TELEMATICS IN THE SECOND MACHINE AGE:
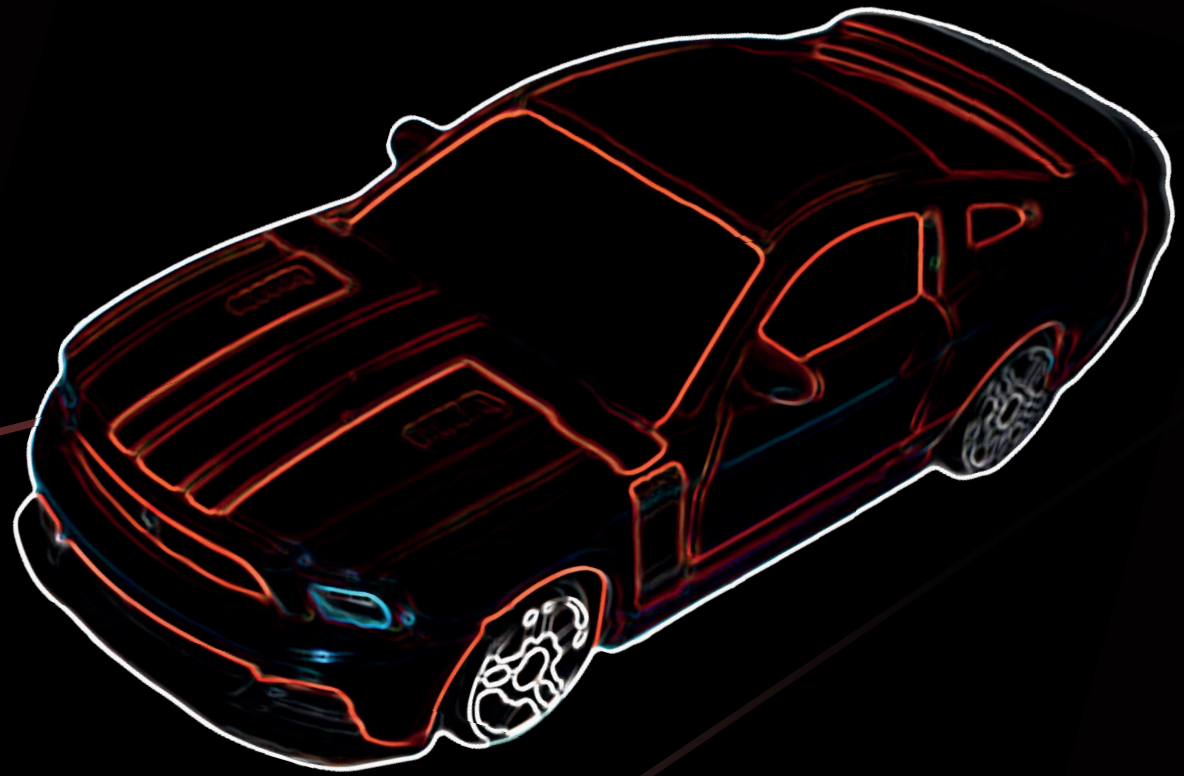
Designing a Novel Business Model for Repair and Maintenance of the Connected Car.

by Andreas Pattichis

Master's Thesis
Collaborative and Industrial Design
Department of Design
School of Arts, Design and Architecture
Aalto University

Aalto University
School of Arts, Design
and Architecture

ABSTRACT

The running decade constitutes a substantial point in time, as digitalization has managed to revolutionize every fathomable industry at an exponential rate. The transition to the Second Machine Age, where machines gradually overpass our mental capabilities, is ongoing and within that paradigm the automotive industry is heavily in focus. From the point of integrating circuits 30 years ago until today, Information Technology has penetrated the industry, and that entails its own opportunities and challenges for the conventions that manufacturers currently practice.

This Thesis aims to provoke the industry by elaborating on a service concept, supported by a new business model for the car repair and maintenance service sector. The reasoning of choosing this specific sector, was to offer a different perspective to the abundance of visions that exist about the future of the car, which only consider the first-hand user, and are mostly used for marketing purposes. Due to the geographical context of the Thesis, the focus market is on the Finnish car market, but the eventual recommendations can be applicable elsewhere as well.

The approach that was used to succesfully carry out the Thesis project, was heavily reliant on an extensive overview of the various enablers of the connected car (ie. telematics), along with a stakeholder research. Car users were approached with a wide-spread online questionnaire, and interviews were conducted with various influential representatives in the repair and maintenance scene. The insights gathered signaled about the changes of consumer behavior in terms of car ownership, and the weakness of having a cost-driven structure in service provision.

Eventually, a design brief and drivers were defined that lead the conceptual phase. In the concept, the vehicle

is seen as a platform that is adaptable to the various ownership modes, provides increased and improved interactions between users and service providers, and has a transparent subscription-based pricing model. The future-driven approach of The Thesis has also given space to provide recommendations to vital players in the scene (service providers, network providers, manufacturers) along with a short iteration on the timeframe.

We're still in the first minutes of the first day of the Internet revolution.

Scott Cook
Director of eBay and Procter & Gamble

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A. Personal Prologue

THIS IS AN EXCITING TIME TO BE A DESIGNER. The role of design is shifting immensely, and focus no longer lies on dealing exclusively with the aesthetics of a physical artifact. Consumerism is always there, but western society is going past it and focuses more on processes, experiences, brands, and the status quo. Design, with its ability to adjust to its time, has become a means to an end of building these experiences, resulting into designers becoming the facilitators of innovative creation and collaboration with and for the people. It is in these premises where this Thesis is positioned.

The foundations of what enables us designers to work on such experience-driven instances lies within design thinking. Tim Brown of IDEO states that design thinking is *"a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity."* With that fundamental way of thinking I explore people, technologies and businesses through discussion, research, and participatory methods, an application of which can be observed in the next pages.

In the exploration of technology, I see myself face to face with amazing challenges and opportunities. Technological advancements are happening today at an immense rate. What could only be imagined a few years ago, is already out in the market today. The future is a very exciting time right now.

What you are holding in your hands is the result of exploring the past, the present, and the future of technology and people. Mobility is at the core of the topic, with a focus on the automobile industry that after centuries of steady growth is now called to enter a realm that has not been possible before, in the appearance of the second machine age. Mobility is merging with connectivity, and within that merger, vehicles are becoming platforms for both. They are retrofitted with 100s of computing units, which have gradually and unknowingly entered the industry in a whole new world to which a response needs to be made to sustain the industry succesfully.

Visions have started to appear in the recent years, as a result of experimentation and curiosity. Manufacturers, researchers, and futorologists, have all made their contributions in search of promises and exciting opportunities. Today, though, lost in the plethora of visions the Thesis is aiming to take the next step by providing a concrete concept where key elements are put together

to enable a novel interaction and business model with a secondary stakeholder in the bigger picture: the car repair and maintenance service sector.

The topic was initially provided in 2014 by an agency that I was involved with, but as financial factors did not allow for a longer collaboration, the topic took a different path through personal interests to the topic, driven by what I wanted to learn. Designing an interactive solution for a secondary stakeholder, has had its challenges due to a lack of academic references. The latter, though, gave me the opportunity to provide an academic substance to the topic by involving experts from different parties surrounding the sector in question. The stakeholder research provided a very coherent, grounded and concrete picture of what was happening. Shifting between the bigger picture and the smaller details, takes place on several iterations throughout the following pages.

The final result is an overview of a service concept based on the design brief and drivers that were defined throughout the research phase. The concept is supported by a brief backcasting exercise, where essential steps in realizing the concept are identified.

Enjoy the journey and welcome to the future of maintenance.

– Andreas Pattichis, 2016

INTRODUCTION

1

Seamless syncing. Image courtesy of IDEO (c) 2015.

1.1 Quick Peek to the Future

IMAGINE ENTERING your car on a day like every other, but instead of starting the vehicle yourself, it takes off on its own and knows exactly where to go based on your calendar. Being able to work on some finishing touches of your morning presentation becomes the norm as you do not have to pay full attention to the road. You see your colleague driving too on the way and he appears on your screen, and start talking about the agenda of the day as both of your vehicles are linked on the road and cruise at the same speed. (IDEO, 2015.) This is what the future of driving could look like, and is just one of the many visions existing today on how mobility could evolve and revolutionize our lives.

Whilst visions are usually based on the mere fiction of the ones who develop them, or on trend and forecast reports, the car industry has been able to showcase already today the feasibility of such solutions. With Google working on the driverless car and having achieved already 1,1 million kilometers of accident-free driving on its prototypes, along with an endless list of other developments, the future seems to be closer than what one can think of (Anthony, 2014).
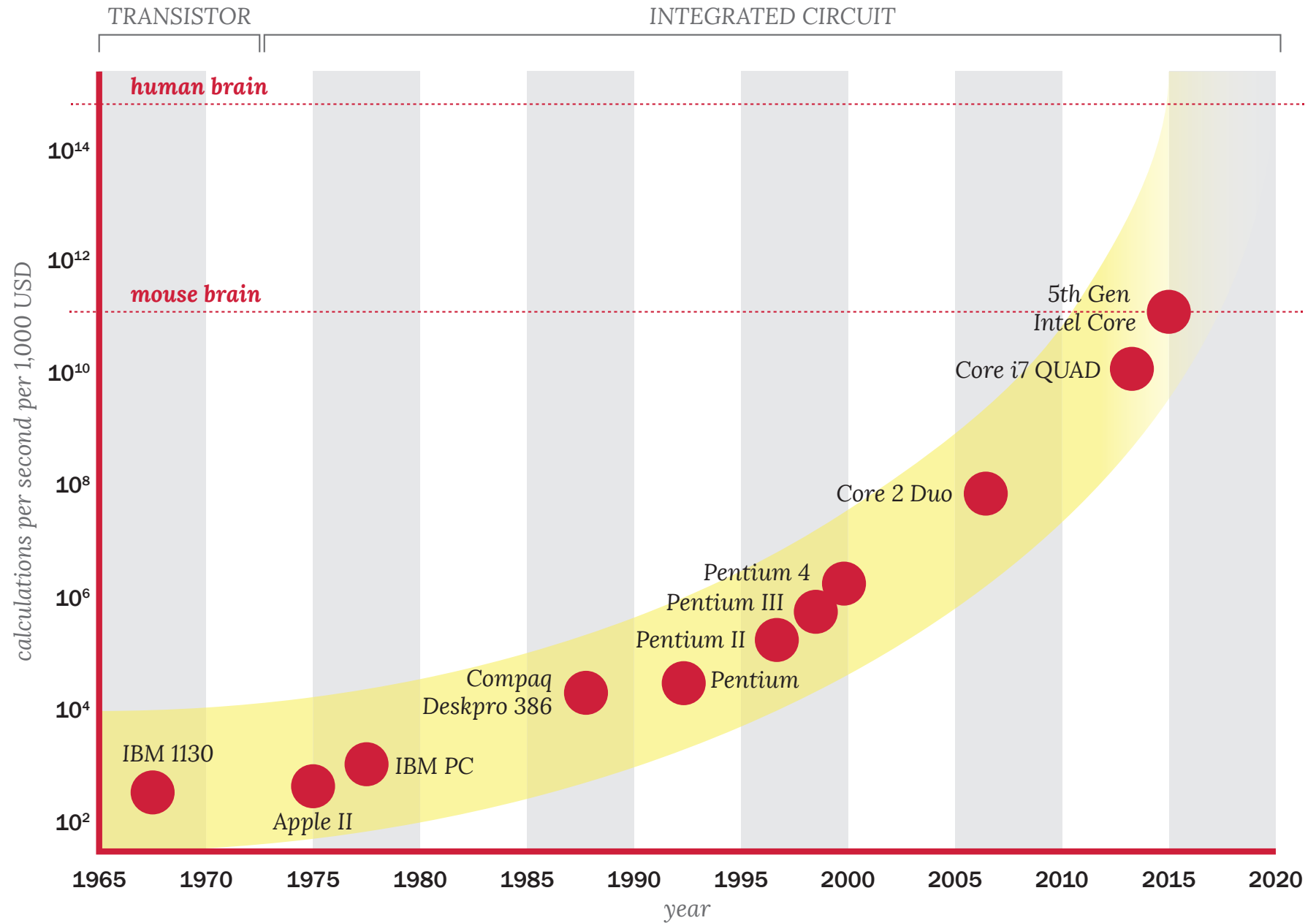
The automotive industry is one of the many technology-based industries that have entered the so-called **"Second Machine Age"**. When the Industrial Revolution took place, and specifically when James Watt introduced his steam engine in 1775, it allowed society to overcome human

and animal power, and produce massive amounts of energy to accommodate the needs of factories for mass production. That time marked the first machine age, when machines surpassed the physical human capabilities. Upon the introduction of the computer in the 80s', it started to pave the way for the rise of the *second machine age*, which refers to overcoming the human *mental power*, meaning the ability we have to understand and create our environments. Technology is becoming smarter at an increasingly high pace, and it easily marks the beginning of a new and exciting era for society. (Brynjolfsson & McAffee, 2014.)

The driving force of this rapid development is well stated in what is known as Moore's Law which is rather more of an observation than a law, but has been able to stand true for decades. Gordon Moore, current co-founder of Intel, published a prediction in 1965 about the development rate of integrated circuits. The prediction stated that with the same cost, the integrated circuit computing power would increase by a factor of two annually. This means that with one dollar you could buy twice as much power today than the year before. This prediction was based on

the observation of the time, when for the three preceding years prior to the publishing, this trend would apply. In 1963 one dollar bought twice as much power as in 1962, and the capacity would constantly double. Moore's Law has been able to stand true until today. (Brynjolfsson & McAffee, 2014.)

The passing of decades, and Moore's Law advancing at a steady pace, has resulted to what is mathematically referred to as **exponential growth** (see Fig. 1.1). When constant doubling takes place for a sufficient amount of time, the latter numbers become overwhelmingly larger than the previous ones, making the initial doublings seem ineffectual. This is exactly the case with integrated circuit power; the development in the beginning was somewhat gradual and eventually evolved rapidly into technological platforms on which artificial intelligence can be now built on. As exponential growth continues to happen within the next years, keeping true to the fundamentals of Moore's Law, sufficient developments are expected to happen in the very near future. (Brynjolfsson & McAffee, 2014.) We, as designers, need to respond and plan fast to utilize the benefits from these developments, but also to be prepared

TRANSISTOR   INTEGRATED CIRCUIT

calculations per second per 1,000 USD

human brain

10^{14}

10^{12}

mouse brain

5th Gen
Intel Core

10^{10}

Core i7 QUAD

10^{8}

Core 2 Duo

10^{6}

Pentium 4
Pentium III
Pentium II
Pentium

10^{4}

Compaq
Deskpro 386

IBM 1130

IBM PC

10^{2}

Apple II

1965   1970   1975   1980   1985   1990   1995   2000   2005   2010   2015   2020

year

for any negative impact they may have in a sociopolitical context.

Within the next chapters, the aim is to provide an overview of the timeframe of the automotive industry from its very beginning to how it has managed to radically alter urban infrastructure today. The automotive industry has a history that dates all the way back to 1763, despite it having a stronger presence in the modern society much later in the 1900s. The historical reference is firstly to provide a foreground to the topic in general, and to partially prove the validity of Moore's Law as integrated circuits were introduced in automotive manufacturing over 30 years ago. Car electronics have been pushed into a cycle of exponential growth, resulting to what we see today in headlines on driverless cars and other developments. In addition to these advancements, manufacturers are required to commit to an average of 50% of fuel efficiency, and simultaneously provide innovations that improve the driving experience (FiA Foundation, 2016). A combination of these factors results into massive investments to be made in cutting edge technologies, where agility inevitably is going to have a substantial role.

Agile and smart technologies eventually become the main focus of the Thesis, through an elaboration of a virtual phenomenon known as the "Internet of Things" and how it correlates to the car industry. What is later on within the text referred to as the Connected Car, is merely a natural evolution of automotive electronics subject to Moore's Law within the wider context of technological developments that are taking place. The car, that has played a substantial role in people's mobility, is found under the spotlight once again in revolutionizing how people travel. As vehicles become virtually smarter and environmentally-friendly, as explained later on in the text, they are transformed into products of immense complexity. In this time of perplexing change, it is imminent that all surrounding industries, from trading to insurance, are forced to adapt but also utilize to what this shift has to offer. It is within that paradigm where this Thesis is positioned.

1.2 Not Another Vision

BY SIMPLY performing a quick Google search on "future car", one would have to face going through a total of 791 million results (28. Feb 2016). The fascination around the topic is evident, with almost each major car manufacturer publishing their own visions on their own future, and consulting agencies of the likes of IDEO working on the topic as well.

Visionary work is important as it is used to define strategies and steps that need to be taken. Some of that visionary work, especially by GSMA (worldwide association of mobile operators), is used for the purpose of this work. In addition to that, though, this Thesis is not aspiring to add up on the redundancy of visions on what a car will look and behave like in the future. There is already substantially stunning findings made in that domain, to which some references are made all across this Thesis document. What this Thesis is particularly targeting to, is to get closer to the layer in the periphery of the sector to serve players that are affected by the evolution of the car, and specifically the **car repair and maintenance scene**. The latter plays an important role in sustaining and lengthening the lifecycle of any vehicle, which also supports sustainable automotive development.

Many of the visions available today are focusing naturally on the car itself and what features it may include, and are primarily developed for marketing use. Minimal contributions are made though in defining the future of secondary sectors affected by these new possibilities and limitations. Naturally, as the Thesis is approaching the future, visionary outputs are inevitable, but the intent is to provide more than just marketing material and offer something that would be of strategic use to this vital sector of car repair and maintenance.

1.3 Research Questions

DEALING WITH a topic as vast and immense as the car industry, some precise research questions had to be set to limit the orientation of the research from the very beginning. These aim to provide the foundations needed in moving forward with the realization of the project, thus their importance along with the results of the research itself, is evident.

The questions were designed in a way that provides a sufficient focus, without though excluding a holistic perception on the car industry itself. One of the objectives of the Thesis is to provide more of an overview of what is happening in the car industry, instead of actually contributing directly to it. The contribution of the Thesis is in providing an input on how the car repair and maintenance service sector needs to adjust its offering to stay ahead of its time in the rapidly changing scene of automotive development and production. The concept that was built later on aims exclusively to serve as a provocation to the vital stakeholders who operate in conventional ways.

What technological developments are affecting the car industry in the future?

Due to the future-driven approach that this Thesis is embarking on, it is essential to research and gain an understanding on how technology has evolved in vehicles, and which are the upcoming developments that will inevitably influence the experience of driving and mobility in general.

In addition to the research question, the most relevant **Thesis questions** are specified separately as they heavily drive the core of the project in its entirety. By finding answers to these questions, the design drivers can be assigned based on which the design decisions can be made.

Thesis Question 1:
Who are the stakeholders that have the power to influence the car repair and maintenance sector in the local scene?

Thesis Question 2:
Which are the pain points and opportunities that these stakeholders can identify from their own perspective in terms of repair and maintenance service provision in the country?

As the focus eventually leads to the elaboration of a concept that is appropriate for the Finnish market, it becomes essential to grasp an understanding of which are the organisations and people that have power in deciding and influencing how the sector operates in the local market. Through the identification of these stakeholders, and as the lack of academic references would later on suggest, the drivers begin to heavily depend on the perspectives of these stakeholders on the pain points and opportunities that the repair and maintenance service sector in the country is currently facing.

THE EVOLUTION OF CARS

2

Crash into the wall. Image available in public domain.

2.1 Establishing the Market in the 18th Century

WHEN ONE THINKS about the automotive industry, it is unimaginable for the modern citizen to grasp how the world would be without cars. Cities all across the globe have infrastructures designed to accommodate the needs of pedestrians, cyclers, transport, etc. but are defined primarily by the road networks constructed mainly for the daily use of cars. Looking back, though, in the evolution of the auto vehicle we can observe a transition that lasted almost three centuries which started off at a point in time when carriages and the rail network were the only means of transporting people and goods. (Wolf, 1996.)

The first vehicle ever to appear was steam-powered and was constructed in 1763 by the French engineer N.J. Cugnot for the purpose of providing a solution in carrying ammunition. Three years later, an improved model carried out its first tests in the French narrow roads. The challenges in controlling the vehicle, resulted into breaking a wall and any further development were prohibited. No significant developments happened until the end of the century. (Wolf, 1996.)

In 1801 and a bit further away, in England, Richard Trevithick introduced the first roadworthy steam-powered car which impressed people with its ability to drive even in steep road conditions. Shortly after, in the 1830s, steam-powered coaches and buses appeared along with the

establishment of bus companies. The private monopolies on the railway, and the decision-makers behind it, felt threatened by these developments and managed to convince the British parliament to introduce restrictions to the steam vehicle. Back in France, though, the exceptionally good condition of the public roads allowed eventually for growth in the usage of steam busses. (Wolf, 1996.)

It was realized quite early on, that steam was not the ideal way to power up a vehicle that undergoes sudden changes in cruising speeds. This observation led to a breakthrough in France in 1860 when the first combustion engine powered by lighting gas was introduced, and thrilled various engineers in Germany who had simultaneously delivered improved variations of the engine. Later on, by the end of the century, petrol though became the ideal format to fuel the engine. (Wolf, 1996.)

At the turn of the 19th and 20th century, the United States joined in the game with Henry Ford playing an important role as he devoted himself to the car business. In 1905, the Model 999 proves to be the fastest car yet (compared to the ones developed at the time in Europe) and the first Ford plant was established shortly after. Within just one year, 1.708 cars were sold, which even though was a significant amount, was not enough for mass production. At the time the ownership of a car was a luxury that only the elites were able to afford. Ford's vision, though, was to make a "car for the masses" and by 1910 the prices of cars dropped significantly. 45.000 cars were sold and assembly-line manufacturing was possible and finally realized in 1914. By the 1920s, other companies introduce mass production of cars, which enabled healthy competition in the field and a financial boom was seen in investments in the surrounding industries, such as oil, chemicals, and rubber among others. In the next 30 years, the U.S. saw a great rise of the car, and in 1950 the 50th million car was registered despite the harsh conditions at the time. (Wolf, 1996.)

2.2 Car Market Development in Europe

BACK IN EUROPE, the development of the auto industry had a slow start compared to the one in the United States, undoubtedly also because of the differences in the scales of the markets. A major financial crisis and two World Wars did not allow for private transport to thrive as it should, with the only exceptions being France and Britain, as mentioned earlier. In the rest of Europe, the car was slowly introduced through military variants of the car such as trucks, tanks, jeeps, etc. Germany played an important role in the expanded use of the car, through a military-oriented strategy introduced by Hitler and the Nazis. The rail networks were militarized completely during the World War II, which even though underwent a massive development doubling the size of the track total, people were not transferred at all by 1943, with the Holocaust as the only exception. (Wolf, 1996.)

As the rail networks were exclusively militarized, simultaneously the Nazis invested immensely to the development of the private automotive industry. An event of vital importance was the speech held by Adolf Hitler at the International Automobile and Motor Cycle Exhibition in Berlin where he presented a detailed plan on the motorisation of the people. Hitler had suggested to reduce transport tax and deduct the tax entirely from new car purchases standing strongly on his vision of "volkswagen", the people's car. The vision was based on his public stance on how it provides a sense of freedom even for individuals with restricted possibilities (blue-collar workers). Eventually the legislation passed already in 1933, which also marked the establishment of the Reichsautobahn Company and soon after an Austrian engineer, Ferdinand Porsche, was assigned to design a new small car fittingly named as "Volkswagen". (Wolf, 1996.)

What many failed to realize at the time, the incentive of pushing an agenda focusing on the strong establishment of civilian car ownership, never ceased to be driven by the militarisation of society. The motorisation of roads and rapid transit routes that were constantly developed, provided the foreground for a new war of aggression. Even the specifics given to Porsche were determined by military interests, where he was asked to focus on universal

operability, road clearance, cross-country mobility, minimisation of wear and costs, low energy use, and space for 3 adults and 1 child which translated, in military terms, meant for 3 men and 1 machine gun. (Wolf, 1996.)

