oil leads to the need to reduce the dependency of oil (KSV 2013d). Measures to prevent climate change have succeeded in most industries; however, in transportation less than in many other industries. Car use, road freight

traffic, and aviation induce most greenhouse gas emissions. Nevertheless, technological development leads to innovations, such as less-consuming vehicles and vehicles applying renewable energy. However, technological innovations solely are unlike to inhibit climate change, but a comprehensive transformation in transport is required (Chapman 2014; Upman et al. 2013; VDV 2013). For example, some technological options are not yet publicly acceptable in terms of cost and function. However, in order to effectively respond to climate change, technologies should be deployed in the next ten years, which however, is improbable. Thus, Upman et al. argue demand reduction in mobility to be vital. (Upman et al. 2013.)

3.5 Technological Advance

Technology has developed rapidly in recent years. In particular, development in telecommunications and mobile devices has been continuously introducing new applications. The utilization of the Internet as well as ways to transfer, process, and share information have created countless possibilities to improve processes. Mobile devices allow users to access information, connect, and benefit from practical applications anywhere and on the go. Smart mobile devices can even be referred to as "mobile offices". Modern information and communications technologies facilitate the integration of services and people, which forwards sharing and the usage of services (VDV 2013). As discussed earlier, sharing and servicizing could reduce the need for owning.

The City of Helsinki is currently preparing a project on real time information on traffic. The project called Real Time Mobility Status aims to gather and distribute real time information on traffic and, based on the information, even predict its short-term development. However, merely few of the possibilities have been utilized. Indeed, the main issue is to discover ways to exploit technological development in transportation (KSV 2013d). As requirements become clear, technology will evolve to meet them.

Representative to the newest technology in car industry are automated cars. They can also be called “autonomous cars”, “self-driving cars”, or “driverless cars”. Automated cars can drive without a driver, based on computer vision, using as map and sensor information as assistance. To date, some cars can already park autonomously with the help of parking assistance. (Linturi 2013.)

Automated cars have been developed already since 1939. Yet, the development has been accelerating since 1980s. Automated cars have been developed by a number of car manufacturers, including Mercedes-Benz, BMW, Continental, General Motors, Audi, Volvo, Volkswagen, Cadillac, Nissan, Toyota, and Google. Currently, Google is the most advanced. Automatic cars have been tested among normal traffic with positive results. However, the Finnish legislation does not currently allow automatic cars. (Linturi 2013.)

Automated cars could potentially greatly contribute to cost savings in transport, as the organization of transportation services, such as bus and taxi services, would be more affordable without staff costs. In case service production costs would become lower,

service fees could also be decreased. This could result in increased use and thus, productivity. If such services as taxi would complement the public transport service supply, the need for owning a car would diminish. However, automated cars could result in increased unemployment, as the need of employees would decrease. Nevertheless, automated cars would most probably promote safety, by diminishing the extensive effect of human mistakes. A human factor is considered notable in 95 % of the fatal accidents in Finland (Duodecim 2014). Human factors have mainly been related to the diminished state of vitality (Duodecim 2014).

3.6 Paradigm Change

As noted in the earlier paragraphs, there are several major trends that currently affect the field of personal mobility and transport as a whole. Inter alia, trends drive towards individualization and diversity (Russ 2013). This section revises some of the already discussed trends and also introduces some additional approaches.

The field of transportation is experiencing a paradigm shift, which has fortunately already reached the governance, as well. This shift has resulted in changes in the design of the system and priorities in planning. In the past, the performance of a transportation system was primarily evaluated on speed, convenience, and affordability. This approach led to favor automobile-oriented improvements. However, this approach proved unsupportable in many well-known ways. Thus, the paradigm has altered to a modern one. The modern paradigm comprehends a broader range of modes, objectives, impacts, and improvement alternatives. The old-established paradigm in transport planning could be seen as mobility-based, as it maximized available travel distances by maximizing travel speed. The modern paradigm, in turn, can be referred to as access-based, while it concentrates on creating access with the means of transport. This stems from the approach that creating access is the fundamental aim of most travel. (Litman 2013.)

Motor vehicle travel constantly grew in the 20th century, and much investment was directed to maximizing road capacity. However, due to of demographic and economic trends, most developed countries are reaching or have reached the peak in motorized and private car travel (Figures 3 and 4). Such trends include aging, rising fuel prices, urbanization, growing health and environmental concerns, and changing consumer preferences. (Litman 2013.)

Litman (2013) also states that the old planning paradigm was reductionist appointing individual problems to separate individual agencies with narrow areas of responsibilities. Such situation could, in the worst case, lead agencies to implement solutions which exacerbated others' work. On the contrary, such approach could have also underrated plain solutions which could have benefitted multiple fields. The new comprehensive paradigm avoids causing severe disadvantages, and may even result in all-beneficial situations.

Litman (2013) finds that the transport field is revising the approaches to define problems and assess solutions. The revision also allows the transportation community to

redefine roles and responsibilities, in order to improve operations in total. Litman however states that new approaches, skills, tools, and data are required. Upham et al. (2013) support the statement that visions of the transport system are changing. They emphasize social innovation and cross-sectoral activity.

The Association of German Transport Companies (VDV, De. *Verband Deutscher Verkehrsunternehmen*) tells that people are disengaging themselves from their routines of choosing travel mode. They are increasingly open for a broader selection of travel modes and searching for the most practical use of modes. This means that they aim to choose the most practical mode in each situation despite of their routines. This strongly contributes to the idea of increasing multimodality, which was presented earlier. The VDV also agrees on people's search for affordable moving. (VDV 2013.)

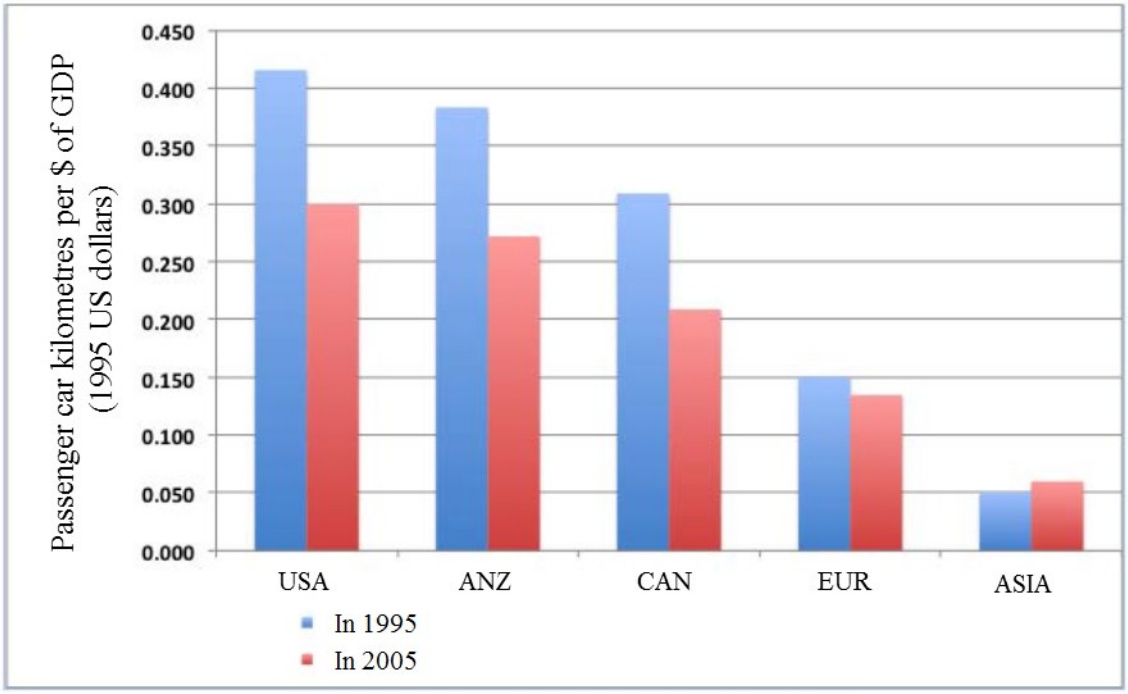

Figure 3. Car use in USA, Australia and New Zealand, Canada, Europe, and Asia from 1995 to 2005 per dollar of GDP (Kenworthy 2013, p. 11).

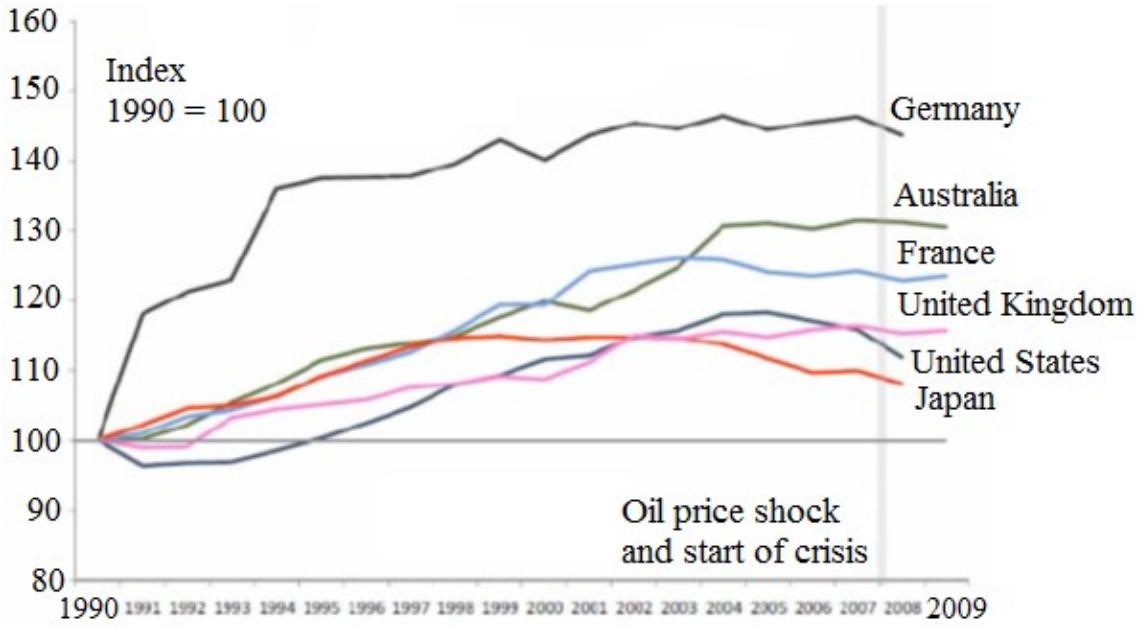

Figure 4. The progression of private automobile use from 1990 to 2009 (Goodwin 2012, p. 8).

In addition to the increasing diversity among travel modes, modern lifestyle is featured by increasingly multifaceted mobility. This means that destinations, travel hours, and reasons for moving vary. Moreover, due to new ways of working, such as remote work and virtual meetings, work-related mobility and its reliance of the office hours decrease. Indeed, mobility is regarded to be an increasingly significant enabler of enjoying life. (Rönkä 2008.) Figure 5 portrays the interchange from work-related trips to shopping, personal business, visit, and pastime trips. Figure 6 portrays the increasing driving in Helsinki. However, for the first time in 50 years, the increase in trips made by public transport was greater than in trips made by private cars in 2013 (Sinisalo 2014).

In addition to the aforementioned trends, some minor trends can be noted. Experiences, leisure time, and personal suitability are being increasingly appreciated. In addition, health and well-being, ecological aspects, and locality are becoming more important for the young. Furthermore, as the young might be rather demanding, users need to be in the central point in services. This is, in fact, obvious, as no service can be profitable without a clientele, and a clientele cannot be achieved without directing services to them. Most of the preferences of the young contribute to sustainable mobility modes and city structures, such as urbanization, locality, and the increased appreciation towards health. (KSV 2013d.)

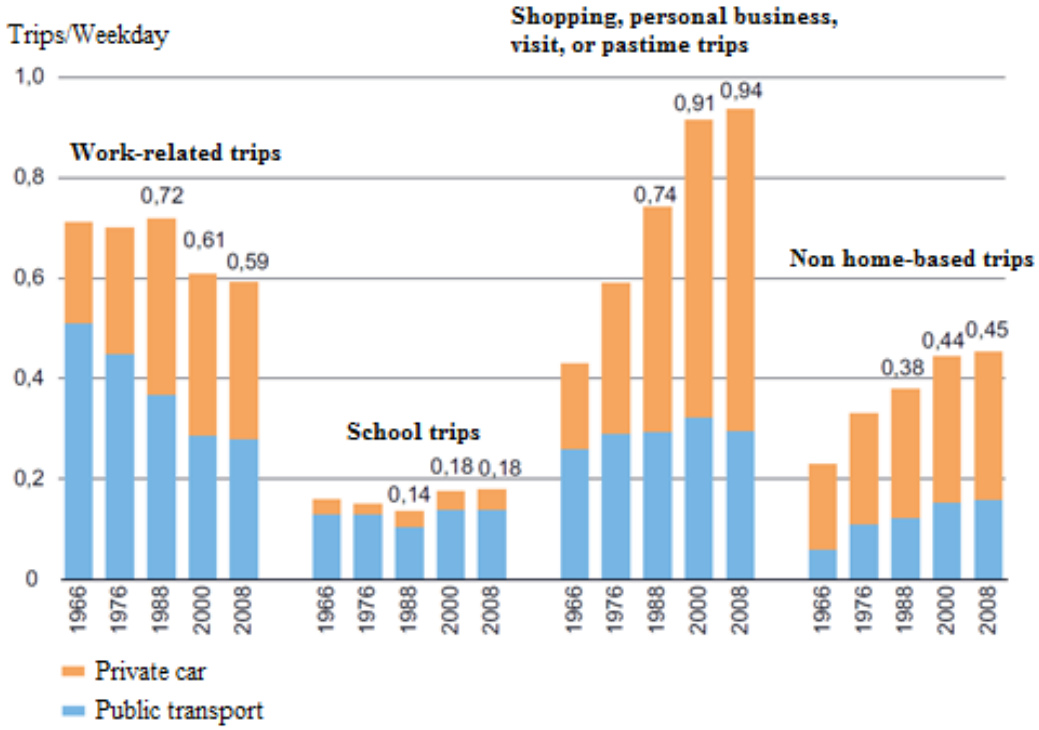

Figure 5. Trips performed by the inhabitants of the Helsinki capital region divided by travel mode and purpose (HSL 2010, translated).

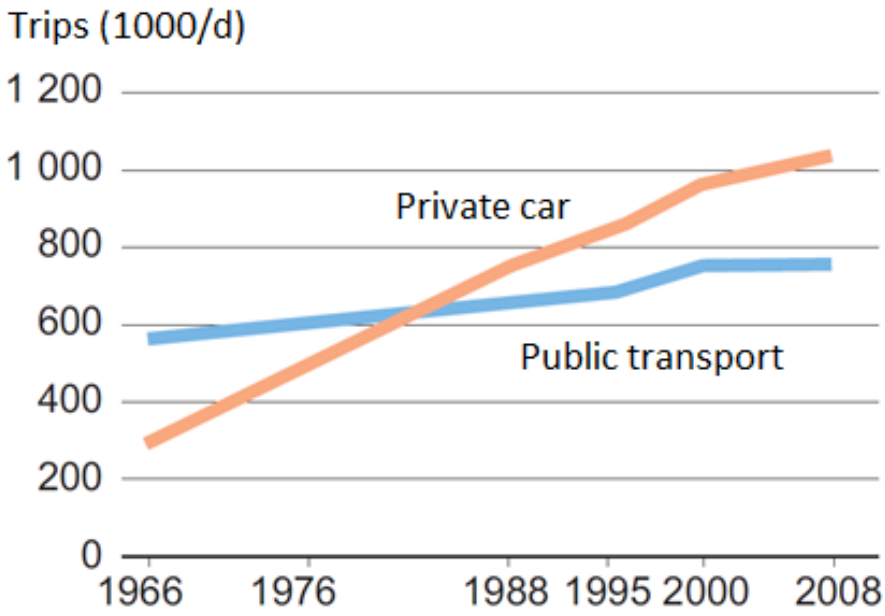

Figure 6. Daily trips that the inhabitants of the Helsinki capital region perform by private car and by public transport in the capital region (HSL 2010, translated).

