

# Human-Machine-Interaction in Individual Mobility

Trend Report 2013

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XXIII, 299 p.

Veronika Gamper · Stefan Nothelfer · Michael Schadhauer (Editors)

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# **Human-Machine-Interaction in Individual Mobility**

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Class 2013 Spring

Center for Digital Technology and Management

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The Center for Digital Technology and Management (CDTM) is a joint institution of the Technische Universität München (TUM) and the Ludwig-Maximilians-Universität München (LMU). This report was created by CDTM students and is part of a project cooperation with Audi Electronics Venture. The CDTM is part of the Elitenetzwerk Bayern.

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## Preface of the Editors

*“Everybody can learn from the past. Today it is important to learn from the future.”*

As the statement by Herman Kahn, one of the founding fathers of modern scenario planning, nicely states, it is tremendously important for strategy and policy makers to get a deep understanding of possible future developments in order to be prepared for them.

We will give a brief overview on the approach behind the creation of this trend report, which involved the creation of future scenarios and the development of innovative product and service ideas. This approach has been developed and refined over the last thirteen years in over twenty projects. The goal is to create trend studies and business ideas in the field of information and communication technologies (ICT). Thereby, we rely on a tight cooperation between industry partners and academia. Combining the creativity and external view of interdisciplinary participants from academia with the knowledge of larger corporations, the outcome are long-term foresights and innovative ideas on how to prepare for emerging challenges in a certain field and product and service ideas that may solve future needs. Recent industry partners were large corporations, for instance Siemens AG, Telekom Innovation Laboratories and BMW AG. Topics were diverse, ranging from Smart Grid Infrastructures and Ambient Assisted Living Technologies to Urban Mobility Concepts.

The Trend Seminar at CDTM is a university course with around 20-25 selected students of various disciplines, such as business administration, economics, computer science or electrical engineering that work on a relevant topic related to ICT. After the topic has been defined, it is broken down into smaller modules, that are then worked on by smaller, interdisciplinary teams.

The course stretches over seven intense weeks, fulltime, during which the participating students dive deeply into the new topic. Thereby, they apply the knowledge they bring along from their main studies and extend it by extensive research. They learn and apply new methodologies, conduct trend analyses, design future scenarios and develop business ideas for innovative products or services.

The Trend Seminar is structured into three phases: The Basic Phase, the Scenario Phase and the Ideation Phase.

In the Basic Phase, the class is split into five teams that look at different aspects of the overall topic. Following the PESTLE approach, the status quo and trends in the fields of technology, society, economy, politics, law, environment and business are analyzed. Knowledge is gathered by literature research, preceded by a series of input presentations by industry experts, held by our project partner or other organizations. At the end of the Basic Phase, teams present their key findings to each other in order for everyone to get a holistic view on the topic to build upon in the following phases.

The following Scenario Phase starts with a two-day workshop. Participants work in four teams, newly formed in order to have experts from every subtopic of the Basic phase in each new Scenario team. Within the workshop driving forces for the overall topic are identified and structured. Two key drivers are identified, which span a matrix of four different future scenarios of approx. fifteen years ahead. The scenarios as well as possible timelines to these diverse futures are sketched out within the workshop. After the workshop, each team elaborates a vivid view of the life in one of the four scenarios.

In the third phase, the Ideation Phase, participants are again regrouped into new teams. The goal of this phase is to develop innovative business concepts, which are then tested against the previously developed scenarios. The phase starts with a two-day workshop on ideation methods. Based on the work by Jacob Goldenberg, Roni Horowitz, Amnon Levav and David Mazursky, the applied ideation methods are a structured way to develop new products or services. At the end of the workshop each team is equipped with a broad set of ideas. Out of these, the most promising five ideas are selected and further developed into detailed business concepts. The business model canvas, developed by Alexander Osterwalder and Yves Pigneur, serves as base structure. At the end of the seminar, the business model concepts are presented to the project partner and guests.

We would like to take the opportunity to thank several people who made this CDTM Trend Report possible: We want to thank Andre Hainzlmaier at our project partner Audi Electronics Venture, who helped to define the topic and scope of the project and, together with his colleagues, provided great insight into current trends and future developments in the field. We also want to thank Felix von Held and Felix Werle for their support in the Scenario and Ideation Phases. Their experience and motivation always results in a great workshop atmosphere and excellent outcomes. Finally, we want to say special thanks to the CDTM students of the class of spring 2013. They put an enormous amount of energy and enthusiasm into this project, which made it a pleasure for us to supervise the course and coach the individual teams.

We hope you enjoy reading up on the results of this trend report and maybe get some inspirations on the future development of Human-Machine-Interaction in individual mobility.

Veronika Gamper and Michael Schadhauer  
Center for Digital Technology and Management

## Preface

The world of individual mobility is facing times of radical change. This change is not only due to *technological advancements*, but also due to the *social, political, ecologic, and economic changes* that we are facing around the globe. This accelerating rate of change is one reason why Trend- and Technology-Scouting have been receiving increasing attention in automotive companies recently. Especially in the electronics and software domain it is paramount to identify upcoming trends and transform them into viable products or business models in order to stay ahead of competition. Today, about 90% of all innovations in the automotive industry are driven by electronics and software. Digital technologies not only help to enhance existing offerings, but also to develop entirely new products and service offerings. These radically new offerings are the ones that will be decisive in the race for market leadership.

Extremely short innovation cycles in the digital world and adjacent industries challenge automotive manufacturers and push them towards *new approaches in innovation*. These approaches increasingly involve a more open model of innovation. A major share of topics with disruptive potential in the mobility domain require cooperation with other companies and industries. Corporate Venturing, business mashups and innovation alliances are common practices to tackle this kind of innovation. Automotive manufacturers will need to further develop capabilities in managing large-scale innovation projects involving diverse partners from different industries. In the future not only cooperative models will be important but also the acquisition of knowledge in totally new fields will challenge OEMs. Absorptive capacity will be one of the main success factors in the industry. The players with higher absorptive capacity will be able to learn faster in radically new fields.

Those new fields may evolve through *new technologies* like gesture control or eye-tracking that could change the way we interact with vehicles but also with consumer electronic products. Piloted driving may generate benefits for drivers that customers may never have thought of and provide new possibilities for innovation. The topic of data and analytics is not only changing automotive companies, but also other industries. A question that is asked across several industries is “what can we do with all the data we are able to collect?”. Data will help to better understand customers and design products that fit their personal needs in any situation.

Trends with regards to *new business models* like peer-to-peer car sharing are challenging the classical business model of automotive manufacturers. Furthermore, the integration of different means of mobility will lead to interesting offerings, while the challenge for automotive companies is the intelligent integration of their offering into those multimodal systems.

*Social changes* like urbanization are not new, but increasingly affect peoples' lives. Will there be cars in the city centers of the future? How will individual

mobility look like in the future? *Customer needs* and usage patterns are changing, while owning a car is no longer the status symbol that all young people strive for. Customers demand a perfect integration of their digital lifestyles with every device they use – including cars.

Also *environmental issues* will have effects on mobility and transportation in general. The increasing awareness of people for the effects of their consumption on the environment will provide opportunities for companies to develop innovative solutions. The effects of this development will go far beyond the automotive industry.

*Political and legal changes* will also have stronger influence in the future. CO2 regulations will have an impact on the design of cars, as well as on the complete mobility chain and the appearance of cities. Urgently needed infrastructure investments will have to be financed, while governments lack the financial power to do so.

The question arises where all those trends will lead us and what opportunities will arise in the future. This is the field where Audi Electronics Venture and the CDTM saw the potential for a fruitful collaboration and the Trend Report represented the optimal setting. First of all, the students analyzed trends that could affect "Human-Machine Interaction in Individual Mobility". They concentrated on Technology, Society, Political and Legal Trends as well as on Emerging Business Models. After forming scenarios, the students came up with an extremely creative long list of ideas, with the subsequent goal to select the most promising ones and come up with five final ideas that were described in detail and checked for scenario robustness.

Throughout the process the students were coached by Veronika Gamper and Michael Schadhauer, who did an amazing job in guiding and consulting the students and integrating knowledge from us, the Audi side. We, on behalf of Audi Electronics Venture want to thank the students for their creativity and their personal dedication for the project. The results definitely have the potential to lead to real life applications in our industry.

We also want to thank Veronika Gamper and Michael Schadhauer for the great collaboration and their efforts for making this Trend Report a real success.

Ingolstadt, Spring 2013

Andre Hainzmaier,  
Innovation Strategy,  
Audi Electronics Venture, Audi AG



The entire trend report was written by CDTM students under the close guidance of research assistants in 2013. The papers compiled here do not claim to be scientifically accurate in every case; they are rather meant to give a structured and broad overview of trends relevant in the context of Human-Machine-Interaction in Individual Mobility.

For more information about the CDTM and its related projects, please visit <http://www.cdtm.de>



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## Abbreviations

|      |   |
|------|---|
| ACC  | Adaptive Cruise Control   |
| ADAS | Advanced Driving Assistance Systems                                 |
| AR   | Augmented Reality   |
| B2B  | Business-to-Business  |
| B2C  | Business-to-Consumer  |
| BAST | Bundesanstalt für Straßenwesen (Federal Highway Research Institute) |
| BYOD | Bring your own device   |
| C2C  | Consumer-to-Consumer  |
| CAGR | Compound annual growth rate   |
| CEO  | Chief Executive Officer   |
| DIS  | Driver Information System   |
| EC   | European Commission   |
| EV   | Electric Vehicle  |
| GMAC | General Motors Acceptance Cooperation                               |
| GPS  | Global Positioning System   |
| HMI  | Human-Machine-Interaction   |
| HVAC | Heating Ventilation and Air Conditioning                            |
| ICT  | Information and Communications Technology                           |
| IPv6 | Internet Protocol Version 6   |
| MaaS | Mobility as a Service   |
| MMI  | Multi Media Interface   |
| NFC  | Near Field Communication  |
| OEM  | Original Equipment Manufacturer                                     |
| OS   | Operating System  |
| P2P  | Peer-to-Peer  |

|       |   |
|-------|---|
| POI   | Points of interest                            |
| R&D   | Research and Development                      |
| UNECE | United Nations Economic Commission for Europe |
| VA    | Virtual Assistant                             |





**Part I**

**Trends**



# 1

## Chapter 1

---

# Technology Trends

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## Executive Summary

Human-Machine-Interaction (HMI) the study, planning and design of the interaction between people and computers, became a key innovation area in individual mobility. The more complex and powerful technologies become, the harder it gets to control them. In order to maintain a sufficient level of comfort, efficiency and safety, human-machine-interfaces have to be intuitive and simple to command. The field of evolving technologies to support this fast development provides a large variety of innovative concepts to interact with the vehicles of the future.

First of all, in-vehicle multimedia systems are constantly advancing. Speech control and enhanced methods, that detect the drivers state of emotion help to mitigate the added complexity of control. At the same time driver information and assistance systems are aiming to increase the driver's safety and comfort.

Secondly driver state detection methods and an enhanced human sense experience such as Augmented Reality (AR) and 3D displays in vehicles are intensively researched to increase the user experience.

Furthermore, the society is faced with the growing need for environmental care as well as legal restrictions that limit emissions. The industry is forced to promote alternative powertrain technologies that will encourage the users to change their habits.

Finally, systems that enable future technology, like vehicle-to-x communication and the integration of third-party-devices increase driver convenience. The way we experience mobility and perceive information is about to be changed completely by future HMI.

## 1.1 Introduction

Analyzing innovation and development processes of Original Equipment Manufacturers (OEMs) and suppliers shows that almost half of the investment in new innovations does not make it in the series production.

A lot of times user acceptance rate is not high enough to achieve the required production scale. Of the remaining 60%, one third is used for series development, one third is used to comply with legal restrictions and only one third is used for profitable new innovations. In the end only a tenth of the innovations accomplish a breakthrough. For premium and individual mobility, human-machine-interaction is a key success factor for a promising product.[62, p. 11]

In the following report the status quo and the trends of technology with a high relevance concerning Human-Machine-Interaction (HMI) in Individual Mobility will be discussed. Depending on whether the HMI is initiated from the Human (driver) or the Machine (vehicle), the status quo and trend section are clustered in the sub-categories Human- and Machine-initiated interaction.

## 1.2 Status Quo

This section will emphasize and give analyses of available technologies in the market of HMI related products. This gives a profound basis for the upcoming trends in the later course of this report. First human initiated interactions will be adressed before explaining machine initiated interactions.

### 1.2.1 Human initiated interaction

In the recent years there have been a lot of developments in infotainment systems which were driven by the need for easier control of infotainment system while driving. This subdivision highlights the improvements in Speech control and In-vehicle multimedia systems.

#### 1.2.1.1 Speech control

Speech control is a technology which enables a user to interact with a given system by only using voice and language[30]. The technology is responsible for converting human speech into an input that is interpretable by machines. It enables a more convenient and safer way to interact with the system while

driving due to fewer distractions. Furthermore, the technology enables the user to interact with the system in a more familiar way than by using individual conventional system controls.

In the automobile industry such systems are widely used by now. Audi for example is offering its own vehicle integrated voice control system that enables the user to control the navigation system as well as several parts of their onboard multimedia system, like the mobile phone and music entertainment[9].

Current implementations of speech control even offer a single and consistent voice interface between multiple automobile vendors. This includes voice input as well as voice output (text-to-speech) techniques. Nuance's voice control for automotive technology[42] offers such an universal solution, which is already implemented in vehicles of major automobile vendors like Audi[51]. With speech control, new use cases of human-machine-interaction like composing SMS and Email messages emerged in the automotive industry.

### **1.2.1.2 In-vehicle multimedia systems**

Systems which provide content in combination of audio, text, images, video or interactivity inside a vehicle are classified as in-vehicle multimedia systems. They include in-vehicle entertainment systems, navigation systems and integration of mobile phones for telephony, streaming and seamless connectivity. Audi MMI and SYNC with MyFord Touch are few examples of advanced multimedia systems. They include speech control and touch control[21] to provide access to multimedia content with ease along with the aim of reducing driver distraction during operation. They are also capable of pairing with smartphones to provide telephony, navigation and streaming services. SYNC with MyFord Touch especially gives owners the opportunity to link up to the World Wide Web with a mobile Wi-Fi hotspot[61]. Advanced multimedia systems occasionally include display systems which allow the driver and passenger to look at completely different content on the same screen. For example, the passenger can watch television or DVD movie while the driver views the navigation mapping[20]. Furthermore, modern Multi Media Interfaces act as central control units. In addition to infotainment, air suspension, exterior lighting, parking systems, seat adjustment also handling- and gear-shifting characteristics of the car can be controlled[10].

### **1.2.2 Machine initiated interaction**

On the following pages the existing technologies which enable the machine to start the interaction with the user on its own are being described. Machine initiated interactions contain automatizations to offer safety and convenience for the driver. This includes the two major aspects of Machine initiated interaction, which are Driver Information System and Advanced Driving Assistance Systems.

### 1.2.2.1 Driver information system

These days drivers are faced with a huge amount of information in the vehicle cockpit. A Driver Information System (DIS) consists of all the hardware or software that provides these information to the driver and their passengers. Also analogues systems are being replaced by digital ones. Basically the DIS can be categorized by the following three subsystems: telematics, instrument cluster and in-vehicle infotainment system. In the broadest sense DIS also includes the heating, ventilation and air conditioning (HVAC) system[45].

Telematics is the integrated information and telecommunication system in vehicles. It is used for in-vehicle applications and for the control of a vehicle. One of the most widely used application is a navigation system with additional real time features, such as traffic jam warnings[48]. The instrument cluster on the other hand denotes instrumentations located on the dashboard which shows the driver the most important information, as for example the speed of the vehicle. Next to travel information, it provides status information and prior indication on potential mechanical or electrical failures. In the premium segment overall information from driving assistants are even displayed on the instrument cluster. One application for this is traffic sign recognition by image processing techniques. Instrument clusters are displayed via LCD displays. With such solutions the appearance of the meters are customizable[43]. Head-up displays are the state of the art technology in DIS. They project important driving information, such as color pictures on the windshield and thereby in the view of the driver[11].

An in-vehicle infotainment system delivers audio and video entertainment, as well as internet based services to the driver. In premium vehicles the heart of the infotainment system is the LCD which displays all the features in a menu based Graphical User Interface. This LCD is also used by other systems like driving assistants and navigation system.

By the high amount of functions of DIS, the provided information is very complex. DIS nowadays is the main hub of Human-Machine-Interaction in vehicles[18, p.253].

### 1.2.2.2 Advanced driver assistance systems

Advanced Driver Assistance Systems (ADAS) provide real-time information, advice or warnings or intervene vehicle control with the help of multiple sensors (laser, camera, radar). The concept of “prediction” is crucial in this sense as ADAS merge all information from powertrain, comprising engine, coupling and gearbox as well as chassis, vehicle environment and drivers condition in order to assist the driver of the vehicle, improve drivability and safety[4, p. 209]. In fact, humans are one of the main causes of traffic accidents next to weather and road conditions. This is due to erratic driving, driving whilst being drowsy or intoxicated or walking on the streets whilst being distracted by e.g. phone

or music. Also humans' inability to foresee danger and to react quickly causes many accidents. Every year more than 1.3 million people die world-wide due to road accidents and by 2020 it will be the 3rd leading cause of death[34, p. 723].

Among ADAS there can be distinguished between the following three mayor types:

1. Firstly, systems like Intelligent Speed Adaption, Lane Departure Warning or Keeping, Collision Avoidance, Park Assist or Blind Spot Recognition use haptic, auditory or visual warnings or feedback in order to reduce driving errors.
2. Secondly, Adaptive Cruise Control, Stop and Go and Intelligent Speed Adaption systems have an even stronger impact on the interaction between human and machine as they do not only warn the driver of a vehicle but also intervene control of the vehicle. Besides that intervention, the driver is still able to take back the control to overrule such systems at any time.
3. Automated Driving, often referred to as "Autonomous Driving" forms the third type of ADAS. As its type is still subject of substantial research and development, it will be further explained in the Trend section of this report (1.3.2.3).

In addition to the three systems explained above, vision enhancement systems like Night Vision, Adaptive Light Control, Traffic Sign Recognition, Pedestrian Recognition or Traffic Sign Recognition are often referred as a category of their own[15, p. 226].

In conclusion ADAS reduce pollution, human suffering or even eliminate driver errors. Also efficiency, driving safety and the amount of vehicles on regular highways can be increased. Research show that ADAS can help to avoid up to almost the half (45%) of traffic accidents for cars, 12% for trucks and 15% for busses[31, p. 5]. On the other hand there are also negative aspects of ADAS. ADAS demands a decrease of complexity of in-vehicle systems. Otherwise it leads to higher distraction from traffic or reduced driver alertness. This might result in a longer reaction time and again might cause additional accidents especially if the HMI is not designed in an uncomplicated and intuitive way.

## 1.3 Trends

Building on the foundation of the status quo, this section outlines which technology trends will shape HMI in Individual Mobility in the near future. Next to the two clusters Human initiated interaction and Machine initiated interaction, this report shed light on how enablers and enhancers influence future HMI developments.

### 1.3.1 Human initiated interaction

In a first step it is explained how user convenience can be increased by providing easier access mechanisms to vehicles. Afterwards it will be stated how the user convenience can be increased by different means of vehicle system controls. Finally the growing trend of virtual assistance is being addressed.

#### 1.3.1.1 Increasing use of advanced authentication methods

Car access and accessibility technology has evolved in recent years with the adoption of RFID and wireless technology (2.4Ghz). Today still, the driver has to carry a key to gain access to the car. With advancements in biometric authentication methods, Near Field Communication (NFC) and security systems, present ways of entering a vehicle seems primitive. With Biometric or NFC, the vehicle is able to identify the driver uniquely. This enables to automatically preset the vehicle configuration without driver action. Biometric authentication methods embrace a variety of discrete technologies, differentiated by biometric characteristic and furthermore by sensor types. The goal for adoption of biometric authentication methods is improved user experience (UX)[36]. Nevertheless, biometric authentication methods can as well provide higher levels of accountability than any other kind of authentication method, since it cannot be shared by other individuals as easily as passwords and keys can. In the long term, it's very likely that authentication means via biometric characteristics or smartphones will prevail over the broad variety of current authentication techniques[36]. Technologies like NFC in smartphones can also be utilized to access a vehicle, which is also shown by Hyundai[7]. The architecture of such an NFC system is illustrated in the Fig.1.3.1.1 .

#### **Impact on Human-Machine-Interaction in Individual Mobility**

New authentication methods will change the way people access the vehicle. The technology further aims to enhance the UX by being the key to your unique driver profile, storing data such as music, phone contacts, radio station preferences, automatically adjust climate control, seat position and exterior mirror. [7]



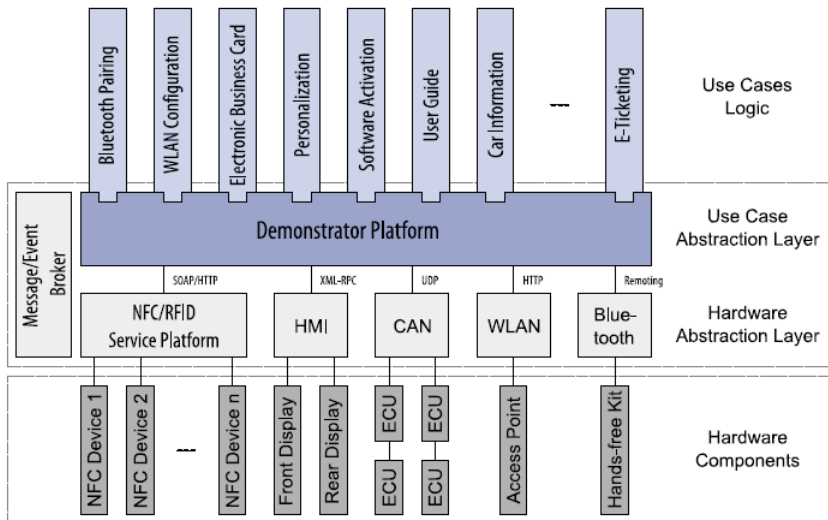


Figure 1.1: Access system architecture overview

Source: [53, p. 5]

### 1.3.1.2 Increasing convenience of vehicle system controls

In line with the fast technical evolution the amount of information flow and HMI complexity increased substantially in the recent years[46, p. 541]. Thus optimal use of different human sensory channels is an approach to simplify the interaction with in-car devices[46, p. 541]. This way the user convenience increases as much as distraction may decrease. Therefore sophisticated systems comprising of touch display with haptic feedback or multifunctional display (MFD) providing tactile interface will be the needs of the future.

There will also be controls using face expressions thereby reducing the need of taking hands off the steering wheel. There will be input devices like wired gloves, cameras or controller-based devices which enable the driver to operate a variety of in-car devices like navigation and entertainment systems with gestures coming from theoretically any body motion. Practically most gesture recognition systems focus on motion coming from face or hand.

### Impact on Human-Machine-Interaction in Individual Mobility

The above mentioned technologies will enable the driver to operate the individual functionalities with haptic, speech and gesture control in an intuitive and effective manner [63, p. 544] thereby reducing distraction while driving. Apart from reducing distraction, it will eradicate the need to enter a hierarchy of menu to reach the various controls thereby making the interface more user friendly

along with enhancing the user experience.

### 1.3.1.3 Growing impact of virtual assistance

Increasing capabilities of assistants in smartphones leads this technology to enter vehicles. It is more useful, intuitive and easier for a driver to interact with digital world in a natural language[54, p. 1]. A virtual assistant (VA) is a conversational, computer-generated character that simulates a conversation to deliver voice- or text-based information to a user via web or mobile. A VA incorporates natural-language processing, dialogue control, domain knowledge and a visual appearance (such as photos or animation) that changes according to the content and context of the dialogue. The primary interaction methods are text-to-text, text-to-speech, speech-to-text and speech-to-speech[6]. Especially in the context of in-vehicle systems such as like VAs text-to-speech and speech-to-text mechanisms ensure a convenient way of communication as well as safe approach for the driver to avoid distraction.

Computer-generated characters have limited potential to maintain an interesting dialogue with users; they need a well-structured and extensive knowledge management engine to be efficient. VAs in service, sales and education are starting to be adopted, with deployment from some Fortune 1000 companies. End-user acceptance of VAs, driven mainly by their larger presence, is becoming less of a challenge than it was a few years ago.

Due to the need of extensive knowledge from cloud systems the usage of VAs is still restricted by the lack of availability of high speed internet while driving. This problem, however, will be addressed by the development of thin, lightweight antennas for satellite communication by companies like Kymeta Corp that takes advantage of metamaterials[49, p. 1]. The resulting satellite connectivity will provide improved speed and availability of internet on the move.

As an example of cloud-based natural language recognition, AT&T WATSONSM, a multimodal and multilingual speech and language engine, will help accelerate this adoption, by allowing users to interact with their vehicle in a natural way, using everyday language[8]. Such services will facilitate processing of speech, text and gesture inputs for things such as placing and receiving calls, navigation and basic web browsing thereby reducing driver distraction factors. These trends increase the possibility of VAs integrated into the vehicles in the near future.

### Impact on Human-Machine-Interaction in Individual Mobility

It is foreseen that VAs can also participate in the next generation Intelligent Transportation Systems (ITS), by helping the drivers and providing useful services, such as calculating efficient routes, saving fuel, assisting drivers in special and emergency situations, etc. The use of VAs in the car industry, embedded in the car's On-board Units (OBUs), will drastically change how

humans see transportation systems in the future[26, p. 5]. It will be a co-passenger which will interact in a natural way while providing the required information as and when necessary.

### 1.3.2 Machine initiated interaction

The next trends aim at reducing the degree of distraction to enhance safety as well as convenience by decreasing the cognitive workload for the driver. Present trends can understand and react to human senses and emotions. Furthermore Autonomous Driving underlines the influence of improved ADAS on the future driving experience. The last passage finally shows that next to all these technology trends drivers need to change their habits and adapt to future, more sustainable technologies due to political mandates.

#### 1.3.2.1 Higher usage of user state detection techniques

As in-car electronics are getting more complex, car manufacturers tend to use voice as a mean of human-machine-interaction in their cars more intensively[24]. In this context the question arises whether voice interaction affects drivers' attention, performance and judgement. Current studies show that the emotional state of a vehicle's driver highly influences the driving safety. According to research a happy emotional state increases the driving safety[24] whereas negative emotions, such as stress, nervousness and sadness[24] and over-relaxation lead to unsafe driving performance[47]. Additionally, machine generated voices that are emotionally inconsistent with the user's emotions lead to more driver distraction than emotionally consistent voices[47].

To enhance driving safety it is desired to influence the emotional state of the driver and to support him in performing necessary driving tasks, like steering and accelerating/breaking the vehicle as well as secondary tasks like operating the light control and the windshield wipers [24].

Affective Computing is intended to help to achieve these goals. The technology aims to recognize emotions of a user by various techniques. The most common one is the analysis of vocal expressions of the vehicle driver. Research projects [38] show that analyzing specific acoustic features in the human voice can be used to deviate the emotional state of the driver. Such systems can detect common emotional states like happiness, surprise, sadness or boredom and this information could be used to adapt machine generated voice output to match the user's emotional state. Additionally the system could positively influence the user's emotional state[24], i.e. to notify an angry driver about his state to calm him down or to engage a fatigued driver in a conversation preventing him to fall asleep.

To enhance the accurateness of such a system, additional facial expression recognition can be used [28]. Utilizing a standard webcam and facial expression

algorithms, the emotional state of the user can be derived based on the users' facial expressions.

There are other techniques for Affective Computing that use physiological sensors to measure emotional factors like the driver's stress level. Research projects [27] describe methodologies to measure the driver's heart rate and skin resistance to determine his stress level. Using this information, an adaptive system can automatically manage noncritical in-vehicle information systems, like entertainment system, cellphone usage and the navigation system. In high stress situations to the driver the system could turn these distractive in-vehicle systems off or limit them to only broadcast information critical for driving.

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User state detection systems will help vehicle drivers to interact more efficiently with the vehicle in terms of user experience, safety and degree of distraction. Especially emergency situations caused by microsleep could be a thing of the past. Furthermore, it will enable the user a more intuitive and convenient mean of interaction and this trend will influence the interaction with other in-vehicle systems as well. The current goal of this technology lies in the retention and even increment in driving safety despite the higher complexity of in-vehicle electronics systems.

#### **1.3.2.2 Enhanced human sense experience**

Today's technology enables humanity to use information anywhere and anytime[40]. The high amount of data and functionality, however, makes the driving task complicated and distracting because the driver has to digest and respond to a huge amount of information[39].

Various technologies are being developed to address this problem, as for example Augmented Reality (AR). This technology enhances the human's perceived reality by augmenting real world objects with the real-time use of data, such as text, graphics or audio[59]. Therefore the human's senses are enriched with additional information. Thus, for example driver safety can be improved by guiding a driver's attention to imminent danger in his point of view[39].

AR also enables various other applications in the automotive area, like the combination of the on-board navigation system with a head-up display installed in the vehicle's windshield (see[40]). This project aims to enhance the driver's navigation perception by augmenting the real-world road environment with a virtual route path that continues the visible real road path. Due to this combination of navigation information and reality the driver's cognitive load is reduced compared to the use of conventional navigation systems, where the driver has to map real road view with navigation information. This is also experimentally proved by comparing the driving performance using the AR system with a state-of-the-art GPS navigation display solution[39].

Automotive vendors also gained interest in AR applications in the vehicle. Daimler for example is developing a whole new kind of AR experience which is called DICE[5]. This system augments the vehicle's passengers view with environmental and social media information via a windshield attached head-up display.

Another sense enhancing technology are 3D-displays in vehicles. Studies show that the usage of such displays has potential to increase user experience without generating a negative impact on the cognitive workload for the user and that this kind of technology is well suited to support secondary driving tasks such as presenting driver assistance information[13, 41, p. 45].

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Technology such as AR and 3D displays in vehicles will certainly change how humans perceive their driving environment. There will be a higher utilization of data and communication interfaces in the vehicle as well as increased user experience to effectively cope with the high amount of functionality in vehicles. Despite the potential of a higher degree of distraction in the driving environment the technology will also increase environment awareness directly which decreases the degree of cognitive workload for the driver.

#### **1.3.2.3 Improvements in advanced driving assistance systems**

The current means of transportation are still directly controlled by humans and offer semi-automatic assistance to the driver. To the contrary, Autonomous Driving goes one step further as it is the most intervening form of ADAS, offering full-automatic assistance to the driver. As all ADAS, also Autonomous Driving is developed by several car manufacturers in order to improve driving safety and to prevent and/or reduce fatalities in accidents. Due to the strong level of intervention of Autonomous Driving, driver control is being overruled by the system.

A large obstacle on the course to realize the vision of driverless vehicles is driver and passenger acceptance. In order to increase that acceptance car manufacturers implement more and more ADAS technologies in the following years so that consumers get used to those technologies and build up confidence and trust[33].

There are already several prototypes of autonomous vehicles existing like the Google driverless car project which has already driven under computer control half a million km with its fleet without any accidents. This means that their record is already better than the one from an average American[55]. With its laser range finder on the rooftop and its other sub systems the vehicle is already 99% of the time driving itself[23]. Car manufacturers like Audi, BMW and GM are also developing self-driving car. The latter even expects to produce partially autonomous cars at a large scale not later than 2015[22].

As costs for ADAS technologies are falling, ADAS technologies will be increasingly offered and democratized to all vehicles[56, p. 4]. Experts state that “autonomous vehicles are the most promising form of intelligent transportation” and furthermore predict that by 2040, 75% of all cars on the road will be autonomous vehicles[33]. If all vehicles would use the available ADAS sensors, highway capacity could actually be raised by 43%. In combination with vehicle-to-vehicle communication (for further information please see 1.3.3.2) the highway capacity could even be further extended up to a total combined increase of 273%[57, p. 5].

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Research shows that through intelligent Parking Assistance Systems 31% of all parking damages could be avoided. Additionally another 22% of material damages could be avoided via Autonomous Braking System[31, p. 5] thereby enhancing the driving experience.

Autonomous vehicles are able to navigate and drive automated without a direct input by its driver. As a result the drivers task is shifted from manual to rather supervisory control and will enable them to focus on other activities like information consumption without having to worry about driving distraction and safety[15, p. 226].

#### **1.3.2.4 Increasing need for sustainability of future technology**

By 2020 the CO<sub>2</sub> emission of new cars must not be over 95g/km. This is a decrease of 27% compared to now[14].

To fulfill these requirements alternative powertrain technologies are necessary to comply with governments’ emission mandates. These legal restrictions will launch a further increase of the focus on innovative mobility and vehicle technologies.

Hybrid vehicles, a system in which combustion powered drivetrains are combined with an electric motor, will be a turnkey solution within this trend[52, p. 122]. Until 2015 the CAGR on Hybrid-vehicle-sales is 21%[62, p. 13].

Multiple variations of these systems already exist. Plug-in-Hybrid (PHEV) technology proved itself the most viable solution up to now and is constantly further developed. PHEVs combine combustion and electric powertrain technology. They can be driven purely electric and are suitable for external recharge. Thus their range can be extended with a range extender (combustion engine) that recharges the battery[29, p. 19 ff]. Hence PHEVs are mitigating the relatively poor efficiency of internal combustion engines, while solving the limited range restrictions of electric vehicles[25, p. 1].

For the future, instead of the combustion engine, fuel-cell-powered engines can serve as a range-extender as well[29, p. 47].

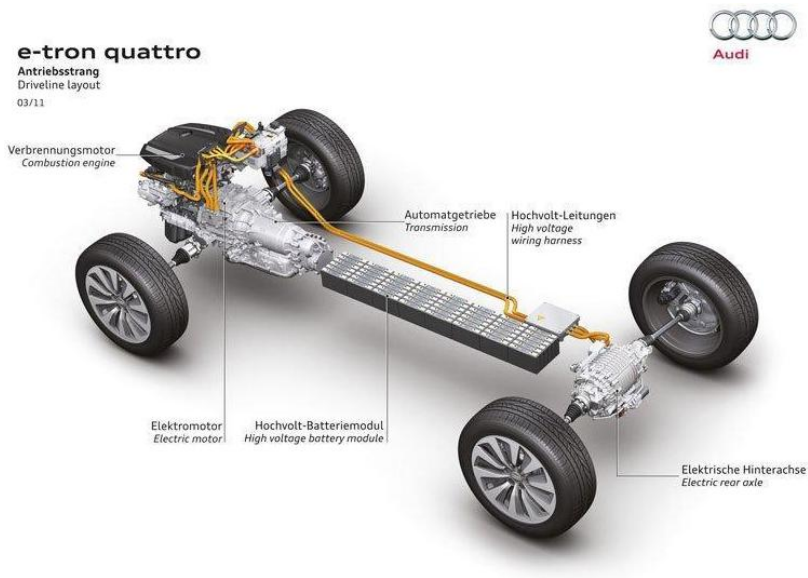


Figure 1.2: Plug-in Hybrid - Powertrain layout  
Source: Adapted from: [audinewsblog.wordpress.com](http://audinewsblog.wordpress.com)  
(last accessed: 03/20/2013)

Besides the Hybrid vehicles, purely electric powered vehicles will play an important role as well.

Addressing both technologies will help to improve the overall efficiency of cars by 2025 significantly (4.97 l/100km compared to 7.22 l/100km in 2011 (just in the US))[60, p. 1].

Although the technology is not new, continued R&D efforts into battery, energy production and infrastructure advancements are crucial to make EVs a sustainable and large-scale alternative powertrain technology for future vehicles. Until 2030 the sales are forecasted to increase up to 469 Bn. €. Current range limitations and high battery costs are the main issues to restrain consumer interests.

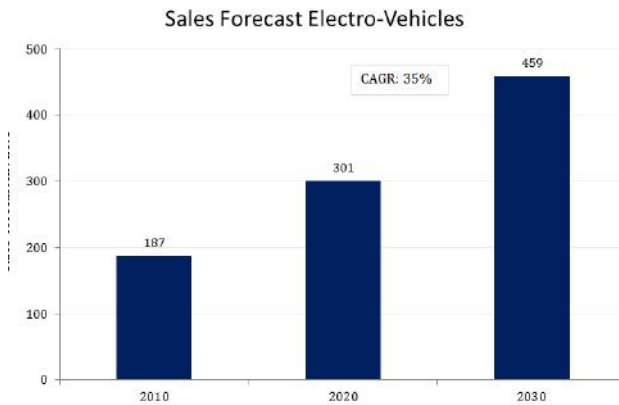


Figure 1.3: Sales forecast for Electric Vehicles  
Source: Adapted from: STATISTA

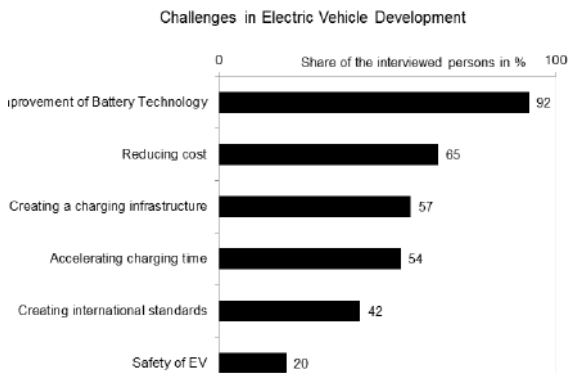


Figure 1.4: Challenges in Electric Vehicle Development  
Source: Adapted from: STATISTA

Besides that government and infrastructure providers need to establish a profound network for electric and hybrid driven vehicles. To promote large-scale EV adoption in the short term, then they will need to offer higher subsidies and



other incentives (no mileage-based taxation). EVs will become an important powertrain technology option for the automotive industry, but short-term and midterm sales may not be as high as proponents had initially hoped[52, p. 91].

### **Impact on Human-Machine-Interaction**

Vehicle information and car-to-X communication solutions need to be developed to encourage use cases, including range anxiety and a conservative driving style (driving moderate and anticipatory). There will be developments in user interfaces which will help users to plan their long distances travel which may include eco-zones as well. The use of EVs and alternative fuel vehicles will change the way car is used for example there will be need to charge an EVs after a day's drive, this necessitates developments for simplification of charging mechanisms. An example of such an development is automated parking for wireless charging point access[37]. To make this simpler, developments in infrastructure and facilitation mechanism will change how humans use these vehicles. Another important factor resulting from new drive train technologies is that it will change the usage pattern of cars by the user.

### **1.3.3 Enablers and Enhancers of HMI**

On the following pages described technologies don't have a direct influence HMI but rather a future impact on the way humans and machines interact with each other. This section will cover the high utilization potential of third party devices and describes the substantial impact of standardized vehicle-to-x communication on HMI.

#### **1.3.3.1 Higher utilization of third party devices**

Currently there is a huge trend of using external devices in the vehicle. This includes the usage of personal devices, like smartphones and tablets as well as other supporting devices, like personal navigation devices. Smartphones, however, have experienced a high usage growth in the last few years and their importance for users increased the focus on solutions that incorporate personal data and information into individual vehicles. [32, p. 102]

Therefore third party applications will be more and more deeply integrated into vehicles. There are various technologies to integrate such devices into a vehicle, such as Bluetooth, USB or Wireless LAN (WLAN)[12].