Eventually when the World War II struck, several car manufacturers rapidly shifted their focus to war machinery. There were strong financial incentives contributing to this shift with companies such as Daimler and BMW noticing an increase of up to ten times in turnover by 1945, when the war ended. Right after the war, manufacturers returned to civilian manufacturing, making cars that were improved based on the know-how acquired during the war. One success story at the time is the Beetle car by Volkswagen, which was inspired by its military equivalent, the Kubelwagen. (Wolf, 1996.)

In its post-war era, Germany had inherited a road network of 350,000 km which was improved and expanded even further, whereas the rail network started to naturally decline partially because of the division of Germany at the time. By the 1960s' the civilian shift from rail to road was evident and within a decade, the German roads witnessed an increase of more than 13 million cars, which opened up the path for mass motorisation. An essential benefactor of private transport was also the taxation system introduced at the time, as roads were constructed and improved with finances of the public, whereas the burden of financing the rail network still primarily landed in the responsibility of private companies. As the train succumbs to this decline, eventually the car became a necessity in order for people to go about with their lives and needs for flexible mobility. The shift was inevitable. (Wolf, 1996.)

Germany's role in the expanded use of the car in Europe was vital but not exclusive. In the rest of Europe, several other developments took place which contributed to the car dominating street views all across the continent. The Group of 7 – or G7 – that included the ministers of the world's most advanced economies, placed the motor industry and all related sectors at the focus of economy in the 1970s', which played an important role in the further advancements made in the field. As motorisation was promoted as a way of life with most European states subsidising road construction, the G7's European member states follow the examples of Ford and Volkswagen by
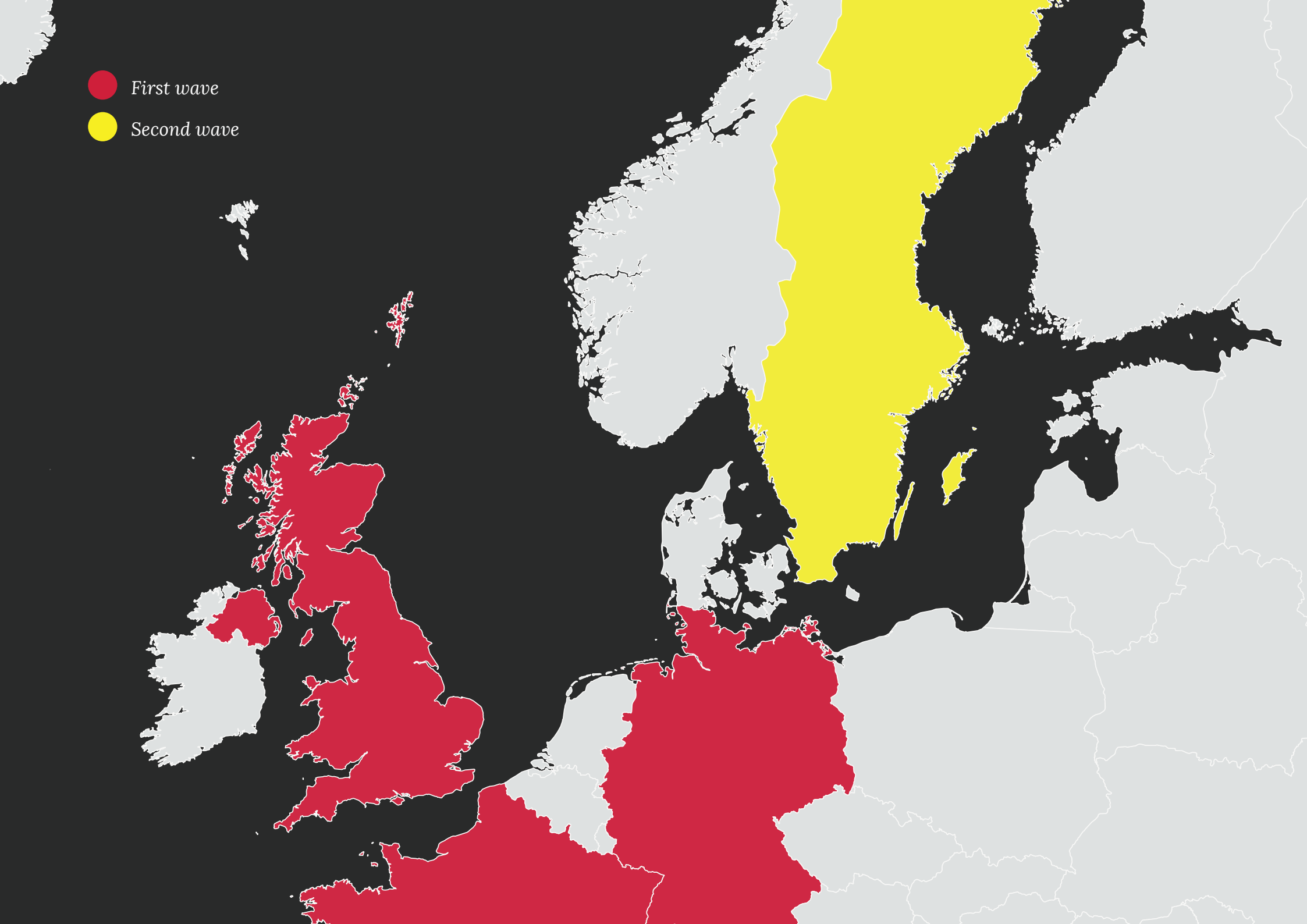
introducing their own versions of the "people's car" and thus establishing indigenous car industries. In France the Renault R4 and Simca 1000 is created along with Italian Fiat 500/600 and British Mini. Sweden also joins in the competition through Volvo. From the mid-60s' we observe a high motor density in Sweden, France, Britain, Germany, Switzerland and Italy and eventually in the 90s' all major European countries reach a saturation point of 500 cars per 1,000 inhabitants. (Wolf, 1996.)

Simultaneously, rail travel underwent both negative and positive developments. It is interesting to observe how despite the decline of rail transport of goods due to the lack of investments needed, rail travel continued to grow but at a much slower pace than individual travel by car. Britain, Germany, France and Italy had the greatest decline in rail transport of goods, but individual rail travel did grow slowly. Switzerland, Austria, Holland and Denmark took great pride in their public transportation policies as a response to the lack of a strong car lobby and indigenous car industries, but eventually the car-boom was observed all across Europe, including Finland, and even in weaker economies such as the ones in Portugal, Spain and Greece.

In other words, the car penetrated the entire continent but at different times in each country depending on the presence – or not – of an indigenous car industry and the overall development in the national economy. The rail continues to exist, even up to this day, but mainly for the transport of people for long distances and large freights. (Wolf, 1996.)

Despite the vision of creating a car for people's mobility needs, interestingly enough it was the car itself and socioeconomic developments that eventually increased the need for mobility and submitted urban developments into road-constructing loops. At a time when motorisation was not present, people used to live and work in smaller urban centres, but through a temporary advent of public transportation it allowed people to live further away. As the car was introduced into people's lives, and public transportation was not able to keep up, we notice a displacement of urban populations resulting into longer distances that at many cases could only be covered with a car. In the 1960s' centres were taken over by businesses, and large-scale road construction and expansion took place. Populations eventually fled to the suburbs, creating

even longer travel distances. As city centres were not able to accommodate any more businesses, shopping malls appeared on the outskirts followed by facilities of larger corporations. Cities began to expand non-stop which meant that a longer distance needed to be covered for a casual break in the suburbs which was a very common activity for car owners in the weekends. Soon enough, cities became extensive road networks, which later on contributed to how cars are used today mainly for shorter distances within the urban environment. Streets, that were once lines for communications are becoming lines of division, and urban streets gain more and more lanes. Finally, the car becomes a symbol of freedom and high status, which were elements that overpowered the impracticality of traveling short distances and having to hassle with traffic jams and parking. Cars are now everywhere, and with urban developments made to support its extensive use, very little could be done to reverse any of the negative outcomes of motorisation. (Wolf, 1996.)

2.3 The Modern Vehicle Market

THE EUROPEAN MARKET is an influential car market on a global scale. According to ICCT (2013), in 2012 alone the total sales in all member states exceeded 12 million vehicles, which represented a share of 15% of the global vehicle market. These figures are expected to grow inevitably on a global scale, and forecasts show how sales will surpass 100 million vehicles by 2018. The biggest growth is expected to happen in developing markets such as the ones in Brazil, India and Russia. (LeBeau, 2014.)

Even though the market growth focuses in developing economies, it goes without saying that sales will continue to thrive globally, though the behavior of consumers regionally does vary. An interesting observation is how ICCT (2013) marks 2010 as the best year for Europe alone in vehicle sales for the running decade, even though on a global scale that was not the case. For this Thesis the focus is more on the European market on a generic level and how it affects and compares specifically to the Finnish market.

Finland, due to its small population, represents only 1% of the European vehicle market according to ICCT (2013), but the scale of the total turnover is around 15 billion euros today annually as stated by the Official Statistics of Finland (2012). On average 8,500 new cars are registered every month, with January being consistently busier with registrations after Christmas. By the end of the calendar year 2013, 3.13 million passenger cars were registered out of which 2.6 million were actively used leaving 530,000 passenger cars inactive in the Finnish roads. Registered cars overall in mainland-Finland have an average lifetime of 13.1 years, whereas active cars specifically have a smaller age of 11.2 years in average. The ones that remain inactive – yet still registered – reach the average age of 22 years. Regionally, Uusimaa (South Finland) has the youngest car fleet and North Karelia the oldest. (OSF, 2014.)

Conclusively, a great majority of the cars that are currently in traffic use have been manufactured in the 2000/2010s', which is an important consideration to keep in mind for the Thesis project and the technological possibilities within various timeframes set in the future.

12,000,000

annual vehicle sales

15,000,000,000 eur

annual turnover of the Finnish vehicle market

13,1 years

average lifetime of a car in Finland

2.3.1   Sustainable Developments

ALONGSIDE the growth of the vehicle market, one cannot ignore also the negative implications it may have for the environment and the way cities are built for living. For that reason, various decisions and checkpoints are made on the political layer either at a European level or within individual municipalities. Simultaneously, Electronic Vehicles (EVs) and hybrids that operate exclusively, or partially, on clean electric power are gaining a stronger presence on the streets. Manufacturers constantly aim to innovate in a sustainable manner due to the rising price of gasoline within recent years.

In 2009 the European Commission has introduced legislation that sets targets for carbon dioxide (CO_2) emissions from cars. Specifically, the fleet average for all new cars phasing in from 2012 and by 2015 must reach a limit of 130 g of CO_2 per kilometer, and later on in 2021 (and phasing in from 2020) a limit of 95 g per kilometer. In order to provide an additional incentive for successful fleet replacement, most Member States – including Finland – have introduced a transport taxation system based on

the average fuel consumption of a vehicle. Additionally, the European Commission itself submits manufacturers to a penalty fee on each registered car in the case its fleet exceeds the required average target. (European Commission, 2014.) An interesting observation is that the majority of new cars being purchased in Europe are powered still by diesel (55%) or gasoline (42%) motors, leaving only the rest of 3% for all other technologies, including EVs and hybrids. That smaller market, though, is slowly growing and has been already embraced more in specific countries over others such as in the Netherlands where hybrids count for 4.5% as part of financial incentives introduced by the local government for low-emission cars. In the U.S. and Japan, hybrids count for 5% and 20% respectively. (ICCT, 2013). On these grounds, one can conclude that these novel technologies are gradually gaining a bigger market share, the growth of which is already evident.

At a municipality level, some cities are realizing that the ownership of a car in an urban environment is becoming redundant. Policies and infrastructural changes are slowly being introduced that favor public transportation and

aim to eventually reduce the use of personal cars. Such policies range from removing cars in neighborhoods with fines in Barcelona, or even by offering free transportation vouchers to citizens in Milan who choose not to travel by car. Car-free urban living is a major topic of discussion in the political context and more European states and cities are embracing it. Helsinki is not one to be left out of this equation, which is aiming to make the car unnecessary by laying out an infrastructure where smaller walkable hubs are interconnected with quick public transportation and by introducing mobility-on-demand services. (Peters, 2015.)

As analyzed later on in the Thesis, these sustainable developments are going to affect the industry at a large scale. Even though cars will continue to be of use, major changes are taking place in terms of social behavior and needs for adjusting to changing requirements.

2.4 The Automobile in Finland

FINLAND SEES its first cars in 1900 when Chamberlain Hjalmar Linder and businessman Victor Forselius purchase the two first cars that were to roam within the country. The year 1907 marks also the time when the first driving license was granted, simultaneously establishing the vehicle register of the country and by the 1920s 1,800 automobiles are registered. The vehicle market underwent a substantial boom but was heavily stalled by the Winter and Continuation Wars (after 1939) when the car stock decreased from 29,000 to 6,230 in a rather short timeframe. By 1945, though, the passenger car market started to grow again and in 1976 Finland reached its one million mark, despite the Energy Crisis of the 1970s. The two million mark happened some decades later in 1998 and today there are over 3 million cars. (OSF, 2007.)

From the first 14 kilometers of motorway opening up in 1963 to the total of over 800 kilometres existing today within the wide road network of 78,000 kilometres, we observe a traffic performance that exceeds 37,000 million automobile kilometres annually. Despite the small population of the country, huge distances still need to be covered, though the biggest traffic frequency in the country appears within smaller regions around Helsinki, Turku, Tampere, Oulu and Kuopio. (Finnish Transport Agency, 2014.)

Car repair and maintenance is closely tied to the motor vehicle trade of Finland and represents a total of 26.8%, or 4.1 billion euros, of the total annual turnover. The commerce is divided into three main industries: wholesale and retail trades of motor vehicle parts and accessories (product-oriented) and maintenance and repair (service-oriented). (OSF, 2012.)

1900
first cars appear in the country

1907
first driving license is granted

1976
one millionth car registered

3,000,000+
number of cars registered today

78,000 km
total length of road network

37,000,000,000 km
annual traffic performance

INTERNET OF THINGS & THE CONNECTED CAR

3

3.1 The Internet of Things

AT THE TURN OF THE MILLENNIA, and with motorization well established across most of Western society, another revolutionary technology inevitably enters the automotive industry. The Internet has truly revolutionized the way people educate, communicate, trade information and operate businesses. The development of technology has allowed for more affordability of computers and appliances, while simultaneously connection speeds have increased to the point where today one can easily download massive amounts of data within a day. Since the beginning of the new millennia, society's dependence on the Internet has grown, especially after the appearance of smart phones in the market, which allow us to stay connected around the clock. The end of the first decade of the 2000s' marked the beginning of a new significant era known as the 'Internet of Things', otherwise abbreviated as IoT.

The conception of IoT is considered to have happened in 2008, when statistically – for the first time in human history – there were more devices and appliances connected to the Internet than there were people on the face of earth. By 2010 more than 12,5 billion devices were reportedly interconnected devices. By 2020, 50 billion devices are expected to be connected aiming to bring forth a modern revolution of connectivity since the appearance of the Internet. IoT is now a reality, and we are all experiencing it the more we move about with our lives and routines. (Evans, 2011.)

As the name suggests, IoT is a phenomenon of the digital society, in which Internet is no longer something that one is able to only have access to through a computer. The low costs of producing the equipment needed to connect to the Internet, by utilizing wireless technologies, has provided space for innovations to happen in various industries. The data implemented in these applications are gathered in the so-called 'clouds', which are virtual servers accessible at all times wherever an internet connection is possible. These applications could be applied in industries ranging from fashion to security. (Evans, 2011.)

Evidently, as the car has become such a huge part of our everyday lives, the automotive industry has definitely not

been left behind in being exploited by IoT. Cars, or any other means of transportation, can also be a means of gathering data before, during and after use. The type of data can be relevant to their use environments, diagnostics and even the behavior patterns of the drivers themselves. A car can generate up to 25 MB of data an hour, and all that information could be accessed through a 'cloud' server and applied for other uses and services. (Dezeen, 2014.)

The huge potential of the Connected Car has pushed the GSMA, an association of up to 800 global mobile operators, to establish the Connected Car Forum. The Forum is not only a platform for automotive producers and mobile operators to operate jointly, but also an essential player in the growth of this market through an extensive network, know-how and investments in the field. The Forum includes the likes of Orange, Vodafone, Audi, Honda, and Mazda among many other big players in this joint scene. (GSMA, 2014.)

The GSMA is aiming to push over 20% of global vehicle sales to include exclusively embedded (ie. fixed to the car already during the production phase) connectivity

solutions within 2015. Simultaneously the aim is to reach a percentage of over 50% for connected solutions in general, that vary from embedded to tethered (using external post-manufactured technology) connectivity and smart phone integration to the use of a car. Subsequently, in 2020 the aim is a whopping 75% of global vehicle sales to include embedded technologies and finally in 2025 every car on the street, ideally, will be connected in various ways paving the path for new business models and innovative services to be introduced to the consumer market. (SBD, 2012.)

A dominant example of tethered connectivity today is through the OBD-II port of a car, which is situated under the steering wheel of every car that was sold after 1996. OBD, which stands for On-Board Diagnostics, is mainly used for emissions testing and to quickly acquire error codes directly from the vehicle in order to fix it accordingly. Even though the OBD-II port was primarily designed for the exclusive use of technicians and professionals, devices have existed for consumer use already in the 2000s' that remain constantly connected to the car even during use and logs all the data to observe driving patterns, behaviors, fuel consumption and even

distances and routes alongside the popularization of GPS (Global Positioning System) technology. (Goodwin, 2010.)

As the Connected Car is becoming a reality we observe the introduction of several product-service hybrids that utilize OBD-II to provide a service that a consumer would even be willing to pay for. An example is Zubie, which provides several features through a smartphone app, such as location tracking of other vehicles, warnings on various car alerts, safe driving coaching and others (Zubie, 2015).

3.1.1   Finland and IoT

In 2008, on the verge of the rise of IoT, the Ministry of Transport and Communications in Finland introduced a strategy, which aimed to provide a 100 M broadband connection as a legal right for all citizens across the land by 2015. In 2009, the Ministry had already passed a law for the right of access to 1 M broadband connection as an intermediate stage of the strategy. Finland is the first country in the world to introduce broadband connections as a legal right, a fact that has intrigued media on a global scale. (BBC Tech, 2010.)

Finland is known for the investments that take place in technology with numerous examples varying from former Nokia, Rovio Entertainment and the Slush Tech Startups. Businesses constantly appear and grow through a solid understanding of the consumer and business value that one can have through the possibilities pertained by IoT. One of the country's Strategic Centres for Science, Technology and Innovation known as DIGILE, aims to increase the development of digital businesses in Finland. DIGILE's IoT unit's mission is to establish the Finnish Information and Communications Technology (ICT) sector as a leader in the IoT domain by 2017. The ICT-ecosystem of the country with an extensive know-how, education and network of professionals are definitely strong foundations to realize that mission. (DIGILE, 2014.) This Thesis aims to contribute also to this goal.

3.2 Telematics

A fundamental part in delivering digital services to automobiles are telematics. By definition telematics *"is the wireless connectivity established between passenger vehicles and infrastructure whether it is machine-to-machine, machine-to-human or direct to the cloud"*. The earliest known form of this technology is the AM/FM radio device that is still embedded in most vehicles. Recently, though, telematics has taken up on a different level that demands various connectivity technologies, such as Bluetooth, Wi-Fi and 3G/4G connectivity which are gradually being introduced by default in newer vehicles. (iSuppli, 2011.)

One of the current issues in enabling the viral effect of having a truly vivid network of Connected Cars is the lack of network operators actually offering specialized plans that would support further expansion of the technology. The only exception, at the time of writing, exists in the USA where AT&T, a nationwide operator, announced that subscribers may add selected cars to their "Mobile Share Value" plans for 10 USD/month (Maisto, 2014).

One of the greatest challenges in bringing the amazing possibilities pertained by the IoT, and the Connected Car, closer to the consumer is the current Subscriber Identity Module (SIM) technology. SIM cards, which are placed in mobile devices that allow access to an operator's network coverage, cannot offer a seamless and uninterrupted connection to the Internet. "Things" and cars tend to move along longer distances, either while being used or for logistic purposes, where the coverage of various operators change constantly, yet a standardized solution is needed across all spectrums. Additionally, in some applications, physical access to the SIM-card reader may be a challenge to provide. (GSMA, 2013.)

The GSMA, as the forerunner of IoT, is aiming to attend to the aforementioned issues by introducing the Embedded SIM, which does not require physical access to switch between operators as the change may happen "over the air". Even though it is not going to replace the well-established pluggable SIM, it will enable the creation of a new ecosystem that will alter and challenge the way in which certain services and features are offered virtually, along with new business and pricing models. (GSMA, 2013.)

A contemporary telematics application introduced in 2012 by the European Union is the eCall initiative. eCall, which is short for Emergency Call, is a platform that is triggered in the case of a severe crash. Even if the individuals on-board are unconscious, a set of data is automatically issued to the nearest provider of emergency services, including the exact location where medical attendance can then be dispatched (GSMA mAutomotive, 2012.) This automated process is estimated to reduce the response time down to 40% in the countryside and 50% in urban areas. The quicker response will, ideally, result to a decrease of road deaths by saving thousands of lives in the EU. It is to be noted that the proposal is valid at the moment only for newer models, and the deadline of applying the technology in new car models is by March 2018. (Vilkas, 2014.)

Despite that, it goes nevertheless without say, that the industry is already at a point where Original Equipment Manufacturers, or OEMs, are obliged to include Telematics Control Units on newer equipment and naturally to new vehicles. (iSupplii, 2011.) Additionally, by politically enforcing this, mobile operators and Member States are also required to execute certain deployments in the near future, therefore ensuring that the needed viral effect will take place, which in turn will allow for a new generation of telematics to take place. (GSMA mAutomotive, 2012.)

Other examples of telematics range from safety and security to information and entertainment, or infotainment as it is characteristically known. The simple application of being able to remotely unlock the door, to using GPS technology for navigation and remotely monitoring your vehicle are all summed up into what constitutes the ecosystem of telematics and its evolution. (InCode Telecom, 2001.) Ernst & Young (2014) services has published a blueprint on Telematics 4.0 as the naming for the newest generation of telematics for "seamless integration of mobility and the web". The evolution is represented within 3 preliminary stages as shown in Figure 3.1. The blueprint refers to an ecosystem structure which includes two primary layers that are to be considered for service delivery (What and How?).

Telematics 1.0 :: Hands-free calling and screen-based navigation

Telematics 2.0 :: Portable navigation and satellite radio

Telematics 3.0 :: Introduction of comprehensive connectivity to the vehicle

Telematics 4.0 :: Seamless integration of mobility & the web

by 2025

today

What are the telematics end-services?

Vehicle-independent services

On-demand entertainment   Navigation

Vehicle-centric services

Safety and Security   Diagnostics

Vehicle-to-vehicle   Other services

How are telematic services offered?

Service Delivery infrastructure   User interface

Customer support   Wireless network (connectivity)

STAKEHOLDER RESEARCH

4.1 The Next Steps

WITHIN THE PREVIOUS chapters, the Thesis aimed to set the pretext and offer a comprehensive analysis of the derivatives and developments of the automotive industry. After gaining a historical understanding of the importance of the auto vehicle, and connecting that to other developments taking place evidently in the technology sector, it is safe to say that the timing of this Thesis is appropriate. Considering the abundance of information existing out there, it is essential for a design project to establish a clear focus, and that was made possible through an in-depth analysis of various stakeholders.

A vital part in defining the specifics and the design drivers of the Thesis topic was to initiate a discussion with essential stakeholders within the field of the Finnish automotive repair and maintenance industry. Due to the nature of the industry and its comparably small size in Finland, purely local academic references are non-existent (Lindström, 2014). Despite the challenges it pertained in gaining a proper academic understanding of the local scene, it also provided the opportunity for this Thesis to

make a solid contribution in the academic stance of the field within Finland. The involvement of stakeholders took place primarily through an online questionnaire aimed at users and non-users of cars and through insightful semi-structured interview sessions with a number of key members of the community. The insights gathered through the stakeholder involvement played a great part later on in defining the direction of the Thesis topic, as it is also required to do so within the user-centered approach in applied design thinking.