4 Experiences with Transformations in Other Industries

The aim of this thesis is to discover the best practice to execute a transformation in the passenger transport sector. Naturally, the transformed situation needs first to be described to some extent. Thus, Chapter 5 presents a suggestion for the transformation and finally a proposal for action to realize the transformation. The proposal for action bases on the results of this study. The results are collected from experiences with similar transformations in other industries. Thus, this chapter examines former transformations in other industries in order to identify significant factors in succeeded transformations. In addition, it covers factors leading to failures. The analyzed industries are telecommunications, energy, airline, railroad and other transport. The examination includes also a few case studies.

4.1 Telecommunications

Since the revolution in telecommunication in 1980s and 1990s, Finland has been one of the leading countries in the world in the industry. Finland witnessed the revolution in telecommunications among the first ones in the world. Research and development have been rapid, partly since they have been funded by the state (Lyytinen & Goodman 1999). The success of the telecommunications industry has strongly affected the Finnish economy. This chapter explains the course of and the reasons behind the great telecommunications revolution, resulting in high economic advance in Finland, as well as in the rest of the world.

4.1.1 Course of the Revolution

As public transport today, telecommunication services were formerly provided as a public service, such as water supply and education. Similarly, without any competition in the industry, the incumbent had no pressure to develop networks and services, resulting in substantially high prices and no choice for customers. (Häikiö 1998.) However, the telecommunications industry experienced a transformation into a vivid competing market. What follows is a description of the course of the revolution.

The first mobile communication in Finland based on a common technology between the Nordic countries known as NMT (Swe. *Nordiska Mobiltelefongruppen*) established in 1982. The industry was monopolized (Laakso et al. 2012; Sokala 2002), and all telegraph and long-distance telephone services were generated and dispensed by state institutions, in Finland by the Post and Telegraph Office (Fin. *Posti- ja lennätinhallitus*). Apart from that, local private telecommunication companies operated as monopolies in their areas in Finland. Thus, the Finnish system was, in fact, a duopoly between the national institution and the private sector. (Häikiö 1998; Howell & Sangekar 2009.) Beneficial from the fiscal point of view was that the local telecommunications activity performed fully on private investment with no state subsidies. Thus, the sector evolved without political weight and government involvement. (Howell & Sangekar 2009.)

NMT seemed to gain wide popularity, resulting in an increasing interest of private companies in activity in this field. The local telecommunication company in Helsinki HPY (Fin. *Helsingin Puhelinyhdistys*) was desirous and had resources to challenge the state institution in a market that was expected to thrive (Häikiö 1998). However, the Nordic administrations of the NMT, which together made the decisions on licenses, all strongly resisted the admission of licenses to external competitors. HPY continuously applied for a license but to no avail. In order to acquire a strong position in the emerging market, the local telecommunication companies joined together to comprise a private enterprise Datatie Oy in 1985. In the same way as HPY, Datatie Oy was not granted a license. As a result, the local telecommunication companies were enforced to discover something else. (Häikiö 1998; Sokala 2002.) The telecommunications industry in Finland witnessed a strong competitive tension between the public and private sectors, resulting in a highly competitive industry (Howell & Sangkar 2009).

In the middle of the 1980s, the government introduced a legislative proposal to the Finnish parliament. The proposal stated that the new law should promote versatile telecommunications that would be enabled by a uniform, equal system throughout the country (Laakso et al. 2012). The law was supposed to encourage competition between players and different technologies (Laakso et al. 2012). Hence, in 1987, the Telecommunications Law (Fin. *Suomen teletoimintalaki*) was decreed, and the telecommunications governance was transposed from the Post and Telegraph Office to the Ministry of Transport and Communications (Häikiö 1998; Howell & Sangekar 2009). The new Law allowed the government to grant operation licenses (Häikiö 1998; Howell & Sangekar 2009), and in 1988, licenses were granted to both Datatie Oy and Yritysverkot Oy, which was a company owned by the national Post and Telegraph Office. This act is said to have opened the telecommunication competition in Finland. In 1989, Datatie Oy begun to construct a radio telephone network of its own, called the Autonet. The governmental Post and Telegraph Office saw the new network as a threat, and consequently, lowered their prices. (Häikiö 1998.)

Nevertheless, the development of technology continued, and already in 1982, the member countries of the European Conference of Postal and Telecommunications Administrations CEPT established a working group to develop a new telecommunications technology Groupe Spécial Mobile GSM (CEPT 2013; Häikiö 1998; Lyytinen & Goodman 1999; Sokala 2002). The Finnish Post and Telegraph Office was active in the European development, as well as all other Nordic countries (Häikiö 1998; Lyytinen & Goodman 1999). The GSM was developed based on the same principles as the earlier NMT with open standards and interoperability of mobile phones in Europe. The GSM standard was accepted in 1989. (Lyytinen & Goodman 1999.)

As the success of GSM appeared promising, private telephone companies considered it essential to begin to invest in the new technology immediately before the state institution would construct the network. In order to compete with the state institute in GSM, local private companies established a joint company Radiolinja in 1988 and applied for a nationwide operating license. However, the license applying raised opinions, and con-

versation expanded to concern a change in the law and the position of the Post and Telegraph Office. As a consequence, the license procedure prolonged. However, it did not hinder Radiolinja to construct GSM network in its local operation areas. (Häikiö 1998.)

Eventually in 1990, the government granted the first operating license for GSM (Howell & Sangkar 2009). It was noted that the market entering of Radiolinja also increased the trade of the Post and Telegraph Office. As the nationwide licenses were granted, commercial, competition-related, and technological aspect rose to the focus of conversation, instead of political ones. (Häikiö 1998.) Consequently, the number of subscriptions proliferated, thus Finland became the top country in subscriber density (Laakso et al. 2012). In 2009, the total number of mobile subscriptions was 7.7 million and the density of subscriptions 144, which is the number of subscriptions/100 inhabitants (Laakso et al. 2012). The ratio is greater than 1, because many people have both private and business phones. Furthermore, the costs of telephone services have been among the lowest in the world (Lyytinen & Goodman 1999).

4.1.2 Deregulation

The telecommunications revolution occurred first in the United States and was followed by the largest economies in Europe and Asia. It was thought that the emerging industry on information services should not be dominated by monopolies, but the market should be deregulated and opened for competition. Deregulation refers to the abandonment or reduction of governmental control (Häikiö 1998). It is expected to rationalize cost and production structures of an industry to be more in line with market conditions. Deregulation appeared as liberalization of information flow, leading to several major technical innovations. After deregulation, a number of competitors entered the market, and due to global free trade agreements, IT equipment and telecommunication services spread globally, and the reform turned into a great economic upsurge. (Mueller 2012.)

Deregulation came to dominate Western Europe and Finland in the 1980s. Finland was rather fast to develop the regulatory framework (Howell & Sangekar 2009). It has been stated that the pressure from the rapid development and innovations in technology, as well as ideological and political motives have contributed to deregulation. The market evolved as a consequence of several factors interacting with each other, including technological advance, policies that governed the interaction, and the activity of market participants (Howell & Sangekar 2009). Open competition was endorsed, instead of protection policy of state monopolies and industrial companies. Deregulation was validated by a more efficient use of resources and the economies of scale. Along with competition, operations have proceeded to comply more with market and customer aspects, rather than technological ones. Also the European Economic Community EEC craved for integration and economic competitiveness of its member countries. (Häikiö 1998.)

Formerly, the state monopoly represented also the regulative institution granting licenses in telecommunication. Being the surveillant authority, the Postal and Telecommunications Institution (Fin. *Posti- ja telelaitos*, former Post and Telegraph Office) had access to information concerning all providers. On the other hand, the institution was ob-

ligated to report revenues to the governmental budget, and investments as well as the fundamentals of payments were decided in the Council of State or in the Parliament. The situation was unequal and irrational and led the Ministry of Transport to declare that one stakeholder cannot embody the regulator and an operator simultaneously. (Häikiö 1998.)

The Finnish telecommunication legislation has continuously evolved. In 1987, the law on telecommunications activity was decreed and the Competition Office (Fin. *Kilpailuvirasto*) founded (Häikiö 1998). Finland has implemented EU legislation since the affiliation in 1995. (Laakso et al. 2012.) Due to the early deregulation in Finland, the legislation has faced issues of re-regulation by the EU. However, Finland has been allowed to preserve its own legislation (Häikiö 1998). The Ministry of Transport and Communications has been given the responsibility for preparing laws and developing telecommunications industry, as the Ministry was found to be consistent and strong in guarding fair competition (Häikiö 1998; Laakso et al. 2012). In addition to the Ministry, the sector-specific regulatory authority Ficora (Finnish Communications Regulatory Authority, Fin. *Viestintävirasto*) has been given many additional responsibilities and more power compared to the 1980s (Howell & Sangekar 2009; Laakso et al. 2012).

4.1.3 Reasons for the Success and Outgrowth

Howell & Sangekar (2009) state that the early predominance of co-operation and private operators have led to the industry to base on government interaction, consultation with commercially oriented stakeholders, and co-operation between companies. In addition, the political approach aimed to simplify the legislation. In the Finnish telecommunication industry, decision-making has also been industry-based. These have contributed to a telecommunications policy firmly relying on market forces. It has been regarded that these matters promoted the early assimilation of technologies and testing of services and products in Finland, and Finland continues to quickly adjust to technological development and pursue innovation. Howell & Sangekar conclude that gentle regulation is viable as long as co-operation, trust, and commercial interaction are maintained.

From 1993 to 1994, portable phones and GSM led to unexpected popularity, resulting in price lowering and service improvement, and consequently further increase in the popularity of phones and services. Phone calls continuously became longer, prices decreased, and subscriber connections multiplied. Due to the escalating competition, companies had to intensify marketing. (Häikiö 1998.) A service operator business model together with free-of-charge operator switching and number portability dramatically affected the prices of mobile services in the beginning of the millennium. During the hyper competition in the 2001 to 2005 period, the already lowered prices of mobile services reduced by more than 40 percent. (Laakso et al. 2012.) Telecommunication had a notable impact on the advance of the Finnish economy in the recession in 1991. Competition has resulted in freedom of choice for customers, lowering in pricing, improvement in quality and customer service. Competition has reformed international GSM operations, as emerged providers have introduced fresh marketing knowledge and a commercial per-

spective, thus compelling the old providers to remarkable changes in order to retain their market shares. (Häikiö 1998.)

The success of telecommunication business in Finland may be partially explained by the early orientation to the newest technology (Howell & Sangekar 2009; Sokala 2002). Howell & Sangekar present that this may have been influenced by the isolation of the country. Telecommunications provided better connections to the rest of the world. (Howell & Sangekar 2009.) The development of GSM and digital technologies was fast and rapidly overcame NMT (Häikiö 1998; Laakso et al. 2012). The revolution of telecommunications led to the success of Nokia but also of several smaller companies producing equipment and complementary services. Already since the end of 1800s, Finnish local providers had been familiar with inviting component manufacturers to bid. (Häikiö 1998.) Thus, domestic industries were accustomed to perform in competition, thus achieving advantage in international competition, as well (Häikiö 1998; Sokala 2002). The time after deregulation was fecund to new telecommunication entrepreneurs. Indeed, investors trusted in them, while traditional telecom providers had to manage with their old-established heavy-structured networks and systems. The telecommunication industry intensified, as large stable and wealthy companies in electronics and electrical power generation begun to invest in the market. (Sokala 2002.)

4.1.4 Some key regulatory changes

Mobile number portability was implemented in Finland in 2003. It denoted that customers were allowed to change the operator and keep the mobile phone number at no charge. This was likely to increase user sensitivity to changing operators, which continues to remain pricing low. Operator switching has been popular in Finland, even the highest in Europe. Operators also competed on coverage. Currently, customers may roam on the coverage area of other operators. Roaming is decreed according to the EU's Roaming Regulation. The regulation has succeeded in lowering the cost of calls, SMS, and data services of EU citizens' made in another EU country including a maximum charge as well. The ascending electronic authentication by mobile phone may induce positive implications for operators, and also for the advance of the information society. Given that Finland has become one of the cheapest countries in mobile operations, it can be considered that the general purposes of the regulatory changes have been achieved. (Laakso et al. 2012.)

When GSM was introduced, EU member states decided to demolish all national monopolies, and each country was obliged to establish at least one enterprise to compete with the national company. For Finland this appeared rather simply, since the system had always comprised of several local monopolies. Hence, competitors were easy to establish. (Sokala 2002.) Furthermore, private companies broke into the novel market rather easily, as the state institute continued to concentrate on NMT, in which it had been investing (Häikiö 1998).

Pivate companies benefitted from their flexible and competitive manner of operations when entering the market. In addition, Radiolinja was an independent incorporated

company with a light organization, while the state institute had to comply with a number of commitments. Furthermore, Radiolinja was wholly concentrated on GSM business and managed according to a commercial business model. The founders of Radionlinja included politically eminent persons, and from the beginning, the industrial life, such as banks and insurance companies, started to invest in Radiolinja. Especially significant was that Radiolinja possessed versatile knowledge; it had knowledge in politics, engineering, economy, and marketing within the company, which the governmental institution lacked. (Häikiö 1998.)

Radiolinja was thought to compete primarily in pricing. However, they actually competed in speed, additional services, and technology, yet, keeping the prices continuously slightly lower than those of the competitor. Price competition with the Post and Telegraph was moderate, since Radiolinja was unable to reduce their prices, and the Post did not desire to reduce their cover either. Thus, as companies mostly competed on quality and service supply, they grew on a healthy and stable basis. (Häikiö 1998.)

The Post and Telegraph Office begun to renew their operations and to develop GSM operations in 1989. In 1990, it changed from a wholly owned government department to a quasi-public utility and begun to apply for private funding, which provided it with better premises in competition. Later in 1994, competition increased as the Post and Telegraph Office was altered into a limited liability company Telecom Finland (later Sonera) and also long-distance operations were opened to competition (Häikiö 1998; Howell & Sangekar 2009). The reform was further advanced by the Market Law in 1997 (Howell & Sangekar 2009). The Post and Telegraph Office thought its weaknesses to be the lack of clientele in the areas of the local telecommunications companies and service commitments to the state. On the contrary, its strengths were experience, nationwide organization, international cooperation, and broad technical research and development. (Häikiö 1998.) However, state-funded research has also allowed small and medium sized companies to participate as well as high-risk technologies to be tested. In addition, the interaction between the industry and universities has been generous. (Lyytinen & Goodman 1999.)

The revolution in telecommunications in the 1990s bears resemblance to the breakthrough of the telephone in the 1880s. Both had defenders of old-established, state monopoly but also great activity in the private sector, resulting in fierce competition of licenses and subscribers. In both cases, the great economic success was based on the extensive implementation of modern technology. The development of technology enabled the generation of new services. (Häikiö 1998.)

The development of the common telecommunications system between the Nordic countries, the Nordic Mobile Telephone NMT, begun in 1969 (Lyytinen & Goodman 1999). The integration of the Nordic countries begun already in the 1950s, in the form of common labor market, exemption from the requirement of a passport, and implementation of common institutions. (Häikiö 1998.) With the establishment of NMT, the Nordic alliance aimed to a functional and roaming system (Lyytinen & Goodman 1999; Sokala

2002). The creation of NMT had a substantial impact on the development and later globalization of mobile phone systems, as significant matters were decided during the establishment, strongly directing the subsequent development. Those included invoicing, roaming, secrecy of telephone communication, and specification of equipment. Generating specifications for equipment in the system was especially notable, thus making devices compatible with each other. Hence, anyone was able to manufacture devices and develop technologies, which turned them more affordable, thus opening the mass market. (Häikiö 1998.) Furthermore, the detailed definition of the signaling enabled to acquire centers, base stations, and mobile stations from various companies, instead of committing to a single supplier. The manufacture and export of these has been strong in Finland (Lyytinen & Goodman 1999). Furthermore, the Nordic telecommunications administrations wanted NMT to possess no copyrights, and licenses were applicable in all Nordic countries. (Häikiö 1998; Sokala 2002.)