A concrete implementation of deep smartphone integration in vehicles is the so-called Terminal Mode technology[12]. It enables the driver to access their favourite applications from their smartphone directly with in-vehicle controls, whereas the applications are still running on the smartphone exclusively. Simply the interaction with the application is realised by the vehicle's head unit. This

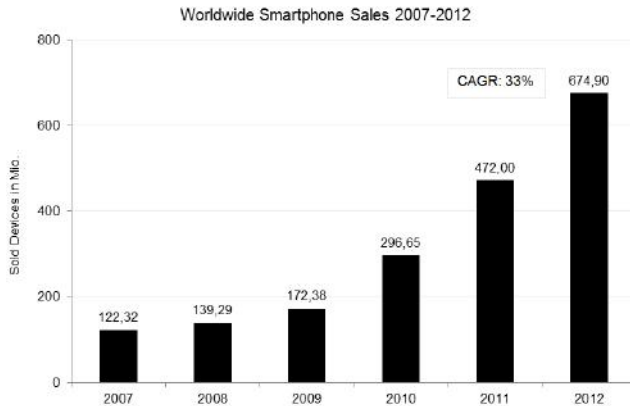


Figure 1.5: Worldwide Smartphone Sales 2007-2012  
Source: Adapted from: STATISTA

ensures a safe and seamless interaction and user experience especially due to the fact that applications, like the navigation application, can be resumed outside of the car.

Thus the technology offers APIs for application developer to interact with a large number of automotive platforms, which makes the platform very portable.

Essential information, social network settings or favorite radio stations are also being synchronized with the car and concisely presented. In the future also security issues can be addressed and the smartphone can work as a authentication method to enter, lock and manage the car externally. [12, p. 56 ff]

Additionally in the next two years more car manufactures will open their app-platform for developers, so the variety of applications and integration of mobile devices into the car will steadily grow[? ].

Very interesting use cases have been presented already by Toyota. Here the application platform “Entune” has a real-time traffic feature that will inform the driver about traffic delays and potential hold ups. This information can be used to change the alarm time of location based appointments of the user as an example[2].

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This will enhance user experience and serve as an important information access (remote diagnostics, consumer insights) and will create multiple new revenue sources. [32, p. 101] Additionally the tight integration of personal third party devices will increase the degree of customization of in-vehicle control and interaction systems. This will lead into a whole new user experience in vehicles as well as portability of user interfaces among different vehicle vendors.

### 1.3.3.2 Increasing standardization of vehicle-to-x communication

So far, cooperative information systems have been used to bring infotainment data into vehicles. In addition, individual components exchanged data within vehicle. In the last decade, inter-vehicle, vehicle-roadside, and vehicle-driver information sharing has been the most attractive trend in intelligent-vehicle research[44, p. 14]. Today various research and development activities have reached a mature technological level and are being standardized[50, 1, 3, p. 1]. Vehicle-to-x communication constitutes the fundamentals of future Intelligent Transportation Systems (ITS).

Today, there exist several similar concepts of an ITS system architecture. One mature concept is sim<sup>TD</sup>, a joint project by leading German vehicle manufacturers, component suppliers, telecommunication companies and research institutions which has been established by a comprehensive field study already[3]. All of them primarily consists of two subsystems. On the one hand there is the on-board ITS Vehicle Station (IVS), which consists of hardware and software components within the vehicle itself. On the other hand there exists the infrastructure subsystem composed of ITS roadside stations (IRS) and ITS central stations (ICS) with connection to traffic management centers. [58, p. 488][35, p. 13].

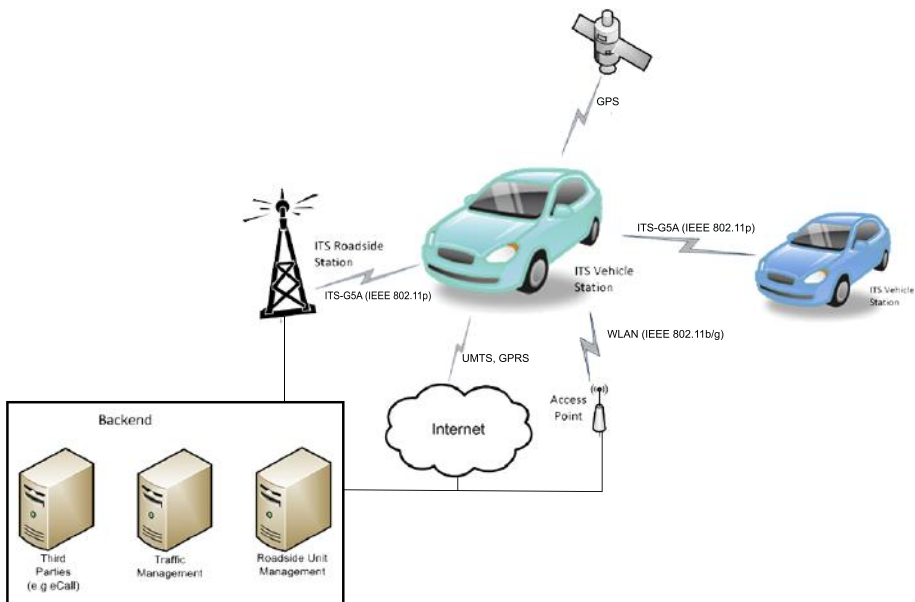


Figure 1.6: Overview of vehicle-to-x communication

As of 2015 cross-vendor cooperative systems will be offered that enable data exchange enable inter-vehicle and vehicle-roadside data exchange by using heterogeneous technologies as shown in Figure 1.6[17, p. 36][19].

With vehicular communication systems, data for example about the speed, position and direction or warnings from on-board sensors can be exchanged, collected and analyzed either by vehicle systems (IVS) or roadside stations (IRS) with backend systems (ICS)[35, p. 11].

Big data analytics will loom large in backend systems like traffic management centers trying to process the huge volume of data in real time to transmit the required information to vehicle systems, such as navigation and safety systems such as traffic lights or traffic control systems[35, p. 87]. Furthermore, the communication with the environment enables the convenient integration of individual 3rd party services like weather stations or gas stations.

Vehicle-to-x communication which will increase road safety, traffic efficiency, and individual convenience will have an increasing impact on human-machine interaction as shown in table 1.1[16, p. 2ff].

## 1.4 Conclusion

The examples of trends in Human-Machine-interaction in the previous paragraphs show, that the impact on future individual mobility is immense.

Although it is hard to predict which trend will influence the industry the most, there are three major trends that can be carried over.

First the advanced support of the driver with assistance systems will intensively change the safety standard. Secondly technologies that enhance the detection of the drivers emotional and physical state will further increase the user experience. Finally the collection of data and communication between different devices will condense the information density by which user can drive safely, efficiently and comfortably.

| <b>Safety</b>  | <b>Traffic Efficiency</b>   | <b>Convenience</b>   |
|--|---|--|
| Roadworks warning  | Adaptable traffic light circuit                                   | Navigation systems listens to traffic management information |
| Car breakdown warning  | Traffic merging assistance  | In vehicle signals   |
| Emergency vehicle warning  | Green light optimized speed advisory                              | Stolen vehicle recovery                                      |
| Slow vehicle warning   | Flow management at large events                                   | Parking pilot  |
| Weather warning  | Traffic management for disasters or extreme conditions            | Third party data integration                                 |
| Pre-crash sensing<br>(Prediction of traffic accident occurrence) | Modify driving for reduced energy, fuel consumption and emissions | Point of Interest notification                               |
| Post-crash warning   | Energy-saving routing   | Remote service diagnostics                                   |
| Motorcycle warning   | Displaying real time urban traffic information                    | Lane Change Assistane  |
| Hazardous location warning                                       |   | Personal Data synchronization at home                        |
| Wrong way driving warning  |   | Drive-through payment  |

Table 1.1: Vehicle-to-x communication and its impact on HMI

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# 2

## Chapter 2

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# Society Trends and Customer Needs in Private Mobility

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## Executive Summary

Society changes at a fast pace. The aging of the population creates new needs with regards to safety and usability of human-machine-interaction. Global urbanization (especially in Asia) requires a smart approach to urban travel to avoid gridlocks and to dam the increasing smog problem.

Approaches to travelling such as the sharing and pooling of means of transportation as well as multi-modal transport are becoming more and more popular. They include complex processes such as vehicle location, payment and exchange that should not be passed on to the customer. This leads to new requirements to the interfaces. Human-machine-interaction has to embrace these new concepts and has to provide the user with the necessary information and functionality to easily deal with the arising challenges.

The demands of consumers with regard to navigation, communication, information and entertainment are constantly increasing. The challenge for human-machine-interfaces is to process and to present all the requested information and to provide simple channels for user input, all minimizing the probability of distraction. Safety is essential to every consumer and must not be compromised. A requirement for the design of human-machine-interaction is

to not interfere with human action or to distract the driver from driving, while giving the feeling of being individual and unique.

## 2.1 Introduction

When thinking of private mobility, one does not usually think of the second world war or the oil peak - actually, a connection between the two seems quite absurd. Yet, they both share a curious detail that is related to private mobility: Gasoline and oil were frightfully expensive, private mobility was hardly affordable anymore. This led to people organizing themselves to collectively use one car, a practice that would be called car pooling in today's terms.

This example shows that a trend in society - such as skyrocketing oil prices - is likely to have an impact on the needs of the affected population. In the example above, the price of oil and gasoline forced people to save on these resources to still be able to afford the mobility that was essential to their lives.

As of today, the forces behind evolving society trends as well as the trends themselves might be different, but they are nonetheless likely to result in changes of the mobility needs of the people. This in turn, has an impact on how humans want to interact with the machines that make the building blocks of their individual mobility. These changes in customer needs can be very strong, disruptive even, and rationalize an analysis of current trends in society to predict future changes in customer needs in the field of private mobility.

The following chapter will begin with the dissection and description of current customer needs in the Status Quo. In the subsequent Trends section, relevant society trends are identified, described and their impact on human-machine-interaction is consequently evaluated. Lastly, the conclusion highlights the chapter's key findings, evaluates them critically and rises further questions.

## 2.2 Status Quo

To understand where current trends in private mobility stem from, the Status Quo describes the current needs of customers in the field of private mobility. The structure is inspired by Maslow's "Hierarchy of Needs" [98]. The customer needs are modeled as a pyramid, where the needs of the lower layers have to be fulfilled before the needs of the next, upper layer arise (see figure 2.1).

### 2.2.1 Essential Needs

The essential needs build the foundation of Maslow's "Pyramid of Needs" (Figure 2.1). They greatly influence the choice of the mean of transportation



Figure 2.1: Maslow's "Hierarchy of Needs" [98], adapted to private mobility

of all customers, as they tend to have the highest potential to have an impact on the customer's everyday life. The essential needs are reliability, safety and affordability. When those essential needs are not met, there is no mobility.

### 2.2.1.1 Reliability

Reliability is the predictability of the behavior of a mean of transportation, for instance the punctuality of public transport or the error-free operation of a car. It is an essential need, because an unreliable mean of transportation is not suitable for trips like the way to work, where punctuality is crucial. Consequently, consumers value reliability as an important criterion when it comes to choosing their mean of transportation. A market study conducted by a consulting company lists reliability as a significant decision factor of Germans when buying a car [105, p. 6].

Reliability and punctuality have also been rated as important by over 94 % of the polled in a study about the everyday mobility of the German population [80, p. 6]. In the Netherlands, a study showed that public transportation generally is considered less reliable than a privately owned car - reliability can thus be considered one of the reasons why some consumers choose the car over the public transportation system [92, p. 30].

### 2.2.1.2 Safety

Safety in a private mobility context sums up all precautions that the mean of transportation has available to ensure that the passengers will not be injured. According to Maslow's "Hierarchy of Needs", safety is a crucial factor of human behavior [98]. As a result, consumers consider safety an important factor when choosing a mean of transportation - in fact, as a study of a second-hand car reseller showed, 93.4 % of the over 1,500 polled ranked safety as the most important factor of the car of the future [66, p. 4].

Safety is not only dependent on the vehicle, but also on the routes and tracks. Higher income countries have less road deaths than lower- and middle-income countries [104, p. 1]. As a consequence, the importance of safety as a decision criterion in private mobility also differs between countries. This can be seen in a poll conducted by a large consultancy showing that safety ranks number four of the most important purchase criteria in Germany, in contrast to number one in China [88].

### 2.2.1.3 Affordability

Affordability describes the relation between the cost of a mean of transportation and the budget of a potential customer. Costs include the buying process, but also subsequent maintenance, taxes, fares and gas or electricity costs. Affordability is an important factor when looking at current and future trends in private mobility.

In 2008, it was estimated that 9 % of the European population could not afford a car [83, p. 2] and were, therefore, forced to use other means of transportation - car-sharing for instance, which is viewed as low-cost by 81 % of the German population [72, p. 32]. Furthermore, the share of transportation costs in the household expenditure of Germans has increased in the last decade, from 13.5 % in 1998 to 14,5 % in 2008 [118]. Transportation costs tend to make up a higher share of the household expenditures in low-income families, while that share tends to decrease with rising income [80].

In individual mobility, a representative German study showed that 84 % of the polled cited the price as an important criterion when choosing a mean of transportation [80, p. 6]. In another study, 69 % of German users of public transport cited its lower price as a reason for preferring public transport over the car [72, p. 28].

## 2.2.2 Comfort Needs

Comfort needs are the needs that are not essential to mobility, yet have a great impact on how the customer rates the quality of the mean of transportation. In contrast to the luxury needs, they mainly concern the functionality of the mean of transportation.



In private mobility, the four most relevant needs that lead to comfortable transport are ecofriendliness, flexibility, infotainment and efficiency. If these four needs are fulfilled, a customer will consider a mean of transportation comfortable and will rate the quality of the mean of transportation higher.

### **2.2.2.1 Ecofriendliness**

Ecofriendliness embraces the reduction of all different aspects of a mean of transportation that can have a negative impact on the environment, be it CO<sub>2</sub> exhaustion, noise or the exhaustion of fine particles. As the transportation sector has been widely recognized as one of the largest factors in environmental pollution, customers have developed a need for ecofriendly means of transportation.

In the year 2012, a study showed that 35 % of the German population thought that the protection of the environment is the most important challenge Germany has to face in the future [72, p. 18]. This percentage is by far the highest in over a decade. Consequently, 93 % of the polled in a study about the everyday mobility of the Germans rated ecofriendliness as an important criterion when choosing their mean of transportation [80, p. 6]. This result becomes evident in the fact that 82 % of the users of public transportation of Germany do so because of its ecofriendliness, in contrast to only 21 % of the car drivers [72, p. 29].

### **2.2.2.2 Flexibility**

Flexibility in private transportation is the need of the customer to be able to react to changes in his plans or his environment. One aspect of flexibility is the temporal availability of a mean of transportation - a study showed that customers want to be able to be mobile at any time of the day [100, p. 388-390].

The importance of flexibility can be seen in a representative study conducted in Germany where 91 % of the polled rated flexibility as an important criterion when choosing a mean of transportation [80, p. 6]. Another study conducted in the Netherlands suggests that flexibility is among the main reasons why many prefer the car over public transport [92, p. 30]. Last but not least, many car-sharing companies have recognized flexibility as an important customer need and thus promote the flexibility of their service.

### **2.2.2.3 Infotainment**

Infotainment is “information-based media content or programming that also includes entertainment content in an effort to enhance popularity with audiences and consumers” [78, p. 143]. In the terms of mobility, infotainment, on the one hand provides information and utility, but on the other hand can be a distraction and therefore a risk to safety.

Distraction can have many causes, such as using a cell phone or smartphone, using a navigation system, operating the radio, CD player, or MP3 player [126]. Concerning the safety risk, in the US, 11 % of all drivers under the age of 20 involved in fatal crashes were reported as being distracted at the time of the crash. This age group has the largest proportion of accidents with the main cause of the distraction of the driver [121]. In addition, drivers who use hand-held devices are four times more likely to get into crashes serious enough to injure themselves [89].

Studies show that a good infotainment system does influence the car purchase decision. To the majority of the polled, an infotainment system mainly added value when enhancing the security or being useful to the overall efficiency of the mean of transportation, e.g. when providing a good navigation system [77, p. 4160].

Another important aspect to consider is the compromise between entertainment and information - in longer trips, the entertainment is focused on the passengers while the information is focused on the driver - extreme examples are the planes, trains or buses, where the entertainment is fully focused on the passengers. In cars, this conflict is solved by the feature to stop playing music in order to present important traffic information. In addition, most car companies offer connectivity to smartphones and tablets, as well as their own in-house solutions.

#### **2.2.2.4 Efficiency**

Efficiency in private mobility describes the relation between the time and effort that have to be invested and the perceived quality of the mean of transportation. For instance, long travel times in public transportation lead to a perception of low comfort.

According to studies both conducted in the Netherlands and in Germany, customers rate the efficiency (time efficiency and comfort) of the car much higher than the efficiency of public transport [92, p. 30]. In Germany, time efficiency is rated as an important criterion when choosing the mean of transportation [80, p. 6], and is one of the leading reasons for Germans to drive car instead of using public transport [72, p. 28].

#### **2.2.3 Luxury Needs**

As the private consumer fulfills his essential and comfort needs, he climbs up the Maslow Pyramid [98] and eventually wants to fulfill the so-called Luxury Needs. Luxury needs are defined as purely “nice-to-have”: They do not add any vital functionality, but rather fit the customer’s demand for being treated in a way that comforts him.

In the following paragraphs, three aspects of Luxury Needs are presented. At first, the individualization component shows the importance of the feeling

of being unique and different from others. Subsequently, the status element puts the individuals into perspective in a society or community. Finally, the low level of effort, or effortlessness, characterizes the ease of being mobile.

### 2.2.3.1 Individualization

The individualization and customization of an object, vehicle or service satisfies the need of adapting this object to one's individual personality. Consequently, one is willing to call the object "my own" and to identify with it. With regard to the means of transportation, individualization is more common in owned vehicles rather than in rented vehicles or transportation services.

There are two stages of individualization that can be differentiated, either before or after the purchase. The individualization before the purchase tend to be static, as they cannot be modified afterwards. Examples in the car segment would include the color of the car or the power of the engine. Those characteristics are also present in bikes, boats, planes and motorcycles.

The individualization after the purchase are more flexible, as they can be reset. Those include, amongst others, the seat position, heating and air conditioning, the music or the position of mirrors. More advanced flexible types of individualization are the setting of profiles of the engine's responsiveness, e.g. sportive or urban driving style, and the automatic adaption of the preferred seat position, music, mirrors etc, to the driver.

As of today, both flexible and static modes are offered in different means of transportation and in different price classes. For example, the Fiat 500 is offered with 100 customizable features, so there are up to 500,000 different models with their price ranging from 11,000 to 16,000 Euros [85]. With increasing price, however, the options and the degree of individualization increase, as well as the likelihood that the buyer chooses to customize the vehicle. Regarding the customers of the Rolls-Royce Ghost, for instance, 56 % of the 2011 sold cars were ordered to include the exclusive Bespoke personalization [111]. The Rolls-Royce Ghost model starts at 213,000 Euros.

### 2.2.3.2 Status

A status symbol is "a possession that is taken to indicate a person's wealth or high social or professional status" [64]. Thus the need for admiration, social acceptance and conformity in a society or community results in the acquisition of such a status symbol. In the broadest sense, this possession might also be a specific status service, such as first class plane trips or the renting of a yacht.

When considering car buyers in Germany, on average, there is a diminishing importance given to status or a brand when buying a car [95, 106, 107]. Looking at specific brands or consumer segments, this importance varies. Consumers with a visionary or progressive global orientation, who already enjoy medium or high social status, tend to rank the importance of status the highest. [95]. Those

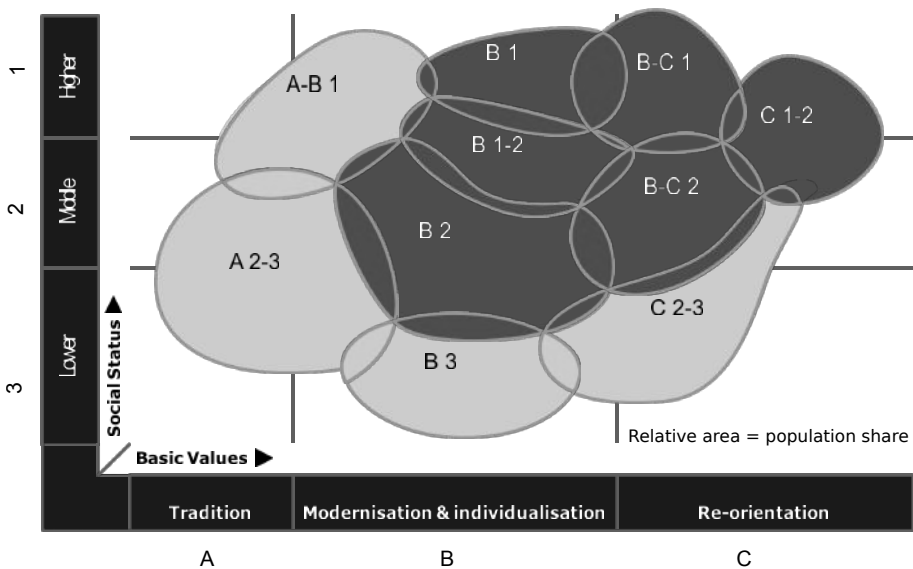


Figure 2.2: Sinus Milieus in Germany 2011

Source: Adapted from [116]

consumers are represented by the B to C and 1 to 2 Sinus-Milieus [116], as seen in Figure 2.2. The Sinus-Milieus are a study and copyright from the Germany research Sinus-Institut Heidelberg. They split the population of Germany into different social status and basic values and report each year what proportion of the population corresponds to which Sinus-Milieu.

When examining the geographical and cultural aspects of customers, more specificities emerge. In Germany, the brand loyalty and preference varies between states, controlling for differences in income. The three analyzed premium brands have the highest penetration among southern states and in general a regionally present brand enjoys highest preference in this state [108]. When looking abroad, sociocultural differences are even higher. In China, only one third of consumers buy cars solely for the functional reason. In Germany, in contrast, this proportion is about 56 % [88].

### 2.2.3.3 Effortlessness

Finally, the low level of effort, or effortlessness, characterizes the ease of using the vehicle and of being mobile. This also includes the maintenance, the registration, the usage fees and the payment of taxes for the vehicle.

When considering only the driving aspect in the car segment, there are chauffeurs. Those either drive the customer's car, or their own car. Depending

on the quality of the car, this ranges between cab and limousine services. One interesting aspect of being mobile with a cab is that the commuter, or cab customer, does not have to care at all about the maintenance or the refueling of the car.

When looking at rentals or the sharing of cars, the consumer does not have to bear but the costs of the rental and possibly the fuel. While the car sharing option is not always the cheapest, it adds convenience and reduces the effort of owning a car [68].

The rental companies are expanding their product range in order to meet the increasing needs of efforts of the customers. Avis, for instance, also offers a chauffeurs service [67], while Sixt has invested in car sharing [117].

Car manufacturers are also providing additional services to offer more comfort when the consumer is not driving anymore. Fiat is offering a roadside rescue services for their car, the driver and passengers in partnership with Europ Assistance, and is expanding its reach in Europe [86].

## 2.3 Trends

The customer needs discussed in the Status Quo are reflected in the near future in the field of private mobility. In the following part of the report important societal changes and the resulting trends in customer needs will be analyzed.

Changes in society, such as population aging and urbanization, are important factors that influence the way people travel in their everyday lives. The trends in individual mobility can be divided into pre-motion and in-motion. For instance, while currently the car is becoming less important as a symbol for one's social status, the willingness to share and pool is increasing and people are considering multi-modal transportation. The proactive lifestyle of customers creates an increasing demand to spend commuting time more efficiently. While offering more and more in-car information and entertainment, the essential need of safety still has to be fulfilled, for instance by providing intuitive and easy-to-use interfaces.

### 2.3.1 Societal Changes

The needs and demands of customers with regard to individual mobility and human-machine-interaction within individual mobility are largely influenced by changes in society. Currently, two major paradigm shifts, namely the population aging and the global urbanization, can be observed and will have a significant impact on human-machine-interaction in individual mobility.

### 2.3.1.1 Population Aging

Population aging or demographic change describes the increase of the median age of a population. A population ages if the amount of young people decreases or grows slower than the amount of elderly people [70, p. 9]. Three major developments cause the German population to age:

1. The fertility rate has been below the level that is needed to maintain a constant population level for 40 years (e.g. in 2010 the birth rate was at an average of 1.39 children per woman versus 1.60 in the EU) [71, p. 14-16]. Thus, every generation born in this time span is smaller than its parental generation, which results in a growing number of elderly people. Besides, this also causes the total population to shrink. The Federal Statistical Office predicts that total population in 2020 will be 80.4 million, which is 1.7 % less than the 81.8 million in 2010 [119]. A birth rate of 2.1 would be necessary in order to keep the population level constant [71, p. 14].
2. Average life expectancy has been increasing constantly by about three months each year for the last 150 years [102, p. 1031]. Average life expectancy for boys born in 2010 is 77.5 years and 82.6 years for girls. A rather moderate extrapolation projects that life expectancy will further increase to 81 years for boys and to 85.7 years for girls [71, p. 21]. As a result, more and more people will reach a high age while still being relatively fit.
3. The net migration has seen a dramatic decline since its peak in 1992 [120].

The results of these developments can be seen in figure 2.3. The relative amount of people who are sixty-five years of age and above has more than doubled over the last sixty years and will grow further in the future. During the same time, the amount of 0-20 year-olds has dropped by about 45 %, whereas the amount of 20-65 year-olds has been relatively stable.

#### Impact on HMI

The growing number of elderly people creates a new challenge with regards to safety, since older drivers (especially over the age of 70) have a higher risk of fatal crashes than all other age groups except very young drivers [81, p. 289]. One measure to enhance driving safety of the elderly are new safety systems. These systems have to be easy to use, e.g. there should be large buttons that give haptic feedback, loud and articulate warning signals and intuitive speech commands that must not distract from driving. Companies in the mobility sector, such as manufacturers as well as providers of sharing services now have the chance to gain competitive advantages by an early understanding of usage patterns of the elderly and by adjusting their technologies accordingly.

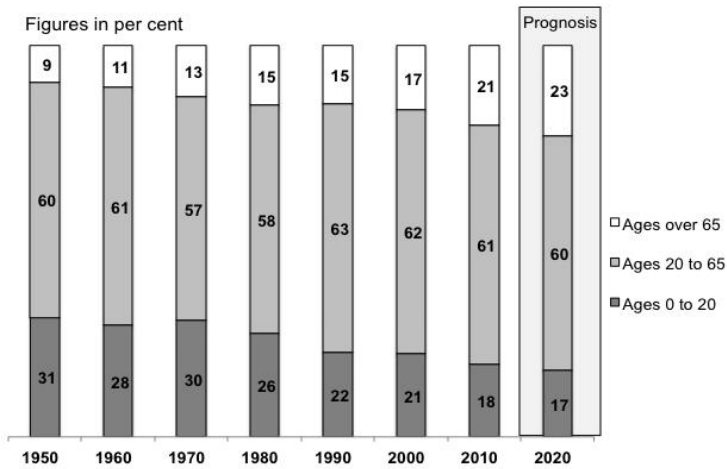


Figure 2.3: Percentage distribution of ages of German population from 1950 to 2020

Source: [113]

### 2.3.1.2 Increasing Global Population in Cities

The urbanization rate of a country is defined as the percentage of its population that lives in urban areas. In 2011, 73.9 % of the German population lived in urban areas - the UN expects this amount to increase to up to 75.3 percent in 2020. Thus, urbanization is not a major change driver in Germany, but very well so on a global scale, especially in emerging markets such as the BRIC countries. At the moment there is a large discrepancy between the urbanization of more developed regions, which is on average 77.7 percent and of less developed regions, which is on average 46.5 %. However, the rapid economic growth in emerging markets sends the people from the rural areas to the cities in search for employment, education and a higher living standard. Consequently, the growth of the global population from 6.9 billion in 2010 to 7.7 billion in 2020 will occur almost solely in urban areas. [124][123]

Figure 2.4 shows the regional distribution of the urban population growth from 2010 to 2020 as projected in the UN World Urbanization Prospects. As can be seen, the vast majority of the growth (roughly 90 %) happens in Asia, Africa, Latin America and the Caribbean. Moreover, China and India alone will have roughly 290 million people moving into the cities.

The distribution of the global urban population between different city sizes is uneven. In 2011, 50.9 % of the 3.6 billion urbanites lived in cities with less than half a million inhabitants. 10.1 percent were living in cities with

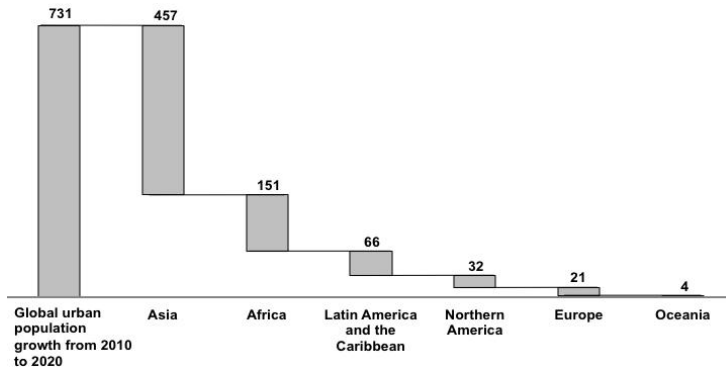


Figure 2.4: Urban population growth from 2010 to 2020 according to regions  
Source: [124]

populations ranging between 500,000 to 1 million inhabitants. The remaining 39 % were residing in cities with more than 1 million inhabitants. The UN predicts that these ratios will change in the future: By 2025 it is expected that the amount of urban dwellers living in cities with a maximum of 500,000 inhabitants will have decreased to 50 percent, whereas 47 percent will live in cities with 500,000 to a million inhabitants [122, p. 4-5]. However, the megacities with 10 million inhabitants and above will undergo the highest percentage increase. Consequently, the number of megacities (amount of urbanites that live in megacities) will increase from 23 (1 out of 10) in 2011 to 37 (1 out of 7-8) in 2025. [122, p. 6-7]

Urbanization is also characterized by a trend towards deconcentration, meaning that the population density within urban areas will decline [110, p. 6]. For instance, urban land area has doubled in OECD countries and quintupled in non-OECD countries since the mid 1950s [101]. Angel concludes that if residential density falls below a certain threshold, this may endanger public transport, which in turn suggests that the deconcentration of cities might increase the importance of individual transportation. [65, p. 64]

This assumption is supported by the fact that the increasing urbanization goes with a growing motorization, e.g. from 1980 to 2003 the number of privately owned vehicles in China grew from 1.78 million to 23.83 million while urban population grew from 302 million to 524 million. This in turn causes more traffic jams, air pollution, traffic noise, number of accidents and, of course, fuel consumption. Interestingly, 60 % of urban travel is still accomplished by bicycle. Policy makers aim to address the increased amount of traffic by further developing the road infrastructure and public transport systems and by implementing carbon dioxide emission and safety regulations. [130, p. 3]



Summing up, the cities will be the epicentre of the global population growth in the next couple of years. Almost half a billion people will move to urban areas in Asia alone. Additionally, nearly one out of two urbanites will live in cities with more than 1 million inhabitants. The urban areas will also increase enormously in terms of their spatial extent, which increases the demand for urban travel and thus results in an increasing motorization.

### **Impact on HMI**

The two big problems arising in cities with regards to transport are traffic jams and smog. Urban travel is usually characterized by the possibility to decide between several means of transportation. Human-machine-interfaces have to help the traveller to reach his destination in an efficient manner, meaning they should support him in the process of choosing the right means of transportation as well as the most efficient travelling route e.g. by taking real-time traffic information into account to avoid traffic-choked streets. This will also dam the smog problem, since overall carbon dioxide emissions will be reduced if people travel more efficiently.

## **2.3.2 Pre-Motion Customer Needs**

Contrary to what one might be inclined to think, mobility does not equal motion. In fact, it is a much more englobing concept and covers a variety of interconnected aspects. They come prior and post motion both temporally as well as organizational. The planning and preparatory phases of motion and its follow-up might very well absorb more time than its execution itself. Decisions about the type and quantity of mobility that are able to satisfy a specific customers need are taken well before the consumer actually moves. In this way they structure much of the framework in which movement can happen.

The customer needs and expectations as well as the resources at their disposal are the foundation for their future interactions. How they assess the reliability, safety and affordability of a certain type of mobility decides if they might consider using it or turn to alternatives. The same goes for the ease of use in terms of intuitiveness, efficiency and flexibility as well as the degree of expected additional satisfaction stemming from possible individualization, effortlessness of use and status related satisfaction which they project on a specific kind of mobility offered. Concerning these phases that frame movement as such, two big shifts in customer needs can be anticipated: a growing willingness to share and pool, as well as an increasing demand for unified multimodal transport.

### **2.3.2.1 Growing Willingness to Share and Pool**

The next big revolution after trains came in mobility with accessible combustion engines for the masses at least since the turn of the 20th century. Automobiles did not only enable private persons to travel long distances reasonably comfortable

and at an affordable price - they also led to an unprecedented individualization and laid the ground for much of what we understand by private mobility today. Private ownership of an automobile did however not only have consequences for the way people could move from A to B. Far more important than the increased radius of movement were the perception of private mobility as an integral part of mass culture, especially youth culture. Car ownership became a status symbol and synonymous with a feeling of freedom and independence.

However, there are indicators that we might be witnessing the onset of a new development shifting from exclusive ownership of means of transportation to a more functional usage of cars and other means of private mobility. Especially in urban settlements in developed countries analysts observe a “waning importance of cars as a status symbol” [82, p. 5]. Driving as such loses significance, cars are increasingly reduced to their primary function as a mean of transportation and direct ownership becomes less attractive. Instead, the service aspect of transportation is increasingly coming to the fore. Growing willingness to share and pool means of transportation constitute a direct consequence of this development [84, p. 5].

### **Pooling**

In private mobility, the term “pooling” stands for the common use of a specific mean of transportation by multiple persons with a shared route, typically without aiming for profit. Car pooling is historically not a new phenomenon, but rather made popular as a part of the private contributions for the United States war effort during World War II. The resource savings achieved by a collective usage however come at the price of decreased flexibility and higher coordination costs. Apart from times of crises such as the war or the oil shock at the end of the seventies, the money-saving potential of car pooling seems to be not sufficient enough for most persons to accept the inconvenience that goes with it. [99, p. 96]

Sticking with the example of the US, the percentage of workers commuting dropped from roughly 20 % at the beginning of the eighties to 13.4 % in 1990. This is mainly due to a significant drop in gasoline prices, which made the organizational costs of car pooling become prohibitive [99, p. 94]. Costs, for which new developments in the IT sector promise drastic potential for mitigation through “technology-enabled ride-matching” [99, p. 105]. Recent investments like the eight-figure funding by the automobile manufacturer Daimler in summer 2012 for the Munich based company Carpooling.com indicate that the vast potential lying in the increasing popularity of IT enabled car pooling is being recognized as a potentially lucrative business field by major players in the private mobility sector.

### **Sharing**

A direct consequence of the decrease in importance of cars as a status symbol and thus their ownership is the rise of sharing. In contrast to pooling, where



Figure 2.5: “Help win the War”  
Source: Adapted from [125]

individuals use a given resource at the same time, sharing is usually understood as consecutive (profit-oriented) short-term rental. The trend towards increased sharing is by no means limited to mobility. In fact, the worlds largest computer expo CeBIT has chosen “Share economy” for their 2013 keynote theme. They explain the term as the “societal shift from owning to sharing” and claim it was “currently the hottest topic for business and society” [75]. This statement seems to hold true for the mobility sector as well: In its annual report for the years 2010/2011 the German Federal Association of Car Sharing Providers states that the number of registered customers rose by more than 20% in a single year [73, p. 2]. The topic of car sharing is also prominently exposed in the media and by far not only limited to urban settings [74, p. 7].

The car sharing market is set in motion by a multitude of new actors competing with diverse business models. Traditional car rental services and OEM enter the market in cooperation with or in competition to each other and established service providers. Increasing competition can be seen as a sign of maturing, an evolution from an economical niche to a future market. Free floating car sharing complements traditional stationary models and further reinforces the flexibility in the mobility provided to the customers. However, not only new business models emerge, but also the traditional, almost exclusive focus on cars as available means of transportation is changing. Bicycles, e-bikes, mopeds and a whole range of alternative means accommodate the customer’s needs for increased flexibility and their desire for ecological transportation likewise.

### **Impact on HMI**

Both sharing and pooling come with an additional effort mainly for coordination, which should not be passed on to customers. Thus the increasing willingness to share and pool entails some very direct consequences for human-machine interaction. These consequences can be split up into possible additional efforts to reserve and book the desired means of transportation, locating them, accessing the vehicle, maintenance such as the need to refuel and administrative tasks, such as billing. Last but not least customers making use of sharing will be confronted with a multitude of different vehicles. The higher the customization of vehicles in their look and feel, the lower the potentially prohibitive usage barrier for the customers and the better their overall experience.

#### **2.3.2.2 Increasing Demand for Unified Multi-Modal Transport**

A loosely related area likely to grow in importance is the increasing demand for unified multimodal transport. In the field of transport, multimodality means the integration of different means of transportation for a single trip. Multimodal transport of goods is already common practice but has so far failed to become a widely spread offer in private mobility. However, as is the case for sharing and pooling, the declining importance of ownership and its impact on how mobility is imagined might open new perspectives in this field, too. Different modes of transportation which substitute and complement reliance on exclusive ownership are able to reach customer segments which remain sealed for more isolated solutions. Thus pragmatic choice between different means of transportation and their combined use in a mobility chain enables customers to “[fit driving] into a larger context” [84, p. 5]. Multimodal mobility offers the opportunity to “capitalize on the strengths of the various systems while avoiding their weaknesses” [109, p. 215]. Examples could be the combination of public transportation with rental services, sharing and more traditional forms of individual transport such as using a car.

There are first solutions available when it comes to planning a trip as well as a few combined offers, such as the already well established partnership between car rentals and flight booking agencies. Some existing solutions also take the customer’s demand for unified “search/optimization model[s] of travel regardless of mode” into account [90, p. 21] - they are however usually limited to the planning phase of a trip and remain rudimentary in functionality. Continuous and seamless integration of different means of transportation and facilitation between them, ideally in or close to real time, are still dreams of the future [99, p. 107].

### **Impact on HMI**

The keyword relevant for human-machine interaction when it comes to multi-modal mobility is “unified”. The integration of a multitude of different means of transportation brings together an equally vast set of distinct interfaces. This

aggregation naturally implicates an increase of complexity. The key challenge for human-machine interaction lies in the reduction of this complexity for the customers, ideally to a single entry point which unifies all deep rooting services and makes them accessible with a common use pattern.

### **2.3.3 In-Motion Customer Needs**

Each day, people spend an increasing amount of time in the car - be it for traveling, commuting to work or for other purposes. In the United States, the average time spent driving is over 50 minutes per day [127], while in Germany people spend an average of 40 minutes per day in the car [94]. In a society where the population is becoming more active, urbanization is becoming a big issue and the time spent at traffic lights or in traffic congestion is increasing - this leads to the drivers' need to spend this time more efficiently. Therefore, there is a continuous trend for offering entertainment to the customer, providing him with relevant information and the means to be always connected. All these features that provide the driver with entertainment and communication are tasks that can distract the driver from his original task - the driving, hence compromising his and his passengers' safety. Thus, there is a continuous need for less complex interfaces and an intuitive human-machine interaction for effectuating the non-driving related tasks.