The interview targets were chosen after an elaborate consideration of various organizations that play an important role in shaping up the future of car repair and maintenance in Finland. Volkswagen Center (VW Center), the official retailer of Volkswagen vehicles in Finland, provide among others repair services as part of their after-sales offerings. Volkswagen has a good brand reputation in Finland, proven also by the fact that for 4 consecutive years Volkswagen cars were the best-selling cars in Finland (Volkswagen Finland, 2014). Additionally, the Turku University of Applied Sciences is one of the few academic institutions in the country that offer degrees

in automotive and transport engineering and economics, and are primarily the ones preparing future generations of engineers for new challenges in the automotive industry. Important insights were also provided by AKL - or Autoalan Keskusliitto ry - the largest automotive industry federation in Finland with a member registry that includes all the car repair and maintenance service providers in the country. Finally, ITS-Finland which tries to push intelligent transportation systems forward, showed an interest in the relativity of the Thesis to their own objectives and provided their own insights about the future of transportation in the country. The next paragraphs report the insights given by the results of the aforementioned questionnaire, and representatives, and an elaboration on the lessons learned and how they defined the prospect of the Thesis.

4.2 User Questionnaire

REACHING A TOTAL of 116 participants the questionnaire managed to gather responses from Finland, U.K., Germany, Sweden, Austria, Poland, Greece and Cyprus. As mentioned earlier, the research focus was on the European market and its close relativity to Finland, thus the target group of the questionnaire was expansive yet beneficial to gain a holistic view. It goes, though, without saying that the majority of the responses were from Finland. The highlights of the results are shown in Fig. 4.1 - 4.8, along with some impressions described in the next pages. *A list of questions that were portrayed can be seen in Appendix 1.*

Out of the respondents with a driving license, 40% evidently owned a car, and only 20% was planning to purchase a car within the next 5 years. This observation, and in combination to the fact that only 14% of the people with a driver's license use a car daily, proves how the exclusive ownership of a car as a trend is fading. With the raising popularity of car sharing schemes across the continent, this does not come as a surprise. The latter is even supported by the 62% share of respondents willing to share the use of their own car in return for a payment. Within car owners, the average age of car fleets stated by Statistics Finland (stated earlier) seems to agree with the results of the questionnaire as well. 42% of responding car owners purchased their current car within the last 2 years and 50% within the last 10. Additionally an impressive 78% were planning to purchase a new car within the next 5 years. This fits and confirms the proposed shifts in terms of reduced fuel emission and increased connectivity in the automobile scene by the end of the current decade. Connectivity is evident even today as respondents who serve either as drivers or passengers, use a smartphone as part of their in-car experience, in addition to talking on the phone.

The questionnaire also aimed, naturally, to explore more closely the aspect of car maintenance and how consumers behaved in regards to the topic. In average, almost 50% stated that they would ask guidance from a technician on repairing or maintaining a part that is not his/her expertise and self-repairing/self-maintaining is something that is not practiced anymore especially between newer car owners. Impressively enough, out of the ones who

did repair or maintain their vehicles by themselves, 92% still required assistance in executing the task. Even with assistance, 62% stated that repairing/maintaining a car individually hasn't always been successful which lead into advising a professional either way. These figures suggest that car users are no longer heavily involved in the repair and maintenance of their vehicles, and assistance or the hand of a professional is needed especially as cars become increasingly complex in the future.

On the topic of public transportation, even though there was nothing substantial to note on the frequency of use, 60% were willing to increase the use of public transportation if the costs of owning a car would increase substantially in the near future. 79% also stated that if access to important locations would not be possible with private vehicles they would switch to public transportation. The latter as a question is connected to different policies that cities are taking across Europe, including Helsinki, to limit the access of privately-owned vehicles to specific areas.

Finally, out of the respondents without a driving license 66% were planning nonetheless to acquire one. When asked to state the reasoning, respondents said how important it is for some jobs to have a driver's license and felt pushed to do so. Others added by saying how a car provides a greater sense of freedom, is useful in transporting goods and is beneficial for traveling longer distances or to remote areas in the city.

Through this extensive questionnaire, it becomes obvious that we are currently undergoing a shift on the role of vehicles in society. At a point in time where private and public transportation hybrids emerge, even though the sales of cars themselves will increase in the future, the nature of their usage will change. Cities across the continent are establishing policies that alter the way cars are used, and as these vehicles increase in mechanical complexity the less actual users will be willing to involve themselves in the repair and maintenance procedures needed throughout their lifecycles. It becomes more apparent how appropriate the timing of this Thesis project appears to be, something that was heavily considered in defining the drivers in a way that would benefit from the ongoing behavioral changes.

Do you own a car?

No
60%

Yes
40%

If you own a car, when is the next car purchase estimated to take place?

Do not know
8%

Next 2 years
37%

Next 10+ years
4%
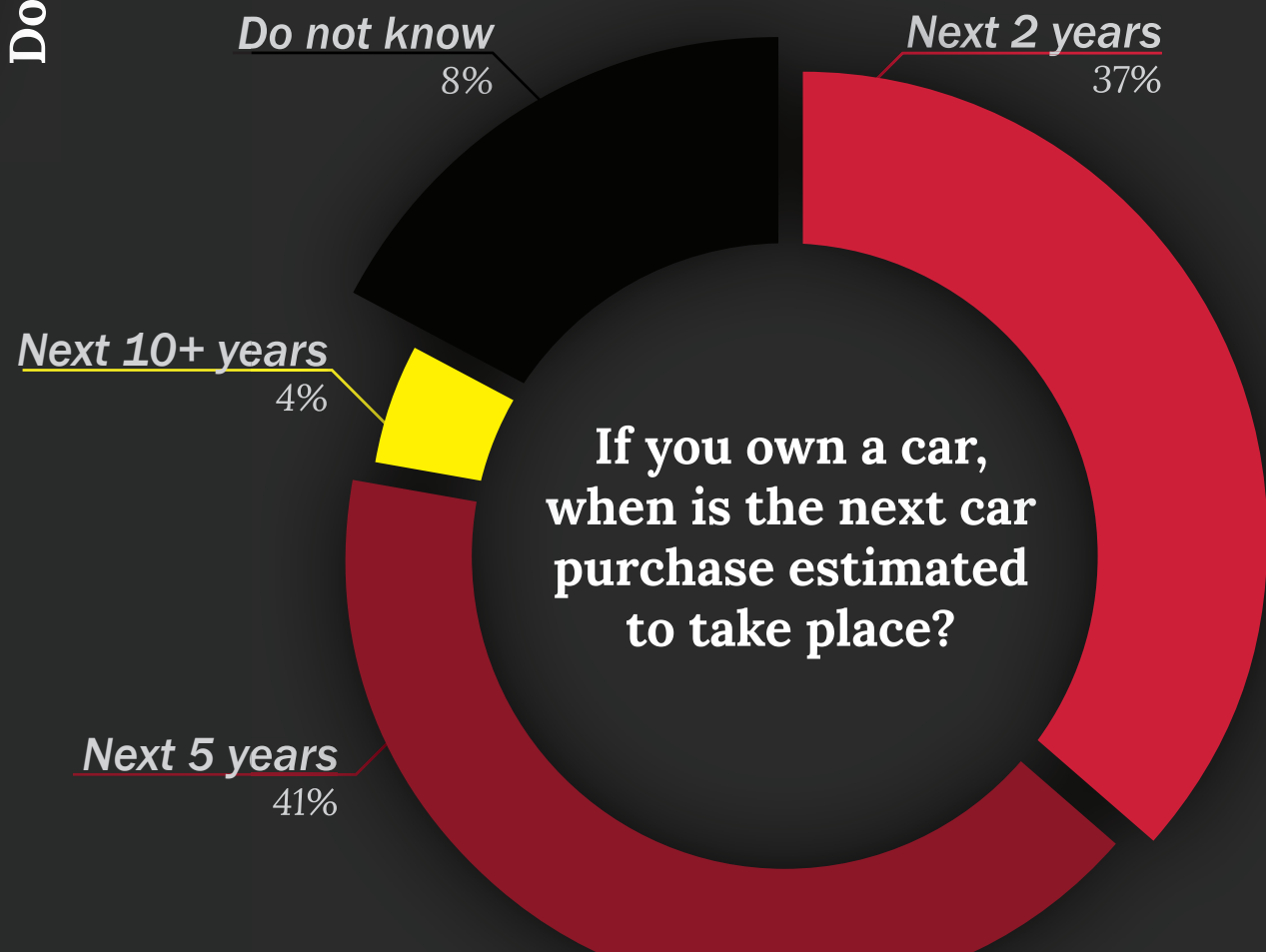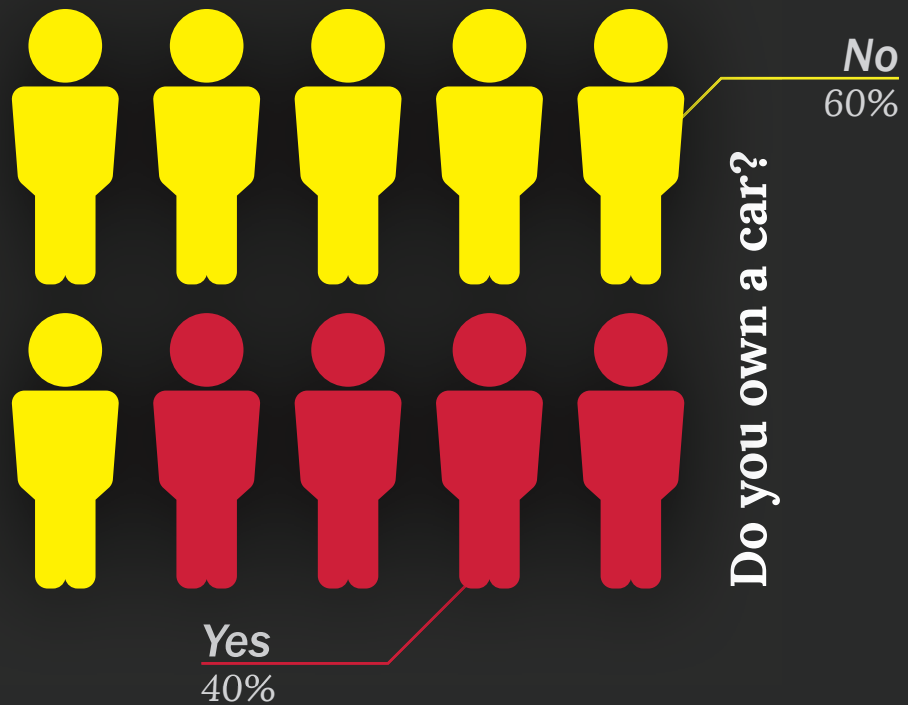
Next 5 years
41%

If you do not own a car, are you planning to purchase a car within the next 5 years?

Yes
33%

No
66%
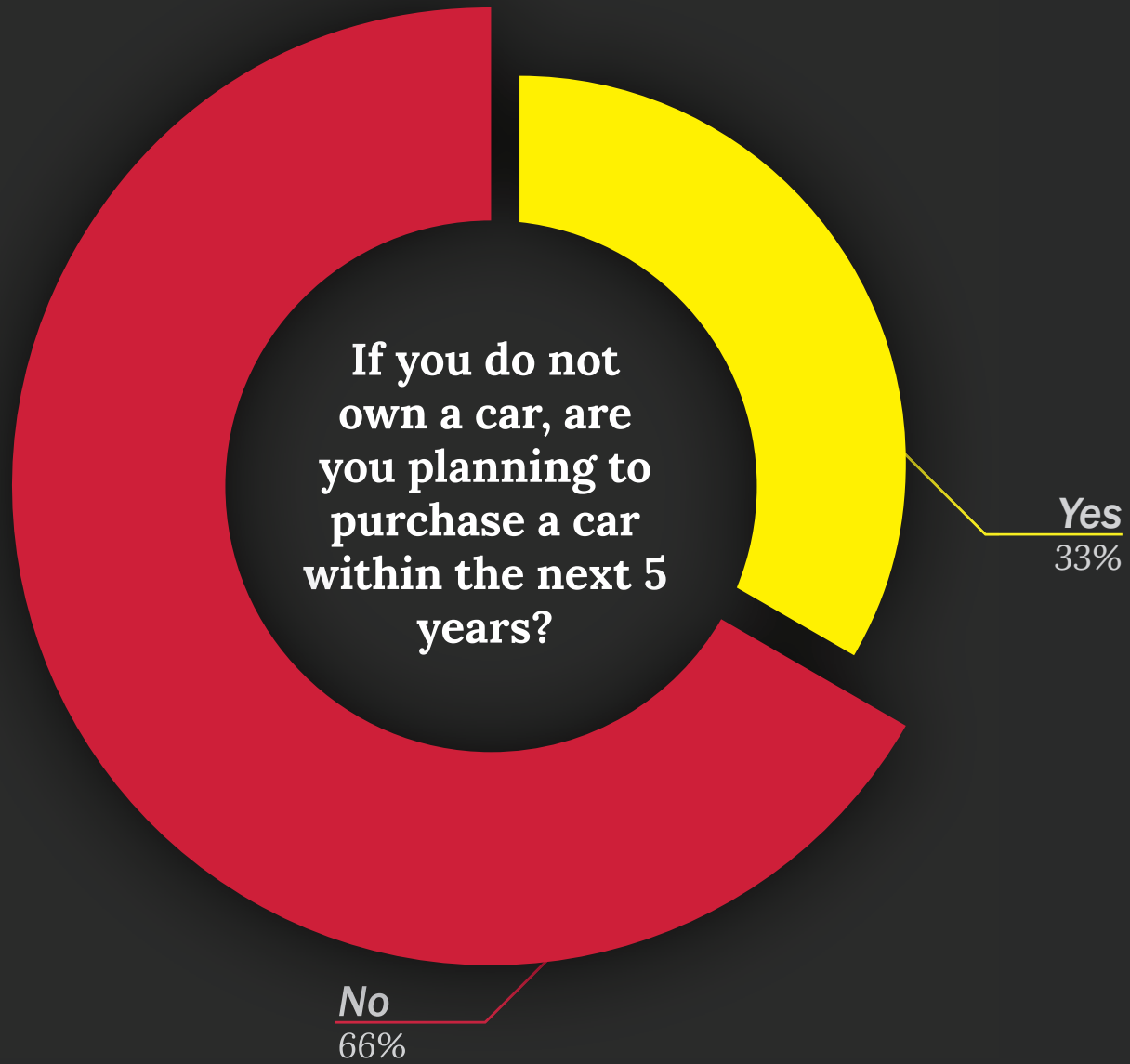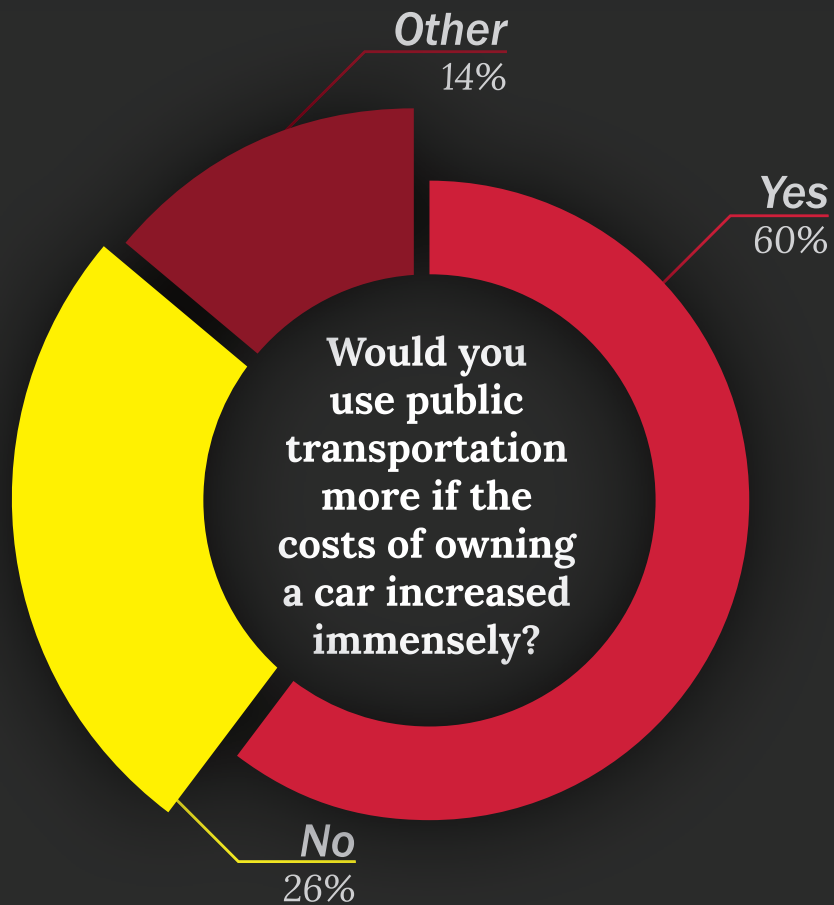
Would you be willing to share the use of your car when not actively using it, in return for a steady income?

Yes
62%

No
38%

Other
14%

Yes
60%

Would you use public transportation more if the costs of owning a car increased immensely?

No
26%

How do you feel about the price you paid on your last visit to a car repair/ maintenance shop?

Other
7%

Cheaper than expected
8%

Pricing was not transparent
9%

Pricing was transparent
19%

Too expensive
43%

Just right
14%

No
8%

Yes
92%

Have you ever asked somebody's assistance when repairing/maintaining a car on your own?

I do not own a smartphone
3%

No
14%

Have you ever used your smartphone as part of your driving experience?
in addition to talking on the phone

Yes
83%

4.3 The Service Provider

WITH ALMOST 13,000 new vehicle registrations in the end of the fiscal year 2014, and increasing numbers in sales for 4 consecutive years in the country, Volkswagen definitely is an essential player in defining the outlook of our public streets with their products (Volkswagen Finland, 2015). On the basis of their impressive figures, Volkswagen's representation in Finland was contacted which showed great interest in the nature of the Thesis topic and willingness to provide insights of their industry. These insights are summarized within the next pages of this chapter, based on an interview that was conducted with Volkswagen Center's Workshop Manager, Jani Kemppainen. *The interview transcript can be seen in Appendix 2a.*

Within the car repair and maintenance sector, the main business activity is the maintenance of vehicles under the ownership of private consumers. The service that is offered keeps workshops busy, and therefore the majority of available resources is used to respond to current needs of customers and not so much in strategizing and conceiving visions. The latter is mainly within the responsibility of car manufacturers themselves and not so much in the providers of after-sales services. Evidently, though, some awareness about what is around the corner in the near future is important to ensure preparedness. Electric cars, for example, and their gradual popularization entails the reduction of maintenance cycles needed throughout a calendar year, as oil-changing and correlative operations will not be necessary. Maintenance as a holistic service offering will not cease, of course, as there are still many parts that require to be checked and repaired despite of the nature of the energy source (eg. brakes, tyres, steering wheel, etc.). Additionally, as new technologies are dominating the car industry, evidently new maintenance operations may appear. Both unaffected car parts and novel technologies will increasingly become the focus of car repair and maintenance service providers. (Kemppainen, 2014.)

As services become more personalized and aim to be more inclusive with their user's lives, the same discussion does seem to exist also in this sector on innovating how to enable user interaction between maintenance cycles. On the product side, accessorizing could be offered more but

manufacturers usually choose a model where accessories are chosen at point of purchase and installed prior to shipping, thus limiting what retailers are able to provide as an additional service. On the software side, though, it is noticeable already that a similar ecosystem to the ones of smartphones could be a better, and plausible, alternative. Today Volkswagen offers, for example, the possibility for drivers to manually download navigation maps to their cars whereas in the past that was possible only through an official retailer. This move is the beginning of establishing an automotive ecosystem with a software perspective. (Kemppainen, 2014.)

Referring to the previous findings from the user questionnaire, the industry representation itself also comes to verify how maintenance and repairing conducted by the car owners themselves is gradually dropping. As cars are becoming more technically complex, manufacturers also choose to provide restricted access points for users and many times some faults are not even easily visible by the naked eye. Additionally, some parts require special tools and parts that are exclusively available to retailer workshops. (Kemppainen, 2014.)

Building on the discussion for consumer behavior, car sharing within certain communities is also a topic that arouses curiosity. In certain cases, as communities are urbanized and public transportation services are improved, the need for a car is not that evident on a daily basis. People might be in need of a car only in certain extended time intervals, and when socioeconomic factors come to play, that group of people might grow. The Internet has also enabled for remote working to become a norm, which reduces the need for people to travel constantly between working locations. In Finland, though, ownership is appreciated and cars continue to be a status symbol that people are willing to invest on. Car sharing is happening, and even though it will not acquire massive dimensions in the Finnish society, it is still something to consider how modes of ownership will vary in the future. (Kemppainen, 2014.)

When it comes to the business offering of workshops, it is evident that the main concern is the ability to react fast to the current needs of users and to prepare for the changes that will happen in line with the popularization of novel technologies and restricted machine structures.

"the form of ownership starts to take different shapes"

The time span between maintenance cycles will increase, altering the focus of the provision to minor check-ups and repairs, and enforcing retailers and other players to enable stronger interaction with users between visits. The nature of interactions that are worth exploring operate in the digital domain as ecosystems are established by manufacturers that allow for an open-source approach. Finally, user behavior does change as the form of ownership starts to take different shapes, and that can also have an influence on the maintenance and replacement rate of vehicles in the market.

4.4 The Educator

IN AN ATTEMPT to explore various aspects of car repairing, it was essential also to gain an understanding of the academic dimension of the field. It should not come as a surprise that when it comes to a country as small as Finland, without an indigenous car industry, there are only very few institutions of high education that offer such degrees. One of these institutions is Turku University of Applied Sciences that offers a Bachelor of Science in Production Economics, Automotive and Transport Engineering and accepts up to 50 students every year. The big numbers of entrants, and an even bigger number of applicants, shows how there is still a high need for workshop mechanics, as the Finnish car market continues to change and grow over time. The aforementioned degree programme's Head Lecturer, Mr. Kari Lindström, has given for the purposes of this Thesis a peek into an academic perspective that deemed to be extremely beneficial for the topic definition. *The interview transcript can be seen in Appendix 2b.*

Within the objectives of the curriculums the primary goal is to provide the foundations needed to successfully carry out the alumni's first job upon graduation and to satisfy the industry standards that are defined by the authorities and repair centers. Such standards include, among others, knowledge on diagnostics, car infrastructure, customer service, and management. With a lack of an indigenous car industry, there is also a limited number of academic possibilities. The only involvement with Information Technology in current education is teaching the required computer skills in operating software necessary for diagnostic and repair purposes. (Lindström, 2014.)

When it comes to connected and smart car solutions, its possibilities are mentioned briefly towards the end of a degree only as a topic of mere curiosity. Finland is suffering from a lack of staff and research made in the field, which in turn does not allow institutions to provide an education in the topic as it would not fulfill certain academic standards. In retrospective, though, students are being taught under the guidelines defined by innovative pedagogy. Innovative pedagogy aims to educate the individual to always look a bit further in the future and be

able to prepare for it by acquiring good networking skills and taking initiatives, along with obliging the student to establish a cooperative within the duration of his/her studies. It must be said, though, that the education to a certain extent is outdated, and the current Thesis topic that is being explored can, and should, be assumed as a revolutionary project for the Finnish industry. (Lindström, 2014.)

Something that needs to be considered about the education of workshop professionals is the constant education intervals they have to follow. Starting from acquiring the degree, graduates still need to follow additional trainings in order to specialize for a certain vehicle part or process, and manufacturer. The basic education that is provided does not have any affiliations with certain brands, which means it is given at a level where the student can only learn the specifics through practical training periods or through orientation in a new job placement. Each manufacturer, in response to competition, has its own processes and production frameworks which naturally affects how repair and maintenance is provided and executed, and it is to the

retailer's full responsibility to provide the appropriate training. The only nationwide standards are the ones defined by the government for legislations purposes such as certain measurement standards and registers. (Lindström, 2014.)

It is intriguing to observe how even though the car industry itself moves forward at a quick pace with technologies and software ecosystems being developed, the education in itself seems to fall behind. The lack of an endemic car manufacturing industry within Finland is having its toll in limiting the academic possibilities professionals of the field have. On the other hand, though, the constant training intervals that graduates have to go throughout their careers is a channel that should be utilized in a way that would allow engineers to be more informed about how connectivity and smart car solutions can affect their daily operations.