To conclude, the revolution in telecommunications resulted in a great spectrum of new businesses, including side businesses. The number of players and subscriptions increased. Competition pressurized companies to increase efficiency, which led to improved quality of services and lowering of prices. The production capacities of companies were increased, and due to economies of scale, products and services could be provided cheaper. In-house R&D has become strong, and new products and services have been introduced continuously. Some companies have become or have potential to become multinational.

4.1.5 Case: Telecommunications in India

India's long-lasting monopoly over telecommunications alleviated in the beginning of 1990s, and the new National Telecom Policy (NTP) was adopted in 1994. The implementation of NTP, however, was marked by a series of conflicts and controversies, resulting in extensive litigation and conflict between the Department of Telecommunications and the private providers, and erosion of investor confidence (Dokeniya 1999). During the monopoly, the quality of services was deteriorating, and no new services emerged. (Chowdary 1998.) Public telecommunications providers (PTOs) burdened with inefficient management and budgetary and fiscal constraints found themselves unable to deal with the requirements of technological advances, or to make investments for large-scale infrastructure projects (Dokeniya 1999).

In 1995, telecommunications service provision was subjected to license and private companies begun to operate. The independent Telecom Regulatory Authority of India (TRAI), which was constituted in 1997, controls the market. Already for the fiscal year ending March 1997, the Ministry of Finance, which was also the driving force for liberalization of the Indian economy and industry, took credit for over US$200 million in license fee revenues. The liberalization of the telecommunications market has been successful for India. Since then, the quality of services has improved, the prices have decreased on average by 50 %, and numerous products are currently made in India. A number of Indian companies have strong research and development. The history of mo-

nopoly in India explicitly indicates the weakness of state-led growth and not of export-led growth. (Chowdary 1998.)

The success of private investment depends on the creation of a regulatory mechanism that provides rules and regulations that reduce the risk that prospective private investors fail to make a reasonable return on investment, as well as a governance mechanism that ensures them against the possibility of arbitrary governmental discretion. Problems in the liberalization process in India reflect the failure to implement such a regulatory regime. (Dokeniya 1999.)

4.1.6 Generation of the Internet

In the same way as in telecommunication, deregulation of information services, market economy, diversity and competition among providers, as well as free trade agreements have been necessary in the development of the Internet. The Internet has a great popularity, since it was not developed under a state-dominated political environment but in a free environment. The present information sector serves global commence, free trade, innovation, and open culture. Mueller argues that when a government owns and operates telecommunications, blocks trade, hinders market access and free development of devices and services, development and innovation are controlled. Mueller also states that countries which are still under governmental control concerning the Internet should be encouraged to permit multiple, competing service providers, and they should renew the regulation to affirm the basic principles but to eliminate protectionism. (Mueller 2012.)

4.2 Energy Market

Electricity market in Finland was opened to competition in 1995, as the Electricity Market Act came into effect. Competition concerns electricity production, sales, and foreign trade; however, network operations are regarded as a natural monopoly. An open market allows customers to purchase electricity from any electricity provider. Selling performs without licenses. Finland was among the first countries to introduce competition to the electricity market, and the current market is still one of the most open in the world. (Energiateollisuus 2013.)

The policy on energy market aims to the functionality of the market and a dependable electricity system, by ensuring the availability of energy while holding environmental emissions at the internationally required level or less. However, it is not considered that the requirements would be fulfilled in a completely free market situation. Thus, several regulative authorities administer the market. The Ministry of Employment and the Economy (Fin. *Työ- ja elinkeinoministeriö*) holds the overall liability of the regulation, and is in charge of the operational preconditions of enterprises, customer position in the market, and company property of the state. Several other authorities supervise, such as the Energy Authority (Fin. *Energiavirasto*), the Finnish Competition and Consumer Authority (Fin. *Kilpailu- ja kuluttajavirasto*), and the Finnish Safety and Chemicals Agency (Fin. *Turvallisuus- ja kemikaalivirasto Tukes*). The Energy Authority (formerly the Electricity Market Center, Fin. *Sähkömarkkinakeskus*) was established to control

operations in 1995, as the market was opened. The Energy Market Authority is assigned to monitor energy networks operations, delivery pricing, and compliance of related laws, as well as issue licensing, gather and publish information on markets, and contribute to the development of the market. It also follows the market progress, proposes reforms to develop the legislation, follows international development and maintains international relations. (Energiateollisuus 2013.)

The energy market comprises a market and a wholesale market. In general, wholesalers are electricity producers, which sell electricity to major electricity users, such as factories and industrial enterprises. The price of the electricity determines according to supply and demand. The subordinate market encompasses brokers, which buy electricity from the wholesale market or produce it themselves and sell it onward to households, agriculture, and small and medium sized enterprises. Recently, electricity brokers with no connections to electricity production have entered the market. Finland, together with Sweden, Norway, and Denmark, belongs to the Nordic market area, the Nord Pool Spot market. (Energiateollisuus 2013.)

Regulation aims to benefit all involved. Due to regulation, users receive high-quality electricity delivery with a fair price. Electricity companies, in turn, are ensured to gain reasonable revenue from their operations. For electricity network operators, regulation ensures a steady and predictable business environment and sufficient revenue to maintain and develop networks. However, the regulation includes setting an upper limit for the revenue and the requirement of maintenance and development of operations. Energy authorities superintend that the prices remain at a reasonable level. The production of electricity from renewable energy sources is supported by subsidies, which aims at increasing its production capacity through economies of scale and its competitiveness. Recently, the European Union (EU) has been more strongly directing energy policies, due to high demands on electricity markets, delivery reliability, and the environment. The EU's directive on electricity markets aspires for strengthening competition and creation of a common European wide energy market. (Energiateollisuus 2013.)

4.3 Airline Industry

Air transport and airline industry globally have witnessed thorough changes in the name of deregulation and liberalization since the end of the 1970s (Charlton 2009; Goetz 2004; Inglada et al. 2006). The institutional environment and long-established regulatory regimes have been modified or abolished. This has resulted in mergers, acquisitions and strategic alliances, which in turn, accompanied by technological development and economic dynamics, have contributed to globalization (Goetz 2004). Deregulation has occurred through changes in legislation and regulation, and currently, operations are decreed by competition laws. In the last 30 years, the number of competition law agencies has been increasing around the world. (Charlton 2009.)

Air transport in the United States (US) became totally liberalized in 1978, while Europe started ten years later completing the process in 1997 (Inglada et al. 2006). However, new regulations seem to continuously come into effect, as some parts of the airline in-

dustry, broadly defined, are calling for re-regulation. The aeronautical industry encompasses a number of separate but interconnected sectors, including airlines, air traffic control, aircraft manufacturers, logistics providers, and airports. Airports, in turn, have landside operations and connecting travel modes. These sectors differ in business drivers, measures of success and imperatives. Thus, each sector should be specifically reviewed, regulated and monitored. Concerning regulation, Charlton states that the emphasis should be in the maturity of regulation rather than the amount of it. Mature regulation refers to regulation which reflects and responds to the specificity of each business. Charlton states that mature regulation requires dialogue between parties. (Charlton 2009.)

The US airline industry has experienced significant changes since the Airline Deregulation Act of 1978. The Act has led to increased competition, and thus the existing carriers to improve their efficiencies and experience even profound restructuring (Inglada et al. 2006; Powell et al. 2012). Deregulation has led to trimming unit costs per seat mile, employee cuts, and reductions in wages and network capacity. In addition, technological advance has significantly contributed to productivity gains both before and after deregulation. Nevertheless, numerous airlines, including a number of traditional airline institutions, have ended in a bankruptcy since deregulation. (Charlton 2009; Powell et al. 2012.)

Competitive markets contribute to efficiency and innovation (Starkie 2012). Thus, deregulation has led to the generation of low-cost carriers (LCCs) in the USA and the EU. In addition, normal rules of business have begun to apply. (Charlton 2009; Dobruszkes & Mondou 2013; Powell et al. 2012.) The LCC business model strongly influences the practices of the old-established legacy airlines, by pressurizing them. The LCC business model concentrates on minimizing costs by several actions, including simplifying products, embracing operating practices that lead to high utilization of resources, simplifying crew training through focusing on one type of aircraft, and encouraging Internet and telephone sales without ticket offices, thus reducing marketing costs. The Internet has significantly affected the change, and it may further catalyze it, since it allows airlines to enter new markets at little cost. The growth of the new carriers has been remarkable; they now account for approximately 40% of European available seat kilometers. The LCC's have changed the European aviation market more dynamic. (Starkie 2012.)

LCCs have acquired a considerable share of the US domestic air travel market. (Powell et al. 2012.) LCCs have contributed to the increase in the amount of services, network development, and decrease in average fees. Thus, Dobruszkes states that countries that wish to enlarge their activities and improve their accessibility should allow low-cost companies in the market. Dobruszkes & Mondou state that liberalization should be considered when the existing companies cannot be relied on in promoting new services, or if LCCs are specifically required in order to meet certain policies. (Dobruszkes & Mondou 2013.) Low-cost services can be considered to have most contributed to the expansion of the European airline network. For example, in 1995, there were 2070 routes in the European air space, whereas in 2012, after liberalization, there were 3254 routes.

(Dobruszkes 2013.) However, excessive regulation and control may hinder creativity, reduce adaptability to internal and external changes, and lengthen decision-making (Merkert & Pearson 2013).

Air service provision between countries has historically been negotiated between the corresponding governments as bilateral agreements. These bilaterals base on reciprocity, and the agreements generally cover fares, capacity, and frequency. Since the deregulation of domestic airline industry, the US has been liberalizing its international bilaterals and turned them to "open-skies" bilaterals, which allow unrestricted market entry and arrangements, in which several airlines may operate the same services with different flight numbers. This has improved the utilization of the overall capacity, and in one sense, increased the capacity and services offered by individual companies. However, such "open-skies" bilaterals could be substituted by multilateral agreements. Multilateral agreements between countries allow any airline to unlimitedly operate in any market within the boundaries of the corresponding countries. (Goetz 2004.)

In general, Asian countries are still bound by highly restrictive bilateral agreements. However, the threat aroused by the international alliances between American and European companies is pressurizing these countries towards liberalization. In addition to liberalization, the 1980s and 1990s witnessed the privatization of several international companies, including British Airways, Singapore Airlines, Japan Airlines and Iberia (Charlton 2009; Inglada et al. 2006). These companies were formerly owned by governments (Charlton 2009; Inglada et al. 2006). The privatization of airlines has continued around the world, except for some middle-Eastern airlines (Charlton 2009). Liberalization and privatization acts were expected to spur competitiveness in domestic and international markets, and improve the productivity of airline companies. (Inglada et al. 2006.)

The American domestic passenger aviation industry has undergone extensive consolidation through mergers since deregulation in 1978, in order to exploit and scale network economies. Mergers may contribute to competition by offering comprehensive networks. However, in theory, fewer suppliers mean less competition, and mergers may establish a monopoly, or acquire a high market power, by increasing market concentration. However, mergers have not always led to the establishment of market power. Many proponents feel that, overall, airline mergers do not present a market power threat and should be encouraged. Proponents of mergers promise cost savings through economies of scale, better connectivity through a comprehensive route network, and increased competition amongst nationwide carriers. Cost savings are passed to consumers through lower fares. On average, the deregulation of American aviation has been a success story for passengers. But the results are uneven, as some midsized and smaller cities face sparse service and high fares. (Schabas 2014.)

International Open Skies agreements and encouragement of international mergers could further lower the cost of air travel and capitalize on the economic benefits of connectivity. Regulation should protect low barriers to entry at airports, to prevent excessive pric-

ing, low frequency and poor service. The merged carriers are in a stronger position to compete with each other at an international level, since they can offer national networks as feeders. The mergers since 2000 have ameliorated competition in international markets. (Schabas 2014.)

US passenger airlines have witnessed a great productivity growth after deregulation. Research suggests that deregulation induced the growth, since decreased prices allowed more people to travel, and capacity was managed efficiently. However, the yield from ticket sales considerably decreased, resulting in poorer financial performance. (Powell et al. 2012.) Due to the financial crisis during 2007-2009 and related increase and instability in fuel prices, the US air transportation system has adopted "capacity discipline". This capacity discipline refers to the 14,3 % reduction in yearly scheduled domestic flights in the US air transportation network during 2007-2012. It was noted that the capacity discipline affected the connectivity of most airports less than the overall number of flights and available seats. This could have resulted from discarding redundant flying between secondary hubs. That is, the abatement of flights to secondary hubs would not necessarily dim connectivity as long as flights to larger hubs remain. However, the connectivity at the secondary hub airports themselves declined. Indeed, the capacity discipline resulted in 21,3 % service loss in smaller airports, as only 8,8 % of services were cut in the largest airports. (Wittman & Swelbar 2013.)

There are differing opinions on the success of the deregulation processes worldwide. Goetz states that the deregulation of the US airline industry has been deemed a success by the government and industry, while labor and consumer groups have been more doubting (Goetz 2004). Duval argues that international air transport will remain highly regulated, as countries may pursue protectionism in order to prevent the domination of foreign operators (Duval 2008). They may favor domestic providers at key airports facing capacity constraints. The perceived favoritism might lead to more countries act the same. In addition, governments traditionally deem air transport as a public utility. However, natural monopolies appear only when the advantages of scale create circumstances, in which service provision costs are the least when services are supplied by only one company. (Duval 2008.)

4.4 Railroad Transport

Railroad transport has been widely deregulated, especially in the United Kingdom. This subchapter provides an overview on differing deregulation processes and compares reorganization processes and their outcomes in several countries.

4.4.1 General

For a long time, a desire to protect consumers and employees has inclined governments to interfere in the transport market, inter alia by introducing quality and safety controls, by supervising numbers of connections and service pricing, by regulating the entry to the market, and by resorting to the public ownership of transport firms. In the majority of countries, urban transportation has been or still is in public ownership, on account of the necessity for substantial capital involvement, the high operating costs, and political

circumstances. Zbigniew and Ciechański state that in the 19th century, transportation had become one of the most regulated fields in national economies. They present regulation in three forms. Technical regulation relates to subjects, such as construction, safety, and environmental protection, whereas social regulation considers, among other, the conditions of employees. Economic regulation, in turn, features market access, the scope of activity, development opportunities, company mergers, and traffic rates. Regulations attend on inhibition of social and financial disparities among areas and social groups. Accordingly, operators have been compelled to offer services for social rather than commercial reasons. (Zbigniew & Ciechański 2006.)

Zbigniew and Ciechański have itemized factors that contribute to regulation and deregulation (Table 1).

Factors supporting regulation	Factors supporting deregulation
The need to facilitate connectivity in transport networks	Provision of incentives for economic performance
The need to ensure safety of operation	Ensuring that efficient operators gain a preferably greater share on the market
The need to create order	
The need to protect infrastructure as this supports national security	

Table 1. Factors contributing to regulation and deregulation (Source: author, based on Zbigniew & Ciechański 2006).

Deregulation or liberalization can be regarded as the removal or weakening of various legislative activities, allowing a more exempt operation of market forces. Deregulation denotes privatization initiatives of the public sector, including denationalization, communalization and regionalization, and commercialization. By creating competition, privatization preferentially aims to increase in efficiency, resulting in cost lowering, and quality improvements. Competition is assumed to pressurize companies to enter low bids (Lalive & Schmutzler 2008). In addition, it allows the procurer to select the truly superior supplier (Lalive & Schmutzler 2008). However, Zbigniew and Ciechanski state that deregulation can on no account denote a termination of regulation, inter alia, as for safety or environmental issues. The deregulation of transport requires comprehensive study, in touch with relevant ideology and state policy. (Zbigniew & Ciechanski 2006.)