#### **2.3.3.1 Rising Demand for Infotainment**

A car is no longer only a mean of transportation to travel from A to B. "It's a workplace, a home and a connected hub for our busy lives." (Seung Suk Yang, president of the Hyundai Motor Company). Consumers today are faced with an excess of electronic devices around them, used for information, entertainment and safety. With more communication channels around them and a growing number of distractions from driving, the overall experience will eventually attract the customers. The heads of automotive industry are aware that the industry is not only technology or economically driven anymore, but "has become more consumer driven. The consumer will be dictating the terms." ( an Indian automotive OEM executive) [90].

The consumer stays at the core of the development of the cars of the future. An important factor to take into consideration is the segmentation of customers according to age, income level, sex, etc. Although there are many different sides of the Millennial generation, studies show that they are all adaptable to new technologies [96]. "We have customers who are really keen on all these new features. It's understood that consumers want to integrate things from their smart phones and from home, and don't want to miss out on this technology in their car." Oliver Sieghart, head of design at a well known automobile manufacturer). Cars will slowly become a place where people live, without being especially designed to be habitable [93]. Therefore, the driver

expects the same connectivity, entertainment and information in his or her car as in his or her home.

Infotainment is a term containing both information and entertainment. As the time spent by a person in a car is quite significant and people have a more proactive lifestyle, the need for spending this time in an efficient way is increasing. The infotainment system should be able to offer relevant information to the participants to the traffic, but also offer them entertainment while driving, such as AM/FM radio, wireless communication and digital multimedia. Three main functions that need to be found in each car infotainment system (CIS): telematics, driver information systems and in-car entertainment. The consumer's demand for such systems has been growing in the last few years [? ].

There are multiple forms of in-car entertainment. A survey with 130 US citizens with an average age of 34 years regarding desired forms of entertainment, it was determined that 90 % of the polled would use displays in vehicles for entertainment and/or navigation reasons. The same survey showed that over 70 % of the polled prefer audio entertainment and almost one half would like to be able to read emails while driving. Less popular were the possibility of watching short videos or playing games. Regarding the content that the users are interested in during driving, more than 80 % wanted to get to know news and two thirds the weather forecast. Most of the people find such an infotainment system useful during the waiting times, for instance, while waiting at traffic lights and, especially, when they are alone in the car (72.4 %). While audio content is clearly preferred by the customers, there is a significant percentage who is interested in using visual content. Their main concern however is to be distracted from driving, which would be a potential safety issue [114].

The younger generation has an increasing high demand for connectivity everywhere. Therefore, cars and smartphones are no longer at opposite poles, but they have to work together and complement each other [128]. As the smartphones still have an increasing market growth it is important to consider unifying the user experience when using these devices in cars and not distract them from the primary task of driving.

### **Impact on HMI**

With consumers demanding more and more functionality such as navigation, communication, information and entertainment, the automobile manufacturers have to keep in mind that safety as an essential need of the customer is at the core of the car and should not be compromised [91]. The information demanded by the driver, both internal (such as fuel consumption) and external (such as weather or traffic situation) has increased enormously [131]. Thus, the information provided to the driver has to be filtered, sorted and fitted to the context. Successful human-machine-interaction has to integrate all the required information and functionalities, while keeping the interference with driving at a minimum. Therefore, an easy-to-use system will be the key for a good user acceptance.

### 2.3.3.2 Increasing Demand in Intuitiveness

Consumers are demanding more and more functionalities from their cars, leading to more complex user interfaces in cars. No matter what the future trends in infotainment will be and what the customers will be demanding, one has to be aware of the essential needs, more specific: safety. Therefore, interfaces have to be kept as easy as possible, offering a high usability. Oliver Sieghart added that “a car is a car and not a home computer. There always needs to be a time to be quiet and concentrate on the driving.” [115].

Distracted driving is a factor in about 4 million motor vehicle crashes in North America each year and research shows that 20 % to 30 % of all collisions involve driver distractions [79]. In Germany alone, more than 2.3 million accidents happened on the roads, with 400,000 victims and 4,000 deaths [69]. In most of the accidents, driver distraction played a major part. The World Health Organization predicts that by 2030, road traffic injuries will become the fifth leading cause of death [129, p. 9]. Therefore, even though not all drivers are aware of it, an intuitive interface for completing both driving and non-driving related tasks is essential and is closely related to road safety.

Intuitiveness is defined as “using based on what one feels to be true even without conscious reasoning” [64]. An intuitive interaction has two components: the consumer can use the interface immediately as well as successfully and the interface completes the expected functions reliably [97, p. 2].

The tasks performed while driving require both visual, manual and cognitive resources. Consuming the visual resources leads to visual distractions i.e. taking the eyes from the road. Manual distractions result in the driver taking the hands off the wheel, while the consumption of cognitive resources leads to a loss of concentration. Recently, the focus has moved to the importance of driver’s cognitive resources for completing a task [76][103, p. 1]. Therefore, user interface designers and user experience professionals must keep in mind that it is critical to reduce the cognitive load required for interacting with a system [87, pp. 239–240].

With the rising demand for in-car entertainment and communication, and the increasing information flow that is available for the drivers, the need for intuitiveness is growing as well. An easy to use and intuitive interface leads to less distracted drivers and thus to increased road safety and less accidents. Consequently, successful human-machine-interaction leads to less injuries and fatal accidents.

#### **Impact on HMI**

In the past, the approach “one function = one interface” was used to design car user interfaces. This led to complex systems that were not adapted to customer needs and did not offer the required flexibility. Consequently, these systems were met with poor acceptance from the customers [112, p. 2242].

As a result of the current customer needs, the interfaces are diverging in

two directions: transparency - meaning that the tasks should not interrupt the user's train of thought, and personalization - meaning that the system should be configurable and adaptable to the driver's needs.

Research has shown that the engine performance is not the decisive factor when buying a vehicle any more, but also environmental issues and citizen responsibility. Drivers expect a stress-free driving. [112, p. 2242]

## 2.4 Conclusion

Society is in a continuous transition, and with the changing society, customer needs are changing as well. Urbanization, population aging and the growing demand in mobility as a service require the interfaces between humans and machines to adapt.

Following an increasing social-economical condition, the luxury needs of individualization and effortlessness wander down Maslow's "Pyramid of Needs" and thus also become relevant for a broader user base, while the need of expressing the social status will decrease in the future. This trend requires human machine interfaces to enable individualization also in non-privately owned means of transportation.

As the adoption and usage of technology is a critical factor and the world's population is aging, the difficult task of finding suitable and intuitive user interfaces arises. This task is of great importance, as an intuitive interface has a significant impact on the safety of the drivers and the passengers. As an essential need, safety will always be a relevant decision factor for customers when choosing a mean of transportation.

Another important factor is the offering of an efficient, entertaining and/or relaxing way of spending the travel time. With the ongoing megatrend of urbanization, time spent in traffic will make up a significant part of people's lives. Consequently, future technology has to fulfill the customer's need for infotainment while keeping the traffic participants safe.

Another question that arises is if the time spent while commuting is necessary or if the overall traveling time can be reduced. While the car will no longer be a social status symbol, more people will prefer sharing and pooling services instead of privately owning a car. This change goes beyond the affordability aspect and affects even the premium segment, as it has the potential to enhance flexibility and diminish the effort and responsibility of the driver. This mentality change enables and supports the use of different means of transportation, shifting the focus from cars-only transportation to a multi-modal approach to transportation. Human machine interaction has to facilitate this trend by providing consistent interfaces and tools that make smooth multi-modal commuting possible.

All these changes in demography and mindset raise great challenges, but also carry opportunities for innovative companies to be the technology leader and impact the way people experience private mobility.



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# 3

## Chapter 3

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# Trends in Society and Customer Needs in Business Mobility

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## Executive Summary

Human-Machine-Interaction plays an integral part in leveraging the possibilities of individual travel regarding business mobility. It can help overcome challenges posed by urbanization and the increasing spatial separation of business partners, which follows from globalization. While newly emerging cities are free to integrate state-of-the-art transportation systems, the developed world is looking for ways to upgrade their existing infrastructure to accommodate the increasing needs of today's knowledge workers, which want to be connected and able to work from anywhere, anytime. Additionally, the younger generation Y – for which place and time as work environment parameters will be of different importances – is starting to enter the workforce, which poses more challenges on companies, which in turn need to balance the different needs of older and younger employees. Internally, companies are optimizing the usage of their resources, e.g. by sharing and pooling cars, as well as by enabling and supporting their employees to be able to work while traveling. In short, started by a revolution in ICT, business mobility is undergoing major changes which will lead to companies needing fewer resources and having more productive employees.

## 3.1 Introduction

The developed world has been shifting from national industrial-based economies to a global information-based economy. Information and Communications Technology (ICT) offer a lot of revolutionary opportunities of where, when, and how to accomplish work and how to efficiently manage employees. In this context, business mobility describes “the various strategies and technologies used by companies to make it possible to conduct business without being limited to a single headquarters or location.” [139]. Business mobility includes travelling on business as well as operating on a virtual level - the latter not being the focal point of this report. In both cases, companies heavily rely on networking and the use of various technological devices. The first part of this chapter describes the Status Quo of aspects concerning individual business mobility. The first subsection describes current issues in society including a description and shortcomings of the existing infrastructure as well as generational differences. The second subsection describes existing ways of organizing business mobility, including challenges such as competition, time pressure, high coordination costs and an inefficient use of resources. The third subsection describes current ways of how travel time is used, namely integration of mobile devices into business processes and poorly conceived out-of-office productivity. The second part describes the Trends in society and customer needs in business mobility expected within the next five years. Changes in needs of society and customers (both employees and employers) highly influence the way companies view and organize their business mobility. Therefore, in the first subsection, changes in society will be explained, including new mobility infrastructures, the rising demand for flexibility and connectivity as well as the increasing environmental awareness. These trends result in the effective planning and efficient execution of business mobility processes described in the next two subsections: The second subsection includes trends of how to effectively organize business mobility, namely ways to reduce the need for mobility, sophistication of trip planning and the increasing importance of sharing and pooling. The third subsection deals with ways of how to use travel time more efficiently. Linking all sections together, the reader obtains a broad understanding of today’s and the future’s trends affecting business mobility.

## 3.2 Status Quo

### 3.2.1 Societal Influences on Business Mobility

In order to better understand individual needs, it is vital to have a closer look on society and the places where people live. In this subsection, the worldwide existing infrastructure and its shortcomings will be examined, followed by a closer look on generational differences.

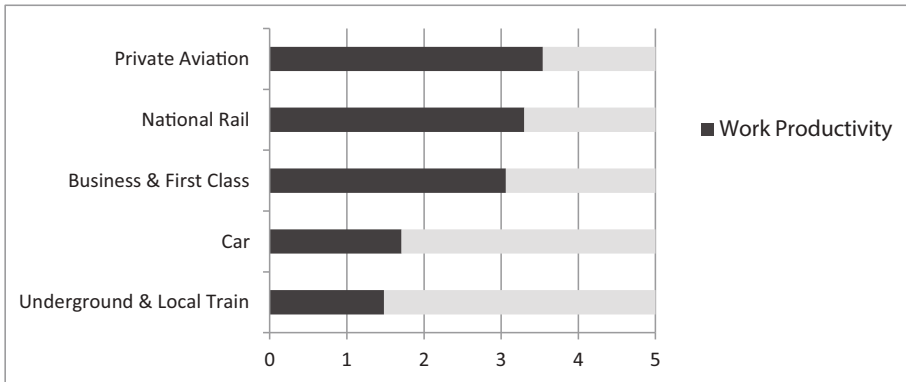


Figure 3.1: UK executives judging work productivity

Source: Own illustration, data from [154]

### 3.2.1.1 Existing Infrastructure and Its Shortcomings

The mobility, transport and logistics infrastructures we know and use today have been developed and built during the second half of the last century where urbanized regions were of much less significance as most people were rather living in countrified regions, casual business mobility was highly exceptional and transportation ecosystems were developed regionally isolated [147, p. 1]. It is therefore not surprising that among the top eight cities in the world – regarding their infrastructures in terms of public transport and global accessibility – four are from East Asia as these cities’ modern systems have been planned and constructed decades later and were therefore able to adapt to the globalization and urbanization that was already happening and much easier to predict [158, p. 56]. This for example can be impressively observed in South Africa where the urban regions of Johannesburg and Pretoria are currently growing towards each other (“Jo-Toria”) forming one new mega city with many new obstacles to tackle concerning their transportation eco systems – mainly consisting of conventional roadways – which is highly incapable of providing the necessary throughput for the growing masses of people and goods that in future will be exchanged [147, p. 4]. Taking a glance at surveys investigating the impacts on business travelers due to the lack of efficient transportation systems it becomes clear that even in the so-called developed world there is a huge potential for improvements. More than 85% of travelling employees in Germany for instance are losing half an hour or more in each of their business trips due to delays [164]. An even bigger handicap has to be faced by executives in the UK who are wasting an average of 34 hours per month due to ineffective trips. Their judging of means of transportation in terms of productivity is shown below [154].

Unsurprisingly, private jets provide the best working environment while being

on the go. However of the 800 to 1000 hours of possible annual usage, an average private jet lays still 80% of the time [188] which in days of narrow corporate mobility budgets [151] - which does not apply for the league of global players – demonstrates a mismatch between choosing the most work productive means of travel and simultaneously meeting financial restrictions. As a consequence, the nine biggest airborne business trip spenders are overall indicating that from 2009 to 2011 there has still been an increasing growth rate (8%) [159]. However the number of business trips by U.S. businesses and the revenue caused by them are overall decreasing [176]. Moreover, flying in business class or renting premium cars has lost its charm as globalization and international meetings have long ago stopped to merely concern C-level executives who cared about maintaining a premium appearance outside their offices and moved on to penetrate the whole corporate hierarchy. Therefore, only 3% to 6% choose their airline or (rental) car with an elite status as the most important aspect, leaving lowest rate (~50%), good service (~25%) and global footprint (17% airline, 8% car) to the rest [163]. However there are also efforts to save the business meeting culture [173, p. 17] which fits most (over 60%) businesses traveler’s opinions that their trips are mainly aimed at cultivating and expanding customer relationships [149] while not so much having an ROI-related financial benefit (only 16%) that would higher the company’s revenue [143]. In conclusion, today’s aging transport infrastructures are not only causing significant costs and more and more introducing unused time to the work day of an employee but they are also mostly not able to provide enough space for radical innovations that might help us to overcome these obstacles [147, p. 1].

### 3.2.1.2 Generation Differences

At the moment, a company’s workforce is composed of three strikingly different generations: The so-called baby boomers – born between 1946 and 1964, the generation X – born between 1965 and 1980, and the generation Y – born after 1980. Many baby boomers define themselves by their careers, feeling that they live to work, thus regarding work as a form of self-fulfillment and status. For them, balance between work and life is neither a real possibility nor a necessity. They are used to working long hours in the office; however, they usually don’t like to work at or from home [177, p. 6].

In contrast to the baby boomers’ strong work ethic, generation X and generation Y rather work to live. They put more emphasis on a balanced relationship between work and life. While they have more than mediocre knowledge about sophisticated technological processes and digital media, the baby boomers do not exploit all functionalities of mobile devices but rather just for exchanging important facts and information. All generations know how to use the Internet, but not too many of neither the baby boomers nor the generation X are very active in social networks; they prefer to communicate via telephone or e-mail

[192, p. 5].

Generation Y employees, in contrast, grew up with the Internet and mobile devices. Thus they have developed technological skills from their childhood on. The so-called digital natives thrive in a multi-media environment; they want to stay connected with their friends, especially via social networks, anytime and anywhere and they are used to communicate virtually. Both generation X and generation Y are very flexible regarding working hours and remote workplaces. In return, they demand high flexibility from their employer [177, pp. 7–10]. Especially for the youngest workers, the line between work and home does not really exist. No matter where they are, they want to spend their time in meaningful ways and stay connected with their family and friends. Generation Y workers also like to travel to exotic places and have grown up with people from various cultural backgrounds, thus are more diversity affine and know many different languages. People less than 35 years currently represent 13% of all business travelers in the U.S. They take an average of 4 business trips per year, whereas employees over 50 take an average of 8 business trips per year and make up 38% of all business travelers [137]. For managers, the great challenge these days is to meet and match the differing needs of the various generations regarding business mobility. Moreover, it is important for them to consider the different levels of digital affinity when it comes to the implementation of sophisticated technological structures in the company.

### **3.2.2 Ways of Organizing Business Mobility**

The status quo in organizing business mobility is shaped by harsh competition and high costs of coordinating mobility combined with an inefficient use of resources. These generate a need for finding and implementing new methods.

#### **3.2.2.1 Competition**

As nearly every business depends on the mobility of its employees, organizing business mobility is one of the essential factors when it comes to competition between businesses. The constant time pressure requires them to strive for any edge they can possibly get over their competitors. This includes quicker as well as more frequent on-site reactions for customer inquiries and in general a better opportunity for companies to create a brand which their clients can fully associate not with the company itself but rather its workers.

#### **3.2.2.2 High Costs and Inefficiencies**

However, although a multitude of businesses rely on mobility, coordinating it remains very costly. This is due to the inefficient use of scarce resources such as time, vehicles, ticket contingents etc. [141, pp. 6]. The reason for such inefficiencies is the fact that minimizing them is a complex procedure that

requires multiple data sources and sophisticated calculations. As the complexity grows exponentially in the size of the business, humans are not able to solve this problem without resorting to machines.

An example for an inefficiency that is difficult to improve without machine assistance are company vehicle fleets. Nowadays, most companies lease cars and allocate one vehicle to one employee. This results in the car's being parked most of its lifetime, while it could hypothetically be used actively nearly constantly, thus significantly reducing the total number of vehicles needed by a company.

### **3.2.3 Use of Travel Time**

The recent revolution of the Information and Communication Technology enables workers to be productive while on the road. However, the fast changes, which occurred in the past years, still pose large challenges for companies. They need to implement the necessary IT infrastructure in a way which fulfills their corporate requirements, but is at the same time attractive enough for their employees to use. Furthermore, the existing infrastructure is not yet fully prepared to give travelers all they need to be as productive as in their home office - on one hand simply because the location-independent emulation of a fully functional work space is not yet technologically possible and on the other hand because today's workforces and their huge generational differences are a big challenge to corporate IT services trying to install a homogeneous service that is homogeneous throughout the entire workforce.

#### **3.2.3.1 Integration of Mobile Devices into Business Processes**

Today, more and more companies are aware of the advantages they have by integrating mobile devices into the business process. But the integration process has just begun and especially with the new BYOD (bring-your-own-device) policies, unsolved issues accrue. In 2011, 13.6 million tablets were used in enterprises all over the world [186]. Yet, their use is mostly restricted to checking e-mails or reading documents. To cost efficiently mobilize their workforce, companies started to integrate BYOD policies. The bring-your-own-device policy allows the employee to use their private mobile device (e.g. smart phone/tablet computer) in the working place to access privileged company information and application. But many companies did not adapt to the changes which accrued with BYOD: Today just 46% of mobile devices are compliant with corporate standards and the companies did not establish a technical support infrastructure for BYOD, yet. Example given, 30 % of asked companies have no support for own devices at all, and 17 % still prohibit personal mobile devices [171, p. 4].

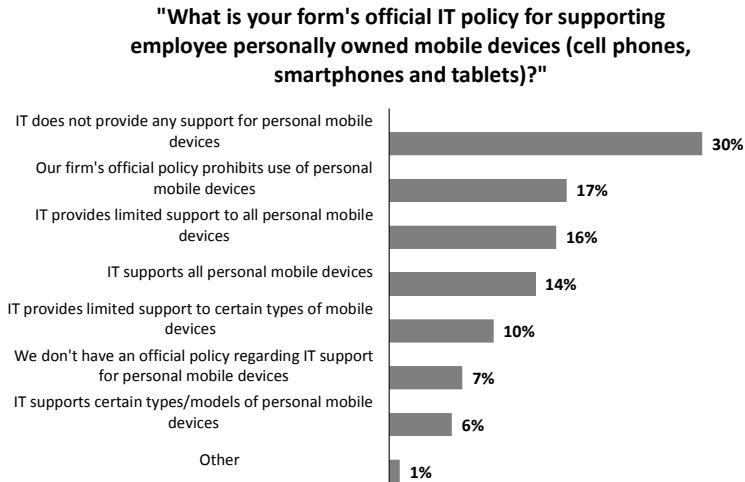


Figure 3.2: IT policy of companies regarding personally owned mobile devices  
Source: Forresights [150]

Another issue which just 20 % of enterprises are satisfied with is the security of data on personal mobile devices and the safety of the devices themselves [15-page 5]. The broad average of enterprises haven't figured out solutions to this problem and are therefore still holding back on BYOD.

### 3.2.3.2 Poorly Conceived Out-of-Office Productivity While Traveling

In 2012 there were 461.2 million person-trips classified as business travel in the US and this number is expected to grow in the future. Of these, 37% are done via air, 46% by automobile and 17% by train or other modes of transportation [182]. Of those done by automobile, it can be assumed that the majority of those trips is not done as passenger, but as the driver of the car, which limits the amount of productive activity which can be done simultaneously. Today, working while driving is restricted to the hands-free telephone and speech recordings, which are sent to the office (e.g. secretary) to dictate tasks or e-mails etc. The voice recordings are not flexible and you always have to have an employee on the other side of the line. Furthermore it is not possible to read an e-mail during your trip as reading a document disturbs you from paying attention to the road. However, for passengers of cars, trains, planes or alternative forms of

transportation, the time spent travelling cannot purely be seen as wasted time, since business travelers are using their travel time for work or work related activities [174], like reading, writing, thinking or communicating with colleagues or clients [145, p. 54]. Indeed, in one survey of train passengers only 24% of those passengers, who were working on the train, said that they would have needed less time for the same task in the office [145, p. 82]. However, on average only 46% [145, p. 11] of journey time was being spent working, which suggests, that even on trains, which are relatively work-friendly, only a subset of tasks can be done efficiently. This assumption is further affirmed by the fact that with increasing journey time, only between a third and a quarter of that increase will on average be translated into additional working time [145, p. 101]. A reason for this might be that important qualities of a good workplace like comfort, light control, the ability to personalize the workspace, interaction with co-workers [140, p. 5], quietness, and privacy are only partially or not at all satisfied while traveling. For other modes of transport, like car or plane, some of these points might be better (e.g. due to privacy in cars), however, overall the problems remain similar.

### **3.2.3.3 Loss of Productivity due to Waiting Times**

When using modes of transportation other than your own car, waiting times can occur before or during the travel, for example while waiting for the train or at the security check at airports [144]. Often, these waiting times include walking from one platform or gate to another. 38% of all travelers using public transportation in New Zealand regard this waiting time as a waste of time [184, p. 3], with a probably even higher number for business travelers around the world. That especially business travelers would like to make better use of their waiting time can be seen for example by the fact that around 50% of them would be willing to pay personally for lounge access, where they can work productively [178]. If no such access is available, the waiting time is often characterized by factors such as: a time-scale of minutes, lack of possibility to sit down, necessity to look around to find the way to the next platform for departure and limited possibility to use hands for interacting with devices since often luggage has to be carried as well.

## **3.3 Trends**

### **3.3.1 New Societal Influences on Business Mobility**

Trends in society must be identified and taken into account in order to understand individual customer needs. In the following, the trend towards more modern mobility infrastructures and the rising demand for flexibility and connectivity will be described.



### 3.3.1.1 Modernizing Mobility Infrastructures

Globalization and urbanization have proven to be the most predictable and steady developments of the past decades [158, p. 19]. By 2030, 60% of our planet's population will live in big cities which however will not resemble the cities we are familiar with today. Their multi-centralism, intelligent networks and environmentally friendly transportation systems will have a huge impact on the frequency, the reasons why and the way we will move ourselves and goods [138].

Many cities today are already carrying out ambitious projects to improve their transportation situation. In the Seattle region for instance, "Transportation 2040" is a long-term plan as a preparation for the expected 40% growth in population and employment until 2040 which will create a huge demand for travel. The main motivation for this project lies in global business competition for which the Puget Sound region wants to be prepared with proper transportation infrastructures including roadway expansion, new bridges and advanced tolling systems [148, pp. 3–8]. Talking about tolling systems, Stockholm in 2008 managed to reduce central traffic by more than 20% through congestion charges [147, p. 10]. And also London's "HS2" is planning to link its center to major northern cities through a new high-speed rail route until 2033.

One of the rather environmentally driven projects is Vancouver's "Greenest City" including the aim that by 2020 over 50% of all trips are done via foot, bicycle or public transit [161].

Premium services within these projects with a strong focus on public transport – not only because of environmental reasons – will have to be created in order to meet and fix the tension between needs in customization and individualism on one hand and financially limited business and private customer mobility budgets on the other hand [160]. A survey from 2011 in Melbourne found out that even the average public transport user is willing to pay a daily extra of up to \$4 for guaranteed seats, access to newspapers and wireless internet connections even though Melbourne already has one of the highest fares in Australia [187]. Taipei City just recently announced that their way of implementing an extra element to public transportation will be done via an expansion of their library services on buses [185]. And in Singapore, one of the most innovative and modern urban areas when it comes to public transport, offers a "Premium Bus Service" (PBS) for commuters on their way to the city's central district during peak hours and has also installed public wireless internet access points throughout most parts of the city as part of their "Next Generation National Infocomm Infrastructure" program [135, 134].

Besides the trend of adapting, improving and expanding existing transportation ecosystems, changes in higher dimensions will be necessary to cope with the most drastic developments. China alone will construct about 400 new towns until 2020 for 300 million people who in the next years will want to move from their countrified regions into urban areas [138]. India's urbanized

population will increase from 350 million in 2010 to 600 million in 2030 while the rural population will barely grow [194]. These numbers trigger huge transport construction plans. One master plan with a budget of \$90 billion will create a transport route between Delhi and Mumbai. Subsequently 24 new cities will be built around it [158, p. 46].

Tianjin-Ecocity, a Sino-Singaporean planned community, will be one of the future pilot projects where the most innovative and revolutionary business mobility concepts will be seen within the next 10 to 20 years [136].

Another known planned city in Abu Dhabi is Masdar City which is to be finished in 2025 and mainly focusing on renewable resources and therefore in terms of urban transportation aiming at a rich network of public and personal transportation which also highly promotes trips by foot due to small distances. This will be reached for example through electrical car sharing services while personal cars will be held outside of the city [152].

These future cities will show how effective geographical planning of business districts will reduce business trips within a city and the latency to international trips to a minimum.

### **Impact on Human-Machine-Interaction**

The way business people travel will move away from isolated premium vehicles such as the corporate fleet's cars or business class flights all the way to service-oriented usage of publically available transport systems for which new ways of customization and individualism will have to be found as a compromise for a sharing and financially limited society and business world. However in the near future one must carefully distinguish for regional differences. Whereas in Mexico City only 16% are using public transport [191], in other Regions such as Seoul or Singapore many projects are being initiated to create one of the narrowest, most efficient and most affordable public transport systems [146]. But in some regions there will be made similar observations as some decades ago in our developed world. China for instance will pass the US as number one private jet market with an estimated volume of US\$24 billion by 2020 [157]. The highest influence on HMI trends and the implementation of its products will be able to be carried out in newly constructed cities. One development however is certain. HMI products will have to be vehicle-independent so that future business travelers will be able to have their work environment in which ever mode they are travelling. As globalization will soon no longer be known as a trend but rather as a given situation HMI-related working environments will have to be standardized globally to a certain extend which implies the role of a trend-giving global HMI provider.

#### **3.3.1.2 Rising Demand for Flexibility and Connectivity**

Within the next five years, the first big wave of baby boomers will retire, and the members of generation Y, also called millennials, will increasingly take

over management positions. With their revolutionary characteristics, they will significantly change the structure of a typical work day and business trip [175].

As described in the Status Quo, generation Y employees have a much higher need for flexibility and for a balance between work and life than their older colleagues. They are thus going to decide where and when they want to work. Moreover, they have a higher demand to instantly communicate with colleagues and friends via mobile devices and social networks. Since October 2012, there have been more than 1 billion internet-connected mobile devices in use worldwide [179]. The increasing popularity of internet-connected devices and their almost ubiquitous use, not least for networking, will entirely change the strategy of companies to integrate those devices in business life [155]. Social Media will also influence the new business traveling process. While travelling on business, 43% of U.S. employees under 30 use social networks, whereas only 20% of those over 50 do. In the UK, the ratio is even 60% to 28%. Moreover, nearly half of all business travelers use Facebook before making business travel decisions. Social media thus have a great influence on business mobility [181]. As more and more employees of generation Y will go on business trips, the general impact of social media while traveling will more and more increase. Another opportunity due to the millennials' technological know-how is to decrease business trips in favor of virtual meetings. This approach would be in line with their wish to reduce pollution caused by redundant trips. In fact, one quarter of generation Y members in the U.S. (37 % in the UK) do not see business trips necessary anymore as (the technology for) telecommunication improves. Only 53% of the same group regard business trips as a necessity, as opposed to 72% of baby boomers [181].

To put it in a nutshell, it is vital for a company to meet the young workers' needs of flexibility and connectivity, especially when considering the existent and increasing war for talent not only due to the significant demographic change [189]. At the same time, the employees' need and willingness to communicate online anytime and anywhere can be of an advantage for employers as well: Employees will neither feel disturbed to work remotely nor to receive work-related emails after office-hours on their mobile devices as they are used to receive instant messages. The following sections will show opportunities for managers of how to leverage these effects.

### **Impact on Human-Machine-Interaction**

There is high potential for technological devices to be implemented in order to meet the needs of the digital natives: HMI could help to better manage work and life. To give an example, a work-leisure management system could be integrated in employees' devices such as real-time information about individual stress levels, telling the owner of the device when to make a break and when to restart working or driving. In order to meet the employees' need of high flexibility, the usage of virtual desktops and video conferences should be increased. In order to exploit their need for connectivity, social networking must be considered as

both a challenge and an opportunity by managers. For example, they might be ready to share travel experiences among their colleagues and managers [181]. Due to their technological affinity, generation Y will have no problem to quickly embrace technological changes in trip planning, and they are likely to push to advance technological changes themselves as they best know the benefits of mobile apps and online tools. However, the needs of people who are not as technologically savvy as the younger ones must not be neglected. For them, more intuitive and less complex applications would be more suitable. If more complex systems cannot be avoided, older generations should receive additional training. However, easy-to-understand functionality and intuitive usability is important for all generations in order to be able to exploit mobile devices most efficiently [181].

### **3.3.1.3 Increasing Environmental Awareness**

Environmental issues have a considerable impact on business travel decisions. With global warming becoming more and more serious, the prices and taxes on resources, especially on fuel and carbon, will tremendously increase over the next few years. In order to stay competitive, companies must find solutions enabling their employees to travel and commute cheaper and cleaner. Energy-efficient mobility will have two positive effects: First, the company will reduce costs, and second, it will improve its image, as its stakeholders are becoming more and more environmentally conscious and will thus prefer companies which take care about their carbon footprint. Especially younger generations expect more sustainable ways to work and to travel on business. About 80% of American adults consider themselves environmentally-conscious, and they are beginning to make travel decisions based on sustainability criteria [137]. Instead of taking the car, which causes smog and traffic jams in the cities, employees will tend to take the bike or public transportation in order to save time, money and the environment.

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Green IT, i.e. IT solutions that help to reduce CO<sub>2</sub> emissions, traffic congestion and air pollution of business trips, have to be developed in more sophisticated ways [170, p. 3]. When taking the bicycle instead of the car, people might want to be available and stay connected, which could be enabled by smart interfaces for bicycles. By integrating devices into clothes or by making them wearable without having to hold them (e.g. Google Glasses), the user can interact with the device while walking or riding a bicycle. In addition, the safety while cycling or walking will be increased if the interaction does not require the user to look down on the device.

## **3.3.2 New Ways of Organizing Business Mobility**

### **3.3.2.1 Ways to Reduce the Need for Mobility**

The intuitive remedy for the problem of high coordination costs and resource inefficiencies in business mobility is reducing the need for corporal mobility altogether. A strategy rapidly gaining popularity in this context is telecommuting. Nonetheless, studies show that at least a certain level of mobility is vital for businesses, so it cannot be minimized indefinitely.

The idea behind telecommuting is that a variety of tasks which are usually coupled with personal presence of employees – and thus the need for mobility – can also be accomplished using digital tools and the Internet. A classical example is a business meeting between multiple partners being held at a specific location (usually an international airport) which every participant is supposed to attend personally. The new approach is to organize such a meeting in virtual space and have the participants use the Internet anywhere on the globe in order to take part in it. The most important participants could still attend the meeting in person; all other participants would receive a video and audio stream, and could contribute just as if they were physically present. Nevertheless, besides technical difficulties there are restrictions to online meetings. It is not possible to see subtle body language and nuances in voice and overall impression of ones person and message can be experienced differently.

Still, telecommuting enables businesses to concentrate their efforts in organizing mobility on situations that cannot be mastered without it.

### **3.3.2.2 Sophistication of Trip Planning**

It can be observed that the processes involved in planning business trips steadily gain importance. Technological advancements enable businesses to seamlessly integrate stages of planning a journey that were separate and independent previously.

The planning process begins with identifying the destination. This involves taking into consideration the tasks that are to be accomplished by employees, their current geographic locations with respect to the potential tasks, and the constraints in mapping them (e. g. areas of competence or expertise of the employees).

The second step is to determine the itinerary a given employee needs to follow. This includes a variety of factors and models: depending on the distance, multiple means of transport (e. g. car, train, airplane) as well as multiple geographic routes might be available. For each of these combinations, there are various factors influencing the attractiveness of a given alternative: cost (ticket, gasoline, sharing fees), current traffic conditions (accidents, weather, holidays, routes of other users), ecological footprint. The weighting of these factors might be set by the business in question in order to reflect its individual goals. [193]

Combining the information from the above-mentioned two steps, a modern IT system could determine an optimal distribution of tasks (thus: destinations) for the employees, supplemented with an optimal itinerary for each of them.

The final step is to keep the employee up to date about their journey. This encompasses informing them about their task and the initial itinerary, but also using the calculated travel information in order to notify them when they are to leave. Such an integration of travel information into the calendar would replace the traditional reminder (a simple notification at a fixed threshold before an appointment starts). It would moreover track the employee during their entire journey, taking into account the current whereabouts, changes in the traffic, weather, pricing etc. – and dynamically adjusting the itinerary. In extreme cases (e. g. accidents, missed connecting flight), the system could even re-assign a given task to another employee who would then be instantly notified and provided with a tailored itinerary.

For these reasons, sophisticated trip planning systems utilizing multi-modal capabilities may significantly optimize business mobility and make the interaction between human employees and machine IT systems more natural. Nevertheless, it also makes us more and more dependent on machines and we humans can become less independent-minded.

### 3.3.2.3 Increasing Importance of Sharing and Pooling

As the present vehicle fleet models are highly inefficient (c. f. 3.2.2.2), the concepts of sharing<sup>1</sup> and pooling<sup>2</sup> vehicles gain importance. Moreover, thanks to ecological movements, they also gain social acceptance.

The main motivation for sharing and pooling resources such as vehicles is the fact that most employees only need a car a few times a day. Therefore, assigning each employee a distinct vehicle is highly inefficient. The new concept is based upon an IT system that has destination information about employees and a shared car pool. The system can both dynamically assign a car to a group of employees with a common destination as well as determine the nearest car from the pool for a single employee to use on-demand.

An inherent characteristic of such a solution is the fact that cars are no longer personal, but rather swapped multiple times a day. Such an approach requires a rather drastic change in the attitude that drivers maintain towards their cars, yet due to the increasing environmental awareness (c. f. 3.3.1.3), this obstacle is currently dissolving.

As both sharing and pooling require machine assistance in order to be efficient, the above-mentioned trend poses new challenges for human-machine-interaction.

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<sup>1</sup>Car sharing refers to the practice of driving someone else's car

<sup>2</sup>Car pooling refers to the practice of using an own car, but giving others a ride

### **3.3.2.4 Growing Independence of Workplace Location**

Yet another emerging trend that is to ease business mobility is the decentralization of workplaces. As traditional offices can no longer optimally meet the requirements for intense business mobility and being on call everywhere at any time becomes more and more important, companies wish to make their employees independent of a specific workplace.

In order to realize this, businesses might rent offices in different locations on-demand, highly short-termed. This would enable organizing meetings (provided these cannot be avoided, cf. 3.3.2.1) in a very flexible manner. For instance, if a consulting company is hired for two weeks to work for clients in Beijing, it might want to hire an office there for a short time. It would then notify the concerned employees and provide them with access to the internal network etc. Moreover, such an approach could be easily combined with the idea of home offices as it has similar requirements.

In order to efficiently implement such a dynamic approach, the business in question could develop an automated machine system that would keep track of all employees and their assignments, combining this with information from interfaces to renting brokers. Thus, it could determine an optimal office and automatically book it as soon as possible.

## **3.3.3 Efficient Use of Travel Time**

Fuelled by the revolution in the ICT, employees engaged in knowledge-work are increasingly trying to be as productive as possible, even while on the road. They are more and more using all facets of mobile technology to stay in contact with co-workers and have access to company data. Furthermore, they are demanding further improving infrastructure in the modes of travel they choose, to take the most of their travel time and either work or rest efficiently.

### **3.3.3.1 Improving Feasibility of Mobile Business Intelligence**

As connectivity and accessibility become increasingly important in the business environment, the new trend of mobile business intelligence is on the rise. Employees can access business data from everywhere and at any time through mobile devices such as smart phones and tablet computers.

An important aspect of this new understanding of connectivity is the increasing use of mobile devices within the company. The total shipment of tablet computers to enterprises around the world will increase by 48 % per year to 96.3 million units in 2016 [186]. Furthermore, 40 per cent of the worldwide workforce will be mobile, and two-thirds of the mobile workforce will own a smartphone in 2016 [155]. Especially in emerging markets, where PCs are very expensive, mobile phones are vital to stay connected as an individual and to stay competitive as a company. Overall, providing mobility support for employees

is a top priority for 64 % of firms in Europe and North America [150] and consequently, the quantity of mobile devices will increase rapidly within the next 5 years. Making this new mobilization of workforce possible, bring your own device (BYOD) will become an increasingly widespread practice. As most employees own mobile devices in private life, the BYOD policy allows them to use their e.g. smartphone/tablet computer at work as well. Besides the cost advantage of BYOD for the employer, the new policy allows the employee to choose their device on their own [162] and do not have to carry several devices at the same time, which increases the workplace morale [162]. The downside of it is that companies have to invest into a supportive infrastructure and ensure that all mobile devices are compliant with corporate standards [169]. Today, nevertheless just 31 % out of 237 companies support a heterogeneous mix of mobile device platforms, which has to be increased in future [150]. Furthermore is the BYOD trend followed by new security trends as well. As the major concerns are about the network and data security of private devices [171, p. 8], there has to be new corporate software, which guarantees safety and backups. Furthermore, the companies will start to track the devices guarding themselves against theft, by which they should not compromise the employees' privacy [165]. Not only will the distribution of mobile devices increase but also their field of use. A Cisco report shows that today reading documents, spreadsheets or presentations are the top activities [171].