4.5 The Authority

A WELL-KNOWN FACT is how the extensive and universal use of cars in any urban environment calls for the inclusion of several authoritarian representations to deal with legislations and preparatory work needed for managing traffic. In the advent of technological leaps in the industry, it is to be expected for associations and governmental authorities to try and prepare for these new challenges and opportunities. Within the context of repair services, it was appropriate to reach for the Finnish Central Organization for Motor Trades and Repairs, otherwise known as AKL – Autoalan Keskusliitto – to provide an authoritarian perspective. The organization's Managing Director, Pekka Rissa, and Technical Director, Jouko Sohlberg, with their extensive knowledge offered vital information for a holistic understanding of the scene. *The interview transcript can be seen in Appendix 2c.*

Currently the real problem at hand is not the acceptance of connectivity in vehicles but, on the contrary, on how to enable and expand the use of these technologies. In a market like Finland, the replacement rate of entire car fleets in the country is very slow and it is safe to assume that within the next 10 years the replacement would happen slowly and gradually. The responsibility of attaining connectivity to what is currently available in the Finnish streets, does not lie anymore in the hands of the manufacturers. On one hand, manufacturers insist on having exclusivity over what is provided in their products, which has always been an issue in the industry as retailers and resellers do not have the necessary freedom to provide additional alternatives. On the other hand, though, the production costs of tethered equipment has dropped to such a level that would easily enable connectivity, something that is already being tested today. The real question at hand is what can be done with the data that now can be gathered remotely at ease? (Rissa & Sohlberg, 2014.)

Within service providers themselves, a significant shift is underway to abide by the user-centricity of services today. The car industry for over a century now has always worked so that the consumer was the one who needed to go to the car shop and/or the reseller to purchase a vehicle or get his/her car repaired. A shift of that paradigm must take

place and challenge the working culture in such a way that the expert is the one going to the paying customer and not the other way around. It is definitely worth wondering, why the consumer is forced to go on a Saturday morning all the way to an industrial area to test drive a car, instead of agreeing that the car can be tested at a certain time and place most suitable for the paying party. At financially challenging times for car sales, user-centricity would go a long way by offering, for example, a personalized report with remarks based on the test drive, instead of asking bluntly whether a purchasing decision has been made. (Rissa & Sohlberg, 2014.)

As mentioned by Kemppainen (2014) the frequency of maintenance cycles will lengthen as novel energy sources are introduced. In addition to that, though, it is also important to note that cars are increasingly becoming hosts to complex information technology in their circuits, of which their repair and maintenance would happen remotely without any user involvement. This will, in the future, become the standard as manufacturers restrict ecosystems for their vehicles and accordingly will alter the typical user's behavior. As the IT industry intertwines with car manufacturing, there are naturally some challenges as well that force manufacturers to reflect on their business cultures. A rather intriguing observation is how right after Google publically introduced the driverless car in 2012, suddenly a number of manufacturers stated that they are also exploring this feature. IT moguls Apple and Google are knowingly trying to enter the market of the connected car, but manufacturers in their conventional approach are still holding on strong to their own ecosystems, which currently is necessary to eliminate risks in cybersecurity. It is already, though, known that the best approach would be to allow IT players in developing digital services early on for the car as manufacturers naturally are more involved in the product itself. It must be realized that manufacturers, of any transport means for that matter, are increasingly becoming platform developers and not just producers. (Rissa & Sohlberg, 2014.)

When it comes to training within the field it is also recognized at a higher level that current degrees do not fulfill real-time demands of the field, as they were developed and introduced within the previous decade. Workshop technicians are increasingly needed to acquire

know-how on ICT, electronics and electricity, and associations are pushing the Education Board of Finland to include relevant modules in degree reformations, which unfortunately take time. A short-term alternative needs to be applied in the form of post-graduation training sessions to respond fast to emerging requirements. These additional trainings, and their content, is based on foreseen scenarios about the industry that are a result of findings from collaborations among various stakeholders. Additionally, trainings are necessary when working cultures are challenged and practitioners need to change their ways of working, as already described. Even though the need for these trainings is increasing constantly, as also recognized by car repair and maintenance service providers, there comes the major issue of limited availability of resources. In a country like Finland, where long distances are common, travel expenses required to attend trainings are investments that are better avoided whenever possible and that is a setback that needs to be tackled in the near future. (Rissa & Sohlberg, 2014.)

Within the appraisal and excitement demonstrated by authorities for the opportunities that connectivity brings to the car, there are still questions left to be answered. The biggest concern is how key players in the manufacturing scene will respond to their working cultures being challenged by the rising incursion of the IT sector, and how that in turn will affect the business models of repair services, even within Finland. Whatever the outcome, though, the training of professionals and the skills that are going to be necessary is a major predicament as the list of requirements grow, yet available resources are delimited in response to extended maintenance cycles and challenges in today's struggling economy.

4.6 The Visionary

IN ADDITION TO shaping up an elaborate understanding of the current situation, it is also beneficial to see how it plays out with well-established visions. As mentioned already in the introductory chapters, most visions are a response to global trends and markets. For the scale of Finland it was necessary to find a more appropriate vision that stands true to the Finnish reality, the provider of which is evidently ITS Finland. Intelligent Transport Systems Finland is a local network of 50 organizations that includes ministries and researchers, among others, that aims to speed up the utilization of new technologies in the country. The association wishes to showcase how things could be done, and following up by realizing visions and ideas with available technologies. In addition to their primary role in establishing visions, they are also heavily involved in developing future plans for transportation in the country, and have a presence in deciding on taxation, among others. Due to the future-driven nature of the Thesis project, the Chief Executive Officer of the association, Sampo Hietanen, provided an eye-opening and well-backed vision for the Finnish roads. *The interview transcript can be seen in Appendix 2d.*

Even though in the future the role of repair and maintenance as we know it today will become smaller, its value will remain intact but under a different perspective and business model. A good example is the shift towards software maintenance as cars are becoming increasingly software-based. About 40% of repair tasks can be made remotely, but for some reason that has not been fully utilized, and going to the repair shop is still required as a way to earn additional profit. It is apparent that when it comes to the business model itself, things have to change in how repair and maintenance services are priced. One of the main reasons why people do not buy a car is because of the big sudden charges that the ownership of a car may entail. Another viable solution would be to charge a standard monthly fee to all car owners and provide services for no additional cost when needed, in a similar way like insurance companies do. By applying this kind of pricing model, it would also force service providers to think of their operation in a different way including how to provide remote services more efficiently. (Hietanen, 2014.)

The exclusivity manufacturers have over their product lifecycles has already been well established, and their endurance in sustaining that is obvious. From a visionary perspective though, supported also by other stakeholders, manufacturers are forced to respond to the radical changes in consumer behavior. These key players at first chose not to react, but as they are required to do so they stumble upon obstacles brought by the trading of cars as it involves major profits in importing, and radically changing the business model at the moment will not result to their immediate benefit. One of the strongest behavioral shifts that is taking place already today is the fading of the comprehensive limits between private and public transportation. Services keep on appearing (eg. Uber, Kutsuplus, etc.) that challenge these limits, and consumers cannot differentiate that easily anymore between the two. The appearance of all these alternatives is, of course, to their benefit and allows them to easily change between platforms as they wish; which also brings up a lot of competition in the long run. Within the realm of transportation platforms, it has once been calculated that for the Finnish capital region, which is home to 2 million vehicles, all transportation needs could be covered entirely by a total of 50,000 Google shared cars. One may request a driverless car to pick him up, drive him to his destination and then drive off to the next user. The fact of the matter is that this is not that far from becoming a reality, at least partially. (Hietanen, 2014.)

All these shifts that so extensively have been brought up throughout the past paragraphs, appear to be still in the distant future whereas the real efforts should go into accepting and embracing these so-called futuristic visions already today. Many stakeholders are used to the conventional ways of working of the car industry and for that reason conscious efforts are made to delay these alterations, partially to ensure short-term profits and because of their inability to understand how they take part in defining the bigger picture. An ownership-based way of thinking, even though still at high today, is not the only way of seeing the industry and novel models of earning money throughout the shift that is taking place need to be established. Many fail to realize that even in car sharing schemes, where the actual number of the car fleet reduces, vehicles have a shorter lifespan and higher

replacement rate as they are used more extensively in smaller timeframes. Using old and rusty cars do not give way for a luxurious customer experience. (Hietanen, 2014.)

If there is one main learning to acquire from a visionary perspective, is the fact that the line between vision and reality at present is very thin. The technologies to turn the Finnish roads into a network of data-hoarding vehicles are already there but short-term profits act as a moratorium for this new reality. On the other hand, though, consumers seem to be willing to take matters in their own hands as they embrace variations of private and public transportation hybrids which in turn are forcing manufacturers and service providers to reflect and respond to this shift sooner than expected. Repairing and maintaining are undoubtedly imperative, though providers must reform in more than one ways, as was also recognized from an authoritarian perspective.

4.7 Conclusion

ON THE BRINK of an extensive stakeholder research, the opinions and knowledge from various perspectives was considered. All the way from car users to service providers, educators, decision-makers and visionaries, certain topics tend to be repeated which is also a clear indication on what are the primary issues that need to be tackled with. On an overall perspective it seems that there is a common framework under which all stakeholders that affect the future of the connected car operate. What differentiates one another, though, is time and money in more than one ways.

Users of cars still appreciate the ownership of a vehicle and consider it a status symbol, yet are more open and prone to offering and using alternative modes of transportation that challenge the limits between public and private transportation. Additionally, on the onset of complex machinery and novel energy sources being introduced in vehicles with restricted technical infrastructure, even the most minor maintenance tasks are increasingly becoming the responsibility of authorized service providers.

Car repair workshops, naturally, concentrate all their resources in responding to these real-time needs aiming to short-term profit. Avoiding long-term strategies forces workshops to operate conventionally without significantly challenging their working cultures, even though there is an abundance of signs that indicate the need for a change.

On one hand there are pivotal players in the manufacturing scene who are strongly holding onto their exclusive involvement in the product lifecycle of their vehicles. In the past this was a mere disturbance for retailers who were unable to offer post-sales partitions because of that, but today the reality is forcing manufacturers to re-evaluate their models. On the other hand, information technology vividly enters the car scene, and a timeframe clash seems to be of first concerns as circuits double in speed over the course of less than two years, whereas development cycles of cars take up to almost a decade. The lack of knowledge manufacturers have in handling this rapid development has stalled the domination of digital services at first, but with tethered technologies becoming increasingly popular, manufacturers have no choice but to respond. Interestingly enough, each player responds

differently with companies, like Ford and Tesla becoming more well-known on their open philosophy.

As the limitations of large scale trading persist, and in the brink of Internet of Things, cars are gradually becoming digital service platforms as hosts to software-based ecosystems that allow for personalization and more user involvement after sales. In the repair and maintenance sector this brings forth several opportunities as maintenance loops expand or even eliminated via sustainable technologies. Remote (over-the-air) maintenance is already possible for many tasks, yet not fully utilized, amongst many of the novel interactions such an ecosystem could endure to strengthen and personalize the service provision of workshops.

With all of these major developments taking place, there is still a setback ensued by education. As current degrees of mechanical engineers have curriculums that were introduced within the previous decade, degree reformations are underway but are taking a significant amount of time despite the heavy involvement of industry representation by associations. Education is rather

outdated and skills on ICT and electronics, for example, can only be offered in the form of trainings provided after graduation, which is nevertheless the norm for professionals of the field as car machinery evolves. The real challenge, though, is that today the need is not only in familiarizing mechanics to new wiring but to entirely new ecosystems and digital expertise, which results into an increasing number of trainings one has to go through. Service providers pride in their ability to be up-to-date but as training sessions multiply, simultaneously training resources are limited which is a major concern that needs to be resolved to allow for a faster re-adjustment period for everyone involved.

From directing all resources to quick responsiveness to entering an era where training and education is becoming a minor nuance in parallel to the inability of manufacturers to respond to new trends, are definitely factors that allow for conventional operations to exist. By many we have already passed the turning point, but by profit-driven reasons the evident results are stalled or even ignored by some, not allowing the end users to enjoy fully the possibilities of a connected car, even

within maintenance as a task. Luckily, though, users have ceased to be obsolete in their environments which has led them to experiment and embrace other alternatives either through their smartphones or by using services that provide a fresh input in an industry that partially operates in a doctrinal manner. As these figures increase, both IT and car industries are tumbled together and are bringing forth many challenges that when tackled will become the milestone of the biggest revelation after the introduction of the combustion engine.

DEFINING THE OUTPUT
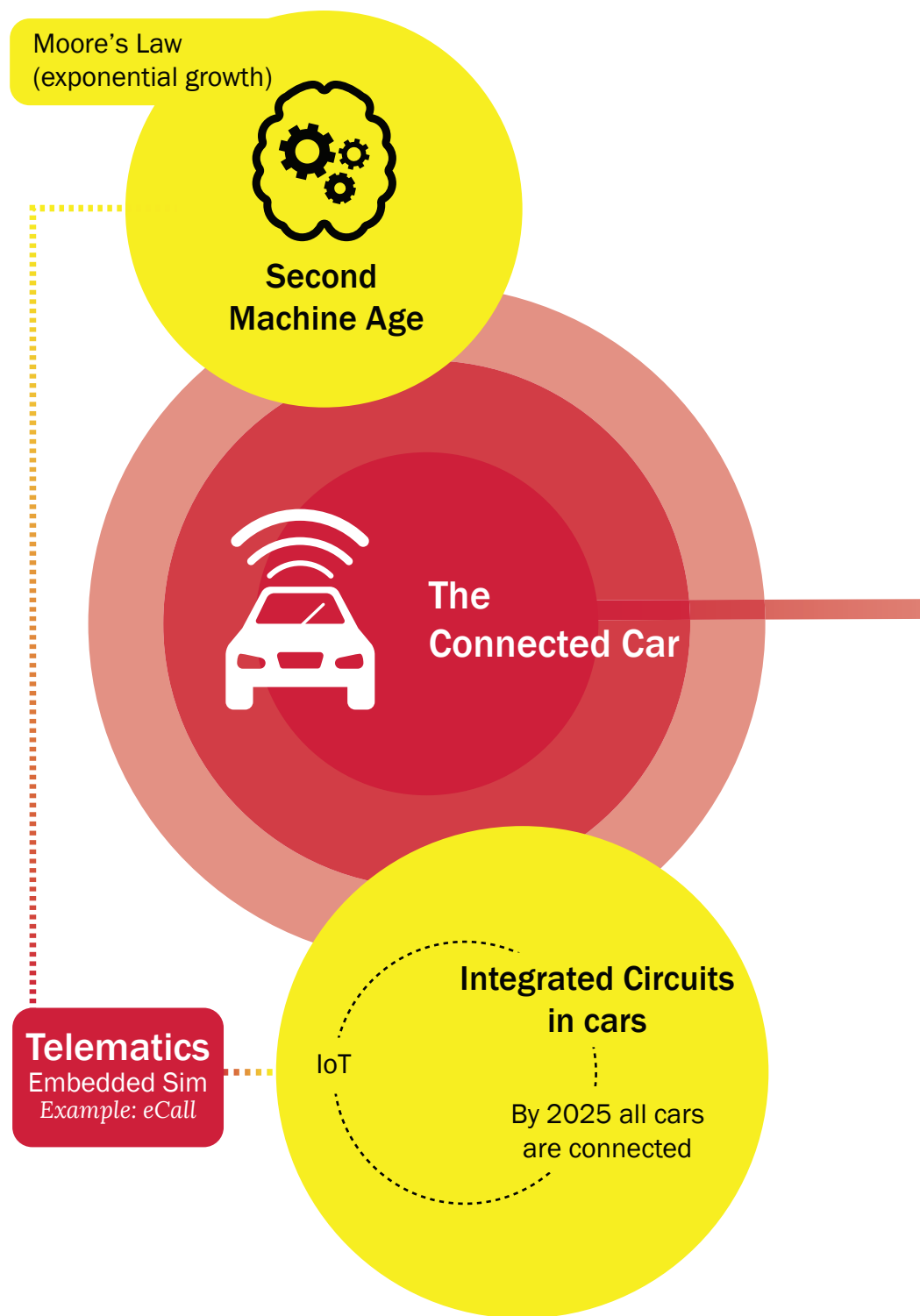
5.1 Research Mapping

AFTER A THOROUGH and timely research process, with observations, literature reviews and contextual interviews, a lot of information had been harvested to advance the project. In order to have a coherent understanding of "the connected car" as a topic, within the realm of car repair and maintenance specifically, a map was laid out to see which topics and issues arose, through clustering and identifying connections between various topics (see Figure 5.1). The most interesting observations were made in terms of patterns, which seemed to happen on several occurrences. These patterns were to be used at a later point to define the design output that this project is aiming for.
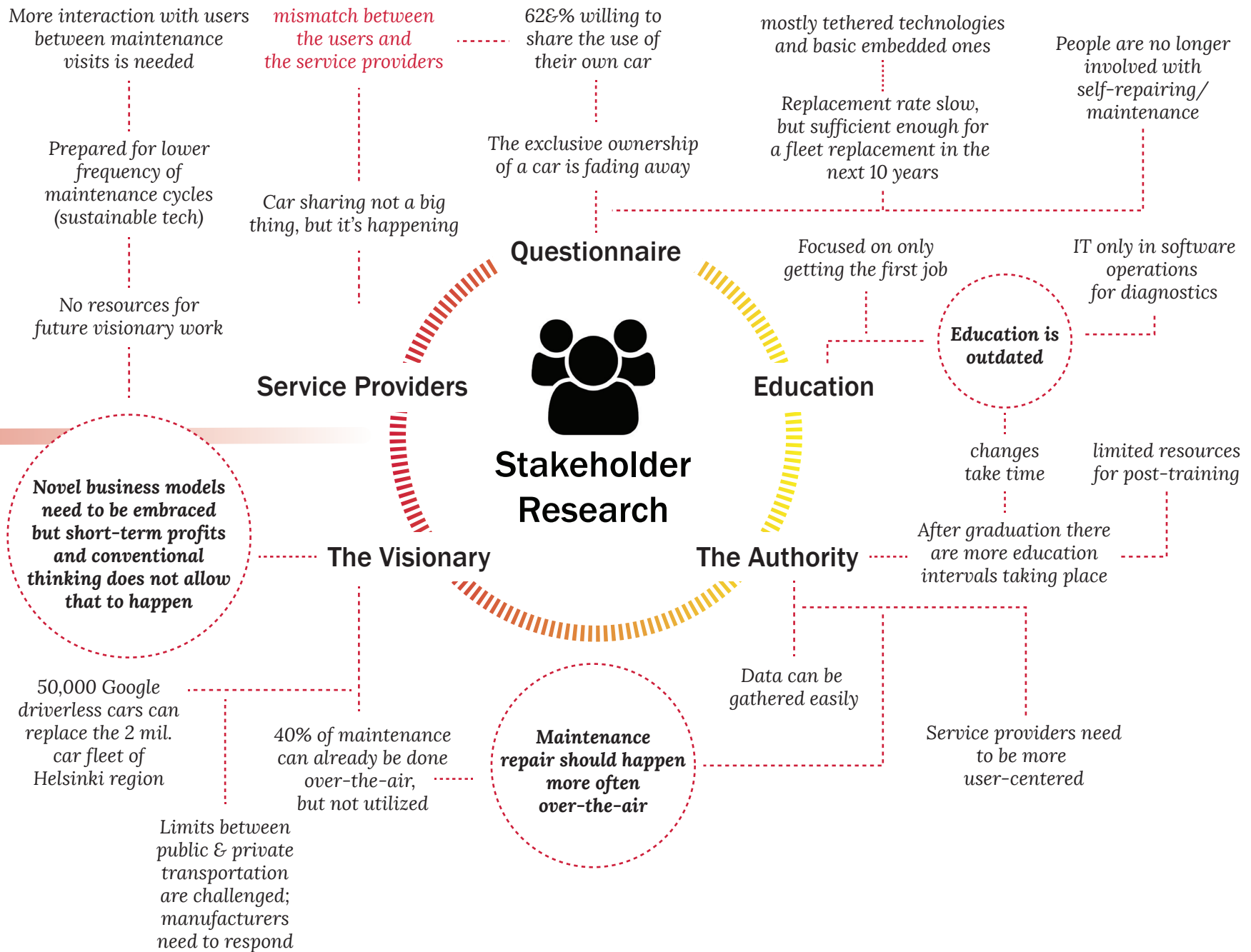
On the stakeholder research part, even though the interviews that took place were with individuals that represented a variety of perceptions in the field, some topics were brought up again and again. From an educational perspective, the fact that education is somewhat outdated was also a problem from an authoritarian point of view. The slow process of re-structuring current curricula, and the costs imposed by enforced post-graduation training sessions, were found to be troubling.

Car service providers admittedly have a short-term approach in their business, which does not allow them to assign resources in preparing for the major shifts that the industry is at best going through. For visionaries, this is a baffling concern, as new business models need to be introduced and embraced, to ensure the survival of a service sector that is already declining. Within these lines, it is an interesting observation to make how even though service providers do not consider car sharing as an activity that will spread easily, visionaries believe it is a given already today. The limits between what is public and private transportation is fading, and even the user questionnaire showed an impressive 62% being willing to share their car. Additionally, the authoritarian and visionary perspectives agree, and are aware, how almost 40% of current maintenance and repair procedures can be done remotely, but service providers have not been able to respond to that shift, thus not utilizing it, as they are not yet structured to gain any financial benefit from it.

The two topics that strongly stood out as elaborate entities for the output of the project, was education and business modeling. Both entities set important questions that needed to be resolved, and were of equal importance in defining the future of car repair and maintenance in the country. In order to choose the final direction, these topics were set against personal interests and requirements of the degree for which this Thesis is written for. It had become apparently clear that business modeling was to be the defined output. Education, as a topic, bares the risk of shifting the project to a pedagogical one in nature, rather than a strategic one: vital for personal professional development in the field of industrial design. Additionally, changes to curriculums are currently underway, and it seems that several initiatives have already taken place to tackle these issues. Business modeling, on the other hand, is a required activity that needs to happen, the need has been identified, but initiatives have not been made driven by the short-term and cost-driven approach of the service providers themselves. With that being said, education had not been abandoned entirely, and was a secondary topic to consider.

Moore's Law
(exponential growth)

Second Machine Age

The Connected Car

Integrated Circuits in cars

IoT

Telematics
Embedded Sim
Example: eCall

By 2025 all cars are connected

Stakeholder Research

Questionnaire

More interaction with users between maintenance visits is needed

mismatch between the users and the service providers

62&% willing to share the use of their own car

Prepared for lower frequency of maintenance cycles (sustainable tech)

Car sharing not a big thing, but it's happening

The exclusive ownership of a car is fading away

Service Providers

No resources for future visionary work

Education

mostly tethered technologies and basic embedded ones

Replacement rate slow, but sufficient enough for a fleet replacement in the next 10 years

People are no longer involved with self-repairing/ maintenance

Focused on only getting the first job

IT only in software operations for diagnostics

Education is outdated

changes take time

limited resources for post-training

The Visionary

Novel business models need to be embraced but short-term profits and conventional thinking does not allow that to happen

50,000 Google driverless cars can replace the 2 mil. car fleet of Helsinki region

40% of maintenance can already be done over-the-air, but not utilized

Maintenance repair should happen more often over-the-air

Limits between public & private transportation are challenged; manufacturers need to respond

The Authority

After graduation there are more education intervals taking place

Data can be gathered easily

Service providers need to be more user-centered

5.2 Design Drivers and Design Brief

PRIOR TO SHIFTING on to designing a novel business model, to meet the needs and requirements set by the advancements of the connected car, design drivers needed to be defined. Design drivers work as parameters that define the orientation of producing the final output. They operate as criteria, which will be set against the iterations made along the way. When reaching an outcome, it needs to fulfill the requirements set by the drivers, thus their importance in a design process is apparent.
Design drivers need to be clear in nature, enhanced by elaborate definitions to justify and inspire design decisions. With that consideration, various potential drivers were assigned based entirely on the research that was made. After an exercise involving the clustering of drivers, and the patterns recognized from the stakeholder research, the following drivers were identified:

ADAPTABLE: In the future, the distinction between private and public transportation will fade. Several hybrids have already started to appear, that challenge these limits, and new ownership modes are born. The new business model must be more welcoming to this shift, and should not direct its efforts only towards exclusively private car owners. The cost structure must accompany owners of all sorts.