The competition arrangement of Sweden, Germany, and the United Kingdom was referred to as franchising (Jensen & Stelling 2007). The theory of franchising suggests that franchise bidding makes a market more contestable by arousing rivalry between competitors in the open market. However, several concerns over franchising have been raised, including the evaluation and enforcement of contracts, inadequate contract specifications, the superiority of the winning bid, and the cost of bidding (Lalive & Schmutzler 2008; Jupe & Crompton 2006). Knowing that operators have an incentive to gain a commendable reputation, and in most cases, operators also profit from their revenues, the concern over quality deficiencies could be overturned (Lalive & Schmutzler 2008). (Jupe & Crompton 2006.) Firms established after deregulation have been willing to develop new service patterns. However, large well-managed incumbents naturally have competitive advantage to hinder or deter the entry of new companies. (Ongkittikul & Geerlings 2006.)

In the 1980s and 1990s, poor development of the financial and market performance of railroad systems resulted in notable restructuring and deregulating measures of the European railroad industry (Cantos et al. 2012; Jensen & Stelling 2007; Lalive & Schmutzler 2008). Initially, railroad transport had been operated by a state monopoly, which owned and managed infrastructure and railroad services (Cantos et al. 2012; Lalive & Schmutzler 2008). The traditional regulation has concerned price and service quality, in order to reduce the power of the railroad monopoly. Any change in the market conditions required governmental approval. Introduced reforms promoted greater autonomy of railroad companies, and a greater transparency of their budget and economic activity. (Cantos et al. 2012)

Deregulation divides into vertical and horizontal separation. Vertical separation decouples the management and ownership of infrastructure facilities from operations (Cantos et al. 2012; Lalive & Schmutzler 2008; Jensen & Stelling 2007). Such reform has been implemented in many European countries due to the encouragement of the EU. The horizontal dimension refers to the relationship between services, and horizontal separation thus introduces competition and private participation to operations. Horizontal reforms in Europe have been moderate. They have embraced mostly new operators entering freight transport and establishing franchising systems in passenger transport. Some studies indicate that horizontal reforms have most effectively improved efficiency, but some disagree. The effect of vertical separation is also unclear. (Cantos et al. 2012.) In Sweden, vertical separation has increased costs, but the introduction of horizontal competition has decreased them. Through the combined effect, deregulation has improved cost efficiency in Sweden. (Jensen & Stelling 2007.) Countries that have completed all forms of reform have the most efficient railroad systems. The positive effects of a specific reform are reinforced when it is completed with the rest of the reforms. (Cantos et al. 2012.) Lalive and Schmutzler propose that vertical separation may have led to quality issues in the UK caused by the deterioration of infrastructure (Lalive & Schmutzler 2008).

Lalive and Schmutzler state that the reformation of railroad industry greatly differs from other industries, such as telecommunications. The revolution of telecommunications followed from significant technological improvements that are not expected in the rather mature railroad transportation. Moreover, a fundamental difference occurs in the smaller cost share covered by users of railroad transport compared to many other industries. The industry is heavily subsidized, and there is little room for reducing the financing of service production. (Lalive & Schmutzler 2008.)

4.4.2 Case: Poland

Rather recently, since 2000, the Polish rail transport has been partially deregulated. Despite its primarily legal nature, deregulation also implies various economic, sociopolitical and spatial consequences. It has direct influence on the nature, quality, intensity and spatial differentiation of transport services. As Poland has been enforced to create market institutions out of thin air after 1989, it has been slowly engaging the process of the deregulation of transport. The main objective of reforming the Polish State Railways (PKP, Pol. *Polskie Koleje Panstwowe*) was to improve the poor financial situation of the railway industry. The elementary conditions for competition did not exist, and there was no legal basis for railroad transport operator activities of others than PKP. (Zbigniew & Ciechański 2006.)

Instantly, as the passenger transport service provision was opened for other operators than PKP, independent carriers were interested in operations. They were entitled for concessions, but their operations were still limited to certain networks resulting in a situation where each company operated in a different market sector. Thus, of course no actual competition emerged. Moreover, the state ownership of companies hindered competition conditions. State owned companies were able to reduce their profits, in order to restrain potential private companies from entering the market. Furthermore, as a consequence, the financing institution was simultaneously one of the beneficiaries from subsidies in the form of a state owned company. (Zbigniew & Ciechański 2006.) It could create unhealthy circumstances if the institution financing operations is simultaneously benefits from the subsidies.

Zbigniew and Ciechański propose a better approach to be to appoint states and regional governments as employers, who would select service providers through tendering, similar to the German model discussed below. However, in Poland, such an arrangement is difficult to implement due to lack of service providers. Nevertheless, the current state of affairs is unbearable. The lack of competition has caused deterioration in PKP services, while financial expectations are simultaneously increasing. Services do not adjust passenger needs, thus decreasing the profitability of services, resulting in cessation of some connections. (Zbigniew & Ciechański 2006.)

The first two Acts of Parliament of 1997 and 2000, which aimed to liberalize railroad transport, turned out insufficient. The Act of 2003 eventually separated freight carriage activity from the management of track, increasing the number of independent carriers. However, access to certain railroad yards, terminals, and depots still remains problemat-

ical. Purchasing of second-hand rolling stock has also been difficult, since PKP has refused to sell stock to competitors. From time to time, concessions for companies have been denied that are interested in operating on connections that PKP has neglected. PKP's monopoly also has a few defenders. In general, efforts to introduce competition have failed. In passenger transport, there are still practically no independent service providers. (Zbigniew & Ciechański 2006.)

4.4.3 Case: Sweden

By making a new transport policy decision in 1988 and beginning tendering in 1989, Sweden became the first country in the world which had truly vertically separated the construction and administration of railroad from operation. The vertical separation of infrastructure provision and transport operations was regarded as a necessity in order to introduce competition. The introduction of competition elements increased the cost efficiency in service production. However, Jensen and Stelling state that some of the efficiency gains would most likely have occurred even without competition, due to development of technology, intermodal competition, and general political pressure. They state that 50 to 60 % of efficiency gains during 1970-1999 were induced by deregulation. (Jensen & Stelling 2007.)

4.4.4 Case: the United Kingdom

The British railroad deregulation process was founded on the privatization enabling legislation and the Transport Department's White Paper of 1992-1993. However, these documents were criticized for lack of discussion on certain key issues and empirical evidence for statements and recommendations. Privatization appeared as fragmentation of rail industry into parts, including an infrastructure authority, rolling stock leasing companies, engineering and maintenance companies, and train operating companies (TOCs). The TOCs were meant to be incentivized by a regulated franchising system promoting efficiency, innovation, competition, and reduction of public subsidy. Hereby, passengers and taxpayers were meant to benefit. The early debate on privatization highlighted the superior efficiency of the private sector and the central role of market disciplines. Privatization was alleged to result in a more efficient allocation of resources through market forces, and to benefitting of the management skills, sense and entrepreneurial tone of the private sector. Private sector efficiency was thought to be encouraged as shareholders could trade their shares if dissatisfied with the performance of the company. However, according to Jupe and Crompton, the regulators were unable to improve TOCs' performance. In fact, it was thought that the main objective of privatization was to advance capitalism by transferring funds from the public to relatively few corporate entities in the private sector, the main beneficiaries being the owners of the companies and the providers of capital. (Jupe & Crompton 2006.)

Several factors, such as continued dependence on public subsidy, public opposition to privatization, and the need for effective service guarantees, created challenges for the regulation of the privatized rail industry. Regulation incorporated price capping, rate of return, and continuous monitoring of service quality, but the regulatory system was

fragmented and overlapping. A system of incentives and fines had little impact, since the performance touchstones were often undemanding, and the system applied to TOCs unequally. Moreover, Jupe and Crompton state that privatization is inappropriate for a highly capitalized industry dependent on subsidy. The TOCs were meant to increase revenue and reduce costs by applying private sector management skills. However, capital-intensive industries, such as rail industry, cannot cover the full costs of operation from revenues from fares, simultaneously making a rate of return. In fact, the former monopoly BR operated in a more efficient manner than its privatized successors. (Jupe & Crompton 2006.)

From 1990s the UK has experienced a shift in rail public passenger transport from largely public sector provision to private sector service provision, referred to as franchising. Initially, private sector provision was thought to involve merely rather light regulation. Decisions on levels of service, frequency and fare levels were deemed to lay on commercial decisions. However, largely to maintain the level of service, there have been moves towards reregulation in recent years. Price and/or rate of return regulations could be necessary to ensure an efficient outcome. (Vickerman 2008.)

The British deregulation had five main objectives:

1) increasing the number of rail passengers;
2) managing franchises in the interests of passengers;
3) encouraging efficiency and economy in the provision of passenger rail services;
4) encouraging investment in rail services;
5) and securing a progressive improvement in the quality of rail services.

However, Jupe and Crompton argue that the objectives were not achieved, due to the deficient performance of the regulatory authorities (Jupe & Crompton 2006).

The railroad operations in the UK remain expensive for users and taxpayers, even though there has been a steady growth in passenger numbers. The operations are heavily subsidized, and still service fares are high. The reliability and safety of operations have been improved with extensive funding. There is an urge to improve the efficiency of the industry and to attract investment in the infrastructure. (UK Dept for Transport 2012.) As the railroad industry has been deregulated, several service providers have been producing transport services. These service providers use and share the same infrastructure, which has led to issues concerning scheduling. For example, trains have been scheduled some minutes before another one to gather all the revenue. (Shaw 2001.)

4.5 Other Public Transport

Reformations have also occurred in bus and other public transport. This chapter shortly discusses them.

4.5.1 General

Public transport systems around the world generally struggle with low productivity, high cost of operation, and thus high demand for subsidizing (Buehler & Pucher 2011). Establishing competition to the industry is often referred to as a solution. In such a situ-

ation, public transport operation is generally assigned to the private sector. Policy makers prospect competition to induce greater efficiency of operations, improved service quality, and investments from the private sector. Moreover, competition is expected to catalyze innovation making. The move toward regulatory reforms, such as liberalization, deregulation or tendering, makes competence increasingly important for companies. (Ongkittikul & Geerlings 2006.)

The governmental provision of public transport planning has often been regarded to lack innovation, owing to the shortage of interest in the issue. Thus, a market approach is desired to some extent. A number of examples show how a regulatory change has led to innovation. For example, the bus deregulation in Great Britain led to a more efficient operation through utilization of minibuses. Deregulation also affects the organizational formation of the industry, resulting in several mergers and acquisitions creating multinational companies. Alternatively, an innovation may induce a turn in regulation, as regulation is renewed to catalyze the deployment and distribution of the innovation. For example, the case of unleaded gasoline in the United Kingdom shows that regulation has been an effective instrument in stimulating the desired outcome. (Ongkittikul & Geerlings 2006.) There might also be economic incentives for operators to accelerate the uptake of desired features as is the case with urban buses in the Helsinki region (Sinisalo 2014).

4.5.2 Case: Germany

Buehler and Pucher have studied the efficiency of public transportation in Germany and introduce advantageous approaches to be adopted in other countries. From the 1990s until today, the quality of public transport has improved and the number of passengers increased, thus resulting in improved productivity, reduced costs, and abatement of subsidies. These results were gained by reorganizing service provision and implementing cost increases and restrictions on car use. However, the achieved cost reductions raise discussion, since they often resulted from reducing wages and benefits of workers. From the mid-1990s, both the quality and quantity of regional rail services in Germany have considerably increased, because of competition but also because of Germany's main rail operator Deutsche Bahn's (DB) grown orientation on customers. In fact, most public transport services in Germany are still provided by public agencies, but in a regulated and competition oriented environment. (Buehler & Pucher 2011.)

A law applying competitive bidding and devolution of regional services was introduced in Germany in 1993. As a result, in 2008, 20-25 % of passenger railroad lines and a substantial amount of services, were produced through competitive bidding or tendering procedures. Competitors to the incumbent railroad company, which is the successor of the former state monopoly, have substantially increased their market share. Competitors consisted of pre-reform operators, local public transport companies expanding their activities, new companies, joint ventures of railroad operators, and foreign firms. Some railroad transport might have even been transferred to bus transport. In Britain, most emerged competitors were initially operators in the bus industry (Jupe & Crompton

2006). In Germany, competition has improved service provision efficiency, quality, service level, and pricing. (Lalive & Schmutzler 2008.)

Efficiency in Germany was achieved though reduced costs and increased revenues. The European financing legislation in 1990s initiated this evolvement, by appointing governments to begin operating license pursuit, and to establish tendering and competition processes. Germany performed rather prominent actions in order to increase cost efficiency. In addition to organizational restructuring, it made cooperation agreements with other agencies concerning sharing of employees and facilities. It also curtailed unproductive connections transferring the resources to profitable services. Some less profitable public transport services are still partly subsidized in the name of equal accessibility. A greater modal share of public transport was achieved by clustering of city development, and integration of public and light transportation. Furthermore, taxation and land-use policies contribute to a higher use of public transport. Exercises include several programs and campaigns by public agencies and governments. Additionally, the quality of vehicles, stations and supplementary services have been improved. However, such actions sometimes caused an increase in the fares. In addition, policies that aim to limit car use often confront issues with public acceptability, fragmented institutional responsibility, financial constraints, and legislative restrictions. (Buehler & Pucher 2011.)

Public transport is much more popular in Germany than in United States. In 2001…2002, Germans made 8,0 % of their trips by public transportation, as Americans made 1,6 %. Buehler examined the differences in the transport policies in the US and Germany and discovered five main differences:

- a long-standing and efficient use of subsidizing,
- better public transport supply;
- better regional coordination and integration of services, timetables, financing, and tickets,
- better multimodal coordination,
- preferable land use and car-restrictive policies that promote public transport. (Buehler 2009.)

Additionally, the German state railways DB (De. *Deustche Bahn*) has commercialized its stations, so that the DB rents the premises to private companies. This way, the station areas are attractive. In fact, a great share of the expenses of the DB's operations are covered with the renting revenue. The DB's sales revenue from renting the areas of the railroad stations rose from 8 to 343 million in a year from 2011 to 2012 (DB 2013). Such arrangements should be also considered in Finland.

Buehler and Pucher propose to encourage regulated competition and the involvement of private sector. Integration, coordination, and policies contributing to sustainable mobility were key factors in success, as well as investing in services with high potential demand. They find the combination of incentives for public transport and disincentives for automobile use to have maximized the positive outcome. (Buehler & Pucher 2011.)

5 Transformation of Mobility

This chapter illustrates a vision of the transformed mobility in 2025 through four user cases. In addition, this chapter presents a proposal for the systemic transformation in the mobility service provision. The proposal for action is based on the experience with former transformations in other industries that were covered in Chapter 4. The lessons from the former experiences are the results of this study, and they are evolved into a proposal for action. In addition, the proposal for action bases on views of experts, which are examined in this chapter. This chapter presents a set of actions for the public governance, as well as for the business sector. These actions are further developed into the seven most significant actions in a succeeded transformation according to the author. These seven are scheduled to a time period from 2015 to 2025, creating a road map. Finally, this chapter discusses the risks and possible drawbacks related to the transformation.

5.1 Scenario 2025

This subchapter portrays a scenario of the transformed mobility and transport sector in 2025. The transformation of mobility would from the user point of view probably mostly affect the availability and versatility of services, and the quality and pricing of them. Figure 7 illustrates the change in these terms. Currently, with some exaggeration, there are two options on how to manage personal transport needs in the Helsinki capital region. Many own a car due to poor public transport connections and for the rather high expense of it in comparison with regular use of car. These car owners tend to use car to fulfill all their mobility needs as it is more affordable than occasionally travel by public transport. In case the car is impractical, for example, due to congestion, lack of parking space, or high parking fees, public transport might be used. The other cohort uses public transport; however, they suffer with poor level of service of public transport. Some trips that are unrealizable with public transport might be left out, thus impairing the quality of life.

In 2025, the transformed organization of mobility services could provide users the desired characteristics of both described situations. The service supplies of emerged service operators could be extensive enough to provide creditable level of service. Nevertheless, service use could be affordable based on several reasons that are explained later in more detail.