As you can see in the figure above, many enterprises plan to implement web meetings, videoconferences in future. Within the next five years broadband internet will spread out, being more stable and accessible as it is today, making videoconferences, web meetings etc. common. Moreover will multi-core processors power legions of smart devices, able to handle even processor intensive operations such as modeling. Additionally, the graph points out that corporate network (e.g. intranet) and referring to it, the connection between workers become more important either. The location independent access of employee to the company's network to exchange ideas with coworkers is a fundamental aspect of mobile business intelligence. They have to be independent not only from the location but also from the device they use, which is made possible by "virtualization" in future. It is closely linked to cloud computing and enables the employee to have access to a virtual hardware platform, network resources and more from every mobile device they have. It enhances flexibility, keeps costs low and simplifies management [162].

The key benefits of implementing mobile devices into the business process and establish a mobile business intelligences are "increased employee responsiveness, decision making speed, and issue resolution" [171, p. 7].

Referring to an Aberdeen report [169, p. 9], 35 % of those 20% top companies, which have implemented smart devices and cloud functions into the business process successfully state that their workforce is extremely productive. In contrary, just 16 % of the group with an averages success making use of mobile



**"In regard to the following types of collaborative applications that can be used on your smartphone and/or tablets, how much of a driver is it for your business initiatives?"**

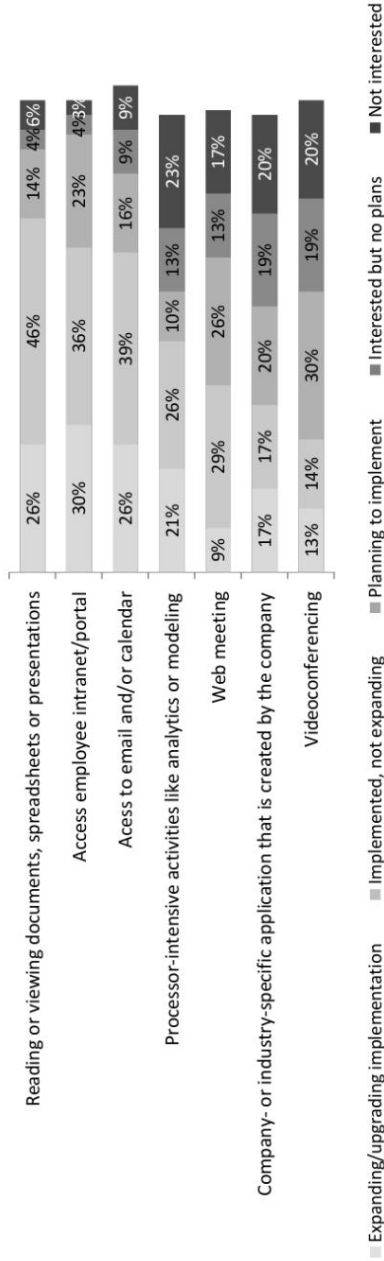


Figure 3.3: Potential applications of mobile devices for business-related tasks  
 Source: [150]

**"What benefits, if any has your business unit or organization experienced as a result of deploying mobility solutions around smartphones and/or tablets?"**



Figure 3.4: Benefits of Mobile Business Intelligence

Source: [150]

devices, state their workforce as extremely productive – less than a half. Impact on HMI: Mobile devices will be all-around, much stronger connected and will have an increased field of use. Taking this into consideration, a normal work day without using business mobility intelligence will be unimaginable. Employees will use mobile devices much more frequently, for a greater range of tasks, which will also displace some of the current working processes (such as meetings etc.). Mobile devices will significantly boost employee productivity and offer great opportunities but especially due to BYOD programs new risks will accrue. As BYOD is considered as the “single most radical shift in the economics of client computing for business since PCs invaded the workplace” [168], companies must adapt to these changes. They must offer mobile applications within their business and create a supportive infrastructure for employee-owned tablets and smart phones.

### 3.3.3.2 Improving Opportunities to Work While Traveling as a Passenger

In the future, the time spent working while traveling will increase further, due to a greater need to be productive even while traveling, as well as improving possibilities to do so. For example, two estimates derived in 2004 and 2008 show a doubling in the percentage of travel time used for working during trips by train from 30% to 57% [145, p. 80]. Furthermore, the amount of business travel itself is growing, not only in America [182], but also in other areas like Great Britain [174, p. 258]. Therefore it is increasingly important for employees to be able to work productively while traveling. As stated in, some of the important

aspects of a productive workplace are comfort, the ability to personalize the workspace, privacy, space, the ability to interact with co-workers and customers, silence, as well as access to the necessary data. Transportation companies are increasingly trying to offer a working environment which fulfills these needs as far as possible, at least in the premium segment. Examples of this development are the introduction of Wi-Fi into planes [190], quiet-areas and a growing availability of Wi-Fi on trains as well as the ability to reserve conference cabins in trains [156]. A growing shift in the perception of limousines from a luxury good to a mode of transportation which “extend(s) the office to the commuter coach” [183] is another facet of this trend. However, productivity should not be limited to the material output of an employee, because for businessmen and -women the “time out” from work-related activities during travel also plays an important role [172, p. 27], which helps them be more productive after their journey.

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The interaction with machines should support employees to be more productive while traveling. To achieve this, machines need to adapt to the physical surrounding of the mode of transportation and also take into account the previously stated qualities of a good workplace. This means that the Human-Machine-Interaction should also work when only limited space is available, yet it still must be comfortable to operate on longer journeys. The use of speech recognition is limited by the need for privacy and silence, except for single-passenger modes of transportation like limousines. Furthermore, since the amount of hardware which can be taken on a journey is limited, connectivity to peripheral devices available in the transport vehicle can increase the comfort and ease to work, for example a monitor or keyboard installed on a train or plane. Easier interaction with co-workers while not physically present can also be facilitated by innovative solutions, for example by remotely controlled robots [167]. Devices, which can reduce the stress involved in traveling, for example when delays occur or a change in the mode of transportation is needed, can further boost productivity or enable the employee to rest more efficiently.

#### **3.3.3.3 Improving Opportunities to Work While Traveling as a Driver**

As one can see in figure 3.5, the number of business trips increases in the US [182]. Therefore, it is increasingly important to be able to work while driving a car, since the automobile accounts for the majority of all business trips, for example for 81% of all business trips in the US [142, p. 1]. About two thirds of these trips are done as the driver of the car [180, p. 3]. As the need to perform work related activities or stay connected to friends and co-workers increases, driver distraction has become a growing concern [153, p. 6], especially for the younger generation [166]. Driver distraction can be of four types [153, p. 10]: visual (e.g. looking away), cognitive (e.g. reflecting on a different

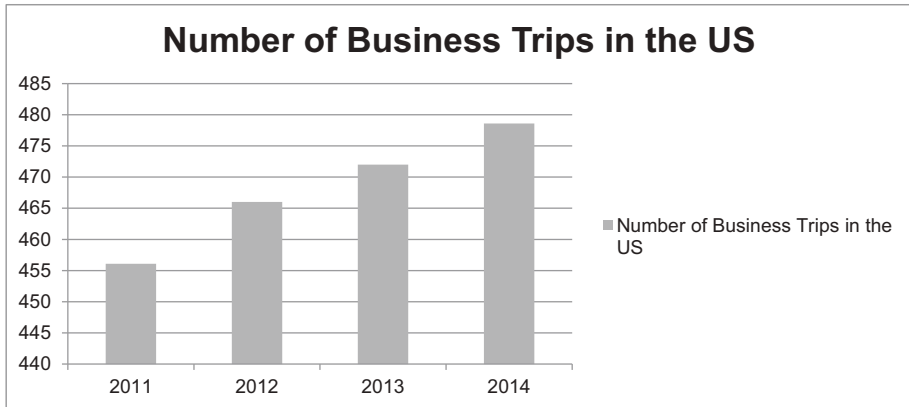


Figure 3.5: Domestic Business Trips in the US  
Source: Adapted from [133]

subject other than analyzing the road situation), physical (e.g. not having both hands at the steering wheel) and auditory (e.g. listening to loud music and not being able to hear signal-horns from outside). In the future, the challenge of Human-Machine-Interaction will be to enable the driver to perform work related activities while at the same time minimizing his distraction from the road. For instance, the driver can listen or dictate complete emails to an on board computer and at the same time is not distracted by typing on a keyboard. Important information will be also displayed into the windshield so the driver can keep his eyes on the street. Additional systems in the car like Adaptive Cruise Control [132] can further reduce the attention needed for safe driving and therefore allow the driver to focus more on work related subjects. Continuing this trend, self-driving cars will be the ultimate goal, freeing the driver from any need to pay attention to the road.

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As stated above, Human-Machine-Interaction should enhance the driver's ability to perform non-driving related tasks, while at the same time minimizing his distraction from the road. Therefore, above all, all devices should be easy to use so that there is no unnecessary cognitive distraction. Furthermore the interaction should not require the driver to look away from the road or lift his hands from the steering wheel, which for example can be achieved by speech recognition and text-to-speech technology. For systems supporting the driver in the traffic, it is important that the interaction is precise and unambiguous to neither confuse the driver nor provoke dangerous situations by car systems behaving in an unexpected way. Furthermore, it needs to be assured that peripheral devices connected to the car act in a similar way.

## 3.4 Conclusion

This chapter gave an overview of the trends in society and customer needs in business mobility of the near future. It can be recognized that Human-Machine-Interaction will have an enormous impact on everyone's personal and professional life by supporting scheduling meetings and planning trips, but also by aiding balancing work and life. The increasing prevalence of HMI will lead to a world where everyone is connected to each other at all times – also while on the go – enabling people to work independently of their individual geographical locations. While this creates a new challenge of staying independent-minded, one thing is certain: HMI will make business more efficient and more flexible than ever before.

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# 4 **Chapter 4**

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## **Political and Legal Trends**

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### **Executive Summary**

The following chapter reflects on the influence of current national and international policies on human-machine-interaction in individual mobility. It offers an outlook regarding trends and their impact within the next few years.

First, the status quo is analyzed: the automotive industry is an important part of many economies and already subject to safety and emission standards. User-operation of vehicles is regulated by national laws which are largely built upon the Vienna Convention. Arising privacy concerns regarding vehicle-to-manufacturer or vehicle-to-owner communication are addressed by the countries' general privacy regulations.

Next, political and legal trends are elaborated: faster innovation cycles demand faster adaption of regulations. Individual mobility needs a more holistic approach to deal with environmental issues and urbanization. A new international legal framework is necessary to overcome complex liability issues resulting from autonomous driving. Political institutions have a guiding role in establishing international vehicle-to-x communication standards that ensure security and privacy.

## 4.1 Introduction

By using a wide range of instruments, political institutions provide legal frameworks in order to directly or indirectly affect the operations of firms and industries. The automotive industry, due to its high economical relevance in numerous countries, will represent an important legal field in the future.

A current key challenge for political institutions regarding individual mobility is international cooperation among countries. Issues (e.g. pollution) have to be addressed and covered by new legislation. The fast development of digital technologies and the accompanying emergence of new business models in individual mobility force political entities to adopt a more international and holistic view.

Particularly in human-machine-interaction, laws and regulations remain unclear and unprepared. Who will be held responsible for autonomously driving vehicles causing accidents? Although some states in the U.S. became pioneers giving permission for autonomously driving cars, European countries seem to be far away from taking this step.

In order to clarify the relation between political decisions and the future of human-machine-interaction in individual mobility, the following chapter will provide a brief overview of the most important aspects and issues.

## 4.2 Status Quo

### 4.2.1 Transition of Political Institutions' Role in Individual Mobility

Political institutions in high-income countries are forced to find a balance between sustainable solutions and economic interests in order to satisfy social demands.

#### 4.2.1.1 Political Institutions More than Infrastructure Providers

A few decades ago the main focus of political institutions' actions in the field of mobility was enabling fast connections between and within cities. Individual mobility in the 21st century requires a more holistic approach. Individual mobility is supposed to not only become fast but also sustainable. Climate change and urbanization are currently reconsidered in the context of road and city construction. [223] For example, European programs aim to enhance fast and sustainable mobility of public and private transport in the future.

#### 4.2.1.2 Economic importance of automotive industry

A fully integrated domestic automotive industry can substantially contribute to economic growth, generate thousands of manufacturing jobs and even create

spillover industries for car loans, auto insurance or after-sales businesses. [201, p. 2][224, p. 30] In 2011, Germany's automotive industry employed 0.8 million people and contributed 10% to the overall Gross Domestic Product (GDP). [242] The Chinese automotive market became the world's largest and substantially contributed to the country's economic rise in the recent decades after declaring it a pillar industry in 1994. [235, p. 9]

Because of the economic importance, governments implemented industrial policies and regulations in order to protect domestic markets against external threats (e.g. through credit warranties and scrappage schemes during 2009 economic crisis). [232, p. 7] On the other hand, governments are prone to lobbying activities of the automotive industry, because in many cases automotive companies are major taxpayers and employers. [235, p. 9]

#### **4.2.1.3 International Safety**

The WHO declared 2011–2020 as the Decade of Action for Road Safety in order to address the implementation of counter-measures on a global level. Over a million people die every year on the world's roads because of road traffic crashes. Another 20 to 50 million sustain non-fatal injuries. Road traffic injuries are estimated to cost countries between 1–2% of their GDP. [245, pp. 1–4]

There have been significant efforts in many high-income countries to limit these casualties. The results are steadily declining road traffic death rates in those countries, which were achieved by implementing proven measures that address vehicle safety, road environment and post-crash care. On a global context, road traffic deaths remain unacceptably high, mainly caused by a sharp increase in low- and middle-income countries, where rapid rate of motorization has occurred without investments in road safety strategies. [245, pp. 4–8]

#### **4.2.2 Regulations Regarding User-Operation of Vehicles**

Traffic is currently regulated on different levels including international agreements, supranational bodies and national laws. The Vienna Convention on Road Traffic standardizes the uniform traffic rules among contracting parties. It came into force in 1977. As of January 2012, contracting parties include EU countries (with the exception of Ireland, Spain and UK), Brazil and Russia. [239]

National traffic laws build upon the framework provided by the Vienna Convention. Besides, contractual law is effective for dispute resolution between any parties claiming tangible and/or intangible losses when accidents occur. Regional bodies, like the European Union, are rather empowered to ensure compliance of their members to licensing and certification standards.

#### **4.2.2.1 Homologation of Vehicle User Interfaces**

As defined by the Vehicle Certification Agency of the UK Department of Transport, “Vehicle Type Approval is the confirmation that production samples of a design will meet specified performance standards.”. [241] In Europe, apart from the Vienna Convention, United Nations Economic Commission for Europe (UNECE) Regulations and European Commission (EC) Directives specify those standards to be met. As of November 1st 2012, EC Directives are replaced by equivalent UNECE Regulations, thus resulting in more international standards being implemented throughout Europe. [212]

#### **4.2.2.2 Usage of External Devices while Driving**

The effect of mobile phone usage on drivers’ attention has been studied thoroughly in recent years. A report on distracted driving fatalities from year 2009 was released by the U.S. National Highway Traffic Safety Administration in September 2010. According to the report, 18% of all distracted driving fatalities were due to drivers being distracted by mobile phones. [226] Another study in 2003 concludes that mobile phone usage may range from 1.5–5% among all contributing factors to distraction-related accidents. [206]

Currently, in EU countries, Australia, Brazil, Canada, China, India, Iran, Israel, Mexico, Russia, Turkey and the U.S. it is illegal to use hand-held phones while driving. Japan and some U.S. states have even extended the ban to usage of hands-free devices. [219, 200]

#### **4.2.2.3 Advanced Driver Assistance Systems**

The following advanced driver assistance systems have already got some mainstream adoption: in-vehicle navigation systems, adaptive cruise control, collision avoidance systems, lane departure warning systems, automatic parking and electric vehicle warning sounds. The purpose of implementing advanced driver assistance systems is to increase car and road safety.

Currently there is no worldwide consensus on standardization of advanced driver systems (with the notable exception for electric vehicle warning sounds [233]), mostly because of all current implementations being within the Vienna Convention’s boundaries. [236] Countries and supranational bodies impose their own certification standards for approving those technologies individually (see 4.2.2.1).

### **4.2.3 Privacy Regulations Regarding Communication between Mobility Stakeholders**

Vehicles, especially cars, are increasingly equipped with more built-in electronic devices. Wireless communication infrastructure, at least in developed countries,

is widely used and GPS-based localization became commodity. [222, p. 40] As a consequence, privacy issues arise and privacy regulations determine how data is dealt with. Currently, the sensitive data in those scenarios is the driver's data, e.g. his current position and driving characteristics [222, pp. 42–45].

#### 4.2.3.1 Communication between Vehicle and Manufacturer

Starting with the OECD Guidelines on the Protection of Privacy and Transborder Data Flows of Personal Data<sup>1</sup> of 1980 [227], there have been efforts to harmonize privacy regulations around the world. Still today, regulations differ significantly among countries. While the European Union imposes fairly strict regulations in the Directives 95/46/EC [214] and 2002/58/EC [215], there are only scarce privacy regulations in other countries, e.g. in the United States. [202, 230]

As of March 2013, only 13 countries, among them Argentina, Australia, Canada, Switzerland, Israel, New Zealand and to some extent also the United States<sup>2</sup>, were considered to ensure an adequate level of data protection by the European Commission. [209] Protected data under the Directive 95/46/EC can only be transferred to those non-EU countries. [230, p. 380]

While there is no specific legislation for communication between vehicle and manufacturer, it is restricted by the countries' general privacy regulations. For example, Directive 95/46/EC demands data centers and servers to be located within the EU or one of the above countries as soon as protected data is transferred to the manufacturer.

#### 4.2.3.2 Communication between Vehicle and Its Owner

From a privacy point of view, the communication between a vehicle and its owner is unobjectionable as long as the owner is also the driver of the vehicle. However, privacy issues arise as soon as the vehicle transmits driver's private data of a third person to its owner. Current privacy regulations differ significantly from country to country, as explained in 4.2.3.1, but in general there are no special regulations for communication between vehicle and its owner. Instead, the countries' general privacy regulations are applied and limit communication between vehicles and their owners:

Car rental companies often track vehicles using GPS to protect them against theft. In July 2012 the car rental company Europcar was fined because they tracked some of their cars without the knowledge and consent of the car renters, as it would have been required by German data protection laws. [195] BMW offers a "Vehicle Finder" functionality to their customers. In order not to infringe privacy regulations, the application will only reveal the car's location if it is within a 1.5km range around the smartphone's location. [197]

<sup>1</sup>These guidelines are not legally binding for the OECD member nations.

<sup>2</sup>under the "Safe Harbor" Principles

## 4.3 Trends

### 4.3.1 Political Institutions as Fast Adopters or Active Shapers of Future Individual Mobility

According to the UN, 60% of the world population will be living in urban areas by 2030. Sanitation, health, education and employment tend to improve through economic development, while transportation paradoxically tends to worsen. [203, p. 2] Political institutions and local governments throughout the world developed a shared vision of sustainable mobility, defining it as socially-inclusive, environmental-friendly and economy-promoting. [238, pp. 8–11]

#### 4.3.1.1 Towards Socially-Inclusive Mobility

Socially-inclusive mobility aims to enable all parts of society to participate in mobility. This includes elderly, disabled and poor people as well as people living in remote areas. Furthermore, socially-inclusive mobility is about limiting the negative effects caused by mobility, like air pollution, noise and road traffic casualties. [238, pp. 8–11] Local governments started to ban or restrict the usage of motorized vehicles in certain areas of cities in order to improve quality of living (e.g. speed limits, “Umweltzonen” in Germany). [238, pp. 18–24]

#### Impact on Individual Mobility

The usage of motorized vehicles will continue to be discriminated in many parts of cities, thus reducing the convenience of this means of transportation. Stricter safety and emission regulations (e.g. speed limits) and their enforcement may negatively impact the perceived experience of individual motorized mobility.

#### 4.3.1.2 Towards Environmental-Friendly Mobility

In many countries, private car ownership is growing exponentially due to population growth and improved economic conditions. [228, p. 64] Without adequate political measures, the ecological costs will increase exponentially as well, with unpredictable effects on the environment.

Many major cities are neglecting non-motorized infrastructure in their planning policies. [245, p. 7] Still, first movers start to encourage and enforce the usage of public transportation as well as individual non-motorized transportation (e.g. walking and cycling), while improving their accessibility and safety. [238, pp. 25–33] To date, pedestrians and cyclists account for 27% of global traffic deaths. [245, p. 1]

Increasing the energy efficiency of existing mobility is another way of addressing the ecological impact of mobility (e.g. EURO emission standards). In recent years, the Chinese government encouraged automakers and local governments



to develop new-energy vehicles (NEVs), especially electric vehicles (EVs), which should exceed 1 million unit sales by 2015. [235, p. 5]

Political institutions increasingly act as educators by raising public awareness for sustainable mobility among citizens. However, in China and India, the automobile is still officially touted as a symbol of progress and modernity, which is likely to change in future. [203, p. 6]

### **Impact on Individual Mobility**

As political institutions engage more in improving non-motorized mobility, it eventually becomes more attractive and convenient. Greater parts of society will not consider cars a status symbol and therefore will be less willing to purchase them. Traditional automotive manufacturers might need to adapt their business models.

#### **4.3.1.3 Stronger Focus on Efficient Mobility in Urban Areas**

Due to congestion, significant percentages of the GDP are not realized in many major cities (e.g. Buenos Aires, 3.4%; Mexico City, 2.6%). 90% of those result from productivity losses of drivers waiting in traffic jams. [228, p. 54] Road pricing policies have been implemented in cities like Singapore, London and Stockholm, where drivers pay for going into city centers or accessing driving lanes. In many Asian and South American cities, rationing policies restrict car usage during rush hours. Major Chinese cities established monthly license registration quotas limiting the demand for cars.

In the long term, political institutions will reduce people's need to travel by integrating traffic concepts into urban planning. The vision is to bring together housing, work, shopping and services and thus create "cities of short distances".

### **Impact on Individual Mobility**

Car-free development offers opportunities for economic, environmental and social advancement without major dependence on motorized vehicles. Particularly, this will be relevant for developing high density cities, which have not yet become fully motorized. Those cities will have the opportunity to potentially leap-frog over car dependence into a new paradigm for transport and urban design. [203, p. 10] Already today, in Hong Kong 85% of all trips are made via public transportation. [228, pp. 45–48]

#### **4.3.1.4 Faster Adaption of Regulations to Innovation**

Regulatory frameworks have significant impact on innovation activities within companies and industries [196, p. 1], since they may either inhibit or stimulate technological change. [244, p. 483] However, fast development of new technologies within the automotive industry will lead to an inversion of this phenomenon within the next years.

Governments will have to collaborate with innovative companies and standardization institutions in order to ensure competitiveness of domestic industries in globalized markets. More precise, new technologies will shape new regulations. To date, within the EU, regulations addressing technological innovation require extensive bureaucracy and coordination procedures until their final implementation into the legal system. [204, p. 29] These procedures highly contradict fast technology innovation cycles and may lead to inefficient and obsolete laws.

However, some first attempts to overcome long regulation adaptations are provided by the European Commission, in order to enhance dialogue with relevant stakeholders via a specialized platform. [208] In May 2011, also the U.S. published a memorandum that encourages overseeing emerging technologies in order to adapt their regulations faster and more adequately. [220]

### Impact on Individual Mobility

Companies could participate more in the law making process resulting in more manufacturer-friendly legislation. The expected time-to-market of products based on innovative technologies might decrease.

## 4.3.2 Regulations Regarding User-Operation of Vehicles

In 2011, the Bundesanstalt für Straßenwesen (BASt) Working Group came up with definitions of vehicle automation degrees:

- **Driver only:** Human driver controlling the vehicle manually.
- **Driver assistance:** Human driver permanently taking control of either longitudinal (forward and backward) or lateral (to the left and right) control, other task can be automated by the assistance system.
- **Partial automation:** The system taking over longitudinal and lateral control. The driver is obliged to permanently monitor the system and shall be prepared to take over control at any time.
- **High automation:** The system taking over longitudinal and lateral control, however the driver does not have to permanently monitor the system. In case of a take-over-request, the driver must take over control within a certain time frame.
- **Full automation (autonomous driving):** The system taking over longitudinal and lateral control completely and permanently. The system will return to the minimal risk condition by itself, in case of a take-over-request not being carried out. [237]

Driver assistance systems and partial automation are currently regulated by law in Germany and in other developed countries. However, highly automated driving and autonomous driving are currently not consistent with international

regulatory laws, since they would lead to a breach of driver's duties. [240] The question is whether existing regulations can be adapted to highly automated and autonomous driving, and which conventions and/or legislation need to be addressed.

#### **4.3.2.1 Adaption of Regulations to Highly Automated Driving**

In order to understand whether adaptive measures would be sufficient regarding highly automated driving, the existing regulatory framework should be analyzed (see 4.2.2).

Article 8.5 of the Vienna Convention reads "Every driver shall at all times be able to control his vehicle or to guide his animals.", whereas Article 13.1 reads "Every driver of a vehicle shall in all circumstances have his vehicle under control so as to be able to exercise due and proper care and to be at all times in a position to perform all manoeuvres required of him. (...)". Obviously, the Vienna Convention could not foresee technological advancements, and would de-facto be obsolete in the world of tomorrow. Most levels of automated driving are well beyond the boundaries of the Vienna Convention. Given that such international agreements take time to be changed and ratified, adaptive measures should be expected from lower-level regulations (from supranational bodies and nations). The Vienna Convention allows contracting parties to grant exemptions for "vehicles used for experiments whose purpose is to keep up with technical progress and improve road safety" and "vehicles of a special form or type, or which are used for particular purposes under special conditions" (Annex 5 Chapter 4). [239]

Adaptive measures can be taken by changing national laws and adapting regulations on driver education. Regarding the regulations of driver education, there are no common regional efforts in any part of the world. However, within the European Economic Area, uniform driving licenses were introduced on January 19th, 2013. [216] One might expect Europe-wide licensing standards to cover the area of newly adopted driving skills by drivers making use of high automation.

Today's predominant advanced technologies like adaptive cruise control or electronic stability control do not provide an insight into what regulatory trends there might be in the future, as both are already within the boundaries of the Vienna Convention. [236] Yet, looking into adaptive legal framework regulating the aviation industry might provide a hint regarding the speed and scope of any common regional or international efforts in the future.

The aspect of liability would need to be addressed as well, and national laws in this case would be most effective adapting to the era of highly automated and autonomous driving. The EU has initiated some recent projects on this topic [240], mostly for analyzing national laws. However no special regulations should be expected for highly automated driving. In fact, the focus of current

efforts is on autonomous driving and most aspects of highly automated driving will be covered once regulations on autonomous driving are more advanced.

### **Impact on Individual Mobility**

Regulations being adapted to the era of highly automated driving only on national level might make it difficult for some advanced technologies to penetrate into international markets, as regulations would differ from one country to another. Yet, regional and international efforts on standardizing driver education might be seen as an opportunity, as it could provide a common framework for countries to agree on. The Vienna Convention should at some point be changed to cover autonomous driving, which in turn would let highly automated driving benefit from.

#### **4.3.2.2 Need to Rethink Regulations due to Autonomous Driving**

Autonomous driving is currently the highest level of automation available, meaning that a vehicle can drive on its own without a driver. Out of this concept, there arise the most complex liability concerns, questioning all of today's regulations ranging from highest international level to how to deal with everyday level issues. [229]

The Center for Internet and Society at Stanford Law School maintains a list of legislative and regulatory developments related to autonomous driving, self-driving vehicles and driverless cars.<sup>3</sup> As of March 2013, three U.S. states, Nevada, Florida and California, have laws covering autonomous driving. All those hold the person liable, who gives command to the vehicle to drive itself. [234]

The vision behind permitting autonomous driving is to save lives, given that the vast majority of crashes are due to human errors. However, there still would be a huge room for human errors, as autonomous driving systems themselves are designed by humans. One might expect the aspect of liability to change drastically from the current implementations of U.S. states. Current technologies are being approached as “experiments” rather than complete solutions, but in the future a clear and comprehensive framework covering liability concerns should accompany the maturity of the technology itself. [198]

### **Impact on Individual Mobility**

In contrast to highly automated driving, autonomous driving would require regulations on international level. Only then, complex liability issues can be addressed.

International regulations being implemented on national level would prove the maturity of the technology, and autonomous vehicles could only then become mainstream, changing public's view from “experimental” to “useful”.

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<sup>3</sup>[http://cyberlaw.stanford.edu/wiki/index.php/Automated\\_Driving:\\_Legislative\\_and\\_Regulatory\\_Action](http://cyberlaw.stanford.edu/wiki/index.php/Automated_Driving:_Legislative_and_Regulatory_Action)

### 4.3.3 Regulations Regarding Interactions between Mobility Stakeholders

Connectivity between mobility stakeholders is increasing, especially due to the upcoming vehicle-to-x communication. Therefore, new challenges arise that have to be addressed by political decision makers. Especially when it comes to establishing vehicle-to-x standards and ensuring privacy in future applications, guidance by political institutions and possibly also new regulations will be necessary.

#### 4.3.3.1 Need for Guidance by Political Institutions to Establish Vehicle-to-X Standards

Vehicle-to-x communication is the communication between a vehicle and its surroundings, that might be: other vehicles, parts of the infrastructure (e.g. traffic lights and traffic signs), external electronic devices (e.g. smartphones) and so forth. In this communication, a lot of different devices of different genres and different manufacturers and with different capabilities will interact.

In 2010, Directive 2010/40/EC [217] was put into effect in the European Union. It aims to support the deployment of Intelligent Transport Systems (ITS), part of which is vehicle-to-x communication. In order to ensure interoperability of devices throughout the European Union and availability of the systems to all applications, service providers and users, the Directive 2010/40/EC argues for open and public standards.

Initially, vehicle-to-x communication will suffer from network effects: the more vehicles have it installed, the more useful it is, but as long as there is little penetration, it is also little useful and thus few car buyers will be willing to pay extra for vehicle-to-x communication.

In order to achieve one open and unified standard for vehicle-to-x communication and to overcome initial obstacles of the new technology, there is a need for guidance by political institutions to establish vehicle-to-x standards.

#### Impact on Individual Mobility

In order to fulfill their guiding role in establishing vehicle-to-x standards, political institutions can use various measures that can have an impact on both manufacturers and consumers, e.g.:

- In order to overcome entry barriers, political institutions might incentivize or enforce the installation of vehicle-to-x communication equipment as happened with other road safety enhancing systems such as the ABS in cars.
- Political institutions will shape the development of vehicle-to-x communication technology by providing funding to certain research projects related

to vehicle-to-x communication such as the OVERSEE project<sup>4</sup> or the DRIVE C2X project<sup>5</sup>.

- Because it is desirable that in the end there is only one standard that ideally is applied throughout the world, political institutions push the standardization of vehicle-to-x communication. For example, the European Commission issued a mandate for European standardization organizations such as the ETSI to standardize vehicle-to-x communication. [211] ETSI is cooperating with other international standardization organizations for harmonized vehicle-to-x communication standards. [207]

#### 4.3.3.2 Increasing Privacy and Security Concerns Regarding Vehicle-to-X Communication

Privacy issues are seen as an increasing topic in automotive IT security. [221, p. 145] In Europe, vehicle-to-x communication is promoted by the CAR 2 CAR Communication Consortium (C2C-CC), a consortium of car manufacturers and numerous partners from industry and academia. C2C-CC regards anonymity and data security a pre-requisite for vehicle-to-x communication. [199]

The necessity of special measures to ensure not merely functionality but also security and privacy of vehicle-to-x communication is widely accepted among scientists and engineers who develop future vehicle-to-x communication [205, 231, 243, 221] and legal decision makers (e.g. see Directive 2010/40/EC [217]). Political institutions support research projects in the field of privacy and security regarding vehicle-to-x communication, such as the PRESERVE project<sup>6</sup> and the MODAP project<sup>7</sup>.

This shows, that privacy and security are considered important topics for future vehicle-to-x communication systems. Vehicle-to-x communication raises a number of challenges that have to be tackled by vehicle manufacturers, mobility providers and researchers together with standardization organizations and political institutions.

#### Impact on Individual Mobility

With open standards (as pursued by political institutions, see 4.3.3.1), potential attackers will have detailed knowledge on how the communication system works. Therefore, the system has to use strong cryptography to remain secure and reliable. In the future, vehicles might take actions based on information they receive from their surroundings, e.g. brake strongly when a vehicle running ahead reports an accident. Such actions might be necessary in case of an emergency, but fatal, when performed without any valid reason. [231, p. 132]

<sup>4</sup><https://www.oversee-project.com/>, funded by the European Commission in FP7

<sup>5</sup><http://www.drive-c2x.eu/>, funded by the European Commission in FP7

<sup>6</sup><http://www.preserve-project.eu/>, funded by the European Commission

<sup>7</sup><http://www.modap.org/>, funded under EU FET OPEN 2009–2012

Hence, authenticity of the received information has to be ensured which in cryptography is usually done using signatures. Cryptographic signatures on the other hand can endanger the privacy of the sender. [231, p. 132]

Given the dramatic increase in complexity and opaqueness through electronic devices, investigation of accidents and crimes will become less feasible. In December 2012, the U.S. National Highway Traffic Safety Administration (NHTSA) proposed regulations to make event data recorders<sup>8</sup> mandatory. [225] While this eases traceability, it can as well be seen as a threat to privacy.

#### **4.3.3.3 Increasing Privacy Concerns Regarding Usage of Crowd-Collected Data**

Even in the European Union with its fairly strong privacy regulations, 70% of the people are concerned about companies misusing their personal data. [213, pp. 1–2] Therefore, in January 2012, the European Commission proposed a comprehensive reform of the existing privacy regulations. [210] In the U.S., the Federal Trade Commission sets out for new standards in the field of privacy as well. [218]

#### **Impact on Individual Mobility**

Both initiatives specifically target online services. Car manufacturers will ship their vehicles with ever more services that on the one hand transmit data collected by the vehicle into the internet (to the manufacturer, are processed, recombined and stored there) and on the other hand download and use this data to provide the user with added-value. For example, speed information of one vehicle can be used to detect traffic jams. This information can then be used by another vehicle to circumnavigate the traffic jam. The more such online services manufacturers will provide, the more they, their products and their customers will be influenced by new regulations.

## **4.4 Conclusion**

The results of this chapter underpin the high influence of national and international policies and standards on individual mobility. It reflects how current laws face and regulate issues such as driver safety, security or privacy.

Future problems will be the simultaneous accomplishment of competing social, economical and environmental goals. More precise, conflicts between driver safety and security standards on the one hand and fast adaption of regulations to innovative mobility features on the other hand, might become one key issue in the next few years. Although continuously working on their improvement, legal entities appear to be hardly prepared for the dynamic technological progress within the automotive industry. An important question will be, to which

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<sup>8</sup>An event data recorder is a device similar to flight recorders.

extent consumers will have to give up on their personal security and privacy claims in order to benefit from new technologies e.g. in the area of vehicle-to-x communication.

Besides legal issues concerning safety, security and privacy, which can be directly assigned to human-machine-interaction, also more general legal trends in mobility (e.g. enforcing environmental and social conformity of vehicles) should not be underestimated. Those trends go hand in hand with drastic political measures, and are expected to serve as a starting point for tomorrow's individual mobility.



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# 5

## Chapter 5

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# Business Models in Human Machine Interaction in Individual Mobility

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## Executive Summary

Completing the technological, consumer-oriented and legal perspective of Human Machine Interaction in Individual Mobility, Business Models need to be identified and analyzed. The transition towards a digital technology century penetrates all kinds of industries. Who will be the next Google or Apple when it comes to Individual Mobility? What challenges are the traditional providers of individual mobility facing and which are the new concepts and players emerging from the transition towards digital technology? Considering opportunities for innovation in business models arising from connected cars as part of mobility concepts, and taking on the perspective of mobility as a service, we analyze the status quo and emerging trends in the respective field. We argue that freemium as well as subscription-based revenue models increasingly gain significance when it comes to business model innovation in individual mobility. Findings further suggest that platform-centric approaches enable entirely new opportunities for value propositions as well as a role shifting of mobility suppliers in business

models. Our research also shows that the upcoming technology of autonomous or piloted driving enables game-changing innovation in business models for human machine interaction in individual mobility.

## 5.1 Introduction

“A business model describes the rationale of how an organization creates, derives and captures value” [295, p.20]. It can be understood as a conceptual tool that explicitly states, how a business functions [291]. In recent years, companies do not only rely on product innovation, but increasingly on business model innovation, since this can be the element differentiating global competitors [259]. Hence, this chapter investigates the status quo and trends in business models in the respective field of human machine interaction (HMI) in individual mobility. Human machine interaction represents a rather new field in relation to individual mobility. Therefore the focus of the investigation on the status quo business models is merely centered to the field of individual mobility. The trend analysis takes emerging opportunities of human machine interaction in individual mobility into account.

The aim of this chapter is to develop a deeper understanding of conventional business models as well as their inherent innovation opportunities in the area of human machine interaction in individual mobility.

The remainder of this section is structured as follows: First the status quo of business models in relation to individual mobility is summarized, distinguishing between sales-centric business models and mobility as a service. Second, we identified trends and opportunities related to those business models. We elaborate on the central question of which players will shape the field of individual mobility and their options to generate revenue streams. Furthermore, for every identified trend, its’ impact on human machine interaction is highlighted.

## 5.2 Status Quo

Conventional business models for providing individual mobility date back to ancient Rome, where drivers offered horse carriage services. Passenger services like those still represent a viable business model and can be assigned to the section of ‘Mobility as a Service’ 5.2.2. ‘Sales-centric Business Models’ are comprised of operations built around the asset sale of a means of transportation 5.2.1.

### 5.2.1 Sales-Centric Business Model

By sales-centric business models we understand such business models that have revenue streams merely originating from the sale of one central product.



In 2011 42.66 million cars are registered at the Kraftfahrtbundesamt in Germany, the national bureau for vehicles [285]. This means out of 81.8 million people [302] 52.2% own a car, which therefore represents the most important means of individual mobility. For the last century, car manufacturers sold their products through direct sales or resellers.

In this section, three traditional sales-centric business models targeting individual mobility are presented.

### **5.2.1.1 Upfront Payment for Vehicle**

A car as such is traditionally seen as a status symbol, guaranteeing its owner access to individual mobility at any time. In 2010 the Kraftfahrtbundesamt has admitted 3.1 million new cars [284]. Out of those, 55.9% were bought and directly paid (or through financing), the remaining 35.1% vehicles were leased [281, p. 7]. This shows that buying a car with upfront payment still represents the most important way to acquire possession over a vehicle as a means of individual mobility.

The central value proposition automotive companies are offering, is the ownership of individual mobility; be it standard, premium or luxury. Firms with this business model, engage in the production and selling of vehicles as an Original Equipment Manufacturer (OEM). Whereas the distribution is often handled by resellers. OEMs strive for excellence in quality, price or incremental innovation, related to their core activities (development, production, sales). Therefore the most valuable assets of automotive manufacturers are their technology, production facility and the strength of their brand. Within the business model of OEMs and resellers, revenue streams are generated by asset sales with fixed pricing, targeting a segmented and diversified market.

Although firms are increasingly adapting to upcoming customer demands such as access to social media, more environmentally friendly cars etc. there hasn't been any major change in the business model of providers of individual mobility.