ACCESSIBLE: In this instance, accessibility refers to two specific sets of action: increased interaction between maintenance/repair visits, and a fast response to any problems that may appear, especially in a country like Finland, with longer traveling distances. As maintenance cycles get extended through sustainable mechanical developments, service providers must find ways to sustain a relationship with their customers between visits. Additionally, as consumers get more accustomed to the benefits of constant connectivity, the expectations on the nature of services that are made available even during use of a vehicle, must be met.

TRANSPARENT: The user questionnaire has strongly shown the dislike on the lack of transparency, and sudden costs, that seem to appear on any repair and maintenance cycle. Based on several of the interviews that took place, a pricing strategy inspired by the business

model applied by insurance companies seems to be a viable solution. Transparency is also a reference to utilizing connectivity in a way that makes drivers more aware of when maintenance is needed, and how their vehicle usage affects these intervals, something that may be of benefit to other service providers as well.

As research questions were set earlier to kick-start the research process, similarly a design brief is required to successfully shift to creating a well-established output. By merging the design drivers, the following design brief, operates as a statement that drives the process through until the end:

"Establish a novel business model for the Finnish car repair and maintenance service sector, with transparent pricing enhanced by user-centered interactions between visits, and is adaptable to the variation of ownership modes that may appear by 2025."

5.3 Current Revenue Model

AS A BUSINESS MODEL acquires a central role in the design output of the Thesis, it goes without say that the current business model needs to be explored. It is not to the focus of this project to go into detail on what is the business model of a specific service provider, but more so to have a generic impression on how these providers operate. For the purposes of having an appropriate focus, though, the business models that will be explored on the latter part of the text are the ones of car-brand exclusive service providers, driven also by the fact how Volkswagen Center operated as a representative on their behalf. Nevertheless, there are no sufficient differences in the current way these stakeholders in the Finnish industry operate, therefore on the basis of what has already been elaborated, the main actions were summarized in the corresponding building blocks of a business model canvas (Figure 5.2).
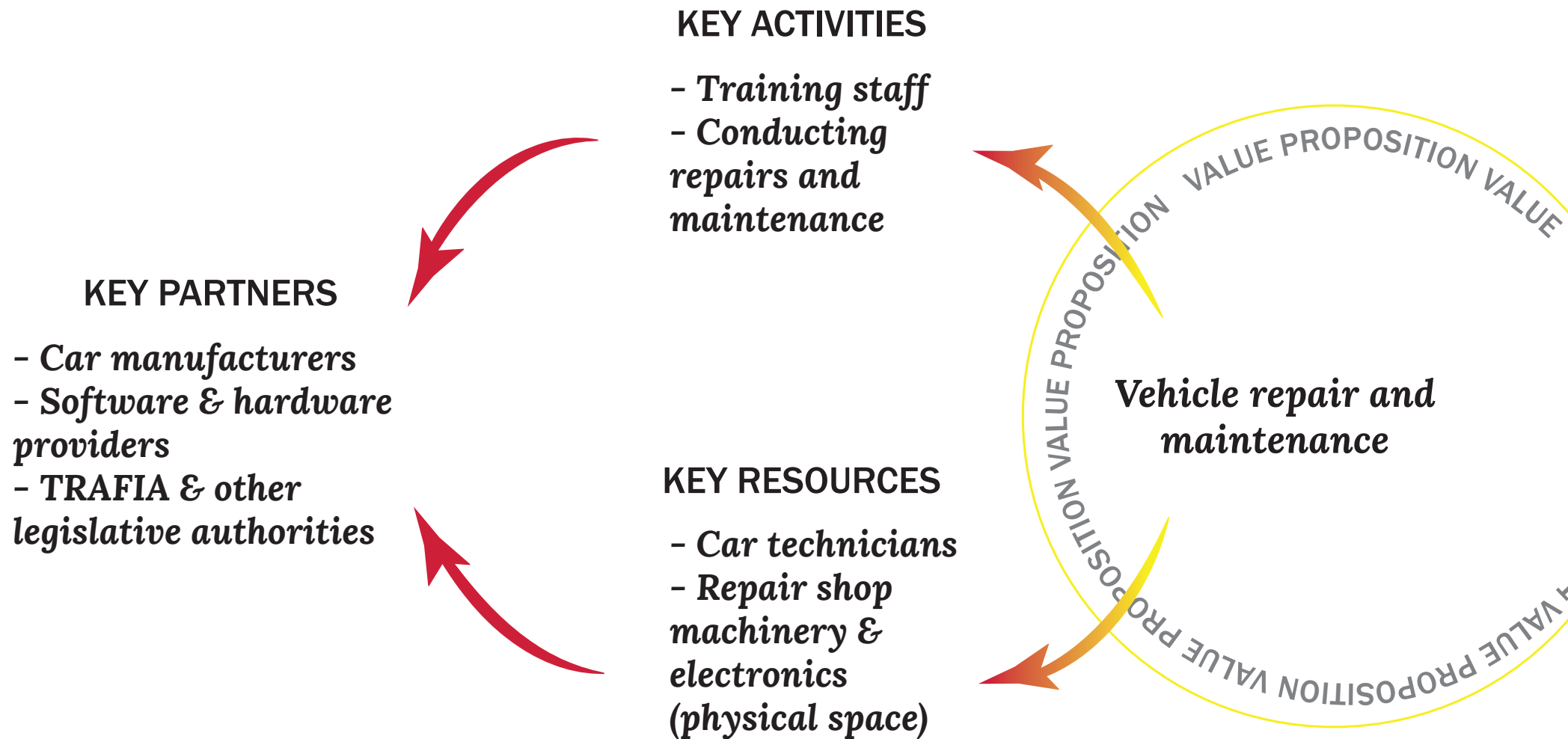
Osterwalder (2010), states that "a business model describes the rationale of how an organization creates, delivers, and captures value". The canvas itself, that has been used as a tool to support the interpretation of the current business model, constitutes of nine building blocks that demonstrate how an organisation creates meaning and generates revenue, considering the four main business areas: customers, offer, infrastructure, and financial viability.

The service providers' value proposition lies plainly in repairing and maintaining, with a promise to extend the use-life of a vehicle that is on its own a costly investment. The primary customer segment is private car owners, from which revenue originates in the form of per-visit costs, which is a total of service and hardware costs. In order to acquire new customers, and to sustain current ones, customer relationships are made through new vehicle purchases and car brand exclusivity, along with ensuring to offer a high quality repair/maintenance operation on the vehicles. The service is offered exclusively through repair shops, and call centers and/or potentially a website, are channels through which a consumer may acquire support.

The key partners are, naturally, the vehicle manufacturers themselves, along with providers of software and hardware equipment needed, and legislative authorities

that set certain standards (such as TRAFIA, AKL, etc.). To succeed in their value proposition, key activities is the training of new and current staff, as well as timely repair and maintenance itself. The cost structure aims for immediate profit, and is mostly driven by reduced cost rather than increased value. Fixed costs are expenditures on personnel, spatial operations and standard equipment, whereas variable costs derive from spare parts, that are ordered individually based on the need and the nature of operations made within a particular timeframe.
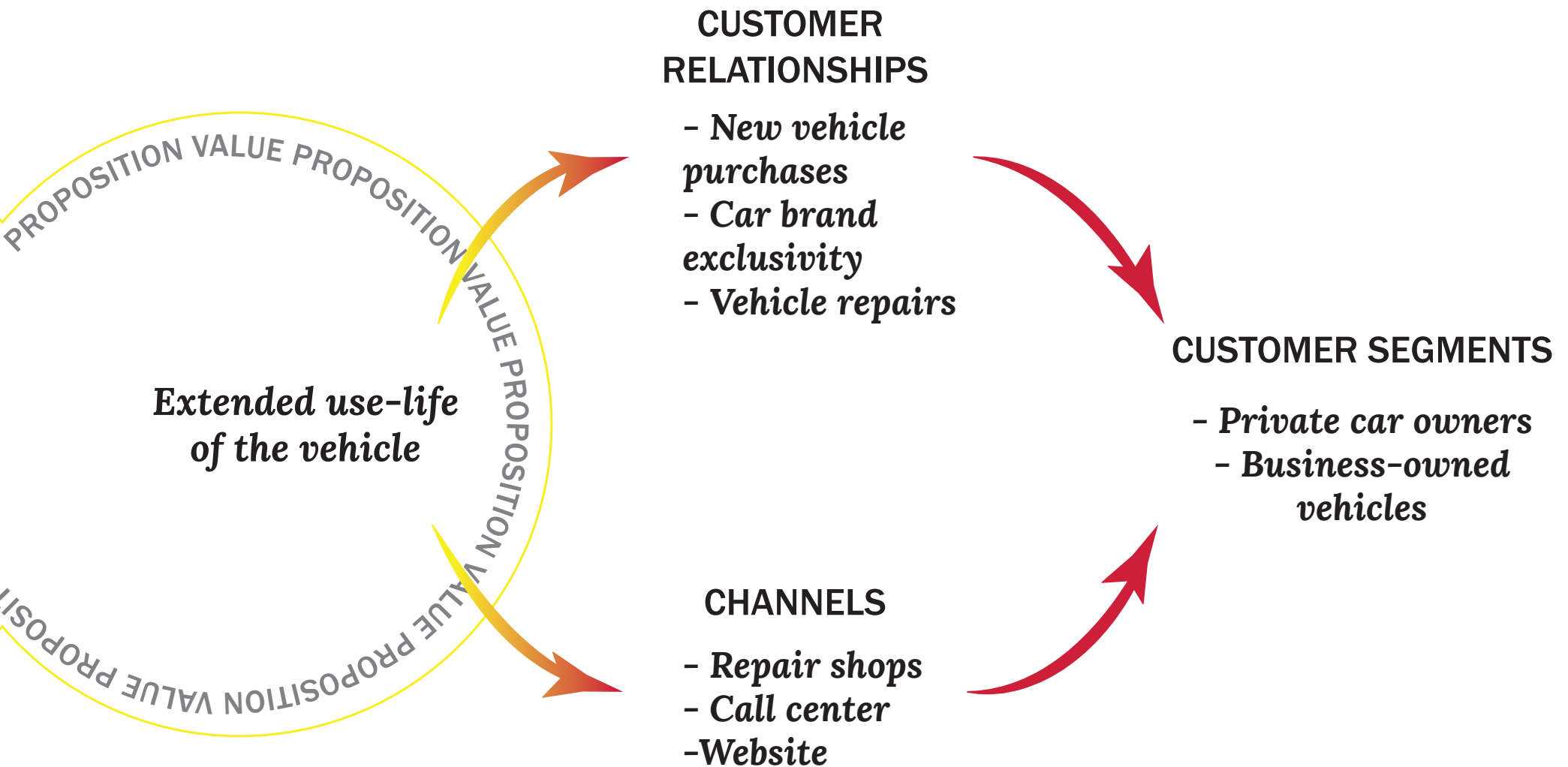
KEY ACTIVITIES

- **Training staff**
- **Conducting repairs and maintenance**

KEY PARTNERS

- **Car manufacturers**
- **Software & hardware providers**
- **TRAFIA & other legislative authorities**

KEY RESOURCES

- **Car technicians**
- **Repair shop machinery & electronics (physical space)**

VALUE PROPOSITION VALUE PROPOSITION VALUE PROPOSITION VALUE PROPOSITION VALUE PROPOSITION VALUE PROPOSITION

Vehicle repair and maintenance

COST STRUCTURE

Immediate profit, cost-driven structure.

Mainly fixed costs: Personnel, space operations, maintenance costs
Variable costs: Spare parts

VALUE PROPOSITION VALUE PROPOSITION VALUE PROPOSITION VALUE PROPOSITION VALUE PROPOSITION

Extended use-life of the vehicle

CUSTOMER RELATIONSHIPS

- *New vehicle purchases*
- *Car brand exclusivity*
- *Vehicle repairs*

CUSTOMER SEGMENTS

- *Private car owners*
- *Business-owned vehicles*

CHANNELS

- *Repair shops*
- *Call center*
- *Website*

REVENUE STREAMS

Per-time fees from each repair/maintenance visit (potential monthly fees)

5.4 Putting the Pieces Together

ONE OF THE major benefits from the variety of stakeholders that were interviewed, is how all of them – in one way or the other – had already some ideas and solutions to the issues concerning the adjustability of the Car Repair and Maintenance (CRM) sector. Each stakeholder group just had a different perspective of the future needs portrayed by the Connected Car, and it becomes evidently clear that despite the common interests in the matter, these organizations have not collaborated thus far.

As the Thesis project advances towards a service concept, putting these pieces together to grasp the bigger picture at hand, and relate them to the defined design drivers, seems to be the appropriate next step. This enhances the role of the research made, and provides valid justifications to the design decisions to be taken during the conceptual phase. Additionally, current benchmarks for various functions were looked after, to also provide a market foreground rather than exclusively basing hypotheses on theory.

In the epicenter of the concept, the vehicle still remains to be hugely in focus, but with the twist of trying to introduce a platform-based way of thinking. The vehicle *BECOMES* the platform, that is adjustable to the various ownership modes. On the technical side of things, vehicles are enhanced with sensors and the embedded SIM technology. These core technologies allow for the car to be constantly connected to the "cloud", and provide a continuous flow of information. This information can then be utilized to identify driving behaviors, road types, and other data that the drivers can benefit from in line with the "quantified self" phenomenon striking the IT industry even today. In short, the quantified self is self-awareness of behavior through follow ups and logs generated mostly by wearable tech, among others. The car has the capability to become one of these wearables, as the driver uses the vehicle.

Continuing on the topic of the technical aspect of the vehicle, it is essential to remind how along with the development of newer car models, and especially with the advent of electric cars in the market, there will be less access to the machinery of cars. Manufacturers direct their production more into ecosystems that are only accessible

by official resellers and repair specialists, similarly to how smartphones are today. As the access to mechanics is restricted, though, more electronics and software are introduced within the ecosystem. It is striking to observe how premium cars nowadays run on over 100 million lines of code. Cars are enhanced with 100s of electronic control units (ECUs), and the amount of code needed to operate them, surpasses even coding needed to operate aircrafts. Interestingly enough, Boeing's 787 Dreamliner requires only 6.5 million lines of code. This is a heavy indication on how vehicles are becoming electronically complex, even more than aircrafts. (Charette, 2009.) With this in mind, it becomes rather clear why up to **40% of faults found in vehicles are software-related.** As the vehicle becomes constantly connected, over-the-air updates and repairs should be possible, but that also requires repair centers to alter their conventional ways of operation.

As focus shifts to operation, the stakeholder research repetitively bumped into comparisons made with the insurance-based business model. Insurance service providers in principle equally divide the financial responsibility between all of their customers with a monthly subscription fee, on the basis that only a percentage of their customer base will be in need of covering their costs from certain types of accidents and theft. Through this approach, the end costs for each individual customer end up being much smaller compared to covering unplanned individual costs, and the insurance service providers profit from the mass of their client base. Simultaneously, these providers, in order to be cost efficient digitalize and automatize many of their processes for the benefit of both ends. The insurance-based model seems to be a perfect fit for the car repair and maintenance sector: the client base already exists, and the cost structure does not have to be the reason of disappointment for customers who unknowingly end up paying more. A substantial difference here, though, is that all cars need to be maintained, and that is definitely something to consider.

Some examples of an insurance-based business model for CRM services in Finland already exist today, but still do not fully utilize the principles described earlier in terms of cost structure, and especially digitalization. The best found examples are showcased in the following pages.

VOLVO SOPIMUS

"VOLVO Sopimus" offers for a monthly subscription fee unlimited repairs on certain car models. This is the best found example in the Finnish market of an insurance-based business model for CRM services. "Sopimus", though, still requires manual software updates and frequent visits to the repair shop.

SEAT

MII | IBIZA | IBIZA SC CUPRA | IBIZA ST | TOLEDO | LEON | LEON SC | LEON ST | LEON X-PERIENCE | ATECA | ALHAMB

PALVELUT

> HUOLENPITOSOPIMUS

Sopimuslaskuri

Vaihtoautojen
huolenpitosopimus

LIIKKUMISTURVA

JÄLKIMARKKINOINTI

Seat's "Huolenpitosopimus" offers for a monthly fee full maintenance and repair coverage for up to 6 years. In this case, though, the price is defined by a calculation of all the costs within the defined frame and divided monthly. "Huolenpitosopimus" does not utilize the customer base at all, thus increasing the price level radically.

HUOLENPITOSOPIMUS

Huolenpitosopimus - järkevä tapa huolehtia autostasi

SEAT-huolenpitosopimus asiakasystävällinen palvelu, jonka avulla varmistat itsellesi riskittömän, vaivattoman ja helpon tavan huolehtia autosi huolto- ja korjauskuluista. Huolenpitosopimuksen idea on

Mitä hyötyjä huolenpitosopimus Si

› Matala kynnys päästä mukaan a
hallintaan.

› Huolenpitosopimus sisältää huolt
ko... at muutoi

› Huolenpitosopimuksella budjetoit

Tuki

Huoltopaketit

Uuden Teslan rajoitettu takuu on voimassa 4 vuotta tai 80 000 km (kumpi täyttyy ensin). Akun ja voimansiirron takuu on 8 vuotta ilman kilometrirajaa. [...] vuositarkastus joka vuosi tai 20 000 km välein huippul[...] Tesla kunnossa on hankkia huoltopaketin kattamat vu[...] etukäteen. Ennalta maksettuun huoltopakettiin sisä[...] Huoltopaketin voi ostaa paikallisesta huoltokesku[...] auton toimituksesta.

TESLA offers repair and maintenance package deals ranging from three, four and eight-year coverage. The packages are, though, prepaid deals which means you need to pay the full price beforehand (1575/2450/4675 eur) causing quite a substantial peak in expenditures, in addition to purchasing a new vehicle.

Kolmen vuoden huoltopaketti 1575 €

Sisältää yhden tarkastuksen / vuosi tai 20 000 km (kumpi täyttyy ensin), kolmeen vuoteen tai 60 000 kilometriin saakka.

Neljän vuoden huoltopaketti 2450 €

Sisältää yhden tarkastuksen / vuosi tai 20 000 km (kumpi täyttyy ensin), neljään vuoteen tai 80 000 kilometriin saakka

Kahdeksan vuoden huoltopaketti maksaa 4675 €

Sisältää yhden tarkastuksen / vuosi tai 20 000 km (kumpi täyttyy ensin), kahdeksaan vuoteen tai 160 000 kilometriin saakka

In addition to the package deals, and subscription-based offerings described earlier, most repair centres also offer the possibility to pay a bill with credit in monthly deposits. Even though none of these examples fully follow the cost structure of insurance providers, it does become rather apparent that there is a need. Customers are clearly demanding more flexible and affordable ways to extend the lifecycle of their cars (as the user questionnaire also suggests), which can be seen as a validation to the need of introducing such a price model in the future.

THE SERVICE CONCEPT

6.1 Welcome to the Future of Maintenance

AS A FINAL DELIVERABLE for the Thesis project is a service concept that aims to provide a solution to the design brief defined earlier. The extensive research that was conducted was able to provide a coherent understanding of the challenges and opportunities the CRM sector is currently going through. The shifts and novel demands in user behavior regarding mobility, as well as the various hybrids that appear in ownership seem to be the most essential variants. On the basis of what was elaborated earlier on putting the pieces together, creating a service concept in itself was more a matter of defining building blocks based exclusively on the design research.

Welcome to the future of maintenance. The following pages will elaborate on a service concept, the most vital touchpoints in the service, along with mapping out the system as a whole in relation to the stakeholders that are needed. The most vital perspectives shown will be the ones of the driver, the service provider (CRM), and the manufacturer. The chapter concludes with a roadmap, based on the principles of backcasting, which will be explained further.
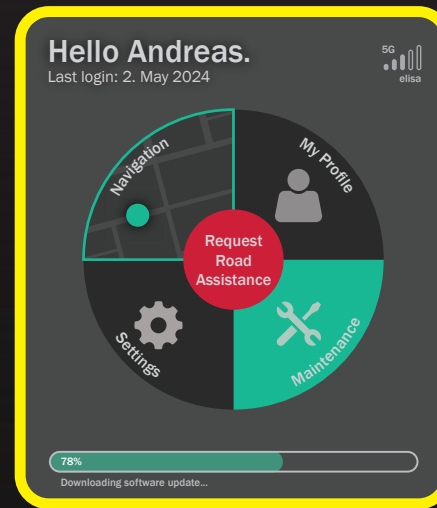
To ensure a coherent understanding of the concept, the Ernst & Young's blueprint for Telematics (see pg 41), is used as a basis for what needs to be considered in the concept. This chapter will take a stance on the service delivery infrastructure, the user interface, and how customer support is provided and given through the interface as a core feature for the service concept. Finally, a short summary will be made on issues regarding connectivity and what is to be expected from telecom operators.
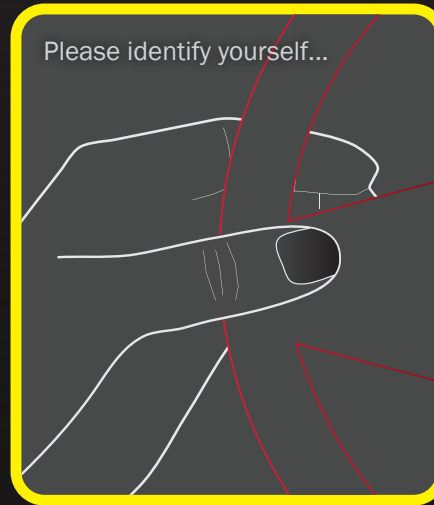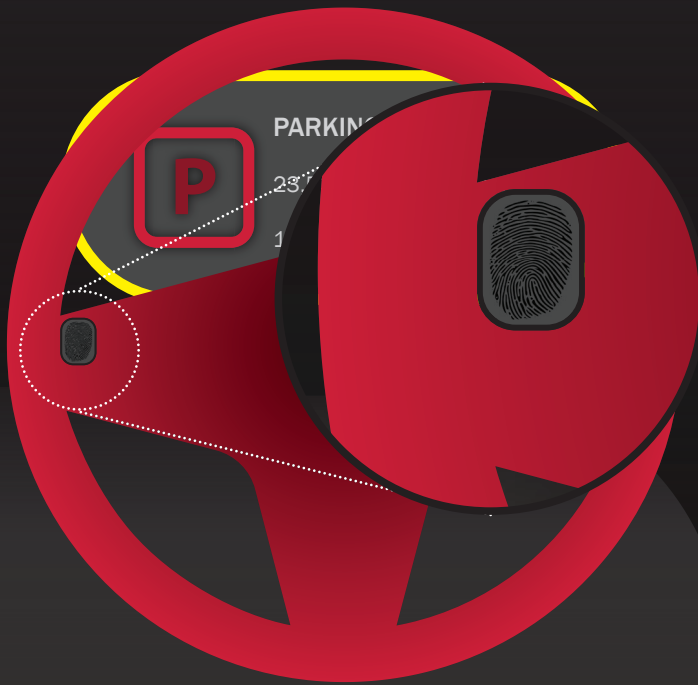
The appearance of hybrids in modes of ownership, ranging from exclusive ownership all the way to shared cars, and company- or city-owned vehicles, it becomes vital to be able to follow up the activity of each individual driver within a vehicle. **This is also reflected in the design drivers of adaptability and transparency.** By tracking the activity of a driver, not only is the driver him/herself more aware of his/her driving patterns and behaviors, but it becomes much easier for various stakeholders surrounding the vehicle (CRM, insurance, owner, etc.) to follow up any activity with the appropriate individual without any speculation.

Using something as simple as fingerprint identification technology (popularized already today), the driver can identify him/herself while simultaneously starting the vehicle reducing the need for a physical key. From the moment of identification, personal settings and information are loaded from a secure cloud server.

PARKING MODE

23,538 km driven so far

16,462 km until next inspection

Hello Andreas.
Last login: 2. May 2024

5G
elisa

Navigation

My Profile

Request
Road
Assistance

Settings

Maintenance

78%
Downloading software update...