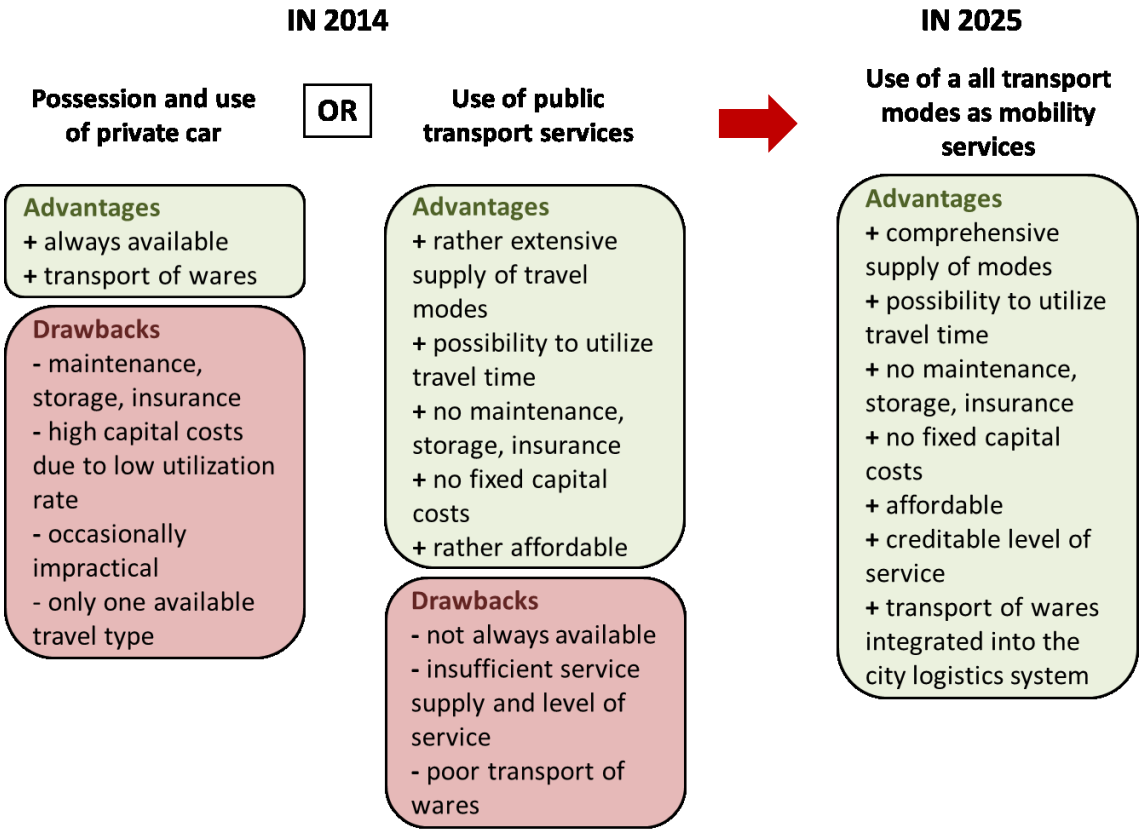

Figure 7. The transformation of the mobility service use in the user's point of view (Source: author).

The scenario of the transformed mobility sector is presented in the form of four user cases. These user descriptions are based on statistics on some critical issues and trends in the society, as presented in Chapter 3. The scenario provides an illustration of the current, problematic situation of the households and the improved situation in 2025, owing to the transformation of mobility.

User case 1: A young family
Parents Pirjo and Taneli,
and children Kiia, Samuel, Peppi, and Julius

In 2014:

Pirjo, 35, lives with her husband Taneli, 34, and their three children, Samuel, 6, Peppi, 3, and Julius, 1, in Paloheinä. Apart from his new family, Taneli has a daughter Kiia, 8, from a former relationship. Kiia stays every other week at her father in Paloheinä and every other week at her mother in Kilo, where she goes to school. Thus, during every other week, Taneli and Pirjo have to transport her to school in Kilo, taking much time.

Pirjo is unemployed and spends most of her time at home. She continuously searches for work and has registered for an employment agency. Through the agency, Pirjo occasionally succeeds to get short-term work. However, the work is located anywhere in the Helsinki region and she might get informed of a work occasion only some hours in advance. Thus, Pirjo often has problems in organizing her transport there.

Pirjo grew up at the countryside. Although she has been living in Helsinki already eight years, she is still unaccustomed to the traffic and avoids travelling in public transportation. She is disturbed when confronting drinkers and noisiness on streets and stations, as she is also often accompanied by small children. Additionally, she finds public transportation vehicles and stations unclean and smelly. Pirjo would appreciate calmness and private space in public transportation. The six-year-old Samuel goes to pre-school a couple of kilometers from home. The pre-school ends daily at early afternoon, which is problematic for the family, since Samuel is too young to walk or travel home by himself. Peppi and Julius need to be taken care of throughout the day.

Father Taneli does a shift work in variable shifts at the Vuosaari harbor. Previously, he worked at the harbor in Länsisatama. At that time, he enjoyed bicycling to work from early spring until late autumn. Unfortunately, the distance to Vuosaari is a little too long to bicycle. Thus, he usually travels by both public transportation and a car, although occasionally, as the public transport connections are weak in early hours, he drives the whole way.

Because of the rather a big family, Pirjo and Taneli drive to the supermarket for grocery shopping. They think that public transportation vehicles do not provide sufficient space for wares, such as shopping bags and hobby gear. In addition, they drive to Taneli's squash and gym a few times a week and Pirjo's yoga class every Thursday. Occasionally, Pirjo would want to go to swim or a zoo with the children. However, the car is often with Taneli at his work. The car is also necessary for carrying tools and large equipment home from hardware stores, since Pirjo and Taneli are renovating the bathroom and sauna. The car is also vital in actualizing the annual summer road trip, during which the family drives throughout Finland to visit relatives.

In 2025:

> *Taneli's daughter Kiia travels herself to the school in Kilo by a customized demand responsive Kutsuplus service, which has special attention on unattended minors. The service takes children to predetermined destination and, for example, when arriving to school, the guardians receive an automatic message from the system with information that the minor has reached the school. The service is constant or has been ordered in advance.*
>
> *The service quality has improved. Vehicles contain more single seating to provide calmness. Intensified supervision and improved physical conditions, such as*

lighting, weather shield, and emergency call arrangements secure public transport vehicles and surrounds. Improved information services have changed the mobility system easy and convenient also for people not familiar with it, such as tourists and visitors. Real time information of the course of traffic and the route network is provided by displays inside and outside of vehicles, on stations, and through the Internet being accessible also by mobile devices. Hereby, one can see the exact location of a particular vehicle, the approximated arrival time, the next stops, the interconnections provided by the next stops, or even information on nearby attractions. Thus, travelling is simple and inviting.

In order to meet the requirements of citizens, public transportation needs to be regarded as transportation of people and their things. Assuming that people who go to work, thereafter to aerobics, and finally shopping would use public transport, transport means need to provide appropriate space. In 2025, there is particular, designed space for wares, trolleys, and bicycles in public transport vehicles. There are more storage lockers, also for over-night keeping, around the city. Lockers can be reserved and paid monthly or as a one-time payment through the combined public services charging.

Taneli continues to bicycle to work. He usually bicycles with his own bike to a station, ascends a bus, and carries the bicycle with him in the bus or leaves his own bicycle at the station and continues the trip with a city bike. In case the conditions are not satisfying for bicycling, Taneli finds a car or ride sharing service with the help of a platform that he uses through the mobile phone. In addition, a daily demand responsive transport service, such as Kutsuplus, fetches Samuel and his classmates from pre-school and conveys them to the neighborhood, where they can continue spending the afternoon together.

Pirjo and Taneli order groceries home through the Internet, thus saving time and effort. They order the desired products on the website of the supermarket and receive the shopping home. Pirjo enjoys of being able to forego the carrying. In addition, several other goods and wares may be ordered through the Internet home or to a near service point.

Renting a car has become affordable, and thus more popular, which further contributes to the affordability and service quality. As a consequence, cars may be rented for occasional needs, and the family rents a car for their annual summer trip. During the renovation, Pirjo and Taneli order the delivery home or rent a car to transport the wares.

The use of all the aforementioned services can be paid in one. There are several ways of payment, which depend on the personal or household specific mobility operator. In general, services may be paid directly with a combined public services charge card, through a monthly invoice, or through mobile phone.

User case 2: An elderly couple
Tuula and Raimo

In 2014:

Tuula, 60, and Raimo, 56, live in Munkkiniemi. Raimo is highly overweight and been ailing for some years. He is early retired due to diabetes type two and has ache in his knees. Due to the poor condition, Raimo barely bicycles or walks long distances. Even a short walk to the grocery store feels excessive with a shopping bag. Raimo neither desires to squeeze into full public transport means, where it is difficult for him to fit on a seat and where he easily sweats. Moreover, he finds the course of travel uncomfortable due to braking actions and accelerations - especially if there are no free seats remaining and he has to stand.

Tuula is an entrepreneur and works in different places around the capital area. She has an active life, and she is comfortable with travelling in public transport. Occasionally, Tuula works in a shared office where she rents a desk. In the shared office, she can network and exchange thoughts with other entrepreneurs and business people. However, she often travels in the capital region to meet clients and counterparts. She also enjoys working in cafes, for she becomes stimulated and enthusiastic when meeting people and experiencing the bustle of the city.

The couple is fond of culture and regularly travels to the city center for a concert, theatre or another cultural event. They also enjoy having a fine supper in a restaurant. They drive to the city center, as Raimo enjoys the convenience and individuality of the car. He also feels that the car provides him the discretion on time and destination. However, Tuula and Raimo are annoyed by the high parking fees in the city center. Moreover, because of his aches and illness, Raimo might not to be able to drive a car after some time. Tuula does not possess a driving license.

In 2025:

> *Tuula and Raimo are pleased with the public and for-hire transportation service package, which allows the reserving, use, and payment of all possible services, including car rent, taxi, public transport, and even storage lockers, through the simple integrated portal. In fact, Tuula and Raimo have a common account for public service use. Tuula is grateful for the clear instructions for the use of services through the Internet and readily available telephone service.*
>
> *Information of mobility services is available and clear. In addition, there are single seats and wider seats in public transport vehicles. When needed, Raimo orders a car in front of their front door. This may be an automated car, taxi, an*

enterprise offering connecting traffic to public transport, car or ride sharing, or a group of young ice-hockey players who wish to have more use for their "mopoautos" (small car-like moped vehicles that may be driven at a low speed at the age of 15). One option is also a demand responsive transport service, which may fetch other customers on the way, as well, thus lowering the price of the trip. However, Tuula and Raimo may travel also alone, in case they wish for privacy, as Kutsuplus offers such a premium service when requested.

The multitude of services offers discretion. Raimo values the customized individual public transport services and vehicles. Even the drivers are trained to provide a more convenient course of travel, and they are also in other respect more customer-oriented. The fact that Raimo soon has to forego driving does not concern the couple anymore, as there are several other car-like and otherwise convenient services to choose from. As the couple uses individualized services often, they have a contract with their mobility operator on a service package containing a lot of them. Thus, the use of services is rather affordable. The expense is well competitive with the expense of owning and using a car.

User case 3: A single parent with teenage children
Parent Markku and children Jalmari and Janna

In 2014:

Markku, 45, is a single parent living with his two children Jalmari, 15, and Janna, 11, in Viikki. Markku is a busy business man working for a company in a leading position. He works long days and often has meetings around the capital area, so that he has to switch location several times a day. In addition, Markku travels in Finland and abroad for his business. Often in the morning, when driving to work, he participates in phone conferences. Markku's company in Pitäjänmäki has modern spacious garage. Due to the easiness and convenience, Markku drives to work. He appreciates the fact that the car is always available. However, in winter, he has to reserve extra time to clean the car and yard from snow. After a hard day, Markku feels exhausted and becomes extremely irritated in the congestion in the Ring I, for still delaying the homecoming.

Markku is divorced and takes care of the children by his own. Fortunately, the grandmother of the children, Tuula, is glad to visit them every once in a while and keep company with the children. In order to leave the stressful work behind, Markku is fond of exercising. He rides a bicycle and plays tennis once a week at the tennis club with a friend of his. Markku could bicycle to work; however, he often wears a suit or has important papers to carry. The office provides proper showers, but Markku does not feel up to taking the effort to carry the change of clothes and leave to work a bit earlier from

the busy morning with the teenagers. Markku is well-paid and not concerned about parking fees or possible future congestion fees.

Jalmari practices ice hockey four times a week in Myllypuro, where Markku conveys him. Jalmari has a huge gear bag to carry to the practices. Although he has a locker at the stadium, the equipment has to be brought home to be washed every week. Transporting Jalmari four times a week to the stadium and back takes a notable share of Markku's free time. Jalmari also goes to a specialized secondary school on sports in Haaga, where he travels by bus. Janna plays cello once a week in Pukinmäki, where she also needs to be transported due to the large size of the cello and her young age. Janna practices also at home, so the instrument needs to travel with her. To school, Janna travels by bike or by foot.

In 2025:

When one day staying in congestion in the Ring Road I, Markku begun to observe the cars standing next to his. Almost all cars contained only one person – a person with a displeased face similar to his. Additionally, he discovered that a number of people drive the exact same route as he every day. Markku found it absurd and begun to examine other alternatives and found several other preferable ones. Thus, Markku turned into an active user of ride sharing and car sharing services. Currently, he joins a car to go to work nearly every day and has even become friends with other car sharing users. Markku has been promoting ride sharing at his office, and consequently, his company made a contract with a mobility operator on ride sharing services, and thus, it is effortless for employees to share rides. Furthermore, the same contract includes other transport services.

Markku is pleased to note the improved satisfaction among employees on the broad mobility service supply supported by the company. The company purchases now the right to use a set of mobility services and offers them to employees instead of putting car owners before. Formerly, the company provided a spacious garage free to use for the employees but no perquisites in other mobility. Indeed, the renewed arrangement has released a lot of parking space in the office building. Hence, the company has opened a multifunctional sports center for the employees in the former garage.

Through ride sharing, Markku both conveys others with his car and travels in the cars of others. As the usage of his car is diminished, he leases his car on occasions it is not in his use but would lie unexploited on his yard. The leasing occurs conveniently through a mobility operator. The operator manages all practicalities, such as insurances, reservations, and charging of the car. During the day, Markku sometimes orders an automated car to the front door of his office to travel to meetings. The cost of the service depends on the time that Markku orders it in advance, and whether it may collect others on the way or Markku pre-

fers to travel alone. Markku orders and uses all these services through his mobility operator that he uses by mobile phone. Automated cars are also the best option when participating in phone conferences. Additionally, Markku may use mobility services through his mobility operator also in other cities due to roaming. He may visit the area of other operators in the same way as in telecommunications, as his operator has contracts on roaming with other providers.

Jalmari travels to ice hockey practices by a demand responsive transport service, such as Kutsuplus, that is directed to his team. The Kutsuplus car collects all players from nearby to take them to the practice at a fixed time on certain days. Twice a week, the Kutsuplus car collects the group of players directly from school. This way, the team can utilize the cheaper stadium turns in the early afternoon. After practice, the Kutsuplus service returns them home. Furthermore, Jalmari stores the gear at the stadium, where it gets washed by a laundry service. Also other's than Jalmari's family find the arrangement tremendous. Parents save an enormous amount of time and effort by servicizing both transportation and laundering, and children do not need to carry the equipment. Also Janna travels to her cello lessons by Kutsuplus or by a combination of automated car and public transport. All services are simple to use by children, elderly, and intellectually disabled. Janna has also heard from a friend of a service in which cello teachers arrive to some public properties, such as schools, to give lessons. These places are located near to the homes of children, and thus, they are easily accessible by children and the young.

User case 4: A student
Piritta

In 2014:

Piritta, 21, studies at Aalto University. As a student, she has little money to cover the expenses of her living and studies. She lives in Tapiola and goes to university in Otaniemi two kilometers from her home. She also visits the campus of the school of economics in Töölö for lessons twice a week. Sometimes she needs to change the campus in a very short time between lectures. Piritta is in a good physical shape and usually bicycles from her home Tapiola to Otaniemi. However, in winter, she travels by public transportation. Alongside her studies, Piritta works once or twice a week at the Helsinki-Vantaa Airport in Vantaa. By public transportation, it takes more than an hour to travel to work, and she needs to change travel means twice.