### **5.2.1.2 Upfront Payment for Connected Car Services**

Nowadays, together with a car, a customer can acquire certain entertainment and service functionalities, fixed for the lifetime of the vehicle. Those can consist of navigation as well as multimedia systems. First generation telematics and infotainment systems were introduced in the mid-1990s [278, p.4] and they make up around 5% of a car price today. Traditionally the telematics and infotainment services are bought upfront such as the AUDI MMI system or the BMW iDrive. Prices start at around 2.000 EUR (including GPS) and are mainly targeted at premium and luxury cars, however can also be found in standard editions [261].

Newer versions of infotainment and telematics systems already include access to emails, social media, internet or google local search. However the business model remains sales-centric and hence customers need to decide upfront, whether they want to include it in their car or not.

### 5.2.1.3 Leasing of Vehicles

In 2010 1.1 million out of 3.1 million newly admitted vehicles were leased [284]. This represents 35.1% of the entire market volume [281, p. 7]. Leasing differs from the upfront payment of a vehicle mostly in the value proposition. A leasing contract gives a customer the exclusive allowance to a means of individual mobility, in exchange of a monthly fee. Involved parties are the seller, the customer and a bank. After the contract's termination, a customer usually returns the car or acquires ownership by paying the remainder of the car's value. Dealerships often offer leasing contracts together with a service and maintenance contract in order to guarantee their customers more comfort [281, p. 6]. The majority of leasing customers in 2011 are firms, representing 86% of the customer base, the remaining 14% are composed of the state of Germany (3%) and private households (11%) [301, p. 16]. The specific needs of firms as leasing customers, are often met by an extended lease contract, which includes additional services regarding fleet management [279].

## 5.2.2 Business Models in Mobility as a Service

This chapter focuses on business models, based on a different form of individual mobility. The underlying assumption of this form of individual mobility is that mobility is provided as a service, be it through rental models (1.2.2.1) or passenger service models (1.2.2.2).

One can define Mobility as a Service as the transfer of one or more persons from point A to B. Method, time and price of this service are not determined, but offer room for creativity and hence opportunities for business models. Another approach creating room for innovation concerns connected cars. A connected car links the vehicle to its surroundings via transmitters or smartphones with access to the Internet and thereby enables an exchange of information[289].

### 5.2.2.1 Rental Models

Car rental companies have already been established during the rise of automobiles at the beginning of the 20th century. Since then, their core value proposition did not change. Customers can rent cars whenever they need individual mobility, while they neither have to own a car themselves nor care about maintenance or insurance issues [251, 249].

Car rental customers can be segmented into four groups: Enterprise customers, private customers, tourists and accident replacements. The distribution of

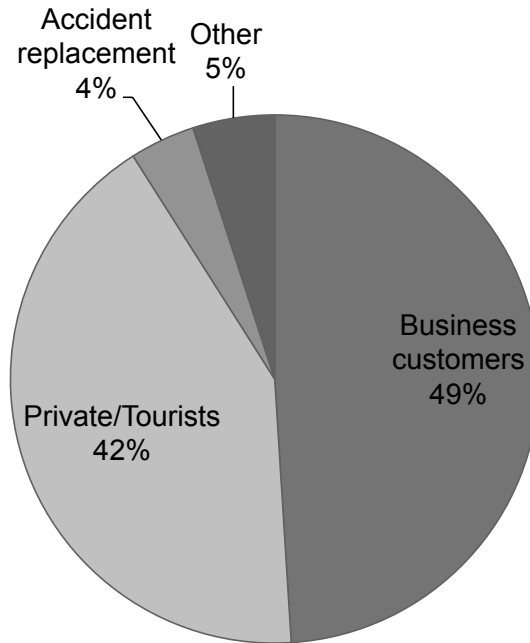


Figure 5.1: Sixt - Vehicle Rental Revenue by Customer Group 2011  
Source: [298, p.45]

revenues among the groups as of 2008 in Germany is shown in diagram ???. The numbers show, that the most significant part of the revenue is generated with enterprise customers (56%). Tourists, who cannot or do not want to use other means of transportation, such as public transportation or taxi services, account for 18% of the revenue streams, private customers make up 15% of the revenue and replacement cars for damaged vehicles make up 8% of a car rental business revenues [298, p.45].

Rental businesses revenue streams are twofold. First, revenue is created by renting cars and secondly by selling cars that are released from the fleet. Typically, customers pay for vehicles based on a daily rate. Price discrimination is applied through offering cars of different segments, e.g. Ford and BMW as well as through allowing customers to purchase additional features, such as navigation devices or full comprehensive cover. Companies often also limit usage, such as maximum daily mileage and demand fees, if limits are exceeded. When a company-owned car is released from the rental fleet it is sold to the general car market, usually after being refurbished in order to increase the resell price.

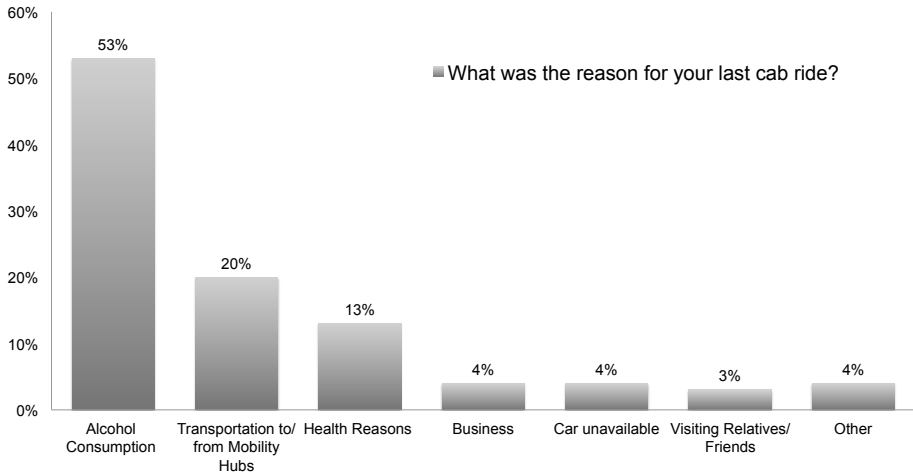


Figure 5.2: Reasons of last Taxi Use

Source: [268]

### 5.2.2.2 Passenger Services in Individual Mobility

When individual mobility is required, renting a vehicle is not always a feasible option. Considering short distances, taxis offer individuals and small groups transportation services. Alternatively technology-enabled car-pooling platforms allow commutes and travellers to organize rides for their way to work or also longer distances.

#### Taxi Cab Service

Taxi services are well suited for individual transportation for shorter distances, e.g. rides within a city or from hubs of transportation such as airports or train stations. Figure 5.2.2.2 depicts the motivation of customers of their last taxi ride. The figure shows that private customers use taxis especially when driving themselves is not feasible and public transportation is limited.

The price of a taxi service consists of a fixed base fee, which depends on the daytime and the weekday, as well as a price per kilometer which ranges from 1,40€ up to 3,30€ per kilometer in Germany [268]. Accordingly, the average total price of a 7km ride in German cities was 16,60€ in 2011 [299]. In addition to fees for transportation, revenue can further be generated through advertisements on and in the car, which typically yield between 50€ and 150€ per month and cab<sup>1</sup>.

With 72%, the majority of cab drivers are self-employed in their own single-

<sup>1</sup>Interview with Mrs. Draugelates, [www.taxi-werbung.de](http://www.taxi-werbung.de), 19.03.2013

person-company [268] and thus have problems to market and advertise their service accordingly. This fragmented market situation led to the creation of central taxi offices, for which drivers pay a monthly fee. Those offices dispatch customer requests for a taxi to the drivers. This model however, is rather inflexible for the drivers, since they pay a fixed fee for an uncertain amount of rides dispatched. It is also rather intransparent, since drivers cannot control the process of routing a customer to a taxi [272].

### **Car Pooling**

Car Pooling describes the idea of combining individual travels to similar destinations into one car. One can thereby reduce travel costs, stress of driving and travel more environmentally friendly. While taxis operate for profit, the financial gain in car sharing only partially covers the cost of the driver and does not reflect the main motivation of the participants.

Authorities have started the majority of car sharing efforts during crises, such as world war two, in order to save rubber or the energy crises during the Arab oil embargo in the 1970s to save fuel. At this time, the amount of commuters in the U.S. using car sharing rose to 20.4% [275]. Due to better road infrastructure, declining fuel prices and social trends, this number decreased to 1x 0.7% in 2004 [307].

Through technological developments, such as the internet and mobile applications more recently, car pooling has gained importance again, because it is now possible to match participants more efficiently and increasingly automated [293]. Platforms such as carpooling.com or mitfahrgelegenheit.de provide a marketplace for individuals to offer and find places for ride sharing.

The revenue streams of these companies are mainly composed of advertisements or small fees for drivers to post offers. According to own information of the car sharing platforms carpooling.com and BlaBlaCar<sup>2</sup>, which both operate throughout Europe, they transport between 550,000 and 1 million passengers per month [246, 248].

## **5.3 Trends**

“A market worth billions is being created. There is a large amount of interest, not only in Europe, but also in the USA and China.” Horst Leonberger (Managing Director of Telekom AG in the “Networked Vehicle” field) about the market potential of Connected Cars and Mobility Services.

The automotive industry is undergoing a drastic change. The vehicle is no longer just a transport solution. Technology innovations, mentioned in the previous chapters, enable the transformation of a car into a smart mobility solution. Connected innovations in the areas of telematics, advanced driver assistance systems, infotainment and data collection [304, pp. 3–5] found the

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<sup>2</sup><http://www.blablacar.com/>

basis for emerging business models in different domains (e.g. advertising, health or autonomous driving). Furthermore, a new dimension of mobility services arises and consequently questions the conventional view of ownership. Business models in the areas of connected car and mobility as a service are the main focus of this chapter.

### **5.3.1 Connected Car Business Models**

Nowadays, advanced technologies allow in-car services to focus on solving problems and give value to the costumers in terms of savings, convenience and peace of mind [278, p. 10]. Many business trends have emerged since vehicles are able to connect to the internet and their surroundings. The traditional focus on sales-centric business models for individual mobility is no longer sufficient. Incremental service subscription models, data, autonomous vehicle and opportunities around the connected cars are current trends that focus on capturing the business benefits of the connected vehicle.

#### **5.3.1.1 Increased Usage of Incremental Service Subscription Models**

In contrast to status quo, connected car services are no longer bundled and sold upfront. In the past, it was difficult and not common for automotive OEMs to make changes in the infotainment and telematics systems after the vehicles were sold. The concept of connectivity and particularly app stores gives customers the possibility to customize in-car services for throughout lifetime of their vehicle [278, p. 7]. The adoption of a model that does not require a frequent subscription but a single payment for each service is crucial. Micropayment, a special form of the incremental service subscription, is particularly suitable as customers can pay per-feature, per-use, per-mile, or per-minute base [260, p. 8]. A pay per-use option could be utilized in the field of in-car services such as the navigation system. This approach is also suitable for contents offered within the infotainment system like videos, music or news. Contents can be sold based on usage or the time of use. Automakers can bill customers directly and thereby charge a share of the content provider's profit. This concept was first utilized by the Amazon Kindle e-reader for the incremental purchase of books [278, p. 19].

Another form of an incremental service subscription model is the Freemium model. The trend towards monetizing free offers has already been identified as a pattern by Alexander Osterwalder [295, pp. 88–92]. The Freemium model allows basic functions or services to be free-of-charge, while the possibility to pay for advanced features is given [295, p. 96]. This approach enables the user to try out the product without any risks. One area of application is the remote diagnostics service. It is offered for free but the vehicle's owner has to pay for extra services [278, p. 19]. A free offer can also have restrictions. It is available for free during a trial period or is limited by usage. Automakers have to bear

in mind that only a small portion of users would subscribe to the paid version of the offer. Nevertheless, the Freemium model gives car manufacturer the opportunity to build a solid and loyal customer-base.

### **Impact on Individual Mobility**

In-vehicle, web-enabled dynamic content is no longer just a marketing feature or brand differentiator but will be an essential buying criteria by 2016 [305, p. 5]. Incremental service subscription models offer automotive manufacturers a favorable solution to monetize upcoming technologies. From a customer perspective, advantages are convenience, a better user experience and the opportunity to use new technologies without binding commitments. Taking on the OEM's perspective, advantages are a constant revenue stream throughout the lifetime of a vehicle a potential solid customer-base. Automotive manufacturers have to familiarize themselves with incremental service subscription models in order to benefit from profitable future businesses.

#### **5.3.1.2 Emerging Business Models enabled by Vehicle Data**

Previous chapters pointed out how connected cars are able to create value for next-generation drivers who are used to information and multitasking. Looking at the big picture, data is the key resource to enable in-car services. Connected vehicles are able to exchange data even without the active involvement of the driver. Future vehicles will increase their ability to collect data and learn about the drivers' preferences and behaviors or even monitor their health.

One of the most attractive opportunities to monetize data is via targeted advertisement [278, p. 20]. Car manufacturers could offer cheaper vehicles and/or in-car-services in return for the permission of the vehicle owner to advertise. Automakers can further generate revenue streams by selling space to advertisers. Targeted advertisements use location or personal data such as demographics or online behavior to create innovative commerce experiences. Data needed for targeted advertising can be collected and analyzed by automakers or sold to a third party advertising networks. Examples for targeted advertising:

- The connected car realizes that driver has been driving for over 5 hours and it is past 8 p.m. Based on the location of the driver, different nearby hotels can advertise and offer discounts if the driver books a room via the vehicle [260, p. 5].
- Based on the driver's preferences and location, a commercial of one's favorite restaurant on the route could be shown.

A challenge for car manufacturers is to draw the driver's attention to the respective commercial while keeping the distraction to minimum. It is also crucial that commercials match the identity of the car manufacturer to some extent (e.g. a premium car manufacturer like Audi might not choose to advertise for low quality products) [278, p. 20].

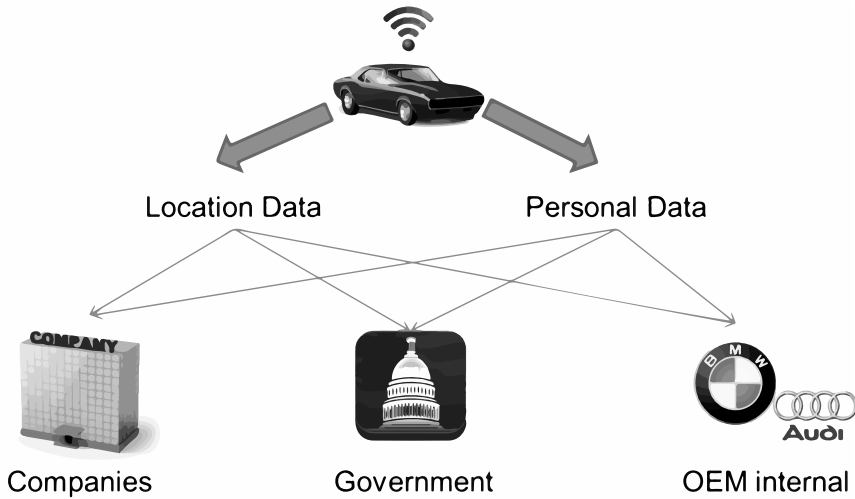


Figure 5.3: Use Cases of Data  
Source: Own Illustration

Besides targeted advertising, selling connected car data or using it internally are other important revenue streams opening up a new field for emerging business models. OEM could sell data to businesses such as dealers, parking providers or insurance companies. Other customer segments can be composed of the government or different car manufacturers as seen in figure 5.3.1.2. One major challenge of this business approach is the willingness of drivers to release their data. A solution could be selling anonymised vehicle data, thereby protecting the driver's privacy. Another approach to get access to vehicle- and driver-specific information could be offering savings opportunities in exchange for data [278, p. 15].

A valuable data source is the vehicle movement pattern. Companies or federal agencies like the Federal Highway Administration, who provides real-time travel information, are able to utilize the information to reduce air pollution, delay and congestions. The government may offer drivers 20% savings on their annual registration fee in exchange for collecting traffic information that is available to the entire community of drivers [305, p. 11].

Healthcare insurance providers are also interested in vehicle movement patterns. They can use the data to offer policy savings when drivers avoid dangerous routes (e.g. mountain passes) [305, p. 16]. One example is the partnership between GM and OnStar. GMAC, GM's finance division, offers OnStar customers reduced car insurance policies in exchange for their vehicle's movement patterns. GMAC in its turn receives the collected data from OnStar for some kind of payment [278, p. 20].



A research by Gartner shows that 26% of U.S. vehicle owners “would like to be able to have a system in the car that can monitor their health and send out alerts if needed” [305, p. 5]. Since researches have detected that people spending a substantial amount of time driving tend to have health problems [287], there is a trend towards integrating health systems into the connected car. Embedded biosensors in the vehicle are able to collect data such as weight, heart rate, respiration, glucose etc. without driver’s involvement. This new concept to connect cars with healthcare services opens up new opportunities for innovation of business models. Existing businesses like Lose It! or Withings can purchase and utilize the collected weight data to enhance their services. Ford for example recently started to include several service providers like Medtronic and WellDoc to offer a Diabetes Manager application [287].

### **Impact on Individual Mobility**

Data is the key resource for many upcoming business models in the area of individual mobility. The possibility to send data from the car to the outside, and vice versa, will have huge benefits for new companies. The business impacts are centered on improving productivity, efficiency, profitability and cost reductions for the customers [304, p. 2]. Collecting and analyzing data for internal or external usage will be crucial for automakers to succeed in the future.

#### **5.3.1.3 Upcoming Business Models through Application Ecosystems**

An application ecosystem is a gateway to game changing developments in future individual mobility. Several OEMs such as Ford are heading towards such a development. Ford released OpenXC [250], an open source platform combining software and hardware that was developed in cooperation with Bug Labs [247]. This platform enables vehicle owners and third party developers to create their own applications [271]. According to Pete Sammler, CEO of Bug Labs the customers can: “[...] use this to create (their) own personalized driving experience” [273]. Further players are BMW and Tesla [288, 290], as well as Renault who introduced R-Link [255].

From a business model perspective, this ecosystem provides new opportunities for car manufacturers. An application market place [264] opens up a new revenue stream through commercialization of approved apps. Furthermore, it enhances the value proposition of automakers through an additional service. Although the app approval is crucial in the automotive industry at this point, eventually most of the applications are intended for development from third parties [290]. The costs remain fairly low for OEMs who are only in charge of attending the ecosystem itself and leaving innovation to developers. Figure 5.3.1.3 illustrates the business model centered on an App Store. Stakeholders are customers, developers and businesses. While businesses build the store in order to cultivate their customers and earn their commitment, the developers monetize their apps by selling them to the same customers. This leads to the network effect.

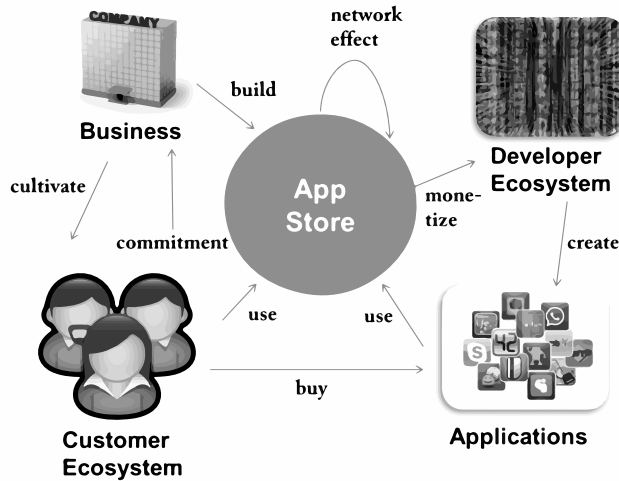


Figure 5.4: App Store Business Model

Source: inspired by [252]

Additional new business models based on subscription or freemium revenue streams become available on the market. For instance, Renault complements its R-Link by offering a 3 month trial period for the R-Link software or alternatively subscriptions between one to three years [254].

In order to complement this ecosystem, hardware devices are used. Besides smartphones, plug-in modules like the ones used by Ford to manipulate the car computer are used to extract data. This data is further used for diagnostics, analysis and interaction with applications [276]. According to Erick Schonfeld, editor of TechCrunch, these types of hardware extensions open the way towards “[...] the new aftermarket” [273].

Another trend in enterprises, which will impact individual mobility with regard to an arising application ecosystem, is the trend of bringing your own device (BYOD) [256]. This could result in car manufacturers partnering up with smart device providers in order to create a better integration of the customer devices in their respecting vehicles. An example is the announcement by Apple, who plans to fully integrate Siri with nine different automakers by 2013 [270].

### Impact on Individual Mobility

Applications ecosystems will expand the dimension of individual mobility by enhancing customization and individualization in mobility, enabling the manufacturers to enrich their value proposition and therefore meet their customers’ demands. By introducing the application environment, OEMs will increase their attractivity for different markets and add new customer segments, for

instance younger, technology-affine customers, to their business model. Similar to Apple, the application store model would enable store providers to lock in their customers in the long run and build up customer loyalty to the brand.

#### **5.3.1.4 Emerging Business Models enabled by Autonomous Driving**

Latest developments in technology have taken this generation one step closer to autonomous driving. In 2010, Google already announced it was operating a fleet of 7 autonomous cars, which already had travelled for 140.000 km total[258]. This technological innovation also brings along new business models. Gartner predicts that by 2016, at least three automakers will offer autonomous technology [306, p. 2].

Self-driving cars are going to play a significant role in creating new innovative value propositions and develop a smart mobility concept [305, p. 7]. Two new value propositions consist of the branded lifestyle and the open system [283, p. 32].

The branded lifestyle is similar to the smart phone. Customers could use their time in vehicle car to consume online contents [303] and to be productive. The car will be able to save valuable time.

The open system value proposition focuses on data and its adjustments. OS developers could become key partners. By providing customizable software for the vehicle they will get valuable information from users who shares consumer behavior data, traffic patterns and topography [283, p. 32].

#### **Impact on Individual Mobility**

Autonomous and connected vehicles will lead to a reduction of the total number of accidents on the streets and therefore make mobility safer. Since the car will be able to choose its own routes which are based on real-time data, people are going to be transported more efficiently and travel time could be reduced. Another important benefit is the travel time that is now available for the user of the vehicle who used to spend it driving. Since it could be used for working, autonomous cars fit perfectly to the concept of a mobile office and other business models which supports seizing time spent in the car. Self-driving vehicles are convenient to elder generations since they are able to reduce accident rates and offer more comfort. Finally, autonomous driving also results in a more fuel efficient transportation.

#### **5.3.1.5 Emerging Business Models around the Connected Car**

Connected car services can not only be offered by OEMs, who leverage on the vehicle as a moving data collector and information receiver, but also by third party suppliers. Those third party suppliers integrate infotainment and telematics applications into mobile systems or apps that can be taken into vehicles.

OnStar is one US-based company acting as such a third party supplier. The value proposition they are offering is a safe form of connectivity while driving (e.g. roadside assistance, hands-free calling, automatic crash response and navigation). There are two options to receive the OnStar Service: one is via an App, the other is a hardware device replacing the rearview mirror. Either way of accessing the OnStar service requires a subscription to a plan of choice for the customer[294].

AHA mobile, another third party supplier, offers a safe personalized information experience through in-vehicle infotainment systems. They can power a wide array of consumer devices through their connected back-end platform, providing users with real-time information on traffic and social media or entertainment. As all the content is read out and voice-to-text functionalities are supported, the system can be handled touch less – making it safer for the driver as he is less distracted. Users can download the App for free. However, content deliverers or OEMs including AHA services will have to make payments to AHA [257].

### **Impact on Individual Mobility**

The internet, Big Data and real-time information enable new business models with value propositions targeting individual mobility. The arising demand of customers for safe connectivity attracts new players and could change in-vehicle infotainment and telematics systems, as they do not need to be built-in any longer.

## **5.3.2 Business Models in Mobility as a Service**

Within the following section, the term mobility as a service refers to the application of a broader trend to the domain of individual mobility: namely the phenomenon that consumers increasingly change their preferences from owning products towards using them by gaining temporary access [262, p. 882]. Gartner predicts that by 2016, “10% of urban citizens will embrace mobility as a service as an alternative to traditional vehicle ownership” [305, p. 6]. Along with this development comes the challenge of companies to monetize this new form of consumption through pay-per-use, subscription-based and other revenue models. In this context, the chapter sheds light on business models in the field of car sharing and examines opportunities for platform-based business models that aim at facilitating and monetizing transactions between third parties in the field of mobility.

### **5.3.2.1 Further Expansion of Car Sharing Business Models**

By the end of 2012, car sharing operators had almost 1.8 million members, sharing over 44,000 vehicles globally. Compared to the numbers of 2006 (347,000 members and 12,000 vehicles), this reflects a compound annual growth rate (CAGR) of almost 30% in terms of membership and vehicle count. Representing

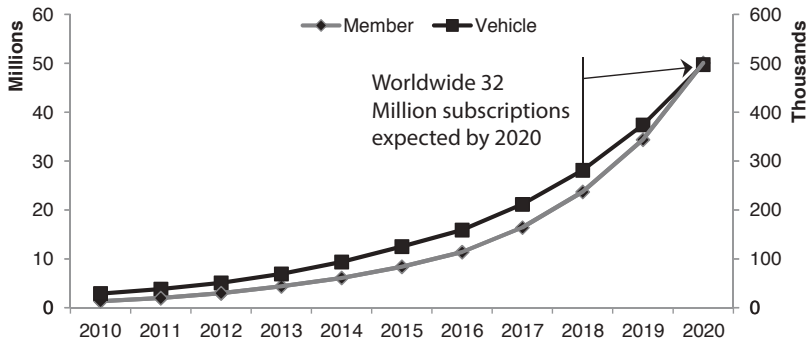


Figure 5.5: Predicted Global Car Sharing Growth  
Source: adapted from [277, p. 7].

50% of the worldwide car sharing users and 36% of the vehicles deployed, North America represents the largest region along with Europe, which accounts for 39% of all members and 47% of total fleets [296, p. 1]. As of early 2012, Germany accounts for 220,000 car sharing members (190,000 in 2011) and 5,600 cars (5,000 in 2011) [266, p. 2]. With respect to the trend of decreasing car ownership especially among younger generations [282, p. 5], it can be expected that the rapid growth of car sharing will continue [297, p. 27]. Revenues from car sharing programs are expected to number around \$3.3 billion in 2016 in the US [262, p. 6] and up to \$9 billion in Europe by 2020 with Germany and the UK accounting for over 70% thereof [277, p. 9]. Currently, car sharing is prevalent in urban areas [300, pp. 18–20]. Figure 5.3.2.1 depicts the global car sharing market growth.

The general value proposition of car sharing is to offer consumers the benefits of a personal car without the responsibilities and costs of car ownership. The shift from station-based towards one-way car sharing, allowing the driver to park the vehicle anywhere within the operating zone, creates further benefits for car sharing as compared to car ownership [297, p. 26]. Another important customer benefit related to car sharing is its potential to provide the customer access to different vehicles for different purposes. A fleet may contain small electric cars for short journeys, combustion driven cars for overland drives and functional vehicles like vans [267, p. 3]. In the remainder of this chapter, car sharing refers to a service giving consumers temporary access to a fleet of vehicles provided

by a dedicated company.

The car sharing enables a car manufacturer to take different roles: one approach is to launch a proprietary car sharing service, building on the car manufacturer's advantage to set up and maintain a branded fleet at low costs. Daimler (car2go), BMW (DriveNow) and Volkswagen (quicar) are currently pursuing this opportunity. Revenue is generated through usage fees charged on a per-distance or per-minute base as well as fixed subscription fees. Key activities consist of fleet maintenance and fleet balancing<sup>3</sup>. Further activities include the development of solutions to locate, reserve and access vehicles and the provision of car insurances. Key partners include car loaning firms that provide an existing infrastructure for customer acquisition and registration (e.g. Daimler partnering with Europcar [308]) as well as urban public transportation companies. The car sharing provider can benefit from the high-range marketing channels of the public company and gain access to an existing, rather sharing-affine customer base. Moreover, a public company may offer valuable space for car sharing stations in the public area and common tariffs via their existing charging infrastructure [265, pp. 94–96]. Another opportunity arises from developing vehicles and technologies specifically tailored to the requirements of car sharing, like the recently presented EDAG light car concept [274] or the General Motors OnStar technology: GM's subscription-based connected car and telematics service enables car owners to grant others remote access to their vehicle when lending it via the peer-to-peer car sharing platform RelayRides [253]. Further opportunities arise from providing shared fleets to business customers. Sharing is less expensive for the customer than leasing company cars, because fix costs are split between more parties and cars are also available to private owners when not needed by the company [310, p. 6]. The business customer's need for permanent availability can be met through additional service offers: in return for a subscription fee or a minimum guaranteed usage, a company may reserve and "lock" cars for a specific time frame or even get their exclusive and company-branded fleet. Since private and business usage times of shared vehicles often differ, this results in a greater utilization factor of the vehicle and higher returns from the car sharing company's point of view [286].

### **Impact on Individual Mobility**

Driven by the emergence of new business models in this field, car sharing will gradually become a common means of individual transportation that integrates seamlessly into the multimodal travel habits of tomorrow. With car sharing operators expanding their services globally, costs will further decrease and the shared car will outweigh the owned car in terms of flexibility and ease of use.

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<sup>3</sup>managing the distribution and availability of cars within the operating zone

### 5.3.2.2 Increasing Opportunities for Platform Business Models

With individual mobility becoming multimodal, service-oriented and less car-centric on a global scale [305, p. 5], opportunities arise for new business models referred to as (multi-sided) platforms.

Platform business models bring together two or more different groups of customers whereas the value for one group depends on the number of customers from the other group. One popular example are credit card firms, which bring together buyers and merchants by facilitating and monetizing their transactions. Some companies leverage on the platforming business model by offering a free service to one of the participating customer groups (so-called subsidy), thereby creating greater value for the paying customer group. Google for example offers a free top-notch web search engine that attracts private customer and generates revenues by selling targeted advertisements to businesses addressing them with commercials [295, pp. 77–81].

Within the platform approach, many business models implement a provision-based revenue model: they earn a share of the revenue stream moving from one customer group to the other. Prominent examples are eBay and PayPal as well as affiliate networks like Zanox. In the field of individual mobility, the start-up MyTaxi is a recent player using the described approach. Customers directly contact and order a taxi using a mobile app. The service locates cabs nearby via GPS and thereby renders taxi offices obsolete within the value chain. Every ride brokered by MyTaxi, the driver is charged 0,79 €. Formerly the taxi company had to pay several hundred Euros per month and car for the brokerage service of a taxi office [292].

Other types of platforms are peer-to-peer (P2P) redistribution markets, where owned goods are shared among end consumers in exchange for money [262, p. 3]. Such platforms are already established for private goods (SnapGoods) and renting (AirBNB). Their idea of P2P sharing recently also entered the domain of mobility: the start-up RelayRides teamed up with Google and GM to offer a P2P car sharing service [263, p. 39]. Car owners can list their vehicle in an online database and set a per-hour price. Potential renters can search and request temporary usage of the listed vehicles. The renter gains access by personally picking up car keys or enter the car via mobile phone. Important activities consist of the provision of resources required to enable the transaction between the end consumers (online platform, customer support, insurance and technology solutions to access the car) [296, p. 3].

Unlike conventional car sharing, no initial investments or maintenance costs for a proprietary fleet occur. Revenues are generated by deducting a share from the transaction between private car owners and renters. In case of RelayRides, charges make up 40% of the rental fee. P2P car sharing becomes increasingly relevant, with over 30 providers worldwide as of May 2012 [297, p. 26]. Dynamic ride sharing, another type of platform business model, has the potential to revolutionize the idea of carpooling: the start-up flinc brings together private

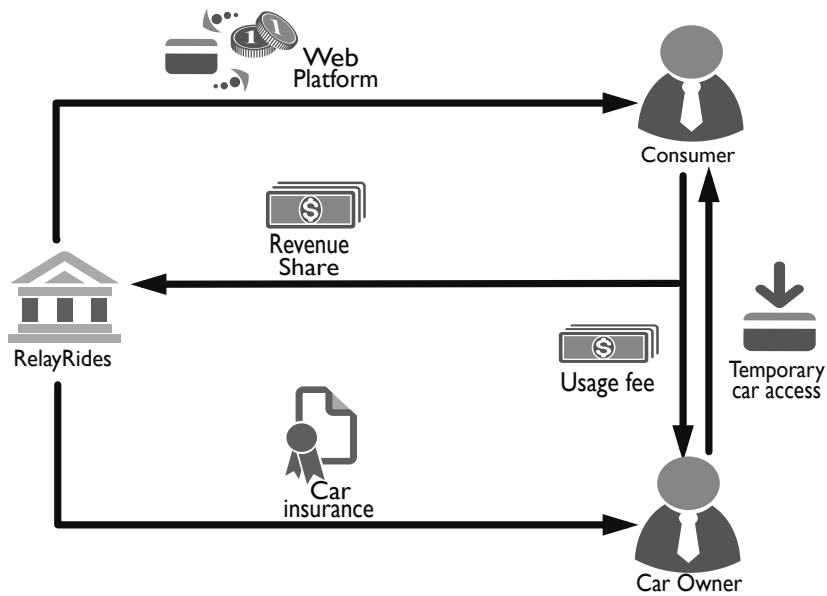


Figure 5.6: Relay Rides Platform Business Model  
Source: Own Illustration

drivers and passengers in real-time via a mobile App and earns a share of the fee paid by the passenger [280]. 5.3.2.2 shows the platform business model at the example of RelayRides.

Finally, opportunities for business models referred to as “mobility service platforms” exist. Their value proposition is to aggregate and integrate different kinds of providers of individual and public transportation within a single IT solution. Customers gain a single point-of-access for information, planning, booking and payment of a multimodal journey. Moreover, there is potential for a similar business model targeted to premium customers: the corresponding value proposition is the company’s pledge to conveniently carry the customer to his destination within a definite time and for a fixed price, no matter what different means of premium transportation are required. Key partners in this business model include third party providers of mobility services like public transit companies, private passenger services, vehicle loaning and sharing companies, railway operators and airlines as well as financial service providers offering integrated payment solutions. Consequently, key activities consist of sourcing and contracting these third party providers and partners [309, pp. 23–26]. Revenues are generated through provisions earned whenever a transportation contract between a consumer and one of the mobility providers is facilitated



through the platform. Additional revenue streams arise from advertisements targeted to the travelers point-of-interest (e.g. hotel offerings at the customer's final destination). Taking this value proposition one step further, the IT solution might consider individual customer preferences (e.g. convenient mobility versus active travelling). A provider in this field is Daimler, who recently launched their mobile service "Moovel" [269].

### **Impact on individual mobility**

Driven by ICT and mobile web technologies, upcoming platform business models will accelerate the consumer's shift in preferences from owning vehicles towards sharing and using them temporarily. Yet, the car remains the most important means of individual mobility in the future. However, with decreasing vehicle ownership, consumers will be more inclined to integrate various means of transportation into their journey. Automotive and transportation companies will reflect this development by changing their business model from producing and selling vehicles towards offering seamless, intermodal mobility solutions[306, pp. 2-5].

#### **5.3.2.3 Emerging Business Models enabled by Autonomous Driving**

Autonomous driving will redefine individual mobility by creating new value propositions relying on the connected vehicle. This further applies to mobility as a service.

An emerging value proposition is the mobility on demand concept. It could start with sharing concepts where driverless cars would reduce the proximity to end-users to zero [283, p. 33]. B2B sharing could gain a certain popularity since autonomous vehicles would provide the office in a car concept, thereby providing more time to work and reducing costs for businesses.

Driverless taxis is a disruptive business model that removes the driver from the process. It thereby makes the passenger service more efficient and simplifies communication channels between taxis and customers through a mobile application for example.

### **Impact on Individual Mobility**

The impacts of the technology of autonomous vehicles are comparable to those described in section 5.3.1.4 however with respect to mobility services. Therefore, mobility services would become more efficient, easier to use and faster by reducing travel time. Ownership models are also influenced by autonomous driving in combination with the above-mentioned mobility on demand. Thus travelers would turn away from owning or renting and tend towards a service on demand [283, p. 28].

## 5.4 Conclusion

### Key Findings

Throughout this research, several trends in business models haven been identified with respect to individual mobility. Figure 5.4 shows the analyzed models and classifies them according to their potential for business model innovation, adapted from Osterwalder’s canvas model [295, pp. 22–23].

|   |  |
|---|--|
| <p><u>Value Proposition:</u></p> <ul style="list-style-type: none"> <li>- Autonomous Cars</li> <li>- Information out of Big Data</li> <li>- Mobility Service Platforms</li> </ul> | <p><u>Customer Channels &amp; Segments:</u></p> <ul style="list-style-type: none"> <li>- Application Ecosystem</li> <li>- Mobility Service Platform</li> <li>- Customer Information from Big Data</li> </ul> |
| <p><u>Key Resources &amp; Partners:</u></p> <ul style="list-style-type: none"> <li>- Big Data Providers</li> <li>- Autonomous Cars as Device Operators</li> </ul>                 | <p><u>Revenue Streams:</u></p> <ul style="list-style-type: none"> <li>- Incremental Subscription (Freemium, Micropayments)</li> <li>- Application Ecosystem</li> <li>- Mobility Service Platform</li> </ul>  |

Figure 5.7: Recent innovations in different elements of a business model.

Source: Own Illustration

The massive collection of vehicle and driver data, also referred to as “Big Data”, will open up many opportunities for future innovative business models. Integrating big data as a key resource into business models will create new sales opportunities for car manufacturers, increase information entropy for several use cases and enhance efficiency and productivity of companies and customers.

The shift from car ownership to on-demand access of cars and mobility options as a service, opens up new opportunities for innovations in revenue generation. Furthermore, usage-based pricing cannot only be applied for car sharing but also create business model innovations in connected car services, through letting the customer pay for features as needed. Freemium pricing and micropayments are identified as attractive options for revenue models.

Application Ecosystems will allow customers to extend and customize the functionality of cars. Ecosystems similar to the Apple “App Store” can create an additional revenue stream for car manufacturers. Furthermore, they will lock-in customers to the application system of a manufacturer or at least create customer loyalty.

The broader range of mobility options for customers will create use cases for intermodality management. Hence the main value proposition is to simplify usage and connection of different modes of transportation. Travelling is thereby optimized for passengers, breaking up traditional customer interactions with mobility services and redirecting revenue streams.

Finally, autonomously driving cars enable diverse opportunities for new business models, such as providing an environment for working in the car or extensive collecting data.

### **Challenges**

The adoption of new technologies will be crucial for the success of the above mentioned business models. Currently most technological innovations, such as connected car services, target merely technology-affine customers. In addition, customers need to become confident with transferring control over route planning or even the entire driving itself to electronic systems. Trust and confidence into technology have to be built up. The increasing amount of multimedia functionality in cars also leads to more complex user interfaces. In order to allow for safe driving and to fully exploit the full potential of all functions, innovative user interfaces for drivers have to be developed. Those could be related to voice or gesture control. Besides these challenges there are also legal and privacy issues to be solved, regarding autonomous cars and collecting data on cars and passengers.