Immediately after a successful identification, the driver is presented with an interface that includes the most vital options and information: navigation, personal profile information, maintenance-related tasks, settings, and the ability to request an immediate dispatch of an official in the case of an emergency or technical failure. The next pages will elaborate on the features of the interface more thoroughly.
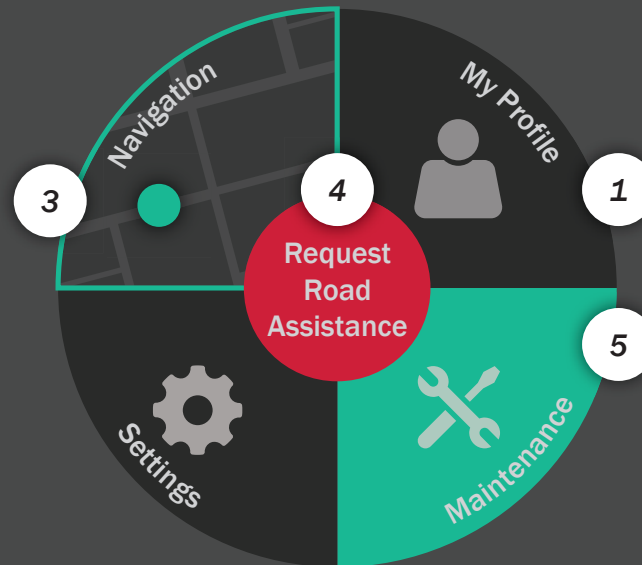
① My Profile

A dedicated section for personalized features. The driver may view all the data the vehicle has recorded of his or her driving instances, based on which the service may provide reports with recommendations on how to improve and extend the vehicle's lifecycle through better driving performances.

Additionally, various documents may easily be accessed, and shared, that are of vital importance to the driver. Such documents may include rental agreements, purchase contracts, driver's licenses, etc.

Finally, insurance-related tasks can also be performed through the interface providing a seamless integration of offerings from both maintenance and insurance providers. The type of data gathered can easily be applicable to the needs of insurance providers, but that is not to the focus of the current concept.

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②

As vehicles feature an embedded SIM, it is to be expected that they would be constantly connected. Whilst using the interface, the signal strength should always be visible. It is worth noting here that 5G-networks* are expected to be popularized by 2025, as they are planned to be introduced by 2020.

5G is the next generation of wireless bandwidth connectivity, that is aiming to reduce end-to-end latency, and increased speeds. (GSMA Intelligence, 2014.) Such features are vital to ensure the operation of Connected Car solutions, such as the ones featured in the Thesis.

Navigation ③

One of the most vital features today, and definitely in the future, is the use of GPS-enabled technologies. GPS Navigation provides us with accurate information on our current physical location, and how to get to our final destination.

The navigation tab has a central role in the use of the Connected Car, as through that, one also has the ability to enable, or disable, Auto-Drive. Auto-Drive will be made possible with the introduction of sensor-heavy vehicles and driverless capabilities in the future. This feature is also partially inspired by the already existing, and heavily used, autopilot-capabilities in the aviation industry.

(4) Request Road Assistance

A central element in the interface is a call-button for road assistance. This aims to provide an easy way for summoning road officials on the spot, in the case there is a technical failure or the driver witnesses an accident that requires immediate assistance. The type of assistance needed is clarified on pressing the button.

When technical assistance is needed, the vehicle automatically transmits coordinates and diagnostics to the nearest repair and maintenance center. The center responds by evaluating the situation, and dispatching a mechanic to go on-the-spot for further assistance. ***This feature is also a means in increasing accessible interaction with car repair and maintenance centers between scheduled visits, as required by the design drivers.***

When Emergency officials are requested, the coordinates are transmitted to the Emergency Responce Center (ERC). Additionally, using the 360-degree camera on the vehicle (required feature for the Auto-Drive to operate) a panorama picture is also sent, or potentially even a video stream. The visual material provides a real-time view to the ERC, in order for them to evaluate the type of assistance that is needed.

The call-button compliments the eCall feature. Whereas eCall is designed to respond automatically in the case the vehicle and the passengers are damaged/hurt, the call-button is a continuation to that, where the driver can assist road officials in other instances that require attention.
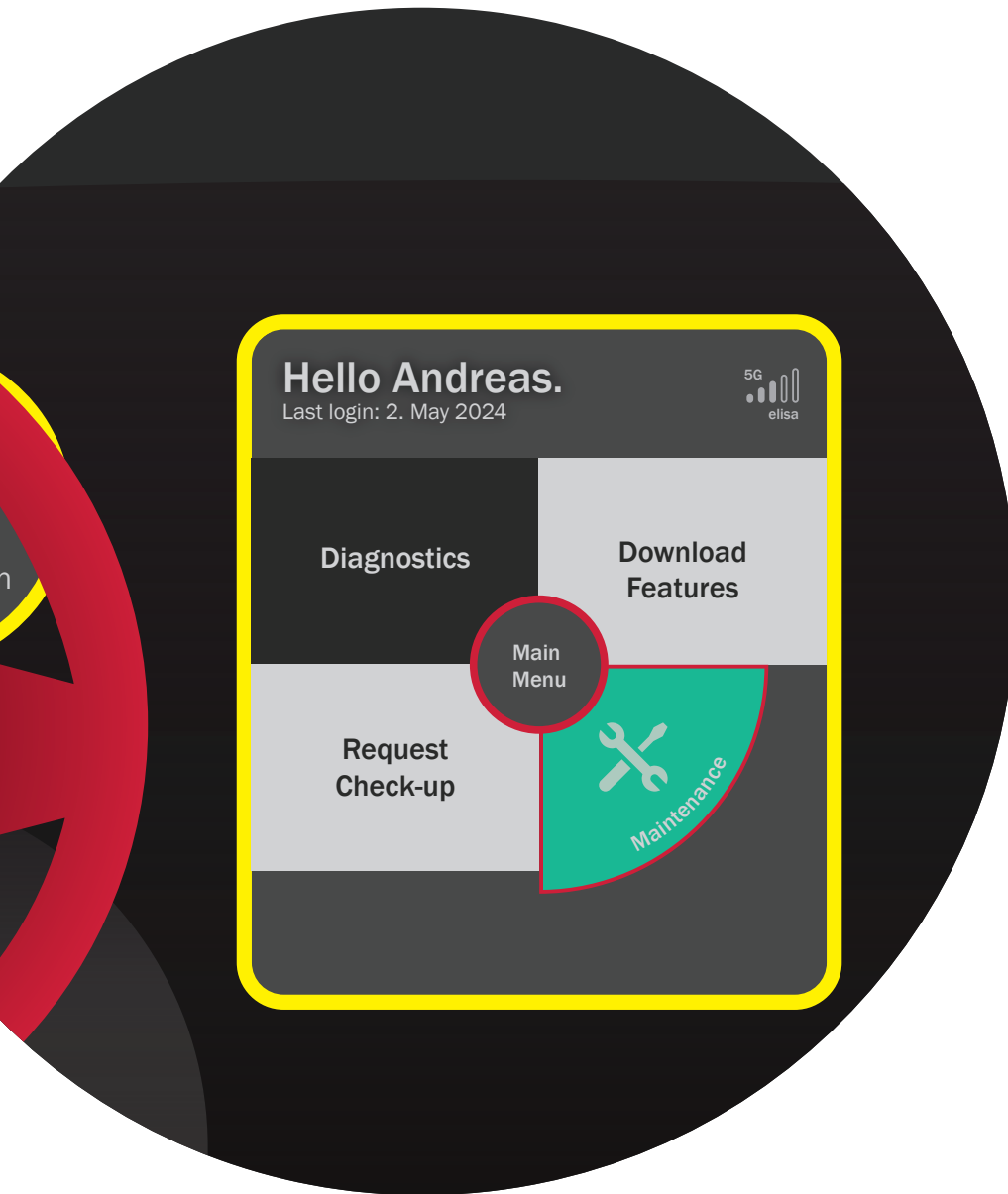
Through the maintenance tab, the driver is able to interact with the repair and maintenance service provider for any necessary tasks that need to be taken care of. It must be noted that the maintenance tab is vehicle-centric, which means that the available information and features are identical irregardless of the driver profile. Potentially, though, for shared cars, access to this tab can only be limited to the individual or organisation that owns and maintains the vehicle.

Along the lines of the augmented self as a phenomenon, diagnostics of the vehicle will be widely available, in contrary to the existing practice of car shops having an exclusive right to view and evaluate the status of the car. As more ECUs are introduced to vehicles, a precise overview of the state of the car will be possible, which allows primarily for the owner to prepare for any check-ups and repairs that need to be done, or automatically debug software that operates the vehicle.

Utilizing connectivity to the Internet, one can also download additional features that improve car performance and are exclusively developed by the manufacturer and/or third party developer.

Even though maintenance checks are done in certain intervals, one can also manually request for a check-up in the case the vehicle is acting up.

Hello Andreas.
Last login: 2. May 2024

5G
elisa

Diagnostics

Download Features

Main Menu

Request Check-up

Maintenance

PARKING MODE

P

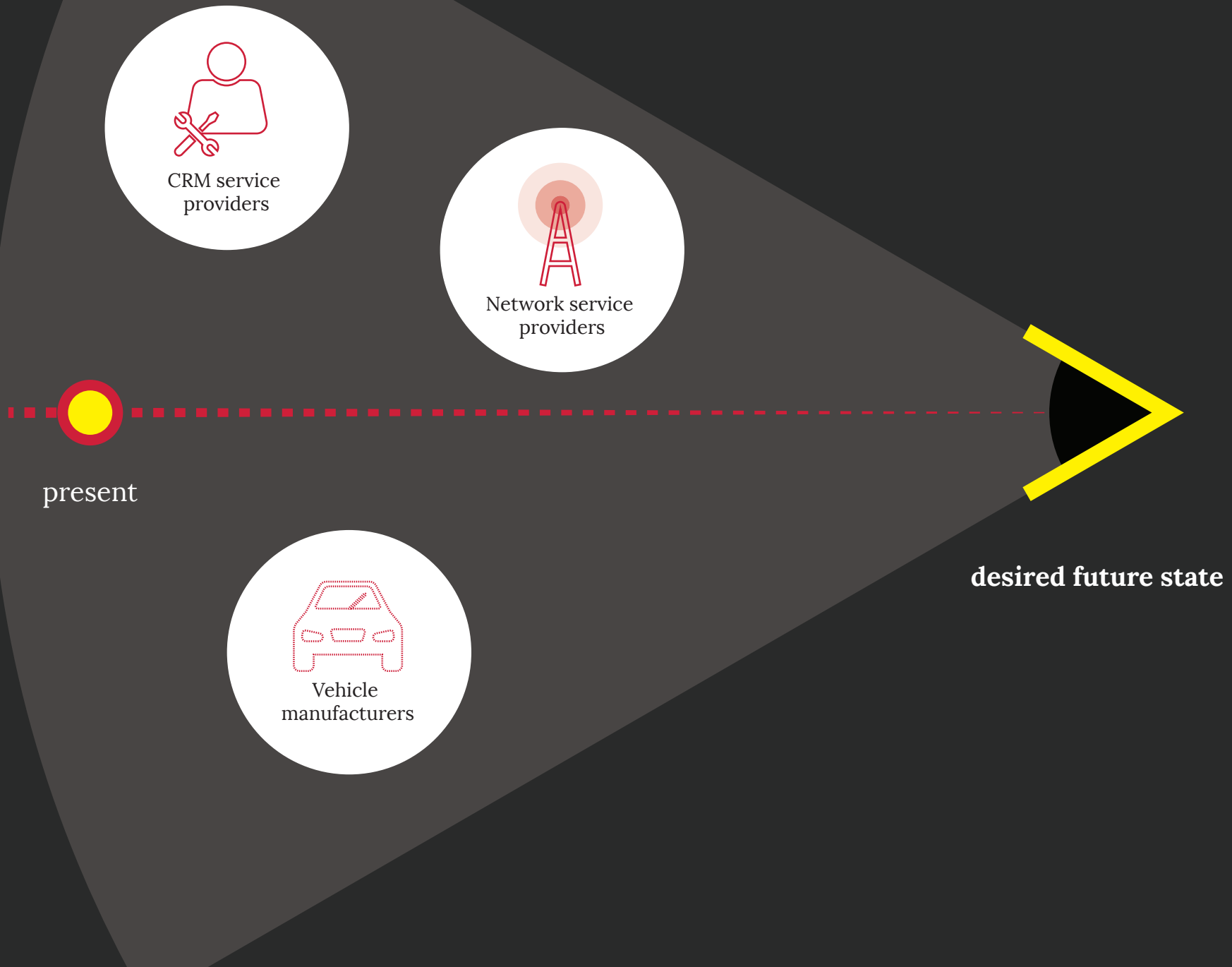23,538 km driven so far

16,462 km until next inspection

On the front panel, the driver will also be able to know when is the next maintenance inspection taking place. Currently in most vehicles there is only a meter of distance driven, and the owner must remember when is the next inspection due. The time-based calculation is made either based on time or distance driven, depending on the conditions and frequency of use of the vehicle. The current practice of depending exclusively on distance driven is not ideal for vehicles that are used in harsh weather conditions, such as the ones found in Finland. By providing transparent and precise information, the driver is relieved of the responsibility, as maintenance checks are booked automatically and performed at an agreed time, without the owner having to drive all the way to the repair centre. The maintenance can be performed on-the-spot when the car is parked and not in use, or be driven by the technician or Auto-drive, in case the task at hand requires an extensive workshop. This ensures that the vehicle is maintained in the proper timeframe, without the owner having to do much on his side, while enhancing **transparency** throughout the whole service experience.

6   78%

Downloading software update...

Over-the-air software updates are done automatically, and does not require the presence of a technician to manually perform the task as it is downloaded directly from the cloud server. Software updates are done right after the driver identifies himself, making sure that the vehicle is constantly up-to-date and secure.

CRM service providers

Network service providers

present

Vehicle manufacturers

desired future state

6.2 Backcasting into the Present

IN ORDER TO ensure the probabilities of the vision presented within these pages, the method of backcasting has been chosen as a strategic approach. Backcasting (interpolation as a process) is an alternative to the more conventional approach of forecasting (extrapolation from the past to the present to the future). Whereas forecasting focuses more on predicting what will come into fruition in the future, backcasting starts from a desired future state and elaborates on the actions required to achieve that state. Both approaches, though, complement one another, as is also the case with the current Thesis project. (Miola, 2008.) For instance, in order for the presented service concept to be feasible, it requires a technical infrastructure that has been forecasted from the technological advancements of the last century, as Moore's Law - among others - would suggest. On the other hand, though, the service concept does require political and cultural changes from the current conventional approaches of manufactures, and other service providers.

In the current section the focus is on backcasting as the future state of the service concept, and technological promises, have already been presented. Similarly to the collaborative research conducted earlier, the most vital stakeholders have been identified who affect immensely whether this vision can even be a possibility: **CRM service providers, network service providers, and vehicle manufacturers.** The next pages will elaborate on each stakeholder group separately.
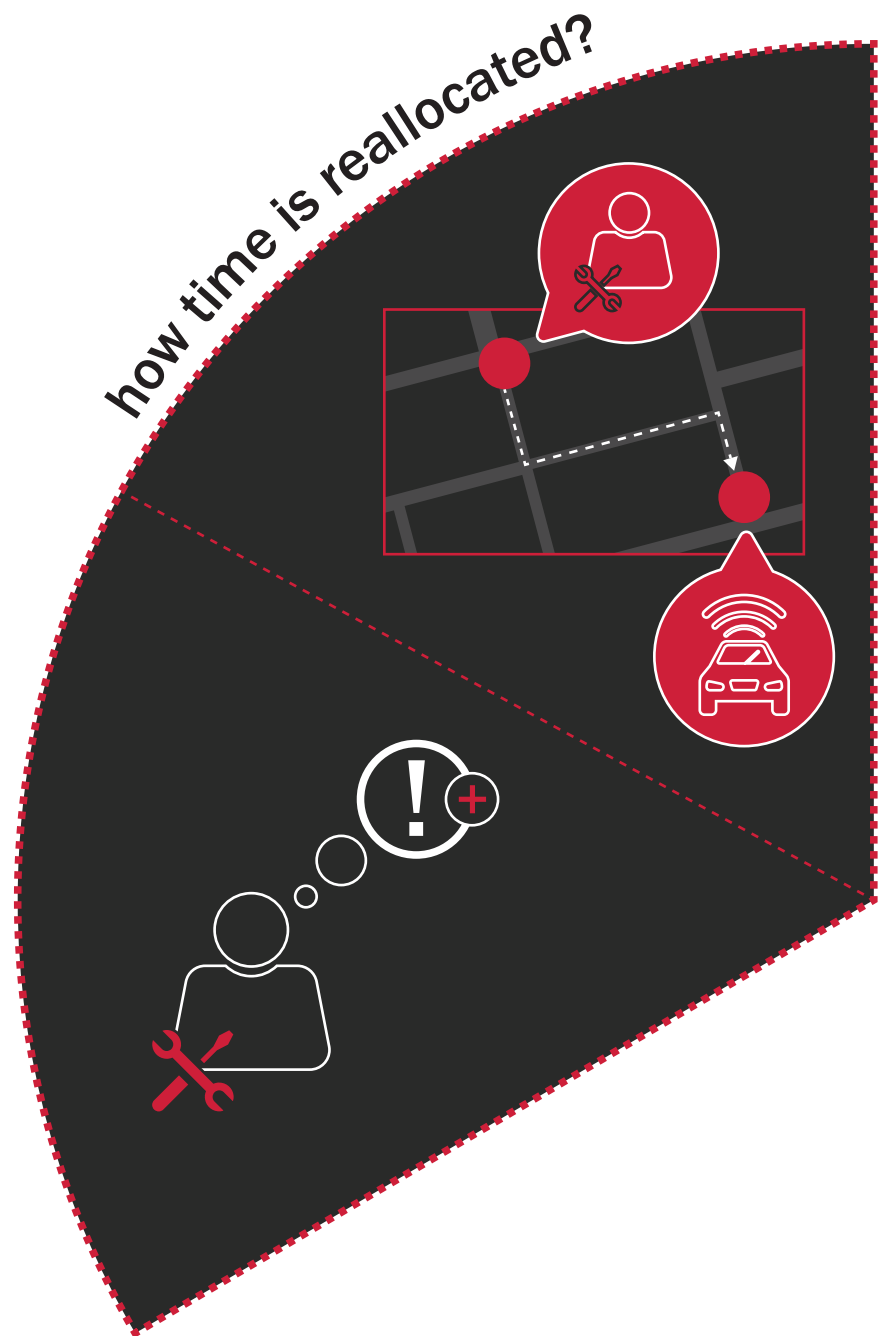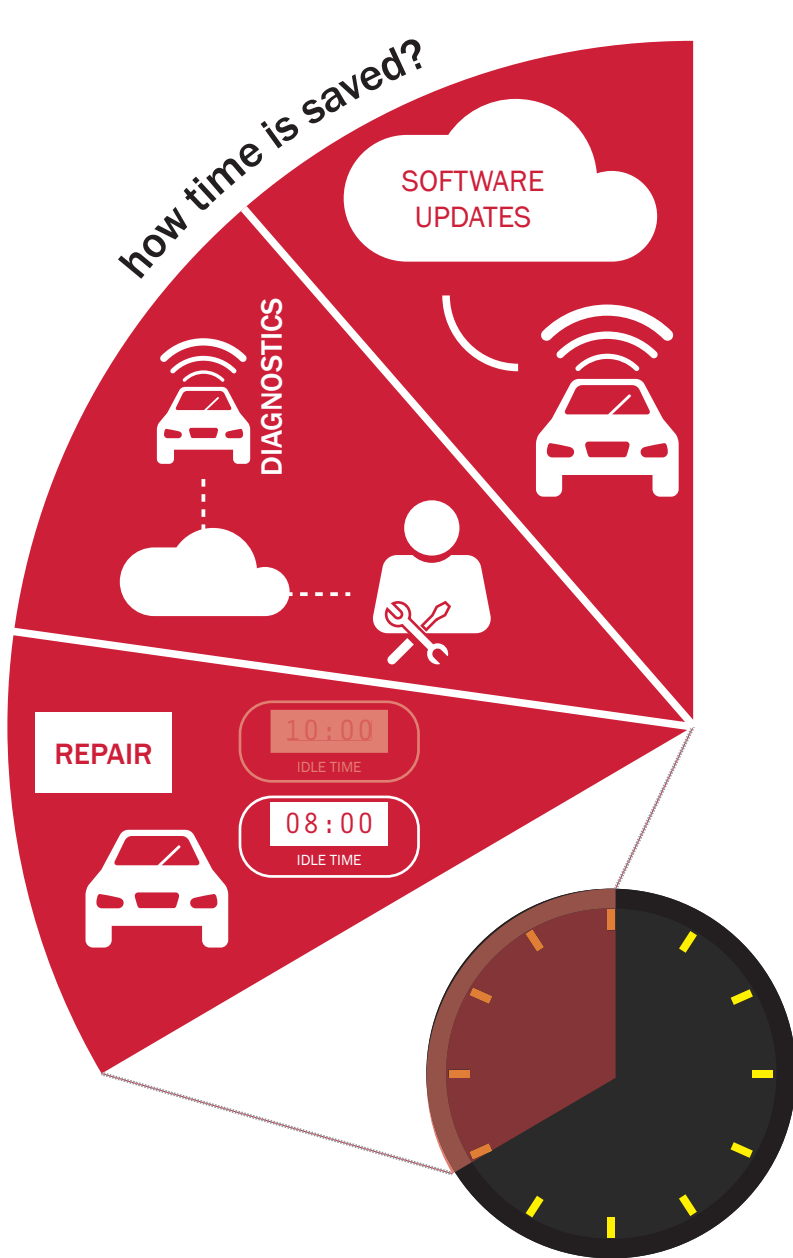
6.2.1　　The Service Provider's Cultural Shift

On the other end of the platform, lies primarily the CRM service provider which undergoes a massive cultural shift to accommodate the needs of users and the service provision, controlled by the platform in itself.

The main attribute that is altered immensely, is the aspect of time and how it is restructured, as displayed also in Figure 6.11. Cloud servers are heavily used to distribute over-the-air software updates and fixups, that should be mostly under the responsibility of the car manufacturer and/or a third party developer. Through automatisation of the process, car technicians are no longer needed to perform manual updates, which in itself saves a lot of time. In addition to that, when a check-up is planned the service provider receives a diagnostics report prior to the visit, which allows for the technician to make a preliminary evaluation on what needs to be attended to, thus reducing the idle time of the vehicle as diagnostics are performed at an earlier time. The duration of the check-up in itself is reduced, which improves the customer experience immensely.

With the time that is saved, it can then be re-allocated into enriching the customer experience. This also includes the time needed to perform check-up and repair tasks at a preferred location for the customer, or picking up the car at an agreed time if the Auto-Drive is not fully utilized. It is worth mentioning here that a similar service is already offered today by Tesla, the Tesla Rangers who, according to their website (2016), are *"specially-trained technicians who will come to your home, office, school, or any location of your choice to perform Tesla Service"* . Additionally, and most importantly, there will be more timely resources available to perform trainings that will be needed, along with the plethora of novel technologies in the industry, and eventually apply that knowledge in practice and in an efficient manner.

Pricing models, and the cost structure in general, is also modified. As already mentioned, a policy similar to the ones of insurance providers, manufacturers and CRMs need to utilize their extensive customer base and introduce a subscription-based cost structure. Within this pricing policy, all car users equally share the fiscal responsibility pertained by the costs that need to be

how time is saved?

SOFTWARE UPDATES

DIAGNOSTICS

REPAIR

10:00
IDLE TIME

08:00
IDLE TIME

how time is reallocated?

covered in repair and maintenance. This not only ensures a steady influx of financial resources, but it also eliminates high cost peaks at an individual level for customers, who pay a certain fee in return for repair and maintenance operations at no extra cost. *Accessibility and adaptability are the key drivers in introducing such a pricing model.*

As local repair centers are the closest stakeholders to the manufacturer and the car owners respectively, it is safe to say that maintaining the local user database is under the responsibility of the CRM centers. The plethora of information available to them, can also be utilized for other service providers who in turn can negotiate a common pricing policy and offer service bundles for customers to enjoy, while simultaneously **enhancing transparency** to both ends. Specifically, insurance providers may have a lot of use for this data who constantly need to evaluate various cases of damaged and stolen vehicles, as well as personal trial and health coverage. Currently evaluations are made based on testimonies, track records, and so forth, but a profile-based log of information allows for a more consistent and realistic evaluation needed.