Apart from studies and work, Piritta plays football. Her team practices three times a week and additionally has matches. Practices are located in Leppävaara in summer,

which is rather near to Tapiola. However, in winter, practices are held in indoor stadiums further away. Matches take place around the capital area. Moreover, Piritta has rather a large bag to carry. As she often travels to practice directly from the university or work, she needs to carry the bag through the day. Moreover, Piritta's team has the latest field turn ending at 9.30 pm. That late, Piritta does not desire to bicycle; however, the headway of public transport is also poor.

Occasionally, Piritta would desire to travel further for horse riding or to the national park of Nuuksio. Additionally, Piritta is active in student associations and enjoys spending time with her friends. Thus, her days are full of activities, and there is no spare time to comply with poor public transport connections. Piritta has tried to utilize travel time for studying, but she immediately starts to feel sick. In addition, Piritta is sensitive and becomes easily anguished on the account of the noise and pollution emerging from traffic.

Due to the good connections from Tapiola, Piritta prefers to use public transportation. She finds it convenient and fast to certain directions, owing to bus lanes and traffic light priorities appointed public transport. In addition, she enjoys meeting people in public transport means and experiencing the bustle of the city. Furthermore, she prefers to live ecologically whenever possible. She values recycling, organic food, energy and material saving, as well as sustainable travel.

Piritta becomes irritated when buses are not on time. She does not want to wait for public transport especially in winter, as she instantly freezes. Piritta relies entirely on journey planner applications in her smart phone when planning her travel. Piritta uses her smart phone also to be updated at all times, to search for maps and timetables, and to read news and emails. When the battery of her phone occasionally is dead, it causes her problems.

Regardless, in order to save time and effort, Piritta has been compelled to buy a car of her own. However, the ownership of a car encompasses several burdens, such as maintenance, storage, taxes, insurances, parking fees, and gasoline costs. Moreover, it is not ecologically sustainable as Piritta drives only three to four times a week and otherwise the car stays unused. Most of her trips Piritta travels by public or light transport. Occasionally, the car may stand still even for some weeks, when Piritta is busy with the studies and has no time to work or practice. Hence, the purchase and ownership of the car is costly in relation to Piritta's usage of the car. In addition, having purchased the car, it would be most affordable to drive all trips by car, instead of occasionally using car and still buy the public transport ticket. However, without the car, Piritta would be compelled to forego some activities that are important to her.

In 2025:

> *Piritta uses her smart phone to check the real time state of the traffic and, for example, the location of a particular public transport vehicle. Owing to that, she*

can wait in the interiors just until the arrival of the vehicle. Piritta uses a journey planner that she can customize according to her needs. In addition, the journey planner is proactive. It continuously reports on possible faster or more suitable services, or if there is going to be congestion or bad weather.

In case Piritta will attend a practice directly after university or work, she utilizes a delivery service, which takes her equipment to the sports hall. Piritta leaves her bag to a nearby grocery store or other service point and receives the bag at the sports hall. The equipment may travel in public transport means during the day. In summer and autumn, Piritta travels by a city electric bicycle with a carrier to practice. Hereby, she can move fast but without excessively straining herself before practice. The bicycle may be rented and returned to any bicycle point or even next to the football field. Due to the modern infrastructure and fleet, as well as improved way of driving, the course of travel is increasingly convenient. In addition, transport vehicles provide "sensitive seats", which are designed for a more convenient travel for people with motion sickness.

To move between the two campuses, Piritta travels by the demand responsive Kutsuplus, which she uses with an affordable student fare. In fact, Piritta has a mobility package with plenty of demand responsive services and services of shared cars. Currently, Piritta bicycles to the university also during winter, because of the excellent maintenance of light transport routes. In the morning before leaving, Piritta assures the condition of the routes online through real time video picture of the routes. Piritta travels to work by the shared car of her apartment building or another shared car that she finds on the nearby streets. She checks the availability of cars, reserves and pays for the use online.

Piritta is an extremely versatile user of mobility services. As mobility operators are commercial, they have a strong focus on customers. Operators provide a wide range of services and clear instructions. They also promote new or alternative services. Piritta finds the proactivity of mobility operators very convenient. Depending on the particular trip, weather, equipment, mood, or physical condition, Piritta may always choose the most appropriate mobility service. The mobility system adjusts to an immeasurable amount of differing desires.

Piritta is glad to be able to forego the car. The broad supply of mobility services completely fulfils her mobility needs. She is proud to live ecologically and marvels at people who spend their time on cleaning their cars from snow in cold winter while someone else could do it. With less costs than the expense of owning a car, Piritta can now use a spectrum of different kinds of services, including services similar to car use.

In the transformed system, services are comparable with each other. This results from the fact that vehicles are owned by companies, and customers pay from the use and merely partially for the fixed costs of the vehicles and their mainte-

nance. As the capital costs of fleet are distributed to a number of users, the expense becomes infinitesimal. In addition, as the utilization rate of cars rises on account of the more efficient use of them and, on the other hand, diminished need to own a car, fewer cars are needed to fulfil the entire mobility need of people. Due to fewer cars, roads and parking places are less occupied. Thus, travel times reduce, travel becomes more convenient, the level of service and fastness of public transport as well as safety improves, and environmental disadvantages decline. The released space can also be exploited by broadening light transport routes and green areas, or by building housing or urban activities.

5.2 Systemic Change

The subchapter 5.1 described how the transformation of mobility would appear to citizens in 2025. This subchapter, in turn, illustrates the systemic change that would occur. The transformation of the sector, proposed in this thesis, would add one level to the organization of service provision, that is, the level of "Mobility as a Service" (MaaS). The MaaS level would contain the provision of the services by mobility operators, as was described in the user cases. The MaaS level would feature the user interface of the transport services. The produce of transport services would be in the "Transport as a Service" (TaaS) level. In this level, transport companies would produce services and sell them to the mobility operators in large amounts. The divergent, originally separate transport services would then be combined into practical service supplies by the mobility operators. Hence, customers would receive ready complete packages of services in the form of easily accessible service supplies. The mobility operators would be commercial and thus, have strong knowledge on user centric operation methods. In addition, they would operate on a competitive market and thus, strongly contribute to the quality of their supplies.

Transport services constitute of services components, which are the use of infrastructure, fleet, and data. The significance of data will increase, as technologies develop, and it will most probably become a considerable part of services. These components could also be provided as services, so that the right of use of them could be sold to transport service producers. In that case, levels "Infrastructure as a Service" (IaaS), "Fleet as a Service" (FaaS), and "Data as a Service" (DaaS) could be created. Already currently, for example, some transport companies lease their fleet. However, the viability of these systems could be addressed in further research.

The change in the purchase and subsidization procedures is vital in the transformation. In the current organization of the transport sector, municipalities purchase some services, such as transport for students, elderly, or disabled, directly from transport service producers. However, in the transformed situation, also these services could be purchased from mobility operators, who might be best in the know on how to organize an appropriate service supply for them, as well. As these services are currently accessible only for the appointed users, through mobility operators they could be used by anyone. Furthermore, the subsidization of public transport currently goes directly to the HSL, as

it could be divided among the mobility operators. The subsidization terms could even direct the use of services and promote sustainable services. Figure 8 shows the transformation from the current organization to the transformed one featuring the abovementioned elements.

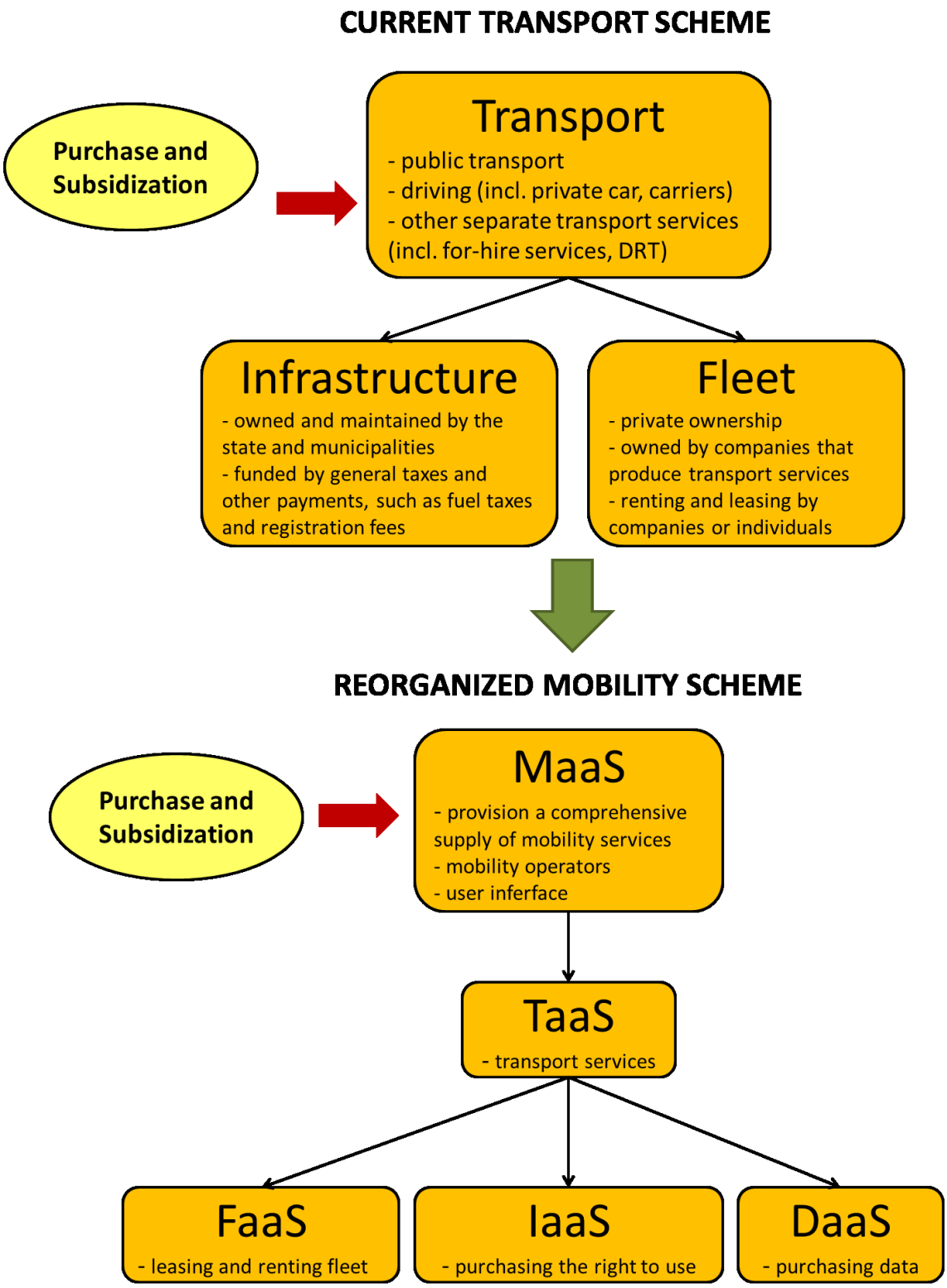

Figure 8. The transformation from the current transport service provision into the reorganized mobility service provision (Source: author).

5.3 Views of Experts

This subchapter provides an overview on the views of some experts in the field of transportation on a similar transformation.

Russ, Vilkman and Pöyry & Kummala have been studying the future of mobility. Russ envisions future mobility to be connected mobility services that concentrate on users. The situation could be similar to one described in subchapter 5.2. As the market evolves, new types of business models emerge. Stakeholders collaborate, and their roles might switch. (Russ 2013.) Vilkman finds that communication, marketing, and export are important in achieving such a system, which is why she presents that a state might not be sufficient for such operations (Vilkman 2010).

Russ states that a market structure for connected mobility services, also referred to as a multiservice model or a service ecosystem, requires a new organizational framework, encompassing open minds, open data, and alliances. (Russ 2013.) Vilkman suggests that data models should base on a standardized data format and that interfaces to authoritative databases should be open (Vilkman 2010). Both Russ and Vilkman state that the quality and availability of data, as well as data protection have to be ensured (Russ 2013; Vilkman 2010). Preconditions for the service ecosystem including products, stakeholders and services, need to be generated, such as earning and pricing principles, as well as payment systems (Pöyry & Kummala 2011; Vilkman 2010).

Russ suggests to progress from strategies to structures and standards. Design should begin from disclosure of needs followed by the design of services. Russ states that as desires are clear, the development of technology will follow. Users must be incorporated into the generation of new services in order to address their needs. Cooperation has to be coordinated between industries, authorities and users, which would result in expanded collective knowledge (Pöyry & Kummala 2011, Russ 2013). Basic structures have to promote participatory development and innovation. Russ craves for new systemic thinking among stakeholders in the field. The governance should test, learn, rethink, and invest. (Russ 2013.)

Public authorities are vital in modifying the regulatory framework. Russ and Vilkman state that the development of the ecosystem requires research programs, long-term structures, and market studies and foresights. These need to be complemented by pilot actions, in order to gain practical knowledge. (Russ 2013; Vilkman 2010.) Pöyry and Kummala further the deployment of usage and location based service and payment models in both authoritative and commercial business (Pöyry & Kummala 2011).

In addition to the abovementioned authors, Casey's dissertation discusses the transformation in mobility. He examines the former mobile and Internet revolutions, which were also studied in Chapter 4. Casey compares those revolutions to a possible transformation of mobility. He examines whether similar structures as in those revolutions could be viable in the transformation of mobility. The starting point of the industry nat-

urally rather strongly determines the possible course of the transformation. Casey examines former and present situations in the industries by their rate of openness and centralization. The next section explains how Casey sees the mobile and Internet revolutions and presents his ideas on deploying them in transportation.

The starting point of the mobile revolution was the model of a monopoly operator. In this model, the state controlled and operated the infrastructure and service provision. Other stakeholders, such as users and device manufacturers, had no impact on the industry. Furthermore, each country had systems of their own. In the past-revolution situation, the government granted licenses to a few operators. Thus, customers were able to choose between operators and terminal device. Hence, the quality of basic services, such as phone calls and SMS, was ensured. Furthermore, systems were internationally standardized, and networks were compatible with each other. (Casey 2013.)

The Internet revolution stemmed from a fragmented model. The fragmented system included isolated local networks, and thus equipment, networks, and services were reliant on each other, resulting in non-scalable services. This fragmented model turned into the Internet model. Hereby, the independent fragmented networks became loosely interconnected. A wide spectrum of players, services, and technologies symbolize the industry. Devices and services may be applied across, and services scale globally. The industry has light standards, although the quality of the services is not ensured. Both transition models move from being closed to open. In addition, Casey describes the monopoly operator model and the mobile model to be centralized, while the fragmented model and the Internet model are decentralized. (Casey 2013.) The GSM and the Internet transitions are illustrated in Figure 9.