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**Part II**

# **Scenario Planning**



# 6

## Chapter 6

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# Introduction

In today's complex and volatile world, it is very hard, nearly impossible, to make reliable decisions or to predict significant changes. Therefore, various future situations, i.e. scenarios, must be taken into account in order to be prepared for unforeseen changes and upcoming challenges. The scenario planning methodology and the approach used in this report will be explained in the following.

### **The Scenario Planning Methodology**

Scenario planning anticipates possible future outcomes and therefore helps companies to deal with major, uncertain changes in the field of political, environmental, social, technological, legal and economic (PESTLE) issues.

Unlike forecasting, which tries to predict the most probable outcome, scenario planning is about considering any possible situations the future might bring without considering its probabilities. In other words, it is about "thinking the unthinkable" (H. Kahn). These possible situations are called scenarios. Scenarios are plausible, recognizable, relevant, challenging and consistent stories about the future. The aim is to collect a wide range of ideas and perspectives in order to include somewhat crazy aspects and details that are not considered in the commonly accepted future forecasts. As a result, an organization's strategy or product can be tested for robustness in all the alternative scenarios, and new strategic opportunities arise which can be implemented as action plans.

### **The Approach Used in this Report**

The scenario planning process typically takes place in an interdisciplinary workshop setting. The two-day workshop for this report was composed of both lectures and intensive group work and had a structured approach that led to the discovery of various scenarios. The students had to work in teams of six on the following tasks which built upon each other:

First of all, striking events or trends that have shaped today's ecosystem of

HMI in individual mobility were mapped on a timeline of the years between 1900 and 2013 using the PESTLE framework. In a subsequent step, today's key challenges regarding the way of how HMI in individual mobility will develop in the future were identified, referring to PESTLE categories. Afterwards, the teams determined the driving forces behind the previously identified challenges.

To build the scenarios, it is crucial to identify the two key drivers which are both highly critical and highly uncertain. The teams rated and arranged every driver on the drivers matrix (see figure 12.2). After an active discussion, the class as a whole selected two key drivers which were situated in the upper right area of the matrix. Subsequently, the four scenarios were deduced by combining the two drivers' bipolar outcomes.

Every team was assigned the development and description of one scenario. In order to give a vivid impression of the various future states, the teams formulated news headlines from today until 2025, representing events concerning the use of HMI in individual mobility in the respective scenarios. By mapping the news headlines on a timeline, the causal chain of developments leading to the respective future states was described. Moreover, each team invented a name characterizing their scenario. In a final task, each team created a photo collage to give a feeling for their scenario of what 2025 will look like. Finally, each team presented its collage to the class, telling a vivid story of the scenario.

After the workshop, the students further developed and finalized their scenario report.

### **Structure of this Chapter**

This chapter is divided into two parts. In the first part, the relevant drivers will be analyzed. They are divided into two key drivers which will shape the future of HMI in individual mobility most dramatically and are highly uncertain. Then, eight additional drivers are described, which will also have an impact, but to a smaller degree. Each driver is portrayed by a general description and specific implications of the possible bipolar outcomes. In the second part, each of the four possible outcomes of the two key drivers will be described as a scenario.

The first scenario depicts the "Communified" world, where using shared means of transportation is the only method of individual mobility, and where the interfaces of the vehicles are highly standardized. The second scenario, "Car.me", also relates to a world with highly standardized interfaces but, in contrast to the first scenario, without any sharing. The third scenario, called "Autonomy", depicts a world without sharing and a low degree of standardization. As the name of the fourth scenario, "Patchwork Sharing", indicates, it describes a world of sharing vehicles and other means of transportation while the standardization of interfaces is low.

After each scenario description, a timeline will be illustrated, including several possible events between today and 2025 that lead to the respective scenarios. Finally, signposts are defined, which will help to recognize a certain direction and possible turning points.

# 7

## Chapter 7

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# Driver Analysis

In order to understand how the world might change within the next decade, especially with respect to HMI in individual mobility, it is necessary to take a close look at the driving forces. Those forces are called drivers. Drivers can develop in one or another direction and thereby significantly shape the future. While the different outcomes of a driver might not be equally probable, its manifestation cannot be foreseen. Social, political, economic and technological developments influence the outcome of a driver. Some drivers could also be correlated.

The ten most relevant drivers for HMI in individual mobility will be detailed in this chapter. Figure 12.2 depicts those ten drivers ranked by their impact on human-machine-interaction in individual mobility and their level of uncertainty. Standardization and sharing were identified as the two key drivers as they have both highest impact and highest level of uncertainty. The different combinations of the potential outcomes of those key drivers lead to diametrical scenarios that will be detailed in the next chapter.

## 7.1 Key Drivers

The subsequent sections provide an in-depth description of the two key drivers for the covered scenarios. Both sharing and standardization are identified to have a significant impact on future HMI in individual mobility.

### 7.1.1 Sharing

Vehicle sharing is one of two key drivers with high potential to significantly shape individual mobility in 2025.

The latest concepts on vehicle sharing are based upon the assumption that one vehicle can alternately be used by a group of individuals, while still meeting

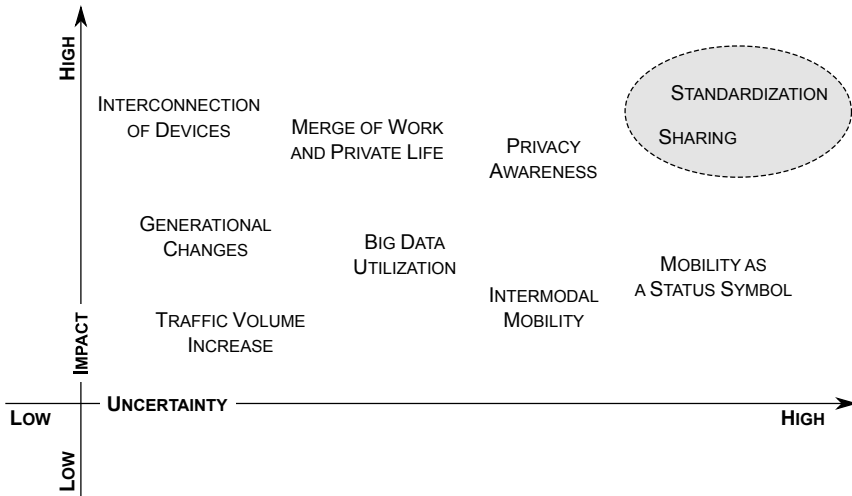


Figure 7.1: Relevant drivers ranked by impact and uncertainty

Source: Own illustration

their needs for mobile flexibility. By providing the access to a shared fleet of vehicles, car sharing companies enable their customers to spontaneously decide on whether and when they want to make use of a car [345]. Thus, car sharing is supposed to ensure flexible mobility of individuals by granting access to multiple vehicles that can be used. This shall replace classical ownership of cars. In a commercial sense, vehicle sharing besides cars also includes bicycles, motorcycles or other means of individual transportation. In the future, yet unknown vehicles might extend that range.

In contrast to vehicle renting, which is far less flexible, car sharing concepts like “Car2go” allow users to spontaneously choose a vehicle for a flexible period of time. The constantly growing number of registered car sharing members shows that the occasional use of vehicles particularly within cities becomes increasingly popular among individuals [313]. Due to simplified online booking procedures and a wide distribution of vehicles, car sharing becomes more and more comfortable. For individuals, the essential advantage of car sharing in comparison to car ownership lies within the fact that all fixed costs related to vehicle maintenance are shifted to car sharing companies. Thus, customers are relieved of expenses for parking, car insurance or repairs [326].

Besides an increasing interest shown by society, vehicle sharing concepts in cities also experience the attention of politics. The achieved reduction of cars due to vehicle sharing could provide a solution to several issues urban areas are currently facing. Thus, air and noise pollution or traffic congestion growth



caused by overpopulation could be diminished. Currently, besides Europe also the U.S., as well as parts of Asia [340], invest in governmental vehicle sharing projects, expecting increased energy efficiency to be one of several beneficial outcomes.

Since vehicle sharing concepts decouple individual mobility from vehicle ownership, their broad implementation in practice has an important impact on the automotive industry. In case of future success of car sharing concepts and their extensive usage by individuals, not only vehicle sales will drastically decrease but also customer perception of automobiles may change. This, amongst others, could have a significant impact on how and to which extent features and accessories within cars are used. The more drivers have access to the same car, the higher the requirements towards manufacturers get in terms of user-friendliness .

Despite several indications on growing trend of sharing vehicles , present attempts within this field remain rather vague.

Today, some members of vehicle sharing communities certainly own a private car and only make use of additional services of vehicle sharing companies in very special situations. To many customers, the private car still represents a meaningful purchase which besides ensuring independence and comfort, somehow also reflects a status symbol. Regarding manufacturers , several automobile companies started to penetrate the car sharing business. Still, their main competencies lie on the development of features that make the private ownership of a vehicle more attractive to customers. Until now, vehicle sharing represents an increasing, but still small part of individual mobility.

### **Possible Developments**

The future of vehicle sharing appears to be very unclear. Will vehicle sharing, from being a trend convert into a global standard in 2025 or will manufacturers manage to make private ownership of vehicles even more attractive?

The extreme outcomes of both scenarios will be considered more precisely in the following.

### **Sharing only**

When vehicles are only shared and no longer owned, the amount of automobiles distributed around the world on average will be limited to one car per 10 persons [326], in 2025. Traffic congestions as well as noise and air pollution within cities will be limited to the minimum. The adjustment of infrastructure to vehicle sharing concepts will enhance the implementation of electric vehicles, and will make their charging and utilization user-friendly. Societies within this scenario will be characterized by their above-average flexibility and adaptability concerning their mobility. Individuals will be less willing to rely on the car as a primary means of transportation in order to move from A to B, as the

distribution of shared cars can become a problem and cars are not always the fastest option of transportation. Instead, bicycles and new alternative vehicles will be increasingly used. Furthermore, the usage of alternative means of transportation will be promoted by governments. The overall positive attitude of society towards environmental protection outweighs the desire to own a private car. Thus, owning a car will be less e regarded as a status symbol.

### **No Sharing**

The failure of car sharing concepts will increase the amount of automotive vehicles on the roads. Therefore, governments will intensively try to control private vehicle usage by restrictions and subsidies. All available means of transportation will be obligated to fulfill high political restrictions, whilst particularly automobiles will be subject to strict environmental regulations.

Due to overcrowded roads, customers will increasingly pay attention to features that ensure comfort within cars. Driver assistance systems and vehicle accessories that improve driving safety as well as the driving experience will be highly valued by individuals. Furthermore, premium and environmentally friendly cars will be preferred over middle class vehicles, as no sharing will increase the will to own a premium car and people will be more conscious about the resources they use. Societies within this scenario in general will give high importance to their self-fulfillment and self-expression, also in terms of mobility.

User needs will force vehicle manufacturers to constantly work on innovative concepts in order to enable personalization in individual mobility. Thus, the implementation of personal devices within the vehicle surroundings will be a standard feature in 2025.

### **7.1.2 Standardization**

According to the definition by International Organization for Standardization (ISO), "a standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose". [351] Standardization as a process, however, is often broader than the ISO definition. Standards can emerge from market domination, or be written by standards organizations, governments, regulatory bodies, corporations and/or trade associations.

Informal conventions or dominant designs make up de facto standards, while on the other hand, laws or regulations define de jure standards. "Open standards" may be published voluntarily by nonprofit organizations, and often they are not legally binding unless specifically imposed by governments and/or regulatory bodies. QWERTY keyboards provide an example for de facto standards, emerging from the dominant layout of typewriters during the nineteenth century. [355] One of the most well-known de jure standards is "ISO 216", introduced by the Deutsches Institut für Normung as "DIN 476" in 1922, which specifies

paper sizes used throughout the world. [352] Recommendations by the World Wide Web Consortium (W3C) are considered voluntary standards, but they provide a common framework for software developers to agree on, and therefore often become de facto standards, e.g. HTML, SVG, XML and CSS. [363]

Today, our lives are thoroughly affected by many historical standards, even if we do not recognize them right away. Standards first emerged in response to the need for interchangeable parts following the Industrial Revolution; most important historical standards being the standardization of railroad track gauge, screw sizes, electrical voltage and frequency, as well as pipe sizes. [357]

Standardization will be one of the key drivers determining the emergence, implementation and market acceptance of new human-machine-interaction technologies within the area of individual mobility. The scope of standardization efforts could include, but would not have to be limited to:

- Human-machine interfaces
  - Graphical user interfaces (GUI)
  - Gesture interfaces
  - Touch user interfaces
  - Attentive user interfaces
- Machine-to-machine interfaces
  - Data interoperability
  - Application programming interfaces (API)
  - Communication protocols
- Compatibility with external devices and interchangeability

The scenarios driven either by "standardization" or "non-standardization" do not necessarily provide an answer whether standardization efforts would prevail and how. They rather focus on effects of de facto and/or de jure standards being existent — or not.

### **Standardization of Human-Machine Interfaces**

The answer to the question whether there will be standard human-machine interfaces in tomorrow's world, would determine how mobility providers distinguish themselves and whether they could create lock-in effects. Uniform GUIs, gesture and touch interfaces would make it easier for users to switch from a car brand to another, or in general, from one mobility provider to another. On the other hand, they might harm the status symbol built on premium means of individual mobility, since manufacturers and providers would find it difficult to come up with radically new interfaces while complying to standards. Another impact of non-standardized interfaces might be on driver education: in that case, need for customized driving licenses might arise, just like today's extensive

custom trainings for each manufacturer and type of aircrafts. The area of human-machine interfaces is where patent wars may occur as well, manufacturers may be inclined to patent their own gestures, GUIs and/or attentive interfaces.

One might expect standardization efforts in this specific area to be driven by governments and regulatory bodies, instead of manufacturers, mostly due to safety concerns. This however should not limit the room for innovation, but rather a shift of R&D efforts to other areas could be expected.

### **Standardization of Machine-to-Machine Interfaces**

Machine-to-machine communication might be another area where standardization efforts could focus on. This raises the question whether vehicles, networks, databases and all kinds of connected devices could communicate with each other making use of open standards, thus an open ecosystem could flourish. The most important challenges in the area are data interoperability and open APIs, as well as communication protocols. Current communication protocols used within cars are pretty much standardized, with important standards being CAN, LIN, FlexRay, Ethernet and Bluetooth. In the automotive sector, reliability is far more important than achievable data rates. Newer and faster protocol versions from the corporate world take several years to be standardized for industrial requirements. [349]

Manufacturers and mobility providers might set up consortiums and push for standardization in this area, since they might like to create richer infotainment solutions for their customers. On the other hand, to bring third party developers into the picture, mobility providers might be inclined to offer standardized APIs for vehicle-to-x communication. Governments and insurance companies' efforts might focus on standardization for data interoperability, as they might find "black box" data useful. Communication protocols are not an expertise for car manufacturers, so one might assume that they would implement standard protocols. If faster protocols are not standardized by the Institute of Electrical and Electronics Engineers (IEEE) in the near future, only then manufacturers might begin developing their own proprietary protocols.

### **Compatibility with External Devices and Interchangeability**

Compatibility of mobility providers' infotainment solutions with external devices would be crucial to understand if "bring your own device" (BYOD) concepts could prevail or not. Bargaining power of connected device manufacturers (smartphones, tablets etc.) would determine if mobility providers could create generic interfaces to fit them all or need to establish exclusive partnerships, i.e. cars of Manufacturer A connecting seamlessly with one smartphone brand only. The degree of interchangeability of vehicle parts (can happen vertically among different series of a given manufacturer, or even horizontally to the most extreme: among different manufacturers and series) would determine the level of customizability that might be offered to customers.

Customer satisfaction and exclusive partnerships would be determining if compatibility with external devices and/or interchangeability could happen. Mobility providers might also find it tempting to offer these as "new" features to their customers, in order to create some distinguishment if standardization on all other aspects occur.

## 7.2 Additional Drivers

Besides the two key drivers, there are eight additional drivers. Even though those drivers are less influential and their outcomes more certain, they also shape the future of HMI in individual mobility and thus must be taken into account as well.

### 7.2.1 Mobility as a Status Symbol

For an item to be a status symbol, it is necessary that it is rare and special. Moreover, it has to be valued highly by other members of the peer group, who as a consequence envy the owner and would prefer to own the good as well. Rarity of a good can be the result of natural scarcity (e.g. gold) or be caused by economic players (e.g. intentionally selling a good at a high price so only few people can afford to buy it). In both cases, high prices are the result representing the value of this good in the group. The possession of such a high value good embodies the high social status of the owner.

For mobility to serve as a status symbol, it is necessary that differences in characteristics, which matter to the people, of the respective means of transportation are represented in the price of mobility. If people value comfort and if comfortable means of transportation are much more expensive than basic means of transportation, people can underline their social status by using a more comfortable and hence more expensive means of transportation. In contrast, if people value efficiency and speed of mobility, but expensive and inexpensive means of transportation differ only little in this respect, the group will not highly value the expensive means of transportation and, thus, they cannot serve as status symbols.

As of March 2013, studies in Germany have already shown that the importance of a car as a status symbol is declining. Meanwhile, extraordinary vacation and smartphones gain importance as status symbols. [337, p. 370]

### Possible Developments

One possible outcome is that mobility serves very much as a status symbol in 2025. It would not only be about getting from A to B, but people would use their means of transportation to underline their social status. Another possible outcome is that mobility completely loses its value as status symbol and people have a very pragmatic approach towards mobility when it is only about getting

from A to B as efficiently as possible. These two outcomes will be detailed in the following.

### **High Acknowledgement of Mobility as a Status Symbol**

Two paths might lead to this potential outcome of the driver. One path is that people value efficiency and speed of mobility and that expensive means of transportation fulfill this need better. This situation could be caused by degenerating efficiency of public transportation services or by expensive cars having an efficiency advantage due to e.g. intelligent navigation solutions or because it is allowed to drive them in upcoming low emission zones. The other path is that people value comfort as well as entertainment while on the go and that expensive means of transportation can serve this better. This could be the result of personalization and of improvements of the user interface and in-vehicle entertainment offers.

In both cases, people can use their means of transportation to show off and underline their social status as they have something rare that their peers want to have as well.

### **Low Acknowledgement of Mobility as a Status Symbol**

Another potential outcome of this driver is that people in the future treat mobility in a very pragmatic way and do not see it as a status symbol at all. This might be the case if people focus their attention on efficiency and speed of mobility but mobility solution providers fail to differentiate their products and to adapt their pricing schemes regarding these needs. To give an example: cars, no matter which brand, suffer from the same efficiency constraints, such as traffic jams. If the focus of people is on efficiency and speed, expensive cars will not be seen as much more valuable than inexpensive cars, because they provide almost the same efficiency and speed of transportation. Therefore, they cannot be used as status symbols. The development towards mobility not being a status symbol might moreover be boosted by other personal gadgets serving as status symbols, like mobile devices.

For this outcome of the driver, people will have very little brand awareness and will not care for the producers of their vehicle, e.g. because they do not manage to differ from each other regarding criteria that are meaningful to the customer.

## **7.2.2 Privacy Awareness**

Today the focus of privacy in the context of digital technology is the ability to control who gets to know which information about oneself and for which purposes it may be used. Privacy awareness is about people being aware of potential privacy issues and actually caring about having their data distributed as little as possible.

The privacy awareness of a society can influence businesses in two ways. On

the one hand, the members of a society act as customers who decide to buy or not to buy a product or service. If an offered service does not fulfill their privacy expectations, they might refrain from using it. On the other hand, the members of a democratic society have an influence on their government. So their attitude towards privacy will eventually guide political institutions in the legislation they impose on businesses.

As of March 2013, internet companies such as Google and Facebook collect enormous amounts of personal data. While users do not have to pay for many of their services, the companies use the personal data e.g. to improve advertising. Privacy regulations differ significantly among countries. [314, 335] But political discussions about and initiatives for privacy enhancement can be seen in various countries. [315, 316]

### **Possible Developments**

With very high privacy awareness, people will seldom or never be willing to give their data to companies and even the government. The use of private or personal data would be very restricted. In contrast, with very low privacy awareness, people will share their information and allow its use in a lot more data-centric products and services. These two outcomes will be discussed in the following.

#### **High Privacy Awareness**

High privacy awareness is one possible outcome for this driver. It might be the result of severe privacy scandals accompanied by very negative press. A series of data leakages on several online platforms would damage the people's trust in the businesses that run those platforms. As companies prove incapable of protecting the commissioned data, people expect the government to protect their privacy using strict regulations. They also become very restrictive with the information they share about themselves.

Summing up, the use of private data is very restricted in this case. The collection and use of data for value-adding services based on big data (e.g. traffic jam prediction) and the transfer of personal data (e.g. driver profiles) would face high legal obstacles and opposition in society. Even though a functionality might be technically feasible, political aspects might inhibit its introduction.

#### **Low Privacy Awareness**

In contrast, privacy awareness of the people might as well decrease, leading to a low overall privacy awareness. Customers might continue to get increasingly used to expect services for free in exchange for their private data. This concept might be expanded to hardware: customers could get gadgets paying almost no money as long as they agree that the company may use their data for its purposes. The choice whether people want to share their data or not, might vanish: if they want to use a certain type of service, they have to give their data, not matter what competitor they buy from. Even though people might

be aware of privacy risks, they would be used to sharing their data and they would not care to limit access to it.

In conclusion, liberal use of private and personal data in services and products offered would be the result of this outcome. Everything that is technically feasible could be done, there would be no legal or societal concerns.

### 7.2.3 Interconnectivity of Devices

An increasing amount of people currently use a smartphone [334]. This goes along with an increased importance of mobile phones and its integration with other services for the users. In the future, the definition of mobile devices will not only include cell phones, but the scope will extend to other portable devices too, such as Google Glasses<sup>1</sup> or smart watches<sup>2</sup> [330].

As hubs of information and communication, connecting mobile devices to mobility systems or interconnecting different kinds of mobile devices can greatly enhance user experience. Various applications of device interconnectivity can already be found in cars, such as making phone calls and streaming music from the mobile device. However, this kind of interconnection is restricted to core functionalities of mobile devices.

#### Possible Developments

Interconnectivity of mobile devices, especially within cars, currently is a trend. Nevertheless there are a couple of challenges that have to be faced in order for this trend to persist. The following two sections explain how interconnectivity of devices could develop and provide possible reasons for the two extreme outcomes of the drivers.

#### Low Interconnectivity

Car manufacturers and other providers of mobility, such as trains, usually have very long development cycles of up to 8 years, as opposed to developments in mobile devices and other electronic consumer products in general. This difference of development pace could make it difficult for the manufacturers to integrate modern devices and leverage their latest features.

In addition, the globally increasing penetration of smart phones , as well as the need for diversification of mobile device manufacturers can lead to a range of various, proprietary interfaces. This drives the cost and the development time for implementing interfaces for a broad range of devices.

Moreover, the failure of approaches to standardize interfaces could block the universal interconnection of devices.

<sup>1</sup><http://www.google.com/glass/start/>

<sup>2</sup><http://mashable.com/category/smart-watch/>



The aforementioned causes could stop further innovations in the area of device interconnectivity in individual mobility. Basic functionality would still be supported, as it can be seen today, but it would not be possible to use the full functionality of a device.

### **High Interconnectivity**

As mobile devices get more important in everyday life of customers, the integration of these devices could largely be driven by customer demands. Car manufacturers and other providers would need to adopt mobile device interface standards or build interfaces for the most widely used mobile devices.

It would then be possible to access and use all information stored on the mobile devices, most likely by one or only a few standard interfaces.

Such an open system could enable mobile devices to perform authentication for vehicle access and make it possible for vehicles to fully adapt to customers preferences and settings. Furthermore the time people spend in cars could be used more efficiently, for example by connecting office content and applications, or social media and other means of communication.

Seamless integration facilitates the streaming of mobile device displays onto the bigger display devices of the car, which will improve ergonomics. It could also be used to stream information from the car's console to augmented reality devices such as google glasses. Such interconnection could reduce driver distraction while allowing the user to fully exploit the potential of mobile devices.

## **7.2.4 Big Data utilization**

The worlds digital data is doubling every two years and has already reached 1.8 zettabytes (1.8 trillion gigabytes) in 2011 [324]. This is a result of data coming from public, proprietary and purchased sources, an increasing amount of sensors that quantify our environment, as well as growing connectivity between data [323].

At the same time “cost of creating, capturing, managing, and storing (digital) information” is declining heavily and currently sums up to only 15% of the cost in 2005 [324].

These two developments led to the Big Data trend, which represents the idea to try to gather new information from available data. Companies try to support and speed up decision processes with information mined from their data sources and perceive this approach as competitive advantage in the market [329]. Big Data can also be used to experiment with and understand customers and markets in more detail. For example, Tesco uses data generated from its loyalty program to improve marketing of their products for specific customer segments [324].

## **Possible Developments**

Currently, Big Data is positioned at the peak of expectations within the Gartner Hype Cycle [336] and it is likely that disillusionment about opportunities and expectations from this trend will happen in 2013. From that point on, two directions are possible: Either companies stop integrating Big Data solutions and the concept does not expand, or it will see widespread adoption, not only for business intelligence (BI) use cases, but also for other fields, such as mobility and travel.

### **Low Significance of Big Data**

Analyzing large amounts of data is a promising approach to find new information and base decisions and deductions on them. However, it is crucial that the data available is correctly questioned, e.g. the right algorithms and invariants are used when processing the data. This currently unsolved challenge could also be the main blocker for Big Data to succeed in the future.

In this case, the current trend would be stopped, with respect to the solutions and products that can be found and new means of processing large amounts of data have to be developed.

### **High Significance of Big Data**

If companies successfully utilize Big Data, the paradigm will shift to other fields as well. In the case of mobility, data from vehicles sensors, such as cars or trains, their drivers and passengers will create new data sources. Manufacturers or service providers will use this and other data to improve customer experience, create new products and improve processes and company-intrinsic information.

The opportunities of Big Data rely on combining behavior data of many users and being able to predict or match this data with other consumption or decision variables. If properly implemented, this results can predict behavior of humans and propose them faster, more pleasing or more efficient solutions. As a result, companies can better serve their customers and even reduce costs through gains in efficiency.

One possible use case in the field of mobility could be the analysis of stress levels in driving routes. This would match driver stress data from sensors on the steering wheel, measured by sweat, with the routes and driving behavior of the driver. As a result the GPS can propose the driver different driving routes by other criteria than fastest or cheapest routes, namely on the stress level of routes.

## 7.2.5 Merge of Work & Private Life

The driver described in the following section refers to the question whether work life will continue to penetrate the private sphere. This includes work-related communication, decision making and even working on entire sub-tasks or projects during private hours. In this context, the private sphere is defined to begin when the employee leaves his designated workplace for his private living space.

The outcome of the driver influences the field of HMI in Individual Mobility in that it might create demand for new technical solutions that enable employees to work more efficiently while traveling. People spend a significant amount of time in cars, both for private and business reasons. In a scenario in which work and private life overlap, this time has to be seen as precious productive time.

### Possible Developments

The first outcome referred to as “High Work-Life Overlap” describes a scenario where there is no separation between the private and the professional sphere. Work has completely penetrated private life especially in management positions. Pressurized by a globalized economy and severe international competition, companies expect their employees to be virtually available 24-7. Making business related phone calls, answering e-mails or attending virtual meetings is no longer a question of personal ambition, but an expected behavior defining the quality and value of a professional.

On the other hand, “Low Work-Life Overlap” refers to a strict separation between work and private life. Apart from exceptionally important phone calls or E-mails, the working sphere is left behind when stepping out of the company building. Yet, the scenario does not necessarily include fixed working hours or exclude performance-based compensations.

### High Work-Life Overlap

Several developments point towards an increased overlap of work and private life. Seamless Internet connectivity “anywhere anytime” and the ongoing consumerization of information technology are important indicators of this trend.

Consumerization of IT refers to the use of privately-owned IT resources such as software and devices for business purposes. Both companies and employees generally embrace this trend, since it bears the potential to enhance work productivity, motivation and autonomy [348, p. 10–11]. Companies are already beginning to react by setting up policies and systems that ensure the secure usage of private devices for business purposes, therefore paving the path towards a BYOD-based work environment. The rapid diffusion of cloud services and web-based enterprise software solutions make work-related files and applications available from anywhere through a simple web browser. This leads to permanent accessibility of work-related resources that were formerly bound to a separated

company IT infrastructure.

Additional factors blurring the boundaries between work and private life are the emergence of flexible work time and home office regulations as well as the shift from working time based salaries towards performance-based compensations. In nowadays's IT-driven economy, many work results consist of digital goods or information. Since the production of such goods is not bound to a certain location, this further enhances the propensity to work at home and therefore mix work and private life.

### **Low Work-Life Overlap**

Although the rapid diffusion of mobile devices and ubiquitous connectivity potentially decouples work from a dedicated workplace, there are indicators pointing at an increased separation of work and private sphere. Working during private hours generally hampers the recreational effect of free time. The usage of private mobile devices in the working environment leads to permanent availability, which in turn might cause stress and lower work performance[350, p. 13–24]. Stress-related diseases like burn-out occur and affect the overall productivity of a company or economy [361, p. 43]. Reacting to this issue, both companies and governments are beginning to counteract the increasing overlap of work and private life.

## **7.2.6 Traffic Volume Increase**

The term traffic volume refers to the total amount of registered private vehicles. The development of traffic volume affects the domain of HMI in Individual Mobility in that it reflects the future demand for privately owned vehicles as well as the way consumers relate to their car: sharing and pay-per-use models might replace the concept of car ownership, therefore reducing traffic volume on a global scale.

### **Possible Developments**

The first possible outcome describes a scenario in which the current increase of privately owned vehicles continues at a rapid pace. The adverse scenario refers to a stagnation of the total amount of deployed vehicles within the next ten years.

### **Further growth of Traffic Volume**

The number of produced personal cars has increased almost every year for the last decades [359]. Especially the growing wealth in Asia and other emerging markets along with the currently very low number of cars per capita causes further growth potential for vehicle sales in the near future. Economies of scale in the car production and the recent strategy to target emerging markets with very affordable micro cars like the Tata Nano support this development. These factors point to a further growth of global traffic volume during the next decades.

## Stagnation of Traffic Volume

On the other hand, there are several signals indicating that global traffic volume might reach its peak within the next decade.

Firstly, the ownership of a personal car as the dominant paradigm of the developed world is gradually replaced by pay-per-use models and temporary access to vehicles [347, p. 3]. Especially car sharing shows a rapid global expansion, with compound annual growth rates of almost 30% since 2006 both in terms of shared vehicles and member count (see Basic Phase - Emerging Business Models - Car Sharing section). Due to a higher occupancy rate, every shared vehicle is said to replace between 5 and 13 privately owned cars [348, p. 8]. If car sharing continues to expand at such a fast pace, it bears the potential to significantly reduce the total stock of cars. Secondly, infrastructures for individual mobility have already reached their maximum capacity in many urban areas throughout the planet [362, p. 9–11]. Especially in Asian mega cities, the massive amount of cars has caused severe environmental and healthwise problems. This might lead to increased governmental bans on (motorized) individual mobility in urban areas and respective taxation that hampers the demand for private vehicles.

## 7.2.7 Intermodal Mobility

Integrating different means of mobility into the transportation from A to B is defined as intermodal mobility. It originates from the seamless transportation of containers by railway, trucks and ships. Nowadays and especially in the future, the term intermodal mobility is transferred to the area of individual mobility [338, p. 4]. Several means of individual mobility are connected to ensure a smooth and flexible transfer of one or more persons [319, p. 1]. Human-machine interaction plays an essential role in the realization and utilization of intermodal mobility concepts.

### Possible Development

Advancements in technology can foster a shift towards intermodal mobility, for instance by providing services, that plan a route for the customer, taking all available means of transportation into account and enabling the customer to book all the tickets at once. This driver outcome would lead to a high importance of intermodal transportation, as intermodal transportation would become very convenient and efficient.

The contrary direction this driver could follow is the emerging dominance of single means of mobility. One scenario that could lead to this outcome is an ever-increasing variety and complexity of human-machine interfaces, rendering it very inconvenient to switch means of mobility multiple times. Intermodal mobility solutions would then have a low importance.

### **High Importance of Intermodal Mobility Solutions**

In this outcome, providers offer a mobility chain that is flexible and suits given circumstances the best. Multiple vehicles are linked and smoothly integrated into travels. One possible scenario could look as follows: B walks out the door, takes the bike to drive to the next available shared car. She drives with the car and then transfers to a bus that takes her to a private boat, which brings B to her final destination.

Due to the integration of different means of mobility, it is plausible that new players emerge. They appear in the form of start-ups who focus solely on the connection of the means of transportation. Furthermore, companies that are strong in digital technology or related fields enter the intermodality market. Google could for example combine their maps service with an information and booking platform for travelers. Thus the company integrates and links all suppliers for individual mobility. Another possibility is that traditional mobility providers, such as automotive manufacturers, integrate and link bikes and cars as well as other forms of mobility to their offer. The described outcome of the driver paints a picture in which mobility is perceived as a service and not associated with a single vehicle providing the transfer from one point to another.

### **Low Importance of Intermodal Mobility Solutions**

The opposite outcome of the driver 'intermodal mobility' assigns low importance to intermodality. Individual mobility is associated with one means of transportation providing it. People rely only on one vehicle to reach their final destination. Comfort and flexibility offered by those means satisfy a traveler's needs the best. Consequently, providers of individual mobility will have to engage into all-in-one solutions that can handle multiple requirements.

## **7.2.8 Generational Changes**

Generations differ by their core values, attributes and habits. If those diverge significantly, there is a gap between the generations. A decrease or increase of this gap has a significant impact on the economy. Hence, businesses and the government need to address multiple, diverse customer segments and target them accordingly. In investigating generational change with respect to human machine interaction in individual mobility, one has to especially consider the aspects of perception and utilization of technology.

### **Possible Development**

Baby Boomers - the generation born between 1946 and 1964 - experienced the beginnings of digital technology, such as the introduction of the desktop computer in 1965. Born between 1964 and 1981, generation X is regarded as being techno-literal [341, p.4-5]. Generation Y, also called the Millennial, are the first generation being digital natives. Born between the 1981 and 2000, members of this generation are usually technology-affine and use technology

regularly in their daily lives[341, p.4–5]. The subsequent generation Z, born from 2000 on, even goes a step further. For them, the usage of technology is as normal as getting dressed in the morning. Generation Z is said to have the word digital written into their DNA [344, p. 4]. Their life and its organization highly relies on technology and connectivity. One outcome of the driver ‘generational change’ is a decreased divergence in between generations. Being a digital native, or at least being in close touch with technology for the Baby Boomers, enables you to keep up with further developments in digital technology. The other possible outcome however could be an increase of divergence between generations. As Millennials and Baby Boomers age, they are overtaken in their technology know-how by the younger generations and cannot keep up with the technological change.

### **Low divergence between generations**

The Baby Boomers and the generation X have adapted to technology and are now merely familiar and comfortable in using it in their daily routine. Generation Y, the digital natives, already grew up with it and display an even more natural way of using technology. Generation Z is born and raised with technology being part of their lives at any time. Hence, further developments in technology are easily adopted by all these generations. The divergence between youngsters and the elderly regarding their use of digital technology vanishes. In 2025 generations have a similar attitude and handling habit concerning human machine interaction. Providers therefore enjoy a high degree of freedom for integrating sophisticated technology into individual mobility.

### **High divergence between generations**

Technology develops and changes in a speed that the aging generations of Baby Boomers and Millennials cannot keep up with. Getting comfortable with smart phones already required a huge effort for the Baby Boomers. Getting used to even more disruptive technologies with increasingly shorter life cycles overstrains Baby Boomers as well as the generation X and Y. Consequently, mobility providers that integrate sophisticated technology to human machine interaction struggle with addressing the different needs of the various generations. Rapid change is therefore hampered and development slowed down.





# 8

## Chapter 8

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# Scenarios

As described in the previous chapter, the two key drivers, “sharing” and “standardization”, have two bipolar outcomes each, namely “sharing only” and “no sharing” as well as “high degree of standardization” and “low degree of standardization”. By combining the respective contrary poles, one obtains four equally plausible future scenarios (see figure 8.1). In the following, these four scenarios will be presented by the means of personae to give a vivid impression of what the world of HMI in individual mobility might look like in 2025. After each scenario description, some key events between 2013 and 2025 are arranged on a timeline to show the gradual evolution and causal linking of each scenario. Signposts are specified at the end of each section. They are relevant indicators for a shift towards a certain scenario.

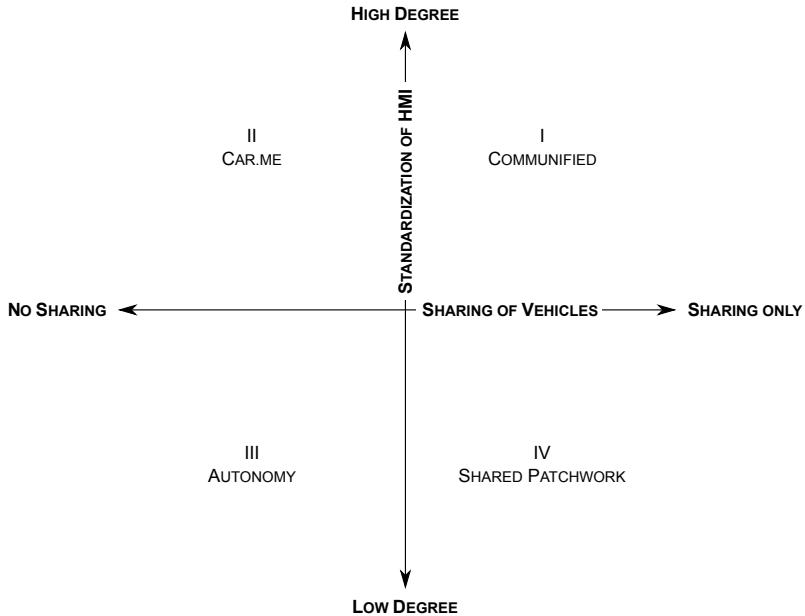


Figure 8.1: The key drivers' outcomes result in four different scenarios  
Source: Own illustration

## 8.1 Scenario I: Communified

Scenario Authors: Patrick Bilic, Hung Dang, Veronika Fischer, Patrick Gebhard, Maximilian Igl, Joachim Neu

The first scenario, “Communified”, is characterized by a very strong sharing mentality and a high degree of standardization. To give an impression of how this extreme world might look like in 2025, the story of Robert, who gets informed by his mother that she will get married for the fourth time the very next day, is described.

### 8.1.1 Scenario Description

Robert is just an average guy in his mid-thirties. Like many people in 2025, Robert is a single dad who lives in a crowded urban area. It is an exciting day since he just received a call from his 70-year-old mother Ursula. Tomorrow,

Ursula is going to have her fourth marriage, this time to her new fiancée Heinz. Robert promised to help prepare the wedding to make it a one-time experience and is going to take the day off after bringing Theodor, his twelve year old son, to school. For getting from one place to another, he uses car sharing services, since privately owned cars were prohibited by law in urban areas in 2018 and have been completely banned in 2024.

As intended, the sedan Robert reserved last night is free for use in front of his house. He likes the fact that it is possible to find and open the car with his smartphone. He could also have used his mobility card to open and rent a car on the street, but this lacks the comfort of the mobile application and is mainly intended for people without smartphones. The car already received his preferences from the cloud and adapted the interior and driving characteristics accordingly. Robert is a passionate, sporty driver and has included an upgrade of motor power into his mobility package, which is a bundle of services that include access to various modes of transportation for a monthly fee. This inter-modality offered by mobility providers enables customers to always use the fastest and most comfortable means of transportation in every situation and change seamlessly between them.