In order to ensure that CRM and insurance policies do not contradict, Figure 6.12 provides a listing of what each policy should cover, using If Finland's (2016) car insurance policy as a basis. It needs to be clarified that by introducing a subscription-based service structure in repairing and maintaining should not, in any way, cause redundancies between these two vital service providers. On the contrary, this aims to strengthen the collaboration between the two in order to offer a more coherent service ecosystem to car owners and users respectively.

INSURANCE COVERAGE	CRM SUBSCRIPTION COVERAGE
Towing, scratches, dents & windshields	Routine maintenance of vehicles
Replacing stolen or destroyed vehicles	Check-ups performed regularly
Fixing any signs of theft and vandalism	Replacements of technical parts that are worn out from normal usage
Covering hospitalisation fees in the case of an accident	Software updates and debugging
Covering costs in the case of natural disasters damaging the vehicle	
Paying compensation fees for every day a vehicle is being repaired	
Assistance in trials, when charges are pressed in regards to ownership or driving disputes.	

6.2.2   Network Infrastructure

None of the elements of the vision would be possible without the involvement of the network service providers, who provide the network infrastructure and enable connectivity. As the partnership of network service providers with GSMA would suggest, their importance in enabling the Connected Car as a whole has fortunately become of interest from an inside-out perspective as well.

There are three elements that service providers need to consider within their upcoming infrastructure upgrades: enable 5G network coverage, support embedded SIMs, and offer vehicle-specific connectivity deals either as stand-alone subscriptions, or bundled with current individual subscriptions.

As explained earlier, 5G networks are currently under development and have the impressive features of an end-to-end latency of less than 1 millisecond (=0,001 second), and speeds that exceed 1 Gbps. It is worth mentioning that 5G is not aiming to replace 3G and 4G networks, as they are sufficient enough for other connectivity solutions that do not necessarily require higher download speeds or low latency. In the case of the Connected Car, though, low latency especially is an essential feature for the vehicle's and driver's security and well-being, and therefore qualifies for 5G support. (GSMA Intelligence, 2014.)

Additionally, with the advent of EU's eCall, service providers are required by legislative means to support the embedded SIM-technology, which will be introduced in new vehicles by 2018. As embedded SIMs become a reality, service providers have the strategic task in their hands to start offering vehicle-specific data subscriptions. An important consideration in offering subscriptions is that vehicle ownership hybrids need to be considered. Under the same connection, the number of users in the end might vary from a single person, to a family, or an entire community. Land-line internet connections are offered today in a similar manner, and the same flexibility needs to be on offer for mobile connectivity solutions as well, which is not really the standard today.

6.2.3 Manufacturers become Platform Providers

Car manufacturers, without a doubt, are at the core of enabling and making every vision this Thesis refers to, a reality. Within this context, manufacturers are not seen as a conventional producer of a hardware product, but becomes the creator of a platform that attends to people's needs in mobility and, more recently, connectivity. Telematics have existed since the advent of the AM/FM radio, which paved the way to what telematics are today, and what they could be in the future. As technology becomes more advanced, telematics are no longer passive technical elements in the car environment, but have emerging complex two-way interactions. It seems that as other interactive solutions penetrate into people's lives, in return, they start to demand similar solutions for mobility. "Uber", a mobile-based service that allows you to use a private person's car as a taxi, is one of many examples.

Car manufacturers, though, on the other hand seem to be slightly left behind in catching up with the fast pace that digi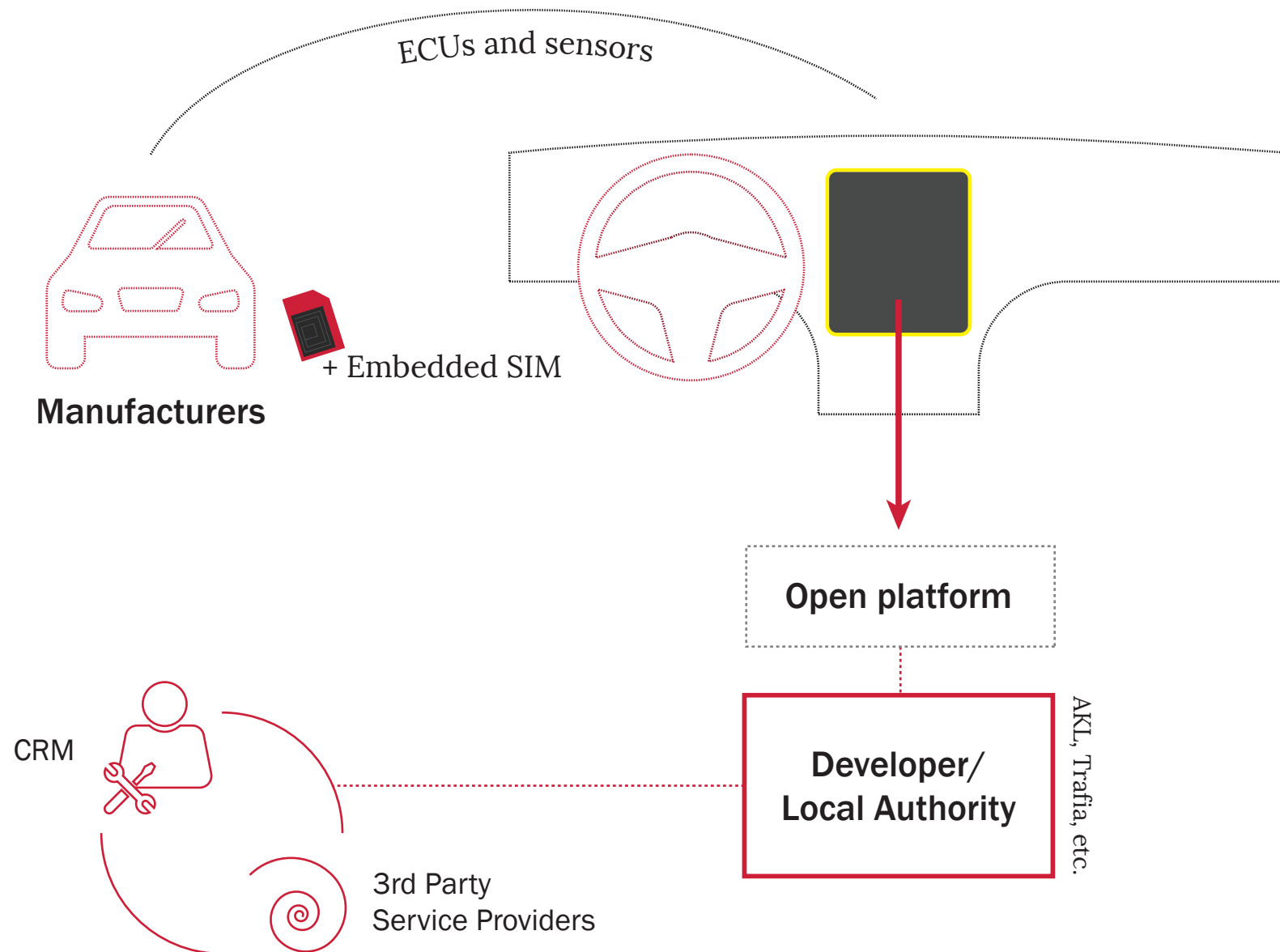talisation is coming to. Simply offering an embedded route navigator and a USB-port is not enough. The main reasoning behind this are the extensively long cycles in vehicle development and research. By the time a new model appears in the market, the novel features are either obsolete or self-evident. Processing power doubles within a 12-month term, and markets are overwhelmed almost on a monthly basis with new findings. In cars, the same increments are observed at a slower pace in every 5 to 10 years. This brings forth a great challenge: on one hand, manufacturers wish to have an exclusive ownership over the entire ecosystem but with slower cycles; and on the other, people's demands change at a faster pace and competition is tougher.

An important element for the current service concept, in regards to the car environment, are the screens featured in close proximity to the driver. The screens, of course, are mere output devices to a platform that is running in the background in which various processing units of the vehicle are interconnected, and provide a constant stream of data for the platform to process and present to the driver. All of these elements that are connected electronically and technically to the vehicle, constitute

an ecosystem. Luckily, this exists already in current newer models to a certain extent where one can view a summarized set of information in one screen that includes the driving speed, mode, distance driven, or even adjust the temperature of the heating in the car. This is a representation, though, of the conventional approach that manufacturers have: simply following up the variants of an activity on one screen is not in itself a novel approach. When a car model appears in today's markets with features that were initially designed within the past 5 years, their appearance no longer charms the markets in order for them to heavily stand out.
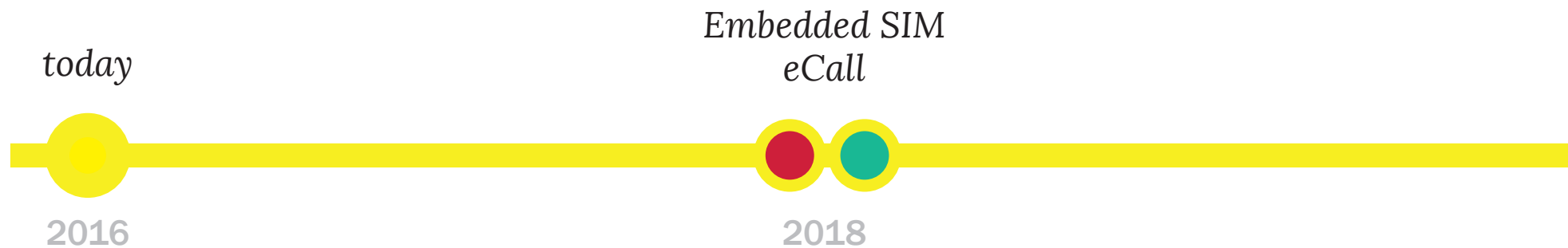
In addition to embedding SIMs to their newer vehicles, car manufacturers are faced with the heavy task of changing their perspective of how their electronic ecosystems are handled. Ideally, the ecosystem should be opened for other third parties to develop services in environments and intervals that are more prompt in responding to user needs and requirements. The manufacturer only acts as an enabler of the service provision by creating a platform that allows for an interaction from and to the ECUs connected to the vehicle.

Having an open platform, though, does have security implications which can be eliminated through the use of their CRM network globally, who could facilitate their local user databases. Additionally, the service concept itself heavily relies on over-the-air software updates. This introduces the heavy responsibility of releasing software updates through a novel channel, but on the other hand all vehicles are up-to-date through automation, which enhances security immensely.

ECUs and sensors

Manufacturers

+ Embedded SIM

Open platform

CRM

3rd Party
Service Providers

Developer/
Local Authority

AKL, Trafia, etc.

6.2.4 Backcasting Roadmap

🔴 Network provider   🟢 Manufacturer   ⚫ Car repair and maintenance

Embedded SIM
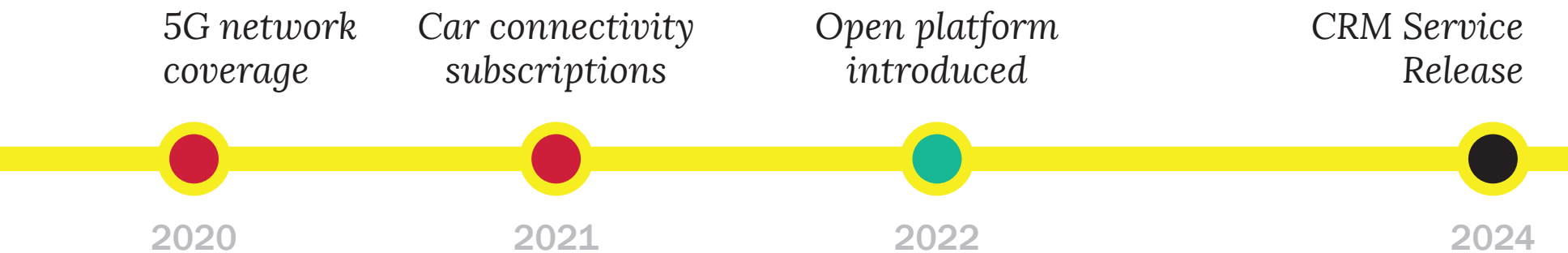*eCall*

today

2016

2018

The desired future state in which the suggested service is released under the responsibility of the CRM service provider, requires for certain actions to take place by other stakeholders. The displayed roadmap is the result of applying both forecasting and backcasting methodology.

The embedded SIM will be introduced along with the eCall service enforced through legislationg applicable in all member states of EU. This requires also for manufacturers to respond by allowing for the embedded SIM to be applicable for new vehicles that will be released in 2018 onwards.

By 2020, 5G network coverage will be on its way towards heavier coverage which is planned to be popularized by 2025 in most European countries. With the growth of

5G network coverage

Car connectivity subscriptions

Open platform introduced

CRM Service Release

2020　　　**2021**　　　**2022**　　　**2024**

5G, and the popularization of embedded connectivity in vehicles, network providers have to respond by providing subscriptions for vehicles.

New vehicles that appear in the market in 2022 (ie. allowing manufacturers up to 7 years time as of today) have an open platform, for which the CRM service will be released by 2024.

CONCLUSION

7

7.1 Provoking the Future

IT BECOMES APPARENTLY clear why choosing the saying by Scott Cook about the Internet revolution is extremely fitting to the topic that has been explored in these pages. Considering how Internet started to be adopted in our households only since the early 90s, it is truly amazing how much has happened in less than 30 years. From dial-up modems, up to having more connected devices than the global population, one can only imagine what the next 30 years might look like.

Amidst this chaos of connectivity, mobility intersects at a time when service and technological development is growing at an exponential rate. Conventional car manufacturers are flabbergasted by the rapid shifts in the industry, and they need to respond whether they would like to do so or not. In that search, futurologists, researchers and manufacturers invest and release visions on how mobility could look like in the future. These visions excite the masses, attract attention by media, and get people talking, but a transition to something more concrete needs to take place.

In this Thesis document, that step to a more concrete vision is realized through two specific variables: CRMs and Finland as the targets. CRMs have been neglected in existing visionary work, as they act as secondary stakeholders in the background, and Finland has a -smaller- scale of market of its own, which presents also its challenges.

In the Thesis, the biggest contribution is the research and the concept. As Finland lacks an indigenous vehicle industry, very little academic research is done in the field internally. The theoretical substance exists only in bigger geographical contexts that are not necessarily always applicable for the smaller market of Finland. This initially presented some challenges in gaining the appropriate literature, but also enabled and strengthened the need for a collaborative approach justifying the application of design thinking. Through questionnaires and semi-structured interviews, along with a coherent literature review on the European market, the Thesis aims to providing a valid overview of where the industry is heading to.

As a continuation to the applicability of design thinking, the conceptual work in the latter chapters provides a concrete representation on how the research can be applied and transformed into value for business and enhanced experience. It must be noted, though, that the concept aims primarily as a provocation for CRM service providers and manufacturers. The provocation aims to demonstrate how alternative ways of thinking, and escaping the conventional, can result into improved experience and business value. It invites stakeholders to look at themselves in the mirror, and become more daring in a challenging economy but in an exciting time of technological growth.

7.2 Lessons Learned

The abundance of learnings have been overwhelming, not only in terms of technological and industrial exploration, but also in terms of project management in itself. Primarily, the conditions under which this project was carried through shifted immensely and had caused great delays and dismay throughout the Thesis timeframe. What first was a project in collaboration with two big actors in the consulting and automotive industries of Finland, ended up becoming an independent and personal project due to financial constraints. Crisis management has been a side track that required timely resources of its own.

Within the topic itself, though, the learnings have been nothing less than exhilerating. Studying the future of mobility, along with making contributions through the involvement of stakeholders, has been a learning curve that can be applicable in many future ventures as the design profession constantly entails a future-driven perspective in insights, concepts, and validation. Trying to find the intersection between theory, collaborative design, and provocative conceptual work have been

exciting dimensions to work and combine with. From a theoretical perspective, documenting the historical framework of the car in today's society and exploring the various phenomenon surrounding IoT and the Second Machine age, provided a contextual understanding that is applicable in many other frameworks. On the collaborative side, which was also the most intriguing one, it was interesting to observe the perspectives various stakeholders had on the topic, and how a collaboration is definitely in place even though that has not been realized yet. Finally, converting both of the aforementioned findings into a concept that aims to provoke, rather than offer a detailed solution, comes at a time where this provocation is needed to enable the shift from a visionary view to a more concrete approach in what could be done in the near future. Even though most visions have a futuristic vibe, as the development of technology might be able to suggest, there is a really thin line between vision and reality.

7.3 What Next?

As explained earlier, the concept presented here serves mostly as a provocation and not as a precise guide on what needs to be applied immediately. Of course, the design decisions rotating around the conceptual elements in themselves are valid and should be -ideally- considered in a post-Thesis project.

The most challenging stakeholder that needs to be reached is without a question the manufacturers themselves. The introduction of an interface supported by an open platform is a radical request to make to something as conventional as the automotive industry can be. That is, though, exactly what they need: radical changes. This is where the provocative factor steps in the hardest. Additionally, it should not come as a surprise that the need for an interactive panel has been expressed before in other visions of the Connected Car. Introducing such an element inside a vehicle is not that unheard of.

Through the utilisation of the networks that were formed during the Thesis project, a follow up is definitely in place to validate and discuss under which circumstances such a concept can be taken forward. Especially AKL, and other governmental authorities (eg. TRAFIA), have shown a great interest in the improvement of customer experiences through digitalisation and automation. By showcasing an elaborate research and overview, along with a concept that offers a concrete perspective on the future, these associations will be able to use these results to take them a step closer to realising this goal.

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APPENDIXES

Appendix 1:
User Questionnaire Questions

The following is a listing of all the questions that were included in the online user questionnaire. The number of given responses in each available answer is in brackets. Please note that depending on certain answers (eg. whether you have a driver's license or not), different sets of questions were shown.

1. Country of residence
2. Do you have a driver's license?
   a. Yes (101)
   b. No (15)
3. Is your original driver's license issued by your current country of residence?
   a. Yes (72)
   b. No (30)
   c. I do not have a driver's license (13)
   d. Other (1)
4. Level of education
   a. Basic education / High school graduate (4)
   b. College (15)
   c. Higher education (97)
   d. Other (0)

Ownership and use

1. Do you own a car?
   a. Yes (41)
   b. No (60)
2. If you own a car: When was the current car purchased?
   a. Within the last 2 years (19)
   b. Within the last 10 years (21)
   c. Within the last 11+ years (1)
   d. I do not remember/know (1)
3. If you own a car: When is the next car purchase estimated?
   a. In the next 2 years (15)
   b. In the next 5 years (17)
   c. In the next 10+ years (2)

   d. I do not know (7)
4. If you do not own a car: Are you planning to purchase a car within the next 5 years?
   a. Yes (20)
   b. No (40)
5. How often do you drive a car?
   a. Daily (16)
   b. Several times a week (30)
   c. Monthly (13)
   d. Sometimes throughout the year (27)
   e. Rarely (12)
   f. Never (1)
   g. Other (2)
6. Have you ever used your smartphone as part of your driving experience, in addition to talking on the phone?
   a. Yes (84)
   b. No (14)
   c. I do not own a smartphone (3)

Car use and maintenance

1. Would you be willing to share the use of your car when you are not actively using it, in return for a steady income?
   a. Yes (63)
   b. No (38)
2. Have you had any experience(s) with car repair and maintenance services?
   a. Yes (go to question 3) (52)
   b. No (go to question 5) (48)
   c. Other (1)
3. How do you feel about the price you paid on your last visit?
   a. Too expensive (33)
   b. Just right (11)
   c. Cheaper than expected (6)
   d. Pricing was transparent (I knew what I was paying for and why) (15)
   e. Pricing was not transparent (I did now know what I was paying for and why) (7)
   f. Other (5)

4. Would you ask your car technician about guidance, repair or maintenance of a part that is not necessarily his/her expertise?
    a. Yes (29)
    b. No (27)
    c. Other (4)
5. Have you ever repaired or maintained the car you use/have used by yourself?
    a. Yes (42)
    b. No (59)
6. Have you ever asked somebody's assistance when repairing or maintaining a car on your own?
    a. Yes (39)
    b. No (3)
7. Have your attempts to repair or maintain a car on your own been always succesful?
    a. Yes (16)
    b. No (26)
    c. Other (0)

Use of public transportation

1. How often do you use public transporation
    a. Daily (35)
    b. Several times a week (27)
    c. Monthly (13)
    d. Sometimes throughout the year (15)
    e. Rarely (10)
    f. Never (1)
    g. Other (0)
2. Would you use public transportation more if the costs of using a car increased immensely?
    a. Yes (61)
    b. No (26)
    c. Other (14)
3. Would you use public transportation more if access to important locations of your routine would not be possible with private vehicles?
    a. Yes (80)
    b. No (14)
    c. Other (7)

Exploring the other means
(if you have no driver's license)

1. Are you planning to acquire a driver's license at some point?
    a. Yes (10)
    b. No (3)
    c. Other (2)
2. Do you think that living without a driver's license affects your quality of life? Give reasons why. (text description)

3. As a car passenger, have you ever been in a car that malfunctioned while on the road?
    a. Yes (7)
    b. No (8)
4. Have you ever assisted anyone in repairing or maintaining a car?
    a. Yes (4)
    b. No (11)
    c. Other (0)
5. Have you ever used your smartphone as part of your on-board experience?
    a. Yes (11)
    b. No (2)
    c. I do not have a smartphone (2)
6. How do you primarily move around?
    a. Bicycle (3)
    b. On foot (2)
    c. Public transportation (9)
    d. Taxis (1)
    e. DRT (eg. Kutsuplus) (0)
    f. Other (0)

Appendix 2a:
Interview transcript with
Jani Kemppainen (VW Center)
(26.8.2014)

Do you have any kind of vision or strategy on the future of CRM services? There are many big changes happening in the car industry ranging from urbanization, connectivity solutions, etc.

As a service we respond mainly to the current needs, so we do not focus too many resources on creating visions of the future. Of course we are aware of the shifts that are happening, such as the popularization of electric cars, that will reduce the maintenance cycles needed throughout a calendar year. Oil changing and other similar maintenance check-ups, for example, is not something we see to be offering as often as we do now. These shifts evidently will change the structure of how we do our day-to-day business activities. Some maintenance of course is to be expected, but the cycles and the scale of repetition is definitely going to be reduced in the future and therefore the amount of cars we will have to serve will reduce as well. On the other hand, other maintenance tasks that are not affected by the energy source but by the level of usage, such as break check-ups, will continue to be at our focus.

Despite the lengthening of maintenance cycles, are there any thoughts of you as a service provider to be more involved with the drivers' car usage on a daily basis in between maintenance check-ups?

Everybody wishes to personalize their product/service to fit their users. For example, in the case of accessorizing more alternatives and variations could be offered. In today's offering, accessorizing in retail is an option that is not easily offered anymore. In Finland, when a person purchases a car, he/she chooses pre-defined accessory packages that are installed prior to shipping, and retailers do not have as much freedom anymore to include additional accessories after the purchase and shipment have been made. On the software side, though, definitely more alternatives could be offered. Even today for VW cars, the user him/herself can update and download maps for the navigation system, whereas in the past it was possible only through the retailers. Most possibly, how we see this happening, is that a similar ecosystem to smart phones will be made where users themselves can choose the applications they want to have on their vehicle's software systems. What is challenging though is to provide applications on technical features and diagnostics of the vehicles, as the existing interface (OBD-port) provides data in the form of error codes that are not easily interpreted and are different for each car manufacturer. The data deriving from the OBD-port are only used to define the direction of what could be repaired, but do not define exactly which part in which car function is faulty. The latter is defined by inspections made at the CRM centers, guided by instructions that derive directly from the manufacturer.

How do you see the DIY-movement affecting your business, where users tend to enhance and repair things on their own?

We personally see that the maintenance and repair made by the users themselves is constantly reducing. Cars are very technical objects, and they are to become more complex in the future as more technological innovations are implemented. The only way to be able to perform any repairs would require proper education and experience. Cars, similarly to any other complex electric appliances,

will slowly have more restricted access points for the users and any possible faults would not be even easily visible by the naked eye. In the past, breaks and parts would break and it would be visible, but now as cars are becoming more technically complex the fault is not that evident anymore. Additionally, some parts require special tools and parts that are exclusively used only in repair centers.