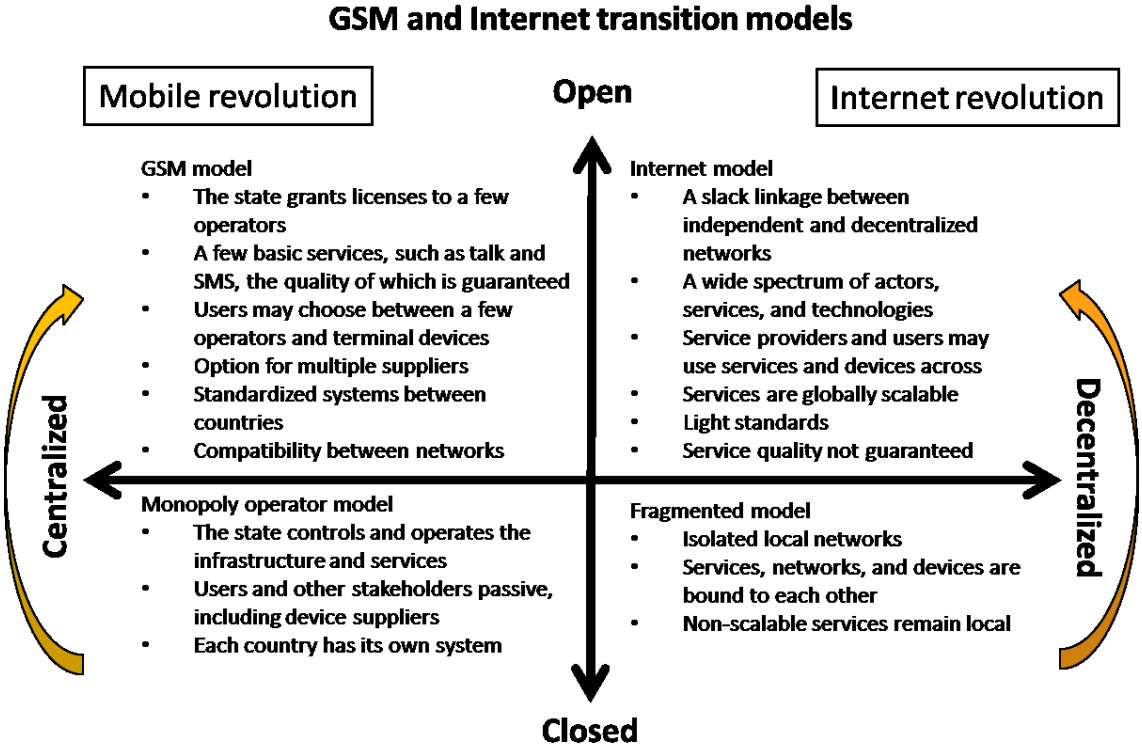

Figure 9. The GSM and Internet transition models (Casey 2013, reproduced).

Let us now examine the deployment of these models in transportation. The mobile revolution model would suggest subjecting operator activity to licenses, and ensuring a few basic services including payment transfer systems and information security. The Internet model proposes to establish a system of several service providers with a loose linkage with each other. This would probably generate a great range of stakeholders, services, and technologies, but without guarantee of the quality. A redeeming feature for the industry would be the scalability of services and systems, since it would create possibilities for international business. (Casey 2013.)

The current situation of the mobility provision in Helsinki resembles the starting situation of the mobile revolution, that is, the monopoly operator model. However, alternative travel modes may be considered to represent the fragmented model. Such systems are locally isolated and unconnected to any other services. The transformation of mobility strongly contributes to the integration of separate mobility services, in order to create a combined, extensive network of services provided to customers through single channels. The objectives of the mobility transformation include increment in services and players, and the global scalability of services, which may be better achieved through the Internet revolution model. However, in order to sustain the quality of services, and thus retain the attractiveness of public transport, mobile revolution model would be preferred. Nonetheless, poor services might become decimated by market forces. Several industries provide empirical experience on the mobile-like revolution, as noted in this thesis, and the regulation of such a transformation could be more straightforward.

The mobile model would allow device and service provision from multiple providers through standardization. Light standardization instead, might ease the entering to the market of new players. Hence, the Internet model promotes the generation of a number of new market-drawn services, whereas the mobile model suggests merely a few basic services. In order to reach the objectives of the transformation of mobility, one of these models do not suffice. Characteristics from both could be beneficial to include.

Currently, public transport service provision in Helsinki is monopolized, whereas other mobility services, such as ride sharing, car sharing, and bike hire operate on their own. Helsinki Regional Transport Authority (HSL) buys transport services from service providers and offers them to customers. The operations are financed approximately half by the local municipalities and half by ticket receipts. As a regional authority, HSL operates on governmental frame, including certain responsibilities. Institutes financed and directed by municipalities are also generally expected to take few risks. Such a framework does not provide HSL with much latitude to innovate. Moreover, because of the extent of the organization and its operations, adjustments require substantial actions and time. However, the poor economic situation demands for higher efficiency in transportation. To make the market thrive, new innovations and new businesses need to be established.

In addition, as there is no competition, HSL might not experience high pressure on introducing new services, improving the quality of the current ones, or lower prices.

Moreover, HSL's services do not include several other, for-hire services, such as car sharing, ride sharing, and bike hire. These considerable issues in the current organization drive to think of reorganizing transportation and mobility service provision in Helsinki. However, in order to ensure the continuity of operations and long-term development, such an authority as HSL, could be required.

Sinisalo compares public authorities and private operators as mobility service providers. He reminds that HSL is accountable of its operations to customers and taxpayers. However, he lists the strengths of a public authority to be integration, continuity, policy goals, strategy, and funding from taxes on externalities. Private operators, in turn, could have strengths such as optimization of operations, dynamic flexibility, efficiency goals, and funding from customer revenue. (Sinisalo 2014.)

At the moment, the HSL allocates bus service contracts by competitive tendering. In the tendering model, the HSL sets routes, timetables, and service requirements. Hence, such a model leaves little latitude to transport service producers. Nevertheless, tendering has resulted in cost savings of the provision and rather quick renewal of fleet, the average age of a bus being six years. In addition, emissions have reduced and passenger satisfaction has remained on a good level. However, Sinisalo identifies risks and challenges, as well. The profitability of service producers is very low, and they are financially weak. Thus, there is the risk of withdrawal and diminishing competition. Moreover, prices are expected to rise. In addition, service quality and efficiency are menaced, as service producers are dissociated from the fare revenue. Maintaining good quality and efficiency requires monitoring, supervision and enforcement of the HSL. Monitoring the quality will facilitate by means of ITS, but measuring perceived quality is more complicated. Perceived quality is mainly measured with the help of inaccurate passenger surveys. (Sinisalo 2014.)

The Association of German Transport Companies (VDV, De. *Verband Deutscher Verkehrsunternehmen*) accentuates that public transport is a key element and a motor of a forward-looking mobility alliance. Mobility alliance refers to bringing all modes of transportation available through an integrated portal, that is, a similar system to the aforementioned service ecosystem. The VDV states that the current public transport is excessively structured, and thus, it does not meet individual needs. In order to provide suitable and individual mobility services, public transport needs to be complemented by various additional mobility services, such as car sharing, taxis, and bike hire. Merely these services together are able to fulfill customer needs and compete with the possession and usage of private cars. All mobility services should be accessed by a common portal, which could be provided by a public transport company. Customers would be charged basing on their exact usage of services, promoting equity. At the end of a certain time period, customers receive invoices that transparently display the usage of mobility services, which are charged directly from the account. The VDV's stand differs from the one presented in this thesis. The VDV suggests that public transport companies could operate as mobility operators, whereas this thesis presents that mobility operators could as well constitute of private firms. (VDV 2013.)

Currently, in most countries mobility is provided by a public transport association. In the renewed system, mobility services would be provided by institutions that make contracts with mobility service producers and with customers, and thus operate as suppliers. These institutions could be termed as mobility service integrators or mobility alliances as mentioned before. This thesis has referred to those institutions as mobility operators. These institutions would make service provision a business. Business naturally requires making the product attractive. Service provision would be made attractive for example by providing individual services, packaging services according to customer desires, informing, and marketing. (VDV 2013.)

As presented before, the VDV also agrees that the service supply would be provided through a simple and convenient service provider-customer interface, including service usage and paying as shown in Figure 10. Customers profit from the improved and more affordable mobility. Service providers profit from increased ticket returns through proliferated business, and the eased access to a broad customer base and thus more effective introduction of new services. General public profits from the improved local environment due to a greater modal share of public transport. Public participation in society improves, as it tends to be greater among citizens using public transport. Road and parking space is released to other uses, and public transport gains a new, innovative, all-inclusive image. The increased amount of service users leads to proceeds, which again leads to investments on service production, and thus improvement of services and a wider clientele. The aim of establishing such mobility alliances is to simplify and improve the mobility of citizens, and to offer attractive all-inclusive service supplies, in order to promote flexible and environmental conscious choice of travel mode. Choice would be influenced by improved service provision, instead of restrictions or control measures. (VDV 2013.)

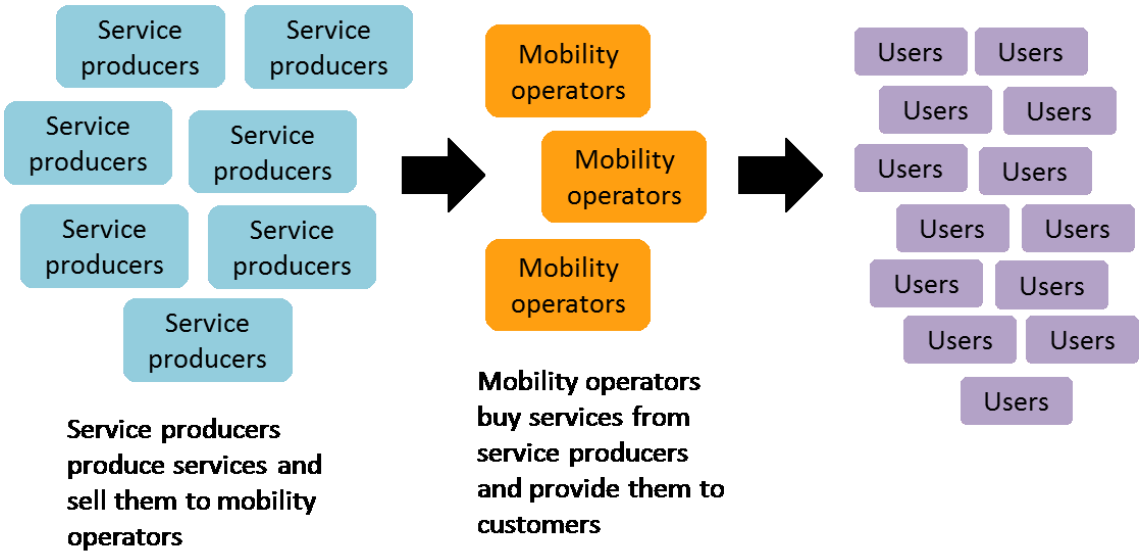

Figure 10. Mobility service provision in the form of the MaaS concept (Source: author).

The VDV praises the good qualifications of present transport companies and public transport associations in assimilating the role of the service integration. The VDV sees that such institutions have ready-made broad customer basis, and it is their original core business to provide, organize and integrate mobility services. Assets are also local knowledge and linkage to other local stakeholders, politics, and the administration. The VDV stresses that establishing an ecosystem for mobility alliance operations demands pioneers able to implement the renewed system. The VDV strongly deems the transport companies and associations, in cooperation with municipalities, to be in the leading role in this transformation by providing the necessary primary system and organizational center stage. (VDV 2013.)

The VDV states that the transition from the present system to a service ecosystem in mobility requires participation and support from the governmental levels imposing the frame conditions. Frame conditions are a regulatory framework, support programs for standards, and pilot projects, as well as target-oriented planning instruments. Legal, financial, and organizational matters are to be considered. The VDV suggest these to be taken over by cities, municipalities, federal governments, and the EU in the form of common objectives and concrete measures. The VDV highlights that the integration stems from cooperation. The highly differing services complementary to another require teamwork of all stakeholders, as well as modernization of the legal and financial conditions. (VDV 2013.)

6 Proposal for Action

The objective of the study was to find the best practice to conduct a transformation in mobility from the current situation to a service ecosystem. Thus, the result of this study is a set of proposal for actions. In addition, as the target year of the transformation is 2025 in this study, the study also provides a road map for the realization of the transformation during this time period. Finally, the viability of the plan and the study is revised. This chapter presents the proposal for action, a suggestion of a road map, and evaluation of the plan.

6.1 Proposal for Action and Road Map

The author has collected experiences from transformations in other industries, as well as professional views on the transformation of mobility in Chapters 4 and 5. This subchapter presents the results, the derived proposal for action, and the outlined road map.

The proposal for action bases on the results of the study, that is, the significant characters of the former transformations. The author has collected the characteristics that have appeared the most significant. These characteristics have been altered to a proposal for action. Thus, Tables 2 and 3 present the characteristics and proposed actions for the public governance and the business sector. The proposed actions for the public governance is more considerable relative to this thesis, and thus, more profound. The proposal for the public governance constitutes of encouraging and supporting the private sector in the establishment of operations. This is due to challenges that are often faced in the early phases of a novel market, and especially as in this case, there is no evidence of the success of the novel market. The business sector, in turn, should contribute to cooperation with the public governance in the development of the service ecosystem.

Results show that especially a new way of thinking and novel approaches are required from the governance. At least in the first phase, public governance could be responsible for collecting and provision of real-time traffic data. This way, the equal deployment possibilities of the data would be ensured. Of course, the governance could procure the operation from a private enterprise. Increased deployment of real-time information would raise the mobility to a whole new level. The legislative obstacles for the full appearance of a service ecosystem need to be erased. In competition, the governance would also be responsible for creation and monitoring the compliance of rules and regulations. In addition, it could be forceful in coordination of cooperation between businesses and institutions. The ending of government ownership of transport service producing companies should be discussed in order to maintain balanced competition. However, for example cities may not be willing to renounce the ownership, as there are also poor experiences in the past. It is also essential to subsidize all multimodal mobility services equally. Research on subject has to be conducted. Moreover, the mobility environment, and parking place management have to support sustainable mobility services. Cooperation with the business sector is essential in developing legal and financial conditions for the service ecosystem and market reorganization.

Exercise for the public governance:

- Encouraging innovation and efficient deployment of innovations
- New approaches, skills, and tools
- New systemic thinking, reorganization, and clear distinction of responsibilities
- Modernization of systems and supporting that of others
- Collection and distribution of real time data
- Revision of legislation to meet the prerequisites of the emerging market and not to restrict innovation
- Creation of appropriate regulation and specifications
- Ensuring real competition and healthy development of the market and companies
- Monitoring the compliance of legislation and regulation
- Supporting market entries by creating stability and possibly allowing front-heavy subsidizing
- Supporting service development
- Supporting the generation of one or more service operators
- Possibly establishment of license procedure
- Alteration of purchase and subsidizing procedures
- Supporting the development and deployment of usage-based and/or location-based service and payment models
- Research, long-term land use, development and action plans, strategies, recommendations, and conferences
- Experimental clauses
- Pilots
- Redesigning the mobility ecosystem and transport environment to better support sustainable mobility
- Renewing parking space management to benefit sustainable mobility services and mitigation of parking space norms in existing and future areas
- Commercialization of stations in order to create vivid business environment
- Cooperation with the business sector in order to develop appropriate legal and financial conditions for the desired service ecosystem and market reorganization
- Coordinating cooperation between businesses, authorities, other institutions, and users

Table 2. Proposed actions for the public governance to contribute to the generation of the mobility service ecosystem.

Exercise for the business sector:
- Innovation and efficient deployment of innovations - New approaches, skills, and tools - Customer orientation and service approach - Encouraging user participation in service design - Orientation to the modern technology - Development and deployment of usage-based and location-based service and payment models - Attracting investments and gaining resources through cooperation - Marketing, market studies - Cooperation with the public sector in order to develop appropriate legal and financial conditions for the desired service ecosystem and market reorganization

Table 3. Exercise for the business sector governance to contribute to the generation of the mobility service ecosystem.

According to the VDV, each governmental level should contribute to the establishment of a service ecosystem. Thus, the VDV sets its own proposals for the governments. The European Union should contribute by financing a coordination office, which would fasten the spread of the activities of the early adopters with the help of Internet platforms and conferences. It should also fund and invest in research. Proposals for other administrations and municipal authorities are collected in Table 4.

State administration	**Municipal authorities**
Amendment of laws contributing to sustainable mobility, including regulation on parking space	Directing incentives to sustainable travel modes by developing municipal regulations, including on parking space
Provision of a budget for the support of sustainable travel modes	Recommendations to support multimodality
Inclusion of car sharing and taxi in subsidy programs	Preparation of municipal car sharing action plans
Experimental clauses for subsidy programs	Supporting mobility companies by implementing attractive mobility stations at public transport junctions

Supporting the modernization of transport control	Redesign of the transport environment to support sustainable travel modes
Supporting communication and marketing that promote multimodal behavior and its acceptance in the general public	
Supporting the establishment of integrated information and sales platforms that base on uniform technical standards	

Table 4. Methods for the state administration and municipal authorities to contribute to the establishment of an ecosystem for mobility alliance operations, according to the VDV. (VDV 2013.)