Sometimes Robert likes to change the style of the dashboard so that the speed and revolution indicators appear in a racing style. The interior lighting can be adjusted and it also serves as a pre-crash warning system when obstacles are approaching from behind or the side. Last week, Robert forgot the shoulder check and would have nearly cannoned into an overtaking car while changing the traffic lane if he had not been warned by flashing lights on the side.

On the highway the car automatically detects another vehicle with a similar destination and offers to follow it automatically. As usual, Robert happily agrees, because then he can read the latest personalized news on his head-up display. Meanwhile, as his son Theodore doesn't like the playlist streamed from his father's device, he adds some songs from his own. He also enjoys playing augmented reality games on his smartphone using the front and rear camera of the car. Shortly before he can beat his friend's high score, they arrive at school.

"You have to use a bike today to get home, since I have to do some shopping. See you later", Robert says. Theodor can use normal and electric bikes as part of his father's family mobility package. As soon as Theodor leaves the car, Robert tells the car it to call Mr. Steiner, his Boss. He needs to persuade him to give him the day off so he can plan the wedding.

After the call, Robert's calendar entry for today is automatically updated on his smart phone and the navigation system is asking for a new destination - "Shopping mall, suit rental and bakery downtown". By now, navigation systems have access to real-time traffic information provided by the Federal Highway Administration. Since it is rush hour, the navigation system recommends Robert to leave the car and take the nearest subway. As the station is quite large, Robert takes his augmented reality glasses with him, which can guide him the

way to the correct underground platform while the car parks itself automatically. The destination is automatically uploaded to the glasses.

Thanks to the real time information on his glasses he knows he has to hurry to catch the next train and thankfully arrives just in time. As he enters the wagon, he notices a free seat with included monitor where he can connect his phone. Although not really necessary, Robert appreciates this form of input since he likes touch-keyboards on large monitors. Before he arrives in the city center, he is able to book a catering service and a band.

After managing to get a present and to rent a suit, Robert's last stop is the bakery. In order to store everything, he needs a larger car. He finds one nearby but has to pay extra since it is not included in his mobility flat rate. He would like to share the costs and doesn't mind some company on his way home. Carpooling has become a very attractive option because people can share costs. Since it furthermore reduces air pollution and congestion, it is subsidized by the government and special car-pooling-lanes are reserved for cars with more than one passenger. The navigation system will notify the driver when there is someone close to his route interested in joining the ride. Soon after departing, Roberts gets a request from two persons just two blocks away and after checking their profile, he gladly accepts to take them with him. It is an Asian couple who has recently moved to Europe and is not accustomed yet to the HMI interfaces of cars here, which is why they prefer not to drive themselves. Although the EU is in negotiations with the Asian government, an agreement for global HMI standards has not been achieved yet. Since they get along very well on the ride, they decide to meet up again so that Robert can show them around in the city. By becoming friends in a social media network they can automatically compare their calendars to find a free date that fits both of them.

In the meantime, Ursula and her girlfriends are rushing to get ready for the bachelorette party. They have already requested a professional limousine driver service via telephone, which will bring them to a party for people aged fifty- and above. The driver arrives right on time and asks the party folks to sign up with their smart phones, smart watches or mobility cards. The introduction of the mobility card in 2020 is a major relief for the elder generations who are not used to smart phones. It enables the holder to conduct electronic payments for all mobility services (e.g. car sharing, taxi, flying etc.) and it has all the preferred settings of the holder preset. Ursula does not own a smart phone, thus, she uses her mobility card to have her favorite music always and in-car settings available (e.g. the configuration of the adaptable seat and air conditioning). The stereo starts to play "Dancing Queen" by ABBA and the pre-party is taking off.

The three women are having such a good time at the party that Grandma Ursula decides to have one more tattoo to eternalize her love to Heinz. She knows that there is one tattoo artist living in a problematic area where she cannot go with a shared car since most providers do not allow parking in such areas. Ursula and her friends still have the opportunity to take the bus. By

2025, public transport also serves the needs of premium clients by allowing them to personalize their environment with their mobility card or smart phone.

The three friends decide to stick with the bus. At the station, Ursula struggles to enter her data using the touch display, so she is happy that speech recognition and gesture control were already introduced a few years ago. Furthermore, it is very convenient that every ticket vending machine understands the same voice commands. She is using the environment search to find her favorite tattoo studio. Because it is her party, she invites her two friends for the ride and books three seats in total. After holding her mobility card to the NFC surface of the ticket vending machine, the ride is booked. Grandma Ursula receives a notification on the display that the bus will arrive within the next five minutes.

By now, many people use the public bus lines to efficiently reach their destinations. Bus lines are no longer fixed in advance, but depend on the destinations of the passengers. The navigation assistant calculates the most efficient route to all individual destinations, but also takes into account that people are waiting at bus stations to pick them up. The seats in the bus arrange automatically depending on the reservations that are received. A group of three seats is waiting for the women. They sit down and Granny Ursula is becoming more and more excited about getting a new tattoo.

Suddenly she receives a notification on the display in front of her that Robert's shared car is trying to access her phonebook. "Probably he is trying to contact all my friends", she thinks and grants him permission to access the cloud-based data.

Indeed, Robert just dropped off his passengers and was contacting some friends of Ursula he forgot to invite before. Unfortunately his arrival at home will be delayed by a few minutes because the City Traffic Management Center closed a large street on his way home, probably because of an accident involving an illegal car without proper car-to-car communication systems.

Finally coming home, he is greeted by Theodor who was timely informed by location tracking about his arrival. After having dinner and chatting a bit about school, father and son decide to take a short trip to visit Heinz since he needs their help on writing his romantic marriage vow. For Robert, it is an unknown route to drive at night. Therefore he is delighted to use the 3D navigation assistant, which guides him in a convenient way. On the road, Robert suddenly realizes he forgot to buy flowers and orders over the car. Thankfully a delivery truck will still pass the flower shop and Robert's home later tonight. He gets real time information about the order and will be able to deliver the package in time. Meeting Heinz the first time is a real relief for Robert because he seems to be a nice and caring man. They have a great time looking up romantic vows over the internet.

As it is getting late in the evening, the three of them are wondering where Ursula is, since she should already be back home from her party. Looking up her location on the internet, which is offered to family members, they see that

she just checked into a cab and is on her way home. As she arrives she proudly presents them her new tattoo: “Ursula and Heinz forever in love”.

### 8.1.2 Timeline

The following events briefly describe a plausible development (see figure 8.2) leading to a scenario where means of transport are not privately owned anymore and the user interfaces as well as the interfaces between devices are standardized to a very high degree. This standardization enables customers to switch between providers easily and have a high and seamless integration of their personal electronic devices into all kinds of vehicles.

Starting with the environmental zones in city centers today, the growing need for cleaner areas with fewer cars led many municipalities to encourage sharing and pooling of cars as well as to increase alternative means of transportation, e.g. by expanding bike-sharing networks and improved possibilities for park-and-ride. Building on the large success of sharing in cities, the Green Party soon included the promotion of sharing and pooling, even in suburbs and rural areas, into their program. As happened before with the anti-nuclear movement, this greatly increased the appeal and acceptance of this new perception of mobility.

At the same time, the implementation of standards for vehicle-to-x communication was driven by the increasing integration of cars into the digital life of customers as well as the growing necessity of cars to be more aware of their surrounding and to interact with it. The growing demand of customers for personal applications and more means of digital customization in their vehicles led car manufacturers to release APIs for their cars to third parties in 2018. Growing functionality of cars and pressure to offer standardized user interfaces to customers ultimately caused the emergence of two large competing operating systems for cars in 2019.

To counteract declining sales due to the growing importance of sharing and pooling and to augment their influence in this emerging market, car manufacturers increased their efforts to not only sell their cars, but to also promote them as part of mobility packages, e.g. by renting them out. For this purpose, they also bought various providers of rental and sharing services.

The growing political and societal pressure to promote sharing led on the one hand to the offer of mobility packages, which grant access to a variety of modes of mobility for a monthly fee. On the other hand, it resulted in governments restricting the number of privately owned cars in cities. In 2019, the first pressure groups demanded a complete ban of privately owned cars in the streets to further accelerate sharing and utilize economies of scale, especially on the sparsely-populated countryside.

The growing complexity of in-car systems and the frequent switching of users between mobility operators as well as manufacturer brands made standardized HMI design patterns necessary to decrease distraction from the road and

consequently reduce the number of accidents. Societal and political pressure on the industry ultimately forced it to agree upon industry-wide standards in 2021. For convenience of the customers, the same design pattern was also adopted by other modes of transportation such as trains and planes. Furthermore, cloud-based driver profiles were introduced to facilitate the seamless switching between different mobility providers.

Ultimately, the societal trend towards sharing and the growing clout of pressure groups led to a ban of privately owned cars in Europe.

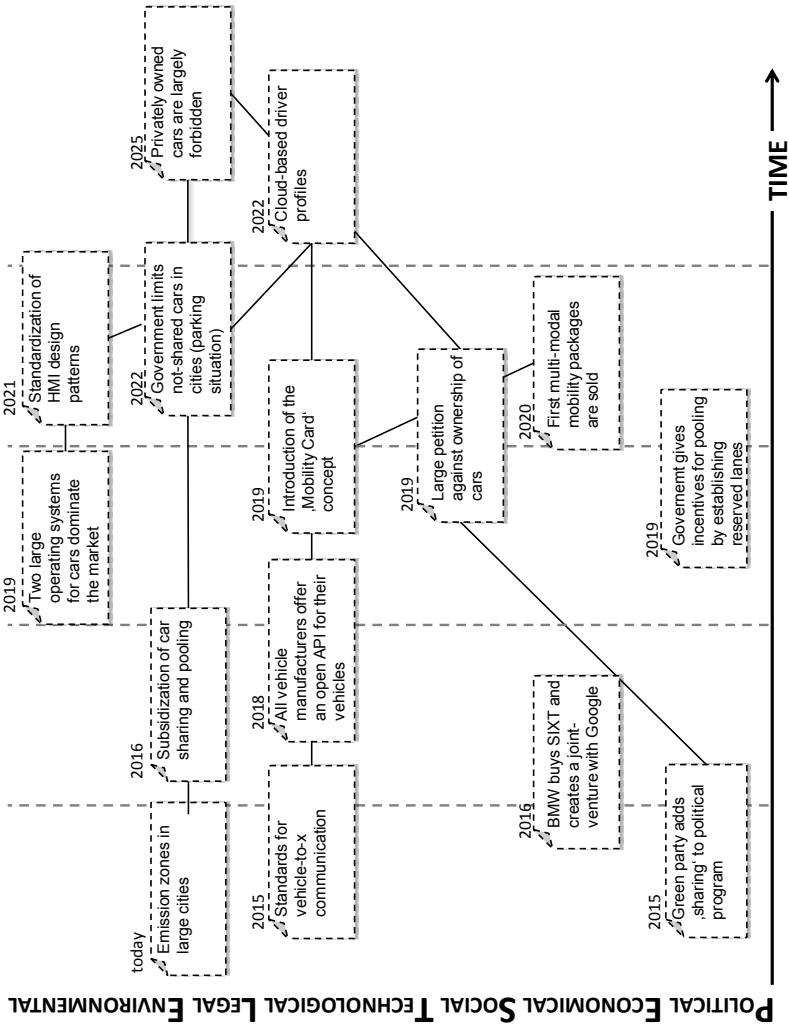


Figure 8.2: Timeline Communitied  
Source: Own illustration



### 8.1.3 Signposts

The timeline and scenario description depicted the way events could unfold and how the future could look like. The following signposts are a few general harbingers of this scenario.

#### **Acceptance of sharing grows continuously due to a better differentiation of services by customer segments**

The concept of owning means of transportation is becoming increasingly unattractive to consumers as sharing services offer a broader variety of mobility options for a smaller price and they are also expanding their operating area. As the market grows, it is increasingly feasible for providers to differentiate the quality and range of services offered to different customer segments. This, in turn, shows on the one hand the maturity of the market, on the other hand it enables the complete coverage of the mobility market as each customer can find mobility packages tailored to his needs.

Moreover, there will be a movement against privately-owned vehicles with the Green Party at the forefront. First petitions against private ownership of cars will be held.

#### **Car manufacturers prepare for business models based on sharing**

Today's car manufacturers will have to adapt their strategy to be prepared for the transition from being a pure production company to a mobility service provider. BMW will buy SIXT to gain their customer base and expertise in sharing. The high standardization allows consumers to easily switch between different vehicles of different manufacturers, which will lead to a declining brand awareness. To counteract this development, Audi will focus on enhancing the attractiveness of its drivers club, offering additional services such as organized road trips and concierge services. This will transform the industry from a sales-based into a service-based one.

In 2025, everyone will have his own cloud-based driver's account or his own mobility card. This enables the seamless portability of all important information such as the calendar, preferred driving settings and favorite music to all means of transportation. Thus, the requirements for in-car IT systems increase radically. They need to be able to manage and process all the data of the driver, other passengers, surrounding cars, the environment and of further service-providers (e.g. airlines offering check-in on the go). Furthermore, a large amount of information needs to be presented to the driver in an understandable and intuitive way. Thus, car manufacturers will need to form partnerships with large IT companies in order to obtain competencies in the fields of database management, search, real-time communication of devices and development of adaptive algorithms to cope with the emerging challenges.

**On-going standardization in the mobility market**

A precondition for the success of sharing services is that they are easy to use and that switching between different providers does not create a big hassle, since single companies will not be able to meet all customer demands. Standards will be set for vehicle-to-x communication to enable communication between vehicles as well as between cars and third-party devices. This, for example, enables to access shared cars of several providers via one interface, which increases the usability and comfort substantially.

The establishment of large strategic partnerships between players in the automotive sector and the information technology (IT) sector will result in a couple of cross-company operating systems (OS) for vehicles on the market.

**Government promotes car-sharing by limiting privately-owned cars in cities**

Policy makers will aim to relieve the road infrastructure and the environment by promoting sharing and pooling services, since they have the advantage of a higher utilization of their vehicles. The geographical extension of environmental zones in major cities will rise and the number of non-shared cars in cities will be limited. Eventually, this will result in a ban of privately-owned cars in urban as well as in rural areas to further promote the mentality of sharing and to be able to utilize economies of scale, especially in the countryside. To promote vehicle sharing, policy makers will subsidize it, e.g. by granting free parking spots for shared vehicles.

## 8.2 Scenario II: Car.me

Scenario Authors: Rohit Bisani, Daniel Endler, Paulina Lewandowski, Erik Muttersbach, Orest Tarasiuk, Michael Wax

The second scenario, “Car.me”, is characterized by a high degree of standardization and a very limited acceptance of sharing. To give an impression of what this extreme world might look like in 2025, the story of family Jones that travels to Italy will be described in the following.

### 8.2.1 Scenario Description

The second scenario, *Car.me*, is characterized by a high degree of standardization and a very limited acceptance of sharing. To give an impression of what this extreme world might look like in the year 2025, the story of family Jones that travels to Italy will be described in the following.

It is August 15th, 2025, and family Jones is just about to finish their preparations for their summer vacation. The packing list downloaded from their home network is being read aloud by Mum Jones’ I-Device. The I-Device is an ID and a user interface used to connect to the cloud. Processing power and data storage is not being realized in mobile devices anymore.

Mum Jones is checking the trunk for relevant items. Just before she finishes packing the car, it triggers an alert: the packing list does not match the weight that the suspension of the car detected. The weight of the packing items was analyzed by comparing the packed items with generic weight assumptions available from the cloud. Papa Jones snorkel equipment or five pairs of little Johnny’s socks are missing. But who added a snorkel to the list?

Mr. Jones still has to visit a new client on the day of departure. This is extraordinary, as in general he works from home: his work station is fully integrated into the company’s IT infrastructure. Therefore, the family has decided to move to a larger and more comfortable house in the suburbs of the city. Mrs. Jones does not even miss the shopping centers since most products are delivered directly to their home anyway.

Mr. Jones works in a sales department that offers tailored mobile app solutions which seamlessly integrate with the standard API in cars and other devices. Most clients are handled per video conference, but new and upper tier clients are still approached in person.

On the way to the new client, Mr. Jones is already looking forward to the vacation with his family. In fact, Mr. Jones decided to combine comfort with necessity and since Mr. Avanti, a tier-one client, is one of the most important

Italian stakeholders, a personal visit is mandatory.

Earlier in the morning, when thinking about the Italian *bella vita* and the upcoming time on the beach, Mr. Jones had told his I-Device he wanted to know the current water temperature and the weather forecast for the next three weeks. “I haven’t been snorkeling for way too long!” he had sighed, after hearing that the water will have astonishing 24°C. This had been instantly recognized by the I-Device which had checked the packing list in family Jones’ cloud storage and, having realized that there was still luggage space available, had subsequently added the snorkel equipment.

To manage the trip, Mr. Jones uses the new integrated travel management software, an interactive application that combines various means of travel in order to schedule the optimal trip, considering comfort, time and cost. Since Mr. Jones does not want to sacrifice his travel comfort, the easiest way is to begin the journey with his own car. In fact, he used to travel with those ancient car-sharing vehicles that had been really popular for a while. However, ongoing issues with privacy, safety and vastly negative press had lead Mr. Jones to canceling his subscription: “You never know who has been in the car before, and certainly not what they did there”. To Mr. Jones, as to most of his friends, an own car is very dear; after furniture and housing, it is the third highest expenditure in his life. Therefore, it must ensure individuality, comfort, and also display the social status.

Since car traffic delays are a significant problem in 2025, the travel management app suggests to take the train from a nearby station to Italy. Train riding has recently become more and more popular. Transrapid connections between the most important European cities have significantly helped to shift the demand to train connections. Due to high travel speeds, a journey from Munich to Rome, for example, takes less than four hours. Adding the fact that the passenger does not need to pay attention and that traffic jams can be avoided, trains have become the fastest and most reliable long-distance travel option.

Moreover, the application recommends to park the car at the train station. This option used to be very expensive, but nowadays, cars can be parked for free as long as the owners agree that their batteries will serve as an energy storage for the local energy provider – due to increasing regulations for emissions, more and more cars are either hybrid or fully electric. The reason for this regulation is the problem of satisfying high energy peaks with renewable sources – solved by a grid of parking lots. The advanced *park & ride* model hence is a big step towards the sustainable integration of alternative energy. This same concept has also been introduced to airports with the so-called *park & fly* model. Here, the situation suits the needs even better because parked cars remain in the lot for several days.

For the time that the family is on vacation, Mr. Jones has booked a full service check that nearly every local shop can provide. Their car will be in an

outstanding shape and, to Mrs. Jones delightfulness, a new color theme will be available when they return.

In fact, Mr. Jones and his son had been in favor of the NY Giants fan decals because the football season starts in just three weeks, but their vote had not stood a chance against the *Blanché Almond*, the theme chosen by Mrs. Jones.

The train trip will be carried out in a cabin that can be used for work, e. g. for conferences and workshops, or for entertainment, as with family Jones. The cabins support a standardized connection to either a workstation or a mobile media device. This train cabin model can be financed due to smart and tight scheduling as well as the customizable arrangement that allows to change the number of seats per cabin arbitrarily between two and twenty.

Still trying to figure out if it is the snorkel or the socks that are missing, Mrs. Jones is talking to her sister via her I-Device. She has called her to find out if her sister got any recommendations for media entertainment for the travel time and was mainly looking for new movies to watch. Just minutes later, her recommendation, an old movie titled *Hangover VII*, is directly pushed to the I-Device which can now stream it to the car and train entertainment systems.

Finally getting annoyed, Mrs. Jones asks her I-Device about who added the snorkel to the list. Being told that it was her husband, she calls him immediately after seeing that his meeting has not yet begun: “Hey, Darling! It is a great idea to do some snorkeling in Italy, but where is your equipment?” “Wait, let me see” – he asks for permission to see through her digital glasses which she grants him using her I-Device – “see there, behind the green luggage...” “Oh, I see, thanks!”.

Overall, the trip to Italy costs about half the price that a normal trip by car would have cost them ten years earlier. At first, Mr. Jones has checked for better discounts when looking for restaurants and hotels. Community ratings have overcome the importance of official travel guides. New restaurants and hotels lure new customers to get a critical mass of recommendations and online scores. By this, Mr. Jones will be able to tell his friends about the fanciest places in Italy after visiting them.

Moreover, the trip has become a little subsidized by Mrs. Jones’ cleverness: She has sold the outer appearance of their car to [www.WeAdvertiseOnYourCar.com](http://www.WeAdvertiseOnYourCar.com) for the duration of their journey. Usually, she does not like to admit that she is running for bargains in front of her friends, but when the car is just standing in the parking lot, she gladly takes the money.

So at last, it seems that all the travel arrangements are successfully accomplished. The I-Devices are being quickly synchronized between family members and the current recommendations for vaccinations are being checked. Happily, the Jones family is already vaccinated, but if it had not been the case, the required medicine would have been ready for them in the train.

Now it is time to leave! Mrs. Jones orders the car to drive out of the garage autonomously. She has never really liked to drive out of the tight garage, mainly

because she was afraid of her husband's complaining about scratches. And besides, garages and parking lots are so narrow nowadays that managing the parking on your own would be a nightmare.

When the car is set up and ready to go, little Johnny asks if he may drive. Even if he is not old enough, their family decides that is never too early to learn how to drive a car – in case of an emergency, the security system would override the driver's actions anyway. “So moving to the right with an open hand means turning to the right. But, Mom, why do I have to open the hand? Is it really that important?”, “Remember, open hand movements are used for driving, and the closed hand is used to control the entertainment system. It's not that hard to remember, just try to skip this song...”.

This way, family Jones manages to perfectly organize and easily conduct their journey to Italy, being able to use all of their time to fully enjoy their vacation.

## 8.2.2 Timeline

The following timeline depicts chains of events that could lead to a scenario of advanced standardization in the automotive industry, yet no mentionable market for car sharing, in the year 2025.

The origins of the standardization initiatives are the car manufacturers themselves, who increasingly realize that standardized interfaces bring multiple advantages and help cut costs. This enables different manufactures to use the same parts of different parts suppliers. This results in a decision to create the Global Automotive Standards Organization (GASO) in 2013 that then assists manufacturers and oversee compatibility compliance by the participants.

Such an event has multiple consequences: in 2016, a first standard interface for communicating between a car and users mobile devices is established. Moreover, all large car manufacturers have to adhere to standards affirmed by international law by that time.

Independently of GASO, a data leakage in the ShareNow car sharing service occurs, resulting in the current location and past routes of all customers to be publicized. This causes leads to major distrust with the privacy of car sharing companies. Moreover, in 2019, the German government completely prohibits the use of GPS-enabled devices in shared cars as privacy concerns accumulate even further. This move additionally weakens the car sharing market, which – combined with safety problems and high maintenance costs as well as new legislation allowing for autonomous driving in 2022 – leads to a rapid decrease of profitability and, ultimately, the disappearance of the market in 2025.

At the same time in 2016, due to increasing environmental problems, a new international Euro-7 regulation is enacted, restricting car emissions even further. This action likely accelerates the transition from combustion to electric engines producing no emissions; these reach a percentage of 25% by the year 2022 and

subsequently lead to the creation of big parking lots used as grid energy storage in order to accommodate for energy demand peaks in 2025.

In 2019, the technology advances as far as to enable the vast majority of German population to utilize a reliable and high speed Internet connection, the Long Term Evolution (LTE). This development enables the standardization of APIs in 2022, enabling users to access personal data stored online in the cloud. This then leads to the car appearance adapting to users personal settings stored in their mobile devices in the year 2025.

A more far fetched consequence of the creation of GASO is the political acceptance of new gesture control standards in 2022, as gesture control systems could be jointly developed by cooperation committees, of multiple manufacturers and a common standard could then quickly be devised and tested. The consequence is the incorporation of gestures into driving exams.

In conclusion, there are multiple interconnected chains of events that could lead to the scenario described above.

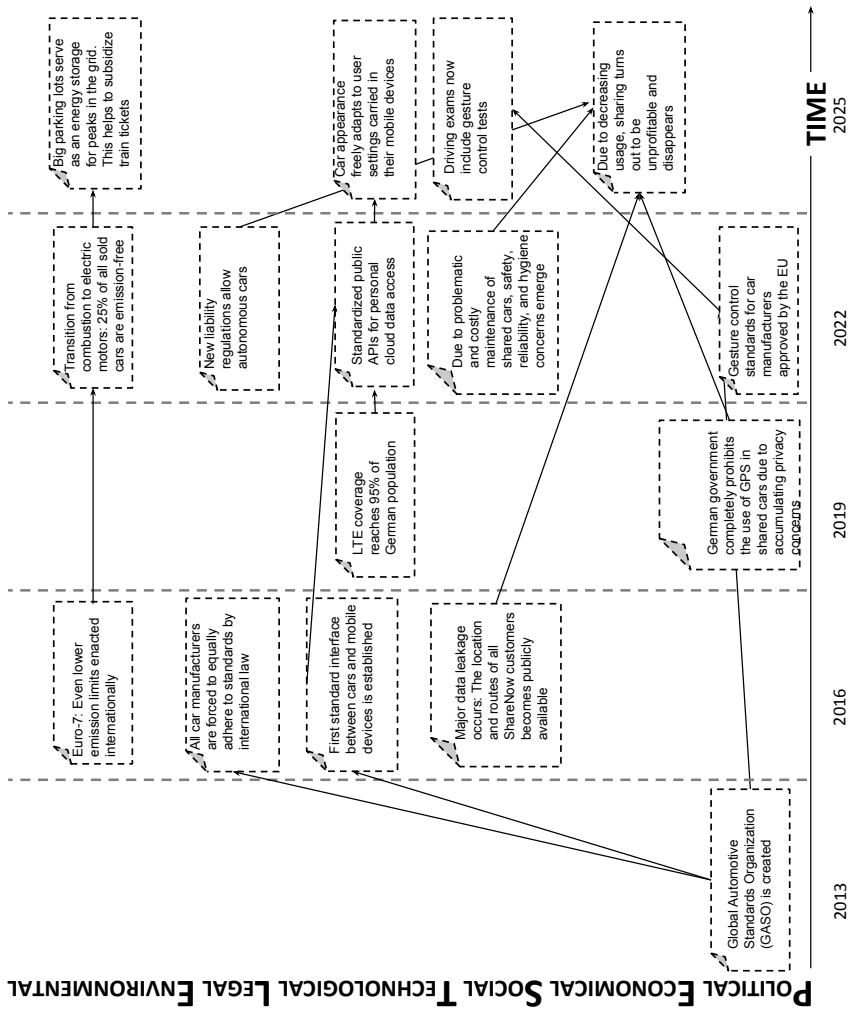


Figure 8.3: Timeline for the Scenario “Car.me”

Source: Own Illustration



## 8.2.3 Signposts

### Standardization of Center Console Control

The formation of standards either by automotive consortia, by governments or by consumer organizations is seen already. It will no more be a herculean task to get used to controls in any car. Users would no longer have to search for the almost randomly placed rear window defogger button, which is sometimes integrated with the HVAC controls, or with the control of external mirrors.

Standardization helps a user to know where to find the required control. For example, gesture control can be used without worrying about the manufacturer of the car. Driving lessons includes instructions on how to use the center console without the driver being distracted. BMW and Audi place the console control panel between the front seats in most of the variants. The idea behind this is to make consumer comfortable with the entire fleet of the manufacturer.

Hunting through menus looking to connect your phone with the car will be a thing of the past – because of standardization, this can be taught in the driving lessons. Advanced features which are not in every car also have a known hierarchy of menu items.

### Forming of Interface Standards

This section describes a scenario in which integrating cars with infrastructure or other devices is standardized. Integrating devices like cell-phone, tablet, laptop or any other personal device with the car will be as easy as bringing the device into the car. It will be possible to stream the display of any smart device onto the console display. As an example, a car would be able synchronize the calendar from the smart devices so that the car knows where it will be and which route it should offer based on information from a central traffic controller. It will use augmented reality to pass this information on to the driver. It could also suggest where to do the necessary break for re-fueling or recharging in the journey.

Long Term Evolution (LTE) would be available in 95% of Germany by 2019, which bolsters cloud data access. There will be standardized APIs for personal cloud data access from various social networks to enhance driving experience. A standardized interface from the I-Device (described in the scenario) will ensure availability of cloud processing power and cloud data storage.

There will be standard plugs all over the globe to charge electric cars. The connection of devices within a vehicle would be standardized so that any personal device could be connected to the car and to one-another. The signs are already visible as wireless charging is reaching the consumer market. There will be challenges to reach this scenario. One possibility is that the I-Device is hacked granting access to vehicle controls and personal data. This would be taken care of by the use of advanced encryption. Not only technical challenges but also political challenges could arise. It might be a great challenge to bring different

standardization committees around the world to agree on a commonly proposed standard.

By 2022, standardization of interfaces and controls would pave the way for the introduction of liability regulations for autonomous cars to the consumer market.

### **Total decline of car sharing**

A number of factors contribute to the decline of car sharing. Firstly, cars will be prominent status symbols and the concept of sharing does not get enough users. The number of users will also decline as cities will get busier and potential customers do not have the time to plan for car sharing or to find a car sharing service when needed. This is because shared cars are usually spread around the city and it is not guaranteed that a shared car is found in the neighbourhood of the consumer. Secondly, there could be a major personal data leakage from a car sharing company causing a lack of trust in the service. Thirdly, around 2019, as privacy concerns raise, governments could prohibit the tracking of shared cars. Questions will be raised on protection of personal data in shared cars. These factors combined, will lead to bankruptcy of car sharing companies and eradicate them from the market. Consumers then prefer personal and individual means of transport over sharing services.

### **Alternative Mobility will be on the rise**

The increasing discovery of alternative and renewable energy sources and the improved efficiency of vehicles will lead to a steep fall of fuel prices. Governments will financially incentivate privately owned means of transport instead of investing in public transport. This will be primarily because of the abundant availability of renewable energy and the falling fuel prices. While the environmental concerns will be taken care of by introducing stricter norms to lower the emission limits even further, investments will be made to develop the infrastructure so that individual mobility does not cause traffic congestion. Companies are already investing heavily on alternate mobility like electric, hybrid or fuel cell cars. This is an indication that alternative mobility will gain significant ground.

## 8.3 Scenario III: Autonomy

Scenario Authors: Gilles Backhus, Ignaz Forstmeier, Can Kaya, Klemens Mang, Simina Pasat, Fabian Steiner

The following story describes a scenario in the year 2025, where there is no vehicle sharing and a low degree of standardization in individual mobility. The scenario is about a typical family living in the suburbs and about their daily life routine. It describes how humans will manage their daily lives in the future. The main character is Paul, a business manager, and his family - his wife Anna and their son Michael.

### 8.3.1 Scenario Description

It's a beautiful Friday morning at 6:30 AM when Paul wakes up and gets started with his busy working day. He quickly gets ready in order to accomplish all of his objectives for today. Unlike her husband Paul, Anna does not need to pay attention to the alarm clock - today her appointments start later than usual and she can stay in bed for another hour. So Paul has to get up and prepare breakfast for himself and his son. Michael also needs a ride to high school and today this will be one of Paul's duties. Taking Michael to school annoys Paul a little - not because he does not like to care for his son, but rather because he usually drives his one-seater electric car to work. Today, however, he has to attach the van module to the car, making it wider and a tiny bit more clunky to handle. Paul really loves his recently bought car because it offers him so much flexibility. He can adapt the vehicle to each situation and it totally fulfills his needs. For instance, he can use his single person module for driving to work and entering crowded inner city areas. However, due to his family's needs he also decided to acquire the van module with which he can extend the space and passenger capacity of his vehicle on the fly. Such vehicles became really popular in recent years due to people's high need of flexible mobility .

After breakfast, father and son are finally in the car and ready to leave. During the drive, Paul cannot withstand to enjoy the nice interior of the car, perfectly tailored to him. Even the interface and controls are customized to his preferences. After all, it was a really good idea to change from Manufacturer A to Manufacturer B. Only Manufacturer B supports the perfect integration of his favorite xPhone and offers speech control with fully customizable voices.

During the ride, Michael starts talking once again about a wish he has for his upcoming birthday - his own car. Sometimes Paul thinks that teenagers nowadays have nothing else to think about. His son always talks about how badly he needs his own vehicle to stay mobile and that all of his friends already

have their own vehicle, with their personalized on board systems and their favorite music sound stations. Though this repeated conversation bothers Paul, he has actually considered it to be a good idea to buy a small car for his son, particularly due to governmental subsidies for small cars nowadays. This would also save him some time, because he would not have to drive his son to school.

After dropping his son to school, Paul is finally able to gather his thoughts for his important meeting at work today. While driving towards the office he is notified by the navigation system that there is a high amount of traffic in the city and that only one person vehicles are allowed to enter the city center. Fortunately, the GPS quickly recalculates the route and suggests switching to the premium railway service offered by his car manufacturer. He has premium membership and this allows him to comfortably use the public transport for reaching the city center. This service was another reason for choosing Manufacturer B, due to its great ecosystem of unique and flexible premium services offered. The partnership between Manufacturer B and the premium local public transport and railway company had a huge impact on making his choice.

After arriving at the train platform, Paul's car automatically authenticates with the train's system. Since the car already registered Paul as a passenger of this trip, the train system accepts him and his vehicle and they are being docked into the train. Paul loves it and remembers reading about this innovation a few years ago. Wasting precious time in traffic jams was the thing that annoyed him most in his daily life. With the promotion of single person vehicles and massive road infrastructure changes, like narrower and therefore more road lanes, the traffic improved considerably in the past few years. Nowadays, he enjoys driving into the city with his own car, but today Paul had to change the plan. On the other hand, public transport is not so bad either - especially because during the train-ride his car is also maintained and the battery is charged. Additionally he is able to relax a little and to clear his mind and to clear his mind before his important meetings.

While waiting for the arrival at the destination, Paul decides to read the news and work a little. Therefore he activates the personal office mode in his car, which changes the car's interior design to his favorite working settings. In addition, a small desk with his most important working tools is presented and the board computer changes to office mode as well. This enables him to access his documents saved on Manufacturer B's cloud. Fortunately his employer supports this kind of cloud service and therefore he is able to access his business data in the car.

Paul opens the newspaper app on his board computer and he is not surprised to see another article about the ongoing patent war between Manufacturer A and Manufacturer B. For nearly 5 years they have been suing each other about stealing each others innovative products and business ideas. Manufacturer B claims that Manufacturer A used its protected technology and that it stole

their innovative driver emotion recognition software without paying any patent fees. As such disagreements are nothing new in today's world, Paul closes the newspaper app. He decides to continue preparing for his work tasks today. With all the rush in the morning he could not eat much, so he cannot focus on work. This is not unnoticed by the board sensors of his car, so he gets a notification about today's menu offered in the train. The menu is fully personalized to his preferences - meat dishes. Sometimes he even thinks that his car knows him better than his wife.

In the meantime, the train arrives to the city center. Big vehicles are restricted to enter the city center, so he has to leave the van module at the train station. He just loves his car - the modules are removable in a blink of an eye. The extra module is stored in the high-tech underground garage. The interior design and functionality is changed once more, disabling the augmented reality displays in the side windows, which are designed for co-passengers. All this is done automatically - he does not have to do anything.

Paul is now ready to drive the last miles to work. On his way he decides to turn on the autonomous driving mode, just to feel some comfort. Driving in this crowded urban areas gets so boring! Unfortunately he also encounters some traffic jams. This situation reminds him of some article he read some days ago - the traffic flow could be further improved by 50% if cars of different vendors would incorporate a general standard for cross-vendor vehicle-to-vehicle communication protocol. However, car manufacturers rather stick to their own standards. This annoys Paul - in the end, it is the client's needs that matter, not the "war" between manufacturers.

This time he is lucky and arrives within a few minutes at his office. To park his car he drives to the parking platform, which registers his vehicle and activates the elevator. The elevator moves Paul's car into the underground parking garage, directly onto his reserved spot. Paul is still fascinated by the giant parking garage with numberless underground floors - something unheard of when he was young. While going upstairs to his office, Paul cannot help but notice his boss' car with its fancy exterior design. "Such a poser", Paul thinks. He feels very happy with his small electric car, and although he drove his son to school, traveled by train and again by car he managed to get to his office in time, fully relaxed. The frustration caused by waiting for hours in traffic jams on his way to work is a thing of the past.

After work, Paul feels really tired. Fortunately his important meeting today was good and he was glad he used his time on the train to prepare for it. Paul has no more energy left, but still wants to enjoy the time with his family in the evening. Therefore, he decides to sleep in the car and let the vehicle drive by itself. Therefore he activates the relax and sleep mode in his car, which again adapts the interior design and user interface. The seat is repositioned, the lights are dimmed and relaxing music plays in the background. The system also changes its notification settings and will only notify him in case of emergency

situations.

Finally waking up at home, Paul is really happy so see that his wife Anna has already cooked dinner. After the nap he had on his way home, he is looking forward to enjoy dinner with his wife and talk about their day. Anna's day was nothing special, but she is really annoyed by her new smartphone. Although the design is really nice and it looks beautiful, the device is not compatible with her car. She cannot use functions such as push-to-talk or charge the phone in the car. Car manufacturer C does not support integration with her device. In the end she decided to return the phone - she cannot afford wasting her precious time. She wants to be able to work on her way to the office, and therefore she relies on using her phone in the car. The in-vehicle work space is her second office and accessing the work files stored in the cloud saves nearly one hour daily. Paul reminds her that before Michael was born such in-car offices were unthinkable and that she should be grateful as their lives improved greatly over the last years. He claims that these ecosystem constraints and limitations are really annoying for everybody, but they will still have to cope with them for a while.

It is almost 10PM and Michael calls his parents - he needs a ride back home from his friend's place. Paul decides to take his wife's car, so he does not have to assemble his modular car. While entering the car, he feels really uncomfortable - the seat was manufactured to fit Anna's stature, the controls are totally different and he does not even remember how to turn on the wipers, although he had lessons for driving this car as well. After picking up Michael and getting home, he will talk to his wife - Michael needs his own car - in the end, everybody will have their own.

### 8.3.2 Timeline

This timeline represents a possible flow of events, starting with the current year 2013 and ending in 2025. The direction for which individual mobility is heading is one without any sharing and standardization. The timeline considers different aspects, namely technological, socio-economical, environmental and legal aspects. For a visual outline of the flow of events, refer to figure 8.4

In the year 2013, first signals for strong individualism regarding mobility appear - at the Geneva Motor Show, important car manufacturers present prototypes of one or two-persons vehicles, most of them electrically powered. Toyota makes its debut by introducing the i-ROAD, a personal vehicle providing flexibility in urban areas, powered by a lithium-ion battery which offers mobility for up to 50km [356]. Tesla Model S is the electric car with the highest range - up to 400km with a single battery charge [354]. All over the world, pollution is becoming a severe problem. In cities like Beijing hazardous levels are reached [360]. As opposed to developed countries, owning a car becomes a status symbol in emerging markets [358].