How do your employees update their knowledge considering all these new developments that are taking place in frequent time cycles for the car industry?

It depends on the technician's specialization. Each employee of course needs to undergo the basic courses guided by the manufacturer and facilitated by importers, even though he/she has an existing degree in car mechanics. Later on, each technician undergoes additional training on a specialization line (eg. diagnostics, motor technology, etc.), and the specialization(s) define how often a technician needs to undergo additional training throughout a calendar year. These trainings are offered by the importer. In the case of Volkswagen Group in Finland, Kesko operates as the founder of the company which cooperates with the importer of VW, Seat and Audi cars. VW Center is a function of VW Autotalot, which is a daughter company of the importer itself. But when it comes to education and training, we are on the same level as other retailers, which means we need to always buy the training packages. In addition to that, there are also trainings offered by the center itself, which are not necessarily required by law but are offered only to increase the know-how of technicians and improve competition.

Do you think the intervals of training will increase in the future?

As products become more technical and complex, the need for training will increase. Additionally more car models seem to appear, and for each car model additional training needs to be made, which inevitably results to the increase of training intervals of experts in the field.

You receive a lot of feedback as a service provider. Are you able to tell how this feedback is used in car development?

Each car has several sets of features. When an actual fault is noticed in the design, of course that is instantly repaired and improved. When users, though, request additional functions, that *might* be heard by the manufacturer. As a repair centre we do not have much say on the development side. This is of course to say for the technical development. On the software side, it is more than possible to see even a radical shift to open-source solutions where each user, or other software developers, can create all sorts of custom-made solutions. It does seem, though, to be the case that these software functions would not be usable during the drive itself for safety reasons. Later on, though, when the popularization of driverless cars is evident, users would then have more time to occupy themselves with other activities on the move. The next revolution would lie in making driverless mobility possible, which would create more business opportunities for the additional time acquired for the user. The problem is, though, not the technical feasibility as it could be possible even today, but more so the investments needed for enabling such technology today and also changing the mindset of people to trust driverless cars. The current generation would not be convinced easily, which means we can only talk about

the generations to come when it comes to welcoming such a radical shift in car usage. In the case of Finland, or any other Nordic country, we also need to consider the challenges pertained by the radical weather conditions in the winter season and how a driverless vehicle is able to respond to that.

In your current service offering, are you utilizing any sort of existing connectivity solutions?

Many options are possible but are not utilized as much today but could be applied in the future, when costs are reduced. On the heavy truck side, though, where the investments made are larger, many connectivity solutions are utilized even today. Volvo Trucks, for example, offers a service where software updates are provided by the maintenance center at a distance even if the vehicle is on the move. It can be easily understood that when you compare the price difference between a 10,000 eur and a 100,000 eur vehicle, naturally the one with a higher price tag also offers more connectivity solutions since the investments are bigger. For trucks there is already the feature being offered where the navigation system uses various sensors to store data for different roads, which can be utilized for other trucks that approach the road, and prepare the mechanics to operate in the most efficient way depending on the road conditions. This aims to benefit also the sustainable value of the truck, by pre-setting it to the most optimal driving performance and avoiding excess pollution from unnecessary speeding, breaking and gear changing.

Other applications also include distant preparations for maintenance intervals, utilizing connectivity, where a CRM-center receives a notification when a vehicle is approaching its limit for the next maintenance cycle, and simultaneously delivers the various error codes already

beforehand. This can also be seen in expensive passenger cars, as naturally all innovations appear first in the more expensive models. In order to see more applications universally in cars, it also demands for the networks themselves to upgrade to sustain the increase of traffic data, as there are 100,000s cars on the move at all times. For any new innovation that appears, it is natural to assume that the more expensive models get to enjoy its benefits first. For example in Mercedes cars, it would be easy to assume that a driverless car function would be implemented first in its S-Class car series, before the costs reduce to allow it to be included in cheaper car models.

What do you see as a threat to your service?

There is a huge competition in the field. As cars become more complex and technical, on one side users themselves are not as involved in the repair itself anymore which means that in some cases the need might increase for certain operations, but then on the other hand competition naturally will increase.
Also as cars are utilizing ICT technologies, we need to be aware of the risks deriving from data security.

How do you see car sharing within communities affecting your service?

As communities are becoming more urban and public transportation services are improved, the actual need for a car in some cases might not be that evident. In the future, one might need a car only once a week or once a month, and this group of people will grow in size due to other socioeconomic changes. Having meetings online is more than possible even today, which reduces also the need for people to travel constantly between working locations, hence reducing the need for a car. As a company reduces its quota of cars for employees, or as it enables sharing

of cars between employees, that naturally reduces the number of maintenance needed as there are not so many cars to maintain, and the same would apply also for other kinds of car-sharing communities. In Finland, though, it is noticeable that people still wish to own something of their own, and cars continue to be a status symbol. Even though the need for a car is not so evident anymore, people are still willing to make the investment of owning a car. Car sharing is happening, but in Finland at least we do not see it affecting the car market immensely.

How are you able to stand out from competition?

Of course the exclusivity to our brand and our expertise helps in that. We know the problems that customers approach us with, and are able to offer the best kind of service. Multi-branded service providers might compete with price-per-visit, but their know-how cannot simply be at the same level as ours when it comes to Volkswagen cars. The lack of contemporary know-how might eventually increase the costs as the problem might still persist which results in more visits and more costs, which would be avoidable if one was to approach us in the first place.

Appendix 2b:
Interview transcript with
Kari Lindström (Turku UAS)
(12.9.2014)

Introductory remarks

It takes around 12 years for the car fleet to be replaced. In Finland there are a bit over 3 mil. cars, out of which passenger cars are around 2,7 mil., and for that fleet the replacement rate is very slow. Not a lot has happened in the last decade in terms of the car fleet, and there are even concerns that the replacement rate will reduce even more due to financial reasons as well. Several car retailers already have undergone some radical staff re-structuring and reductions as a response to the reduced sales of cars.

Price is also going to play a big role for car service providers, meaning that chains and repair centres would prevail over SMEs in the car repair and maintenance scene.

When we talk about education, we always talk about preparing people to be the professionals of the future. How do you prepare the curriculum of your degree in order for it to match the demands of the future?

We apply the principles of innovative pedagogy. The main idea behind it is to educate the individual to always look a bit further in the future and be able to prepare for it, acquire good networking skills and simply take initiative on his/her own. Primarily though, in our degree, the main focus is to provide the foundations needed to successfully carry out the alumni's first job upon graduation and to satisfy the standards needed. In addition to that, we apply the pedagogical thinking where we push the students to

have a yearning for further development in order to satisfy the requirements of the future. Having said that, though, connectivity and smart solutions is not in the focus of our education at all. Repair centers define the standards, and require that the student has the basic knowledge on car diagnostics, customer service, management, etc. which are also the main focus points of the courses offered within the curriculum. Finland does not have its own car industry, which also reduces the possibilities in the educational field on what directions a person can take. It is very uncommon to see professionals of the field specialize in connectivity solutions, which maybe in the case of Finland is more of a focus for the ICT sector. IT though, in general, is a big part of our education as many systems used for repair and maintenance are automatized and computerized, which the students need to know how to operate. Programming or any advanced computer skills, though, is not in our focus either.

Do you have a focus on specific car brands?

No. We have no affiliations with any car manufacturers. The manufacturers and the retailers themselves are in charge of providing the necessary additional training if needed. Our degree aims to fulfill various industry-related regulations, both national and international, as well as the guidance provided by Trafia and the laws set by the government. Despite the inexistence of affiliations, we do aim to collaborate with all the retailers as much as possible, in order to provide as many opportunities as possible for the students as well.

For our basic courses in disassembling a car, and teaching the construction of a car, we use old cars that are provided to us by "Harkka", which is a company specializing in collecting junk cars and car debris. Through this cooperation, the institution has the freedom to use some

of their stock for educational purposes, but there is once again no brand affiliation and the courses are provided merely on the basis of what is currently available. The cars that are disassembled are then forwarded for recycling, as sustainability is also one of the values that the students need to learn when working in the automotive industry.

On the topic of connectivity and smart cars though, the education here is indeed quite outdated and the Thesis you are trying to introduce here should be quite a revolutionary topic for the Finnish industry.

Do you also offer additional trainings after graduation?

Yes, we most certainly do. We either have experts coming here, or we go to certain locations to execute our trainings, depending on the case. Maintenance and diagnostic training is one of the things we do, along with other specialization courses based on the demand.

Is practical training included in the curriculum?

Practical training is definitely a compulsory part of our curriculum for all of our students, which totals to 30 ECTS. The academic year ends by the beginning of May, by which all theory and lecturing is done, and then after that the student is obliged to undergo practical training through most of the summer. Most students by the end of their studies acquire a total of up to 1 year of experience, which is of course beneficial for their recruitment later on.

How is peer-to-peer learning facilitated within your curriculum, if any of that is visible?

For example in the basic courses on the construction of a car, students disassemble various parts in teams. When the part is disassembled, they also need to clean it, after which they have to present to the whole class on what is the part and why is it used. This process is repeated many times, through which students learn from each other.

Despite the lack of focus on connectivity, is it nevertheless mentioned at all?

Connectivity and smart car services is indeed mentioned at the last stages of a degree's framework, but only briefly. It is in no way at focus, and it is only expressed as a mere element of curiosity. One reasoning for that is also the lack of staff and research made in the field in the first place, for us to be able to offer education that would fulfill certain academic standards. One thing worth of checking out, though, is the Car Laboratory at Aalto University (auto- ja työkonetekniikan ohjelma, Kari Juhala).

There is also not much bibliography existing for the field. In Finnish, there is definitely none. The only bibliography you can find in English is papers published by manufacturers and brands, but they are very specific to their own brands.

Does the education that you provide more beneficial for brand-exclusive or all-brand-inclusive service providers?

The education that we provide is at such a generic level, that it is applicable to any service provider. The specifics are then taught primarily through the practical training that students have to undergo. Each car manufacturer sets its own standards, and we cannot possibly create a curriculum that covers every single individual process for each brand.

When it comes to car accidents, manufacturers again set their own processes for measurements needed, but eventually for legislation purposes they do go in the same

system, which we are at least able to teach and show students how it works. The specifics, though, once again, is not our responsibility.

As mentioned, each service provider and retailer is fully responsible of offering the appropriate additional training for new stuff that they recruit.

In order to provide though some business skills, all students have to go through the process of establishing a cooperative in order to understand business modeling and how customer service needs to be designed. The cooperative format allows for more flexibility compared to limited liability companies.

Do you have any alumni who end up working abroad?

Most of our students do end up working in Finland, also because the contents of our curriculum is more relevant to the standards in Finland. There is very little education in the field in the first place, and as Finland does not have its own car manufacturers, the students lack skills in designing and planning new cars as it is not relevant for the Finnish scene. Because of that, it is rather inevitable that at least the student's first job will be within Finland. Of course some exceptions do exist for the field of repair and maintenance, as the standards can be quite similar elsewhere as well. Also, since car manufacturers are international, it can happen in more than one occasion that alumni, through the retail network, might end up working abroad as well.

The focus though is not for an international career in the field as there is still quite a high demand existing already in Finland which we aim to fulfill first.

What is the nature of your Theses works?

There are basically two directions: either the student works with a technical issue, or with process development. It is very rare that the student writes his/her Thesis on something as novel as connectivity in cars, etc. Typically companies provide the topics, where students assist the company to find solutions for a technical of procedural issue, and its feasibility.

Do you have any remarks about smart technologies in the industry?

Smart technologies in the car industry have existed for quite a while now, but now is the time when people are just talking about it more. That is also because the data infrastructure allows for the popularization of this technology, but in order for it to be well integrated into people's lives, more upgrading needs to be done to the networks of service providers.

Back in the days when 3G and wireless technologies were not so evident, the few example of connectivity solutions that existed worked only through GSM calls, SMS messages, or through servers and satellites of the companies themselves. TomTom, for example, offers "TomTom Live" which connects directly to the servers of TomTom through satellites, and calculates the optimal route for the driver, by avoiding traffic jams through real-time data provided by other users. The possibilities are endless, and many have already been established, just not so well integrated or popularized yet.

Appendix 2c:
Interview transcript with
Pekka Risa & Jouko Sohlberg (AKL)
(18.9.2014)

What kind of objectives do you currently have with your recent developments?

We don't want anymore just engineering-based work but we are more interested in focusing on business and service possibilities that can be realized with the current technologies.

We have 3 mil. cars on the roads at the moment, and their average age is around 11 years. That means that there are really old cars and really new cars in the stock. 1,5 mil. are therefore somewhat recent and we do not see the replacement of that fleet happening within the next 10 years or so. How can we get smart connected services to these cars? Clearly that is not from the manufacturers anymore. Of course, each manufacturer wishes to have exclusivity over what they provide in their products, and that has always been an issue in the industry where manufacturers are enforcing only what they can provide, without allowing resellers, consumers and other players in the field to offer and receive substantial alternatives. This operation will continue being the same in the future as well.

Getting connectivity into cars, though, is no longer that big of a challenge anymore as the equipment needed, that can be tethered, is really cheap nowadays and we already have cars currently that are in a test phase. The technical feasibility, though, is not enough. Now we can remotely read your data, but what happens after that? We need to

focus now on innovating on service solutions that can be provided. There are already players in Finland focusing on clarifying the technical feasibilies, and now we need to start thinking of the next steps.

It is very challenging to create a vision and to guess where the next steps are situated, as so much has happened in only a matter of a few years in the car industry. With heavy trucks and the professional vehicle sector, however, connectivity has existed for years already in regards to diagnostics, monitoring, and driving safety, among others.

What are the issues you are trying to tackle in regards to training?

We have been trying to build a distant learning concept for almost 1,5 years now. We have been facing the questions on how can you produce a service on learning that is interesting, intriguing and inviting. We are still in the very beginning of testing some ideas, but still are in great need of guidance on how we can penetrate the entire market, by involving more interaction and learning in the process. Finland is a big country with long distances, and these days there are limited budgets to enable additional trainings. In the past it was the norm that professionals of the field would fly over to Helsinki from Oulu, for instance, and stay for the duration of the training, but that is not possible anymore as the logistics behind it is too costly. On the other hand, the need for additional trainings will increase, but now it has to be realized in a different and more cost-efficient way.

How we see it in the future is that car repair service providers will also be the ones going to the consumer, instead of just the other way around. In those cases we do see the need of being able to provide instructions at a distance, on what needs to be done depending on the

complexity of the task. The car industry for over a century now has always worked so that the consumer was the one who needed to go to the car shop and/or the reseller to purchase a vehicle or get his car repaired or maintained. It has always been one-directional, but now we need to shift that paradigm and train professionals that it could, and should also go the other way, where the expert is the one going to the paying customer and provide his/her services and products. Why is the consumer forced to go on a Saturday morning all the way to an industrial area to test drive a car, instead of agreeing that the car can be tested at a certain time and place that suits the customer? Car sales would benefit greatly by having a user-centered approach, where test drives would result also in individualized remarks on the car's usage, instead of just bluntly asking whether the potential customer has made a purchasing decision or not. We wish to challenge greatly the existing working culture, which is something to bear in mind on the nature of the trainings we wish to realize in the future, along with the other challenges mentioned.

How do you see the involvement of consumers in repairing in the future?

When it comes to providing guidance for individuals outside the field to perform repair tasks on their cars, it can be easily compared to trying to teach someone how to play the piano. Repairing a car demands skills that can only be trained, and safety is becoming a bigger issue especially with the introduction of new technologies (EVs, hybrids, etx.) and the life hazard of electricity-related operations. In some instances, though, it could be possible for example in replacing a car wheel but we do not see a large-scale feasibility of such an approach. Manual repairs are still possible with older cars of course, but when we go into newer models, their technical complexity has already reached such a level today that it is almost impossible

to find what you are looking for without the appropriate training. Not to mention the challenges of getting special tools and components that normally are available exclusively for resellers and car shops.

When we talk about the future, when cars are hosting complex information technology in their circuits, many repair tasks will be possible to perform remotely without any user involvement. Manufacturers are aiming to create closed ecosystems for their cars, meaning that in many cases user involvement will not even be possible.

What is the role of information technology in the field?

Information Technology is becoming a vital part of the car industry, which also challenges the nature of the professions surrounding the field. Technicians will need to have some know-how on coding for instance, and that is something that we are already pushing with the Education Board on introducing different kinds of modules in recent degree reformations. Current curriculums that were developed and introduced 5, or even 10, years ago do not fulfill real-time demands of the field. ICT, electronics and electricity are knowledge bases that are more relevant to us now than they were ever before, and we need to respond to that.

What is your role in the CRM scene of Finland?

We are key players in the field as all car repair and maintenance service providers in the country are our members. We organize with, and for, them trainings. We have established AKL Academy in which through our partners we also find trainers to realize training sessions as needed. Turku UAS, Metropolia, Haaga-Helia are some of those partners. Our role is to provide instructions on what path to take based on scenarios that we foresee about the

industry, and together with these partners we conclude on the types of trainings that need to take place. This is the only way to respond fast, as current curriculums and their reformations take a really long time and we cannot afford to wait for them to happen. We are also involved in the development and introduction of legislation within the field, ranging from consumer protection laws to defining certain standards, and making sure that our members are up-to-date and compliant with current legislation.

Do you have any recommendations on the approach of the current topic, as an authoritarian figure?

When it comes to the Thesis project itself, there are two types of approaches that you could take. One is to improve the efficiency of monitoring our members through the appropriate format(s) of training or secondly, have a consumer focus by analyzing and forecasting what their needs could be in the future and provide us with the requirements that we need to fulfill in consequence. If you take the second approach, no one will be able to disagree with what you provide as it will be an input from the paying customers.

The biggest challenge in introducing any service is how can we create a business model that creates a revenue. AKL is not collaborating currently with any network service providers, but they do collaborate with ITS who is an active partner.

What is your perspective on how the IT industry is going to affect car production in general?

Up until today manufactures have been focusing exclusively on increasing productivity and abiding legislations set to avoid penalties, but then it is interesting to realize how their culture is getting challenged as the IT

industry is getting closer to their ecosystem. When Google introduced the driverless car concept, suddenly you had almost instantly a number of manufacturers stating that they are also exploring this capability. It does make you wonder to what extent this will go and how these shifts are also affecting how manufacturers develop their products in the future.

Google and Apple are trying to enter the market of the connected car, but car manufacturers are still holding on strong to their own ecosystems and do not allow them to become a part of it. The problem though is that Google, Apple or any other IT company would be better in providing digital services for the car, as manufacturers are so caught up in the product itself. Manufacturers should start seeing themselves as platform developers instead of just producers.

Remote diagnostics is already possible today, and through that a car repair shop can receive constant updates about the state of a vehicle and its error codes. When an error appears you can then contact the customer and ask to book a repair time and that's that. The real challenge though comes in when you are driving on a long route, no car shop in sight and you are in need of some maintenance that could easily be solved remotely but the only one who can provide this solution is the manufacturer itself, making any car shop obsolete in the process. On the other hand, though, there is a huge risk on cybersecurity and for now this must remain in the exclusivity of the manufacturer otherwise risks are bigger. From this perspective, as manufacturers may gain a bigger role in after-sales service provision, the rest of the market (secondary car repair service providers, etc.) may inevitably shrink. Ford, on the other hand, has opened their platform to allow for other developers to create solutions on the nature of service that can be provided in the future. Tesla is a company that is worth of checking out on their open philosophy.

What is your response to the popularization of public transportation and the shifts in consumer behavior?

When it comes to the city planning, and the different strategies that are being introduced in reducing or eliminating car usage in certain areas, we do have representation in those boards but we are somehow puzzled with what is suggested. We do support the development of public transportation for cities like Helsinki, where you do have a big public audience, but in most cities in Finland where people live in remote areas, or have longer traveling distances between them, the ownership of a car is inevitable. It does not make sense to start building an infrastructure to sustain metros, trams, trains, etc. In the capital region it is more than embraced to shut down streets and enhance public transportation, but it should not be something that is forced to all individuals and should still be a choice on which mode an individual chooses to take for his/her mobility needs. This is the type of input we try to give in the decision-making process, and of course such radical changes might pose a certain threat to the size of the car market.

Appendix 2d:
Interview transcript with
Sampo Hietanen (ITS Finland)
(22.9.2014)

How do you see digitalization affecting the car industry?

One result of digitalization is how products are nowadays seen as service platforms. Everything is purchased as a service, just like a car is seen a service platform. Car manufacturers have started to realize for some time now that consumers are not just purchasing a car, but additional after-sales services and funding solutions need to be provided. BMW CarShare is one of the best examples nowadays of successful service design made by a manufacturer which is definitely worth of having a look, and its success is definitely partially because of the huge scale it has and how easy it is to access that service.

Car manufacturers are used to be in the lead of every process along the product's lifecycle but that mindset needs to change. When it comes to smart technologies and providing the platform for developers to create solutions, that is still seen as something extraordinary for manufacturers. One exception though has been Ford, which has opened the platform.

Car manufacturers partially realize the shift that is taking place, and the possible changes that need to take place. The problem though, also comes from the trading of cars as it involves major profits in importing, and radically changing the business models might not be to their immediate benefit. There are so many things happening though in the car service sector currently, and even though at first manufacturers have chosen not to radically respond to what is happening, the viral effect of the service sector and how consumers' behavior is changing, they are now put at a place where they have to respond and they partially do.

What is the role of ITS in this transition?

This is a network of 50 organizations (ministries, researchers, etc.) with various experts aiming to speed up the utilization of new technologies in Finland as well as to sustain an international presence. We wish to display how things could be done and follow up by actually realizing different visions and ideas with the available technologies today. Everything that is related to transportation technology, including what is used in repair and maintenance, is our concern which also makes it somewhat difficult to provide a simple definition of what ITS is truly about.

We are very much involved in creating future visions and developing future plans for transportation. We have a presence in deciding for taxation for example in the future, and when someone approaches us with suggestions and relevant plans we also do the necessary actions for implementation.

When it comes to training and education ITS is not in any way involved. There have been thoughts about getting involved but so far there has not been a strong reason to do so.

What recommendations do you have about the future of repair and maintenance?

Even though in the future the role of repair and maintenance as we know it today will become smaller, we do see its value being sustained nevertheless, but under a

different perspective and business models. A good example is the shift towards software maintenance, as cars are becoming increasingly software-based. About 40% of repair tasks can be made remotely (over-the-air), but for some reason that has not been fully utilized, and you still need to go to the repair shop. Also, when it comes to the business model itself, things have to change in how repair/maintenance services are priced. One of the main reasons why people do not buy a car, is because of the big sudden charges that the ownership of a car may entail, whereas another solution would be to charge a standard monthly fee to all car owners and provide maintenance/repair services for no additional cost when needed (similar model like insurance companies). By applying this kind of pricing model, it would also force service providers to think of their operation in a different way including how to provide remote services more efficiently.

We do realize though that there is a huge lack of well-designed services on the commercial side of things (and not just in the training sector). If someone approaches us with well thought service mockups for cars, we are certain that there would be place for further development and implementation very fast.

What are your predictions in regards to consumer behavior?

The limits between private and public transportation are bit by bit fading out. Services keep on appearing (eg. Uber) that challenge the division between private and public transportation. Consumers cannot differentiate that easily anymore between the two, but the appearance of all these alternatives is of course to their benefit, and allows them to easily change between platforms as they wish; which also brings up a lot of competition in the long end.

Once we calculated that if we brought 50,000 Google cars, we would be able to replace mobility needs covered by 2 mil. cars in the urban area of Helsinki today. You could request a driverless car to pick you up, drive you to your destination and it would drive off to the next user. This is not that far from actually becoming a reality and it challenges the industry greatly.

We are currently going through a major shift which we just need to accept, instead of working on how to delay the shift to happen. All players in the automotive industry need to remove their mindset from the exclusive ownership-based way of thinking, and start elaborating on different models and ways of earning money through the shift that is happening. Also, it is important to consider that even though the ownership of cars may decrease in the future, because of shared car schemes (and others), it also means that these vehicles would have shorter lifecycles as they would be used more in shorter periods of time, thus increasing their replacement rate. It is not just about the frequency of use but also a matter of image and branding. When people share cars, they simply do not wish to be in a car that just looks rusty and overused; it still needs to be a pleasant experience.