A number of matters appear to affect the success of a revolution as previous experiences show. Thus, also a set of proposed actions could be given to the public governance. However, the author has processed the aforementioned results and crystallized them into seven most considerable proposals for action that are listed next. These are also the seven actions that are placed on the road map.

The seven most important proposals for action are the following:

1. Coordination of cooperation between all stakeholders, including businesses, authorities, institutions, and users
In order to establish a functional service ecosystem, the demands of all stakeholders have to be included in the development process. Cooperation needs to exist since the beginning, in order to start off right, ensure equal circumstances, and formulate a natural way of working. This cooperation is essential for the sufficiency of the ecosystem, but also for motivating all stakeholders.

2. Revision of legislation and regulation to meet the prerequisites of a service ecosystem
The needs for change in legislation and regulation need to be discovered. The current legislation hinders the development of a service ecosystem and market entering of new companies. Such obstacles need to be removed. Cooperation with all stakeholders is essential in order to find the obstacles and prerequisites of the service ecosystem. Municipalities could function as an intermediary by gathering and conveying the proposals to higher governance.

3. Creation of common rules and appropriate regulation, as well as monitoring its compliance

The emerging market requires appropriate regulation in order to be functional and to ensure that all stakeholders benefit. The appropriate regulation requires further research. Regulation could concern pricing or revenues and it could promote sustainability. Regulation should ensure real and healthy competition and growing of companies.

4. Reorganization of the mobility service provision

The provision of transport services needs to be transformed. The transformation includes the rescission of the public transport ticket sales monopoly of the HSL, so that other companies may also begin to sell public transport tickets.

5. Establishment of the transformed operations

The establishment of the transformed operations requires alteration of the current business models and structures, and generation of mobility service operators. Hence, market entries need to be supported. The generation of more than one operator might contribute to efficiency gains, service improvements, and price lowering through competition. In order to establish the operations, the essential prerequisites for a service ecosystem need to be fulfilled.

6. Revision of the purchase and subsidization procedures

Currently, municipalities and the state subsidize public transportation through HSL and purchase transport services directly from transport service producers. In the transformed organization, purchase and subsidization could direct to the Maas level, from where the funds would be distribute to the other levels. Such directing of funding would provide latitude to service operators to innovatively fulfill the mobility needs. This way, funding could also be better directed according to demand. Nevertheless, appropriate political tutelage could be applied when necessary, and surely cannot be left out in a democratic form of government. This kind of revision of the purchase and subsidization procedures could result in innovation and introduction of new services and service producers.

7. Pilots and test areas

Experiences with pilots give guidance during development processes. Real practical knowledge is vital in the creation of novel operations. Testing operations (e.g., a new service) first in a minor scale indicates the need for improvement but requires merely a small budget. The first prototype can then be developed and introduced again to the market. Therefore, the City of Helsinki is planning to launch several pilots in the near future, in order to gather information on how a service ecosystem could be established and to understand the prerequisites of a functional market.

Figure 11 places these seven actions on a time scale from 2015 to 2025. The position of each action portrays the time when the action should begin. In addition, the length of each line represents the time scale in which the action should be performed.

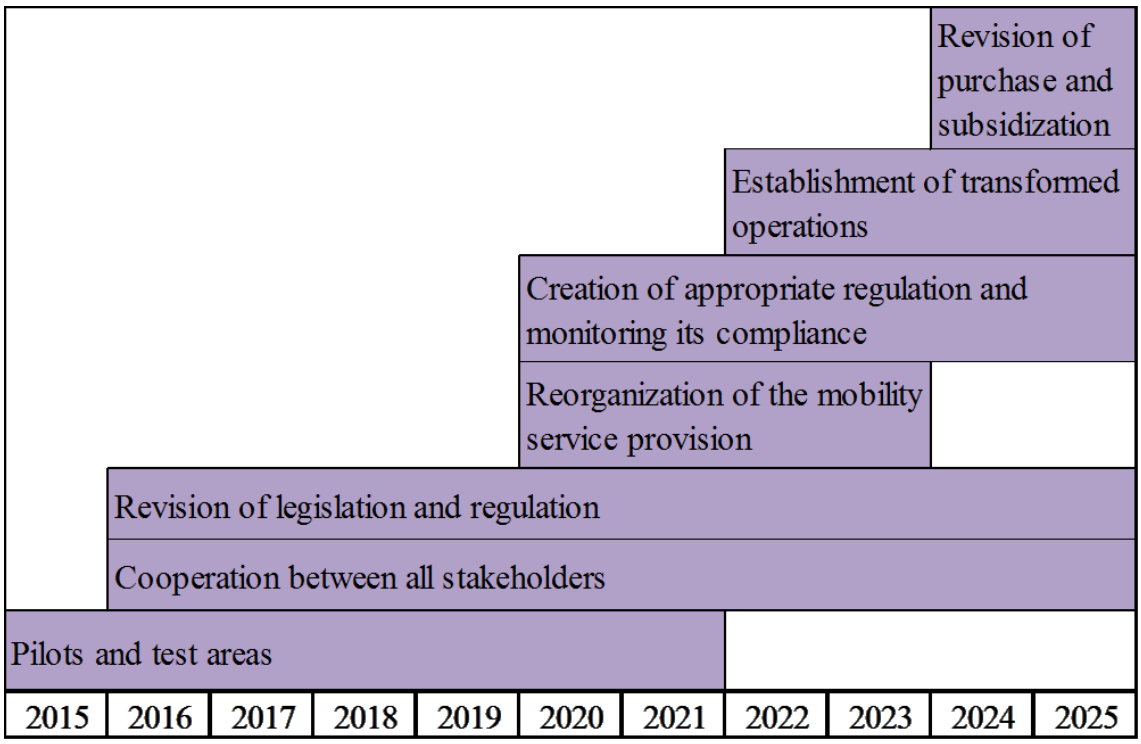

Figure 11. The road map of the process of transforming mobility service provision (Source: author).

As presented earlier, early information on the requirements of services or the service ecosystem is vital. Thus, information should be gathered with the help of pilots. Pilots could be exploited during the process, but they should be begun with right away. The pilots also bring out obstacles that the legislation and regulation might sustain. These experiences with pilots and perhaps novel business ideas could highlight the needs for change in the legislation and regulation, and the revision of it could begin next. The process of revision legislation should be started soon, as it might last long. Cooperation between all stakeholders should also be started directly.

The revision of the mobility service provision should also be started rather soon, as well as the creation of common regulation. All processes this extensive naturally often take long. As the appropriate regulation and the service ecosystem would exist, transformed operations could begin. The revision of the purchase and subsidization procedures should be revised lastly, as the organization of the market and operations would have cleared.

6.2 Risk Mapping

Potential risks and drawbacks in the solution need to be considered before executing. This subchapter discusses the risks and drawbacks that the solution might have.

The reorganization of mobility service provision has rebound effects, as any other phenomenon. As services would become more affordable, they would probably be used more. This could increase the amount of traffic; however, the shift would most likely happen from private cars to the novel mobility services. In the same way, the decreasing amount of cars and the increasing fluidity of traffic could attract more drivers. Some more traffic might be induced. Nevertheless, there are other means to limit the amount of cars, such as parking fees or the pricing of road use. In addition, if work-related trips would be well organized by for-hire and public transport, the induced trips would probably relate to leisure time and thus raise the quality of life. Improvement in the quality of life and the comfort of the city are a part of the strategy of the City of Helsinki.

In the current system, the pursuit of equality between districts drives to ensure a certain level of service in all districts. Given the constricted resources, compromises need to be made. This leads to a situation in which some districts have a better level of service that they would need and some places are not served enough. That is, public transport means may be empty or excessively full, since supply does not respond to the demand but is determined on other principles. The current system mandates to serve districts where service operations are not profitable. This is an issue when appointing service operations to the private sector. No commercial company wants to operate in an unprofitable service area. Operations would most probably be subsidized but competition might function better without subsidizing.

There has been concern over the suitability of transportation to be subjected to private operation. Transportation is highly subsidized in most of the world, and thus, there might not be much to be gained in the efficiency of operations. As a consequence, the operations could not be performed more efficiently by the private sector. However, there is support to efficiency gains when appointing transport service provision to the private sector on a competitive basis, as the case Germany shows (Buehler & Pucher 2011). Regardless, there is spare capacity in transportation in the utilization rate of vehicles and parking places. Furthermore, the reorganization of the transport sector would create a new market and new services and companies, which could induce work places and export.

In order to profitable, commercial service operations need to gain a sufficient clientele. Currently, one major problem concerning public transport in Helsinki may be the poor level of service. The level of service is in some districts low due to the rather small population, resulting in small clientele and unprofitability of service operations. Thus, there might be concern over achieving the economies of scale in the mobility service operations. Nevertheless, there is potential among the current car users, who could turn into mobility service users if mobility service supplies would be made competitive with car. Related to this uncertainty, it is not guaranteed that service operators or new service producers would emerge. Perhaps public authorities could find ways to support market entries and create stability in the business environment. A steady price development could be beneficial for companies to develop in a healthy manner.

There are concerns that relate to pricing. Competition would force prices to more accurately reflect operations costs. That is, popular services would also be more affordable in the name of economies of scale. Thus, prices would decrease in city centers and increase in areas with lower density. However, people living in city centers are also generally wealthy, whereas people living in periphery might not be. Thus, such pricing could result in a biased situation. However, allocated subsidizing might alleviate the issue.

There are potential operational issues in the MaaS concept that are not discussed in this thesis to a great detail. For the first, the quality and safety of services needs to be ensured. For example, the quality of service might reduce due to price competition, and thus safety may decrease. In addition, the market dominion of a single operator could be detrimental for the industry. To avoid market dominion, operators could be appointed a maximum market share. There could be concern over scheduling. As noted before, whether there are no rules on scheduling, service operators could drive a bus a couple of minutes before the competitor and gather the revenue. This might be alleviated with proper regulation.

Assuming that legislation would be altered, the specific alterations and possible consequences need to be carefully evaluated, in order to avoid detrimental implications and rebound effects. The consequences of the alterations could be prefigured with the help of experimental clauses. As discussed, the Finnish electricity infrastructure is well maintained. This is due to appropriate regulation. However, in some cases, deregulation has led to the deterioration of infrastructure, as the responsibility of maintaining it has not been clear. Thus, such matters as well as also long-term planning need to be concerned in deregulation processes.

One potential issue is the expense of modern technology. The deployment of modern technology is significant for the success of a company. However, not all companies may be able in to invest in modern technology, at least in the beginning of operations, resulting in unequal market composition. Nevertheless, competition aims to more efficient operations. Companies, which do not manage, might not be the most efficient ones. The impact of deployment of modern technology to the success of enterprises could be examined further.

Home delivery and other delivery were not much discussed in this thesis, expect for the mention in the user cases of logistics services that could be integrated into public transport. Delivery systems may have the drawback of excessively diminishing the mobility of people, especially of the elderly. For example, in case home delivery would become the most affordable or the only possibility, people would stay at home without getting any exercise. Also if home delivery of goods, such as groceries, would become affordable, advanced elderly or disabled might be told to stay at home and receive groceries there instead of providing them help. This would save money from municipalities, but elderly and disabled would have little contact with the outside world. On the other hand, if delivery services do not diminish the amount of trips made by individuals,

they would most probably increase the total amount of trips, and thus be unsustainable. Thus, a functional solution could be to utilize existing service points, such as grocery stores or kiosks, to also serve as delivery pick-up points. Such an arrangement would partly reduce trips made by the delivery carriers; however, wares would be rather near to customers and easy to fetch on the way to work, for example.

In order to produce and provide services which would appear attractive to customers, information about users' preferences and habits could be advantageous. Thus, competition and the ultimate urge to gain clientele could push companies to learn as much as possible about users. However, users might not want to be profiled. Indeed, there has recently been discussion on privacy and data protection concerning customer information related to a number of services. As this issue has become significant along with the development of technology, a suitable solution would facilitate the future development of services. Nevertheless, in the case of Mobility as a Service, privacy policy issues would not be a big issue at least in the beginning. The system could be based on an arrangement in which people who want to benefit from individual services and proactive information and guidance could join the system; however, the rest could use transport services separately and pay for the use directly to service producers. However, there could be the concern over inequality or the quality of service in the latter situation. In addition, such separation could lead to several people to give their information as they would desire better service. However, dispensing information to other service providers, such as grocery stores or phone operators, is already rather common.

7 Conclusions

The story about Piritta's day, which was described in the introduction, could become real on account of the transformation of mobility service provision:

> *Piritta boards a tram, alights from it a couple of stops later and hires a bicycle to travel to work. After work, she orders a car of demand responsive transport and travels to the sport hall, where her training equipment already waits for her. Finally after practice, she shares a ride in a shared car and travels home. Piritta uses all services through her personal mobility operator and the use of services is charged directly from her account.*

In 2025, after the transformation of mobility, Piritta might truly act this way. This thesis provides a guideline to successfully perform the transformation.

Passenger transportation is experiencing a serious restructuring. Causes for this are natural trends appearing in the society, such a social change, urbanization, the development of technology, and alternating requirements of people concerning transport. In addition, the scarcity of financial resources, environmental issues, and capacity shortages, due to the increase in the population, push to the transformation. Furthermore, several possible benefits intrigue to further study the potential of the transformation. Possible benefits include new businesses and following export, increased efficiency of the operations and thus decrease in the governmental and municipal expenses of transportation.

The City of Helsinki commissioned this study to discover how the passenger transport industry could be reorganized to respond to the aforementioned challenges and to gain the major advantages. Thus, this thesis describes a scheme in which mobility services are provided as an individual and flexible service in a competing mobility operator market. Such organization of mobility service provision is referred to as Mobility as a Service (MaaS). MaaS refers to circumstances, in which comprehensive supplies of mobility services are provided by mobility operators. Versatile services offered by the operators satisfy all mobility needs, thus decreasing the need to possess a car. The means of ITS contribute to the reorganization. The current organization of the public transport provision does not sufficiently support individual and flexible multimodal mobility, and thus sustainability and the comfort of the city.

This thesis examined previous transformations and views of experts in order to compose a proposal of action for the reorganization of the mobility service provision. The scheduled proposal for action provides the public governance a guideline to transform the industry in 11 years from 2014 to 2025. The City of Helsinki is going to exploit the results and the proposal for action in its further actions and research. Providing mobility as a service is supported by the Finnish Government, and the Ministry of Transport is also preparing a transformation.

However, the risks and drawbacks related to the transformation need to be considered and further examined. These include the uncertainty of the profitability of the market and the establishment of mobility operators, equity, safety and quality of services, pricing, and rebound effects.

This thesis is based on a broad study of former transformations in other industries. In addition, possible risks and drawbacks have been discussed. However, transportation has not yet experienced such reorganization, and some similar reorganizations have resulted in poor conditions. Thus, the exact process and outcome of the planned reorganization cannot be predicted. Nevertheless, the thesis aimed to cover factors related to unsuccessful transformations and differences between transportation and other industries.

The main part of the study examined the transformation of telecommunications. Telecommunication was examined due to its great success, in order to discover the successful patterns of a transformation. In addition, the current organization of the telecommunications industry is similar to the desired one in mobility service provision. Furthermore, the revolution in telecommunications occurred in Finland among the first countries in the world. This boosts the perception that the revolution of transportation could also be experienced in Finland first in the world. Unsuccessful experiences on transformations, such as some railroad, bus, and airline industries, were not extensively covered in this study. Hence, further examination on unsuccessful experiences would provide more in-depth information.

In order to overcome the national and global challenges related to transportation, major restructuring has to be appointed to the industry. The concept of Mobility as a Service provides great potential, and its implementation should be further examined and planned.

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