While companies like DriveNow or ZebraMobile are providing services in the inner area of big cities, people living in the suburbs cannot take advantage of them [353]. Furthermore, the costs involved in driving such vehicles for larger distances are too high. By 2016 insurance companies will declare great losses due to accidents caused by shared cars or poor vehicle treatment attitudes of customers and therefore will deny insuring shared vehicles. In an attempt of attracting new and keeping old customers, companies will invent new business models by 2017, based on peer-to-peer car sharing. In spite of these attempts, customers will show an aversion towards car sharing due to a lack of flexibility and by 2021 this industry will slowly face an end. Therefore the modular vehicles presented at the Geneva Motor show in 2016 will enter mass production.

Although in-car apps provide a great advantage to the driver and third parties are excited about developing for new platforms, major car manufacturers decide by 2018 that it is too costly to manage app store contents. All the apps have to be checked in order not to compromise the safety of the driver and not to distract his or her attention. Subsequently, the costs are too high and the margins too low. Some car manufacturers realize that managing the app stores is not their responsibility and state that third parties should be held responsible for the developed apps. However, until 2020 this issue will be regulated by law - car manufacturers will be allowed to have an app store only if the content developed for their platform is properly checked and later offering app stores will be forbidden for external developers.

Electric cars will truly take off and by 2018 such vehicles will have a reach that no longer serves as valid criticism. An electric infrastructure inside mega cities will be mandatory. This new electrical infrastructure will offer automated parking spaces in order to encourage multi-modal transportation and minimize congestion while still promoting the ownership of individual vehicles. For instance, they will enable individuals to switch from their “highway” cars to city vehicles, such as one-seater electric cars or e-bikes. Starting in 2019, emission free zones can be entered only by using public transport or the previously mentioned urban electric vehicles or bikes.

As a result of regulations regarding the APIs, by 2020 no platform for developing car apps will be open for external developers. This will keep innovation within closed ecosystems. With the lack of standardization of physical interfaces car manufacturers will sign strategic partnerships with other companies, such as smartphone providers. Car manufacturer will bring on the market new concepts of user interaction and furthermore they will be able to file patents for their own gesture controls. In 2025, the Vienna convention regulations will be obsolete and they will be drastically changed. For instance, the steering wheel that was considered a mandatory part of the car will be optional, as a result of various new technologies of controlling vehicles. All these proprietary technologies and means of interaction will make switching from one car to a car from another manufacturer really difficult. By 2025, brand-bound training will be required.

As a result of the increased environmental awareness on political levels companies will receive tax deductions for offering one-seater cars to their employees. This, along with the new infrastructures for electric cars, will lead to small electric vehicles dominating the market, reaching 60% of the sales. Modular vehicles will enable the customer to use their vehicle for different scopes and will help keeping the CO<sub>2</sub> emissions low and reducing the average space per car within inner city areas.



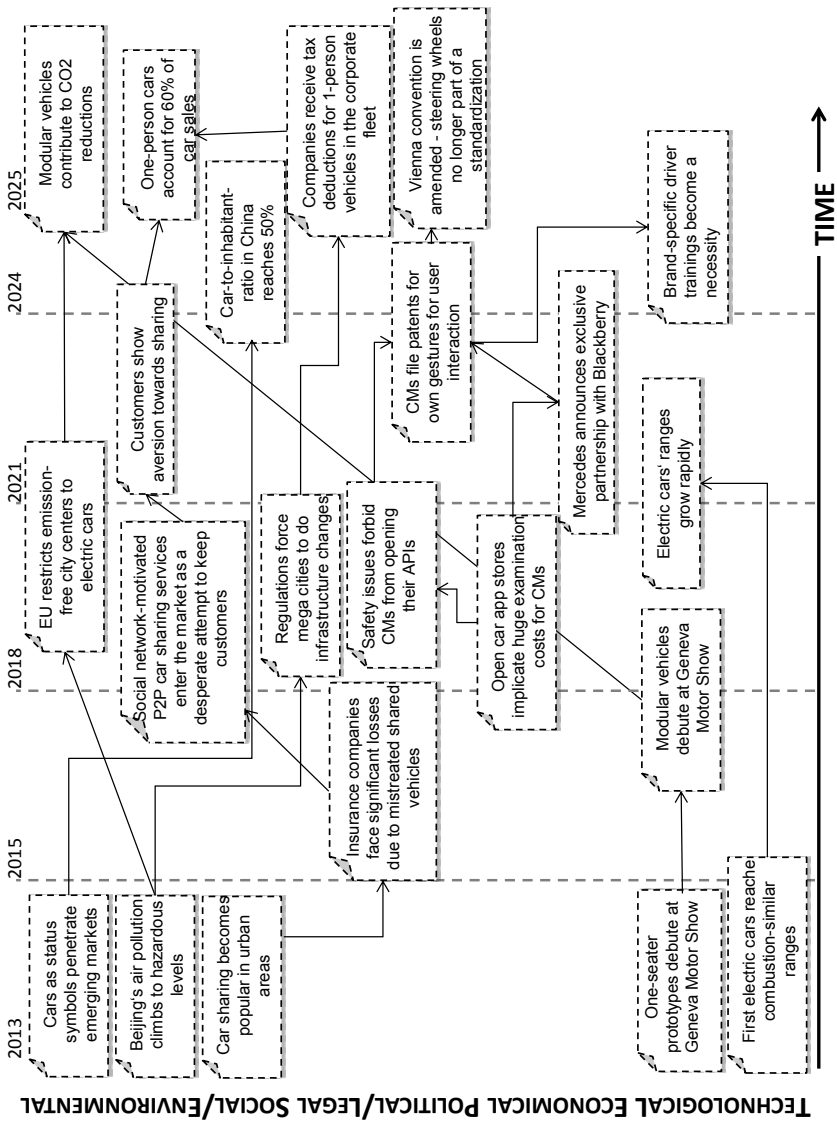


Figure 8.4: Timeline for the Scenario “Autonomy”

Source: own illustration

### 8.3.3 Signposts

In this scenario only minimal sharing of means of transportation and a very low level of standardization are assumed.

#### **Closed Standards**

Standards do not emerge through negotiation but rather imposition. Standardization does not happen as the result of cooperation between different actors with affected interests on equal footing, formalized in associations, consortiums, expert committees and the like in the form of a negotiated compromise. Instead standards are determined by few big players using their market power to establish proprietary solutions as de facto standards. Multiple standards solving a similar issue are likely to coexist and contest each other. A perfectly possible outcome are opposing groups of standards which compete for market shares and engage in fierce cutthroat competition.

#### **Innovation within closed Ecosystems**

Instead of opening up their ecosystems and increasingly relying on the input of short-time partnerships, loose cooperation and agile development strategies, companies strive for maximum control over their innovative processes. This is also because managing an app store is very costly - they have to check all the external developed car apps, as the lives of passenger highly depend on the system they are providing. Thus, they cannot afford to rely on unverified third-party apps. The biggest parts of their investments are therefore for in-house projects, which are also the source of the strongest impulses that push progress forward. Big players foster strong and close ties to suppliers and smaller partners in their respective market segment. Substantial financing support for start-ups working on solutions with potential benefits for individual companies are commonplace. By contrast, there are only few cooperations bringing together competing major companies.

#### **Exclusive Partnerships**

Cross-industry partnerships bring together service providers and manufacturing producers for exclusive cooperation. Strategic alliances providing deeply integrated solutions prevail over platforms unilaterally opened for third parties or even the public. Clusters of strong, cooperating brands which supplement each other allow for well planned synergies in long-term partnerships. They make use of proprietary, closed standards and create strong vendor lock-in effects. Consumers strongly identify with brands, customer loyalty is high and crucial for many business models.

#### **Customized Production**

Customization does not only imply that customers and consumers can choose from a variable range of options offered by manufacturers or service providers. The absence of a strong compulsion towards unification on the industry level

and a high value attributed to personal, individual ownership gives manufacturers the opportunity to offer products which are in parts custom-made. What started with engravings, individual color schemes and some optional paid additions by the turn of the millenium evolved to customization all along the chain of production. The combination of a vast pool of customization options to choose from with the possibility to individually tailor specific customizations according to individual customer wishes provides for truly unique vehicles. Possessing means of transportation which are without identical counterparts clearly satisfies their owners need for individuality and makes their vehicles strong status symbols.

### **Small Modular Vehicles**

Confronted with increasingly overused infrastructure and its consequences such as traffic jams the industry has come up with small and energy-efficient vehicles, which can be modularly extended. This also provides an answer to the customers reluctance to use shared means of transportation and their concurrent need for flexibility in terms of adaptation of the vehicle to changing circumstances. Efficient four seater for daily use, slim roadster on weekends and caravan for trips and holiday. Instead of using several different own or rented vehicles on different occasions, customers purchase a small, basic vehicle which can be complemented with specialized modules.

## 8.4 Scenario IV: Shared Patchwork

Scenario Authors: Michael Chromik, Florian Hillen, Vlad Lata, Matthias Salomon, Anna-Catherine Schwarz, Vincent Sitzmann

The following story describes a scenario in the world of 2025. This scenario is driven by a society focused on sharing means of transportation. Further, a low degree of standardization is prevailing. In order to better understand how these drivers shape the world of 2025, a real life situation is painted. The protagonists are Max, a 22-year-old student of a technical university and Lisa, the CEO of a mobility provider. The events and timeline that led to this development will be described in section 8.4.2 and section 8.4.3.

### 8.4.1 Scenario Description

It is 8 am in the morning on a warm summer day in 2025. The alarm rings and the protagonist Max starts into his day. After leaving his apartment located in the suburbs of the city, he takes the bus to the big parking places just outside the city. After laws were introduced that prohibit the individual ownership of vehicles, the only ways to be mobile are vehicle sharing and public transportation. With his personal device in his hand, Max has to pass about 50 different cars from the more than 25 different mobility providers before he finally discovers the car displayed on his car-finder app.

He opens the car with his fingerprint and immediately the car adjusts its rear view and side mirrors, the driver's seat and the position of the wheel automatically to Max's saved preferences. Furthermore, also his personal information, like music, telephone contacts and his previous navigation destinations are streamed to the car's user interface. Finally, also the front dashboard of the car, which is in fact a large tactile display, is individualized to Max's preferences. It displays information like speedometer, tachometer, navigation and multimedia system.

On the way to university, Max activates the virtual car assistant via speech control, which reads out the latest messages from his favorite news channel. He is not surprised to hear that yet another new mobility provider entered the market, introducing new technologies that push HMI and driver experience to the next level by introducing eye-controlled steering at a very compelling price. As over the last few years the vehicle industry reached a point where there is no standardization of any kind, the velocity of incremental and disruptive innovations has increased dramatically. Since all the different vehicle manufacturers do not have to meet legal requirements or industrial standards anymore, they can focus on the real needs of their consumers. Thus, they produce new compelling

mobility concepts on a weekly basis. “Shall I change my provider again? This would be the sixth time in the last three years. It takes ages to compare and get used to the different services. The price models are so complex. But I could save a lot of money”, Max thinks. With a quick hand swipe Max changes the dashboard layout to check his efficiency value, a score which evaluates the efficiency and safety of his driving style. The higher this value, the less he has to pay for his mobility service. This is also a result of the new mobility legislation, passed four years ago. Max is still stunned by the high impact of the “sharing only” policy on his daily life. Not only are there far less cars on the streets, but also the streets themselves became much narrower. This allowed for more green areas and bike roads to be built throughout the city.

After half an hour, Max finally reaches his university, late as always and in desperate search for a parking spot. He regrets once more not being able to afford the premium mobility subscription as it would enable him to use every available parking spot.

It is 7 am. Lisa, CEO of a premium mobility service provider, wakes up and begins her tightly scheduled day. Being a customer of this provider’s premium mobility subscription herself, she enjoys the “mobility guarantee”. This service distinguishes premium mobility providers from regular providers. Next to having access to a variety of different vehicles like cars, bikes, buses, trains and even ships, the provider ensures that those transportation means are available at any time. Furthermore, they are seamlessly integrated so that the customer only has to declare his destination. Everything else is organized and planned by the provider’s service. This means that Lisa does not have to look for the car, instead the car is already waiting for her in front of her apartment. When approaching the car, a little chip in her personal device automatically opens the car. The trunk is also opened as the car knows from checking Lisa’s schedule that she will bring her yoga equipment for her after work’s yoga session.

As time is short and running, Lisa already begins to work before she arrives at work. This is possible due to the autonomous car fleet of the premium provider. The missing standardization and absent vehicle-to-x communication standards lead to the fact that those cars have to collect and process all the needed information by themselves - this makes them very costly and thus only viable for premium mobility. While relaxing in the comfortable seat, the virtual car assistant reminds Lisa of the first team meeting starting in about five minutes. With a small nod she agrees that the car should drive by itself. The seat moves back, the steering wheel disappears, a little working table pops up and the interior is illuminated. The windows are darkened and the wind shield transforms into a large screen displaying her team members as they start their video conference.

After university Max needs to get to his working place. Max is working for one of the car sharing providers as a field service employee. He already checked during class for the next available e-bike. He signed up with one of the many

low-budget providers. His provider is still using outdated authorization cards for unlocking. With a sigh he thinks about his old e-bike-mobility provider, which used convenient fingerprint sensors for this purpose. "If only they had supported my personal device". Max has switched to his new provider right after they announced an exclusive cooperation with one of the big personal device manufacturers. Now all e-bikes of his provider are equipped with convenient docking stations for those devices. It turns out very handy, since it enables Max to connect to the e-bike's electronics and use the device for navigation and the display of travel parameters. His friends often complain that their devices are not supported any longer.

As Max continues the ride his device informs him that the e-bike is running low on battery. Immediately the next charging station is displayed. Fortunately there is a station of his provider close to his destination. Max thinks of his home - even though there are many charging stations around his apartment, none of them is compatible with his e-bike-provider. Since the battery technology and charging plugs differ between most providers, Max has to walk quite far. He arrives at the office building, gets off the e-bike and connects it with the charging station in front of the building.

Meanwhile, a hard working day ends for Lisa. When leaving the office, the very same car she used this morning is already waiting for her in front of the office with her yoga equipment in the trunk. Due to her premium subscription this car was blocked for other users prior to her yoga session and drove autonomously to her office. While she was at work and other members shared this car, the vehicle ensured that her equipment remained safe.

After an exhausting yoga workout, her friends tease her once again - people like her are the reason why they all had to give away their beloved sports convertibles they owned before the "sharing-only" regulation passed legislation. Secretly, noone would even think about switching back to the old days when they had to clean and recharge their cars by themselves. Not to mention the time-consuming workshop appointments. Back then, each car was a financial commitment that was made for many years ahead. Now, they adore their premium subscriptions, since it enables them to choose a vehicle that fits their current mood, evening dress or weather conditions without big upfront investments.

Lisa's personal assistant reminds her that it is time for her to leave for the opera. Due to the warm temperatures Lisa decides to use a convertible to get there. Whilst trying to book one, her friend offers the convertible he used for the ride to the gym. She gets into the car, starts the autonomous driving mode and uses the free time to put on some make-up and get ready for the evening event. The driver state detection camera in combination with the windshield display serve as a mirror. The windshield contributes to this process by displaying the latest styling trends. Whilst driving on the speedway, the virtual assistant detects a safety-relevant malfunction and notifies Lisa about this incident in a

calm voice. It also reassures Lisa that she will still arrive in time at the opera house and her schedule is not endangered. The provider's road side assistance has already been informed and will arrive in ten minutes. The car autonomously pulls over to the safety lane. At the same time, the virtual assistant offers her background information about the play she's going to watch and provides a sneak preview in order to bridge the waiting time.

At this very moment Max receives a notification that a customer's car broke down and has a problem with an electrical device. This notification already includes vital information about the vehicle's model and location as well as possible resolutions to the defect. This being his last task of the day he quickly takes a car and his toolkit and sets off for the ten-minute drive to the vehicle's location. At the site, Max takes out his augmented reality glasses, which enable him to scan the car and locate the root of the problem. He finds out that a minor electric part is broken, which he is luckily able to repair right away. Whilst doing so Max and Lisa get involved in a conversation - as an expert in this field Max explains her his opinion about the problem. They agree that due to the lack of standardization all mobility providers have to develop most electronic devices by themselves in order to differentiate their offers from competitors. This is unfortunately a direct result of the intense competition on the market that often leads to quality issues. After having repaired the car, Lisa is eventually able to continue her drive to the opera. In consideration of the tight schedule, her virtual assistant suggests reserving one of the premium parking slots right in front of the opera house.

Max returns the service car to the office and gets on his way back home. With the conversation still on his mind, he starts to think about ways to improve the situation.

After the opera Lisa feels exhausted from the long day and tells her vehicle's virtual assistant to bring her back home. This allows her to have a nap. Half asleep, she realizes that she left her yoga gear in one of the previous cars. After an initial shock, she thinks "no worries, I have the premium subscription" and drifts away into sleep.

## 8.4.2 Timeline

From today's perspective there will be major changes in individual mobility. The current focus on owning a vehicle will completely vanish in favor of mobility that is characterized by the idea of sharing all means of transportation. Furthermore, car manufacturers will not find a common ground on how interfaces, be it human-machine or machine-machine, will look like. We will thus see a great variety of different interfaces.

The timeline in Figure 8.5 illustrates signposts and events, which will give hints for the scenario mentioned above to become reality.

Today, we see a great variety of human-machine interfaces with a few dominant

patterns that have established, such as the use of certain input technologies as touchscreens or selector knobs in cars. In terms of machine-machine interfaces, most car manufacturers use common standards such as wi-fi or bluetooth to ensure a widespread compatibility, though some car manufacturers have already provided device-specific connections in the past.

The chain of events that will lead to a complete lack of standardization of interfaces will start with different manufactures such as Audi entering cooperations with information-technology-communication providers, for instance Blackberry, to develop their own interfaces and differentiate themselves from their competitors. As discussions for a common ground for such interfaces will fail in 2018, every car manufacturer settles with a different approach on how interfaces in cars should look like – when it existing comes to compatibility with mobile devices, for instance, Audi could focus on Blackberry devices while BMW cars would only be compatible with Nokia devices. In terms of user interfaces, Audi might focus on gesture control while BMW sticks to speech control and so forth. This will eventually lead to mobility providers offering a unique customer experience but also unique interfaces that are not based on any standards at all.

The domination of sharing means of transportation over privately owning vehicles has four important aspects: A political and legal aspect, an environmental aspect, a social aspect, and an economical aspect.

In the future, environmental problems will lead to further regulations and laws. Even today, in 2013, urbanization has led to over 30 megacities in existence - in those megacities, congestion and pollution pose great challenges. In the future, lack of space in cities will further intensify until citizens virtually cannot use their cars any longer. At the same time, due to the omnipresent threat of climate change and increasing environmental pollution through fine particles and noise, the UN climate conference in 2015 issues harsh environmental regulations that also concern mobility. In 2020, governments all over the world will try to respond to these problems by discriminating the private ownership of vehicles. This trend of legal restriction will eventually summit in the prohibition of purchasing and owning a car as a private person.

When it comes to social developments, the young generation Y will have a significant share in customers in 2025. As a result, the attitude of customers towards ownership and parting will change dramatically. Already today, younger people see cars not as the status symbol it used to be, but mainly as a means of traveling from A to B. This tendency is strengthened in the future and will eventually lead to a point where owning a premium car has no impact on one's social status at all. Consequently, people will see the function and cost advantages of car sharing. Thus, sharing models will experience a boost in popularity and by 2016 more than 90 % of adults aged 25 or less will already use sharing concepts exclusively. As owning a car becomes even less popular in 2019, polls indicate that the majority of people do not want to own a car



anymore.

One of the strongest signposts of this scenario is the economic development: Today, car sales in Europe are already declining, whereas sharing concepts gain an enormous momentum. In 2016, all car sharing providers become profitable and will eventually break even. The success of the sharing business model will increase until in 2019 the revenues of mobility sharing providers will even exceed the revenues of sales from manufacturers, expressed by a higher share of the GDP.

The combination of these four aspects will eventually lead to a scenario where sales-centric business models in individual mobility will be completely extinct. Due to the more efficient use of cars through sharing models, the number of cars will have halved.

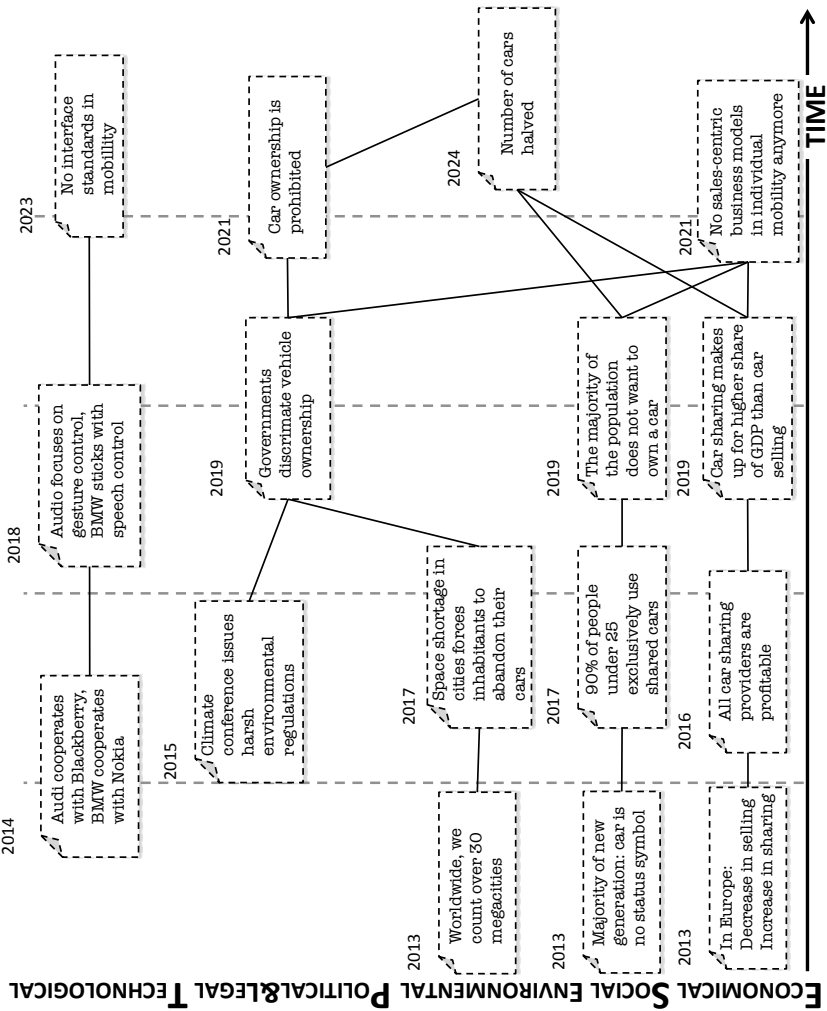


Figure 8.5: Timeline for the Scenario “Patchwork Sharing”

Source: own illustration

### 8.4.3 Signposts

#### **Car manufacturers stick to different interfaces**

This signpost hints at the persistent absence of standards in interfaces in individual mobility. In an effort to increase their know-how in developing interfaces, car manufacturers team up with different large and influential IT companies. Eventually, every car manufacturer settles with a different approach on how interfaces in cars should look like – when it comes to user interfaces, for instance, manufacturer A focuses on speech control while manufacturer B relies on gesture control. Negotiations about standards in interfaces fail as car manufacturers want to differentiate from their competitors and believe in the superiority of their own approach. Besides cars, the lack of standards also has an impact on the interfaces of other means of transportation like bicycles or trains, since many manufacturers decided to provide mobility as a service and thus implemented their own unified intermodal transportation system.

#### **Majority of people do not own cars anymore**

With the increasing coverage, popularity and viability of car sharing, more and more people believe car owning to be too costly and obsolete. Moreover, many mobility providers have implemented unified intermodal transportation that is largely dependent on a functioning sharing system. Switching means of transportations during the same trip becomes more convenient and is eventually much more flexible and viable than exclusively using your own car. Furthermore, expressing one's social status cannot be accomplished by owning a premium vehicle anymore, as the new generation has found alternatives to express themselves. All these developments result in the majority of people neglecting privately owning a car. This strongly suggests that the new generation is willing to adapt sharing as the new mobility concept of the future and that it will eventually eliminate the private ownership of vehicles altogether.

#### **Sharing Outperforms Sales Revenues**

This signpost expresses the growing economic success of sharing-focused business models. After all car sharing providers became profitable, the revenues further rise until car sharing makes up for a higher share of the GDP than car selling.

Whilst some car manufacturers have succeeded in shifting their old business model to a share-centric business model, other manufacturers who stuck with the “selling concept” were either forced out of business or now sell their cars directly to sharing providers. The economic success of car sharing providers is a clear sign that car sharing is not a short-term trend but might be a constant factor in the future of mobility with the potential to replace classic sales-centered business models in the near future.

**Governments discriminate vehicle ownership**

Laws and regulations have a high impact on the future developments in individual mobility. To respond to the increasing pollution, harsh environmental regulations and rising shortage of space in cities, governments all over the world enact laws and regulations that discriminate the private ownership of vehicles. An example for such an approach is already observable in the present: The administration of Beijing, China, basically rendered buying and using a new car impossible. As a result, customers are forced to use other transportation systems like car sharing or public transportation that thus gain additional momentum. Furthermore, such a development indicates an ongoing trend that might summit in the complete prohibition of private ownership of vehicles.

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**Part III**

**Ideation**



# 9

## Chapter 9

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# Driver-centric Adapted Interfaces

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## Executive Summary

custoMy is a dynamic adaptation of the driver-centric interfaces in the car according to an array of inputs, such as mood, weather and traffic conditions, driving experience and age. The idea is that the buttons, music, seat position, lightings, the tone of the voice control, etc. feel individual to the driver and help him to drive safer, stressless and with pleasure.

This product is well suited for individual and sharing cars, as it enhances the driving experience in all vehicles. In addition, custoMy makes driving shared cars feel unique, as the driver's profile accompanies him to each car and thus taking away the hassle to adapt to new cars. As a result there are three customer segments: High-income customers, the elderly and people with disabilities. As custoMy focuses on the driver experience, the customer relationship is of utter importance and the product has to be tailored to each of those segments. Furthermore, customers will be able to exchange their experiences and customizations in communities, which will add more value to the customer.

Important partners for custoMy are mobility providers, OEM, academia and content providers. In the revenue stream one can distinguish between

users sharing cars or customers buying cars. In these cases there would be, respectively, per drive or lump sum payments.

custoMy has a market in all four future scenarios. However, Patchwork Sharing offers the best fit, as demand for adaptive driver-centric interfaces is guaranteed because of the sharing only feature of this scenario. In addition, the OEM have the opportunity to innovate due to the low degree of standardization, which is the second component defining this scenario.

## 9.1 Introduction

Cars are meant to convey people in a convenient and stressless manner, but in practice driving is not always a pleasant experience. There are various obstacles on the way that can negatively affect driving pleasure and that produce bad emotions. Some of them are inevitable, some of them, however, could be easily addressed within the car. In that sense, would it not be great if the car was more intelligent and understood the driver's state? Would it not be great if the car adapted to the needs and characteristics of the driver? With custoMy this becomes possible.

The idea behind it is that every human is individual and has its own values, preferences, cultural habits, etc. However, cars have not offered much room for a customized user experience while driving so far. For example, control-buttons in cars are fixed in characteristics, such as size, position, shape, way of interaction (i.e. touchscreen, physical) in a single car model series. For individual human beings it is desirable though to have a vehicle that is easy to control, adapts in special situations to the driver's state and that may even build up a relationship with the human.

In the following sections the business idea of custoMy is further described and then analyzed with the business model framework of A. Osterwalder[366]. Finally the robustness of the business idea is analyzed by applying it to four different future scenarios.

## 9.2 Business Idea: custoMy

As described in the introduction, there are various features on the driver's wish-list for the car to be more intelligent and adaptive. All these features are characteristics of custoMy. It is a product which integrates existing biometric, emotion detection and camera sensor technology in the car to automatically measure age, emotional state and stress level of the driver. Additionally the system considers environmental data, like weather and the user's personal calendar and emails. Last but not least, it keeps track of the age of the driver as well as his or her condition. For example, there is a differentiation between elder and younger people and the system can also track people with physical or

mental disabilities. All of this data can be utilized to accurately determine how the car should behave when interacting with the driver and passengers.

In specific, the system automatically adapts on-board systems to suit the current emotional state and characteristics of the driver and passengers. Systems that are being adapted by the custoMy are so-called dimensions. Among them are voice assistants, interior lightning and colors, multimedia systems, seat settings, driving options and driving assistance systems. This functionality is provided by the software backend provided by custoMy which evaluates the in-vehicle sensor data in real-time and adapts the on-board systems accordingly. Upon purchase of custoMy, the customer is able to choose suitable dimensions that he or she wants to have embedded in the vehicle. Though, all the necessary sensors are already installed in the vehicle, whenever the user chooses to embed at least one dimension, this is a fundamental assumption to in the custoMy environment, as it makes future installation obsolete and guarantees that the services can be changed immediately. Through personal advisors trained by custoMy and to which each customer is assigned to, the customer is able to choose from a variety of new dimension and test them for a limited time, which then can be purchased and activated online. Additionally, the system should be integrated within cars of key partners, such as mobility providers offering all possible dimensions . To continuously improve the accuracy and quality of the custoMy system, software updates are delivered to customers over the internet. Therefore, both existing customers as well as new customers benefit from product improvements .

The functionality of adapted dimensions enables various improvements for drivers and passengers in vehicles. Increased safety, less distraction and stress, convenience and premium feeling are among them, see A. Osterwalder[366]. The following example should highlight the potential and wide range of application of custoMy in vehicles:

The system is capable of determining the emotional state of the user by emotional voice recognition. If the driver's emotional state reflects characteristics, like stress or anger, that can negatively affect the driving performance the system automatically tries to influence the driver to turn into a calm state. This can be achieved by switching music from the on-board multimedia system to relaxing tunes and by adapting the interior lights to a more friendly color. Additional adaption of the voice assistant regarding the user's emotion can enhance this effect. All of these actions enhance the feelings of the driver and help fulfill their needs.

### 9.2.1 Customer Segments

In order to successfully launch the product, it is vital to consider the different needs of various customer segments. In general, custoMy focuses on the B2C market as the driving experience and its conveyed feelings can best be delivered

to consumers. By meeting consumers' needs and creating even further demand, the business model will attract car manufacturers and sharing companies who as partners will be willing to implement and promote our product (see 9.2.7).

Due to its high value, quality and price, custoMy generally targets people of the middle to upper premium segment. The product serves three customer segments with different needs and problems; it is thus diversified.

The customer segments are:

### **High-income people**

custoMy's major segment consists of individuals between 30 and 60 years old who enjoy comfort, convenience and driving pleasure and who can afford this premium product. Usually, people with a high income are concentrating a lot on their career and thus have a stressful daily life and not much leisure time. For them, time spent in the car should be a comfortable, pleasant experience where they can relax before, during and after an exhausting office day. Moreover, they might appreciate the special features of the system as a status symbol.

### **Elderly people**

The second segment consists of individuals over the age of 65 who are not used to technology and sophisticated user interfaces or who have limited capabilities to safely drive a car. Generally they might not be used to driving and thus be afraid of it. Due to the adaptive interface of custoMy, they won't have to do the interior settings like changing the heating or music manually. Thus elderly people will not be distracted and can better concentrate on the traffic.

### **Disabled people**

The third segment comprises people with a minor to major physical or mental disability who have difficulties in driving a car at first hand or, if they are able to drive, who have restricted capabilities to do so properly. custoMy will provide them with high-level driving assistance enabling them to drive more safely or even to drive at first hand. As many insurance companies and car manufacturers offer some discount on cars for disabled people, the latter will be able to afford a premium system like custoMy even if they do not have a high income. In order to create a socially responsible brand image, custoMy would sell the product to disabled people at a cheaper price.

## **9.2.2 Value Proposition**

As the customer segments have been described for custoMy, one can turn it's attention to the value propositions for those segments. Each segment will be addressed regarding the value added for the individuals that it consists of.

Before looking into how each segment is targeted with a specific value proposition, a general value added across all these segments of the custoMy customers will be presented. A key value for the customers is the continuous adaptation of custoMy and the driving experience. Independently whether they drive their



own vehicles or share, it constantly learns their behavior and adjusts. custoMy also stands for flexibility, usability and adaptability. Customers are free to choose sharing anytime and take their profile with them. The profiles are individual, thus when selling the vehicle, customers keep their profile and can use it in their next vehicle.

The core business of custoMy is user centric, therefore each user has his/her own personal advisor to help them create, choose and adapt their profile (see 9.2.4).

custoMy is best described in Figure 9.1. The essence of the service is about combining external factors (left) and transforming them into an emotional response of the car (right) to the mood of the customer, medical condition or age. The focus is not to spend time in the car, but with the car. Therefore see the customer sees its vehicle, owned or shared, as a companion. In the case of a traffic jam, which might get the driver angry the car responds by adjusting music, light, or just by talking back to keep the driver calm. custoMy does not stand for products or devices, it represents emotions and experiences.

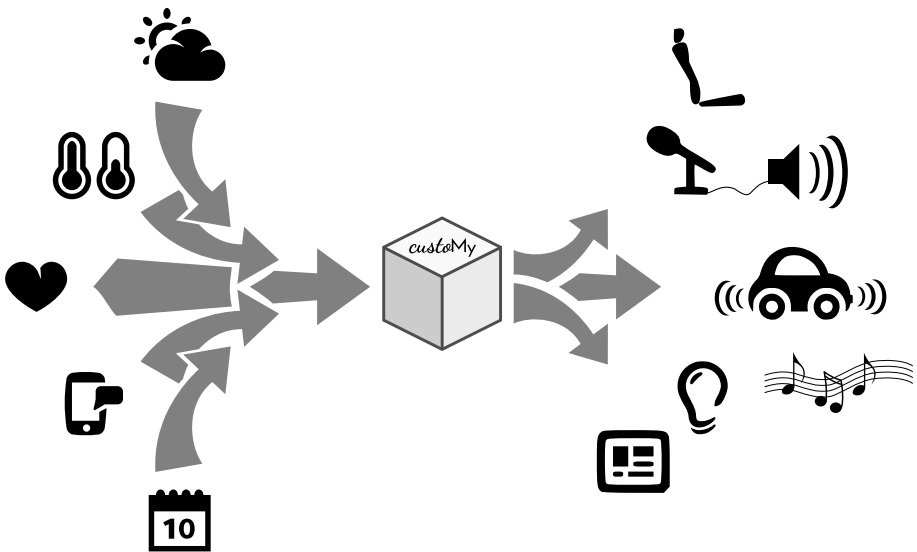


Figure 9.1: Value Proposition Scheme

Source: Own Illustration

### High-income people

The premium segment consists of the high end customers and build the biggest market for custoMy. Therefore they have to be addressed correspondingly. The first and most important value added to this segment is a strong user focused, individualized driving experience. The system enables for cars to

remain status symbols even when shared because the interfaces can be tailored to the individual needs and preferences of each driver. Premium sharing with custoMy would enable usage of multiple expensive cars at the price of one, or even less.

custoMy enables a full control over the vehicle and a totally new driving experience. The driver has the option to let the vehicle adapt to one's driving style. An alternative option is to predefine some settings. For example if the vehicle notices shifting is done at really high RPM values, it could take over the gear box and clutch to perfectly execute the shifts. In addition, the car would register the change and adapt other dimensions as light and music, to enable the best and safest driving experience in this situation.

Since premium customers are mostly business men and women, custoMy delivers a healthier driving experience to them. Because stress is a big part of their daily life, the product can be used to significantly reduce stress. One of the possibilities is providing profiles and adaptations known to reduce stress. This is achieved by using data from calendar, traffic information and weather, with which the car can suggest different routes and create a more stress-free driving environment.

### **Elderly people**

Statistics say that one of the two major risk groups for accidents in traffic are elderly drivers above 60 years.[364] Therefore custoMy will target this segment offering safer driving not only for them but also for the other traffic participants. Since the vehicle's interior and functions are user specific with this system, elderly people can have bigger user interface buttons. Also the voice output can be adapted to fit the driver's understanding and the user interface can be adjusted to facilitate his access to his favorite functions. This leads to a safer, less distracted driving experience for customers in that age range.

Additionally custoMy makes driving not only safer, but also healthier for them. The system can take input from doctors or by just scanning treatment recommendations and adjust seat settings and UI positions to best fit their medical condition. Furthermore, once the input is in the system, it is able to remind the drivers to take their medicine if they are in the car, or just reduce the driving hours if the doctor recommends it.

Last but not least, following from the two reasons above, using custoMy could reduce the insurance fee paid by elderly – both car and health insurance.

### **Disabled people**

Helping disabled people is a significant social contribution to the value proposition of custoMy. custoMy offers a new driving experience for disabled persons, by tailoring the vehicle to their special condition or disability. Customers on wheelchairs are empowered to drive by moving the function of the pedals to the hand area, which is only a software implementation and cheaper than a full hardware adaptation of the car. In the example of deaf people, they

would use custoMy to get navigation directions not by sound but using the head-up display combined with haptic feedback using small vibration in the steering wheel. . custoMy could also warn disabled drivers of changes in the surrounding, such as cars driving closer behind. This specific warning could be signaled by using strong red lights combined with small seat vibrations on the respective side.

custoMy offers disabled persons more independence by enabling them to decide and drive on their own, without needing an assistant or a special vehicle. In addition, being adapted to the person's condition, cars equipped with custoMy are much safer because they know exactly how to support their drivers and provide help whenever needed.

Since the system is also intended for sharing, custoMy offers disabled persons a lifestyle experience as never before. They would be able to choose among different cars from convertibles to off-road vehicles, all fitted to the user's needs.

### 9.2.3 Channels

This section describes how custoMy will deliver its value propositions to the three customer segments.

Generally, the system's software will be installed in new cars of car manufacturers and car sharing companies which have partnered up with custoMy. The end consumer is thus also targeted through car manufacturers and sharing companies because it is in their interest to sell or rent the cars with the system installed. They will receive a certain percentage share for each car sold or rented respectively (see 9.2.8 and 9.2.9). Once installed, the system will only have to be activated via Internet.

In an initial phase, it is important to conduct several surveys tailored to the different customer segments in order to find out about their needs and demands. Having those needs in mind, it will be easier to create specific advertisements which will arouse positive feelings in the customers and which might even evoke needs that have only been latently existing before. Moreover, there should be pilot projects in order to examine the success of the product. After the testing phase, the customers will be interviewed about their experiences and feelings while driving in a custoMy car. Positive opinions and statements of the test persons can be a valuable marketing source.

The value of the product will be communicated and distributed to the customer segments via different channels according to the respective needs.

#### High-income people

For people of the high-income segment, the product does not fulfill a basic need like the ability to drive or the need for safety, but it fulfills rather luxury needs. People of this segment appreciate driving in comfort but they might not know yet what is technologically possible, therefore they cannot describe what they are searching for. As the latent need of comfort and relaxation while

driving is already there, it should not be too difficult for custoMy to persuade people of the premium segment to buy or rent a car with the product features implemented. In order to successfully create the need and will of high-income customers to drive a car with all its premium dimensions, it is important to communicate the value of the product emotionally and to convey the idea of how great it feels to drive such a car by visualization and sound. Video marketing (both online and on television) is most suitable to deliver the features efficiently and the message most emotionally.

Another suitable distribution option for the premium segment is through companies. Managers themselves are the target group of this product, and their employees might also draw their attention to the product once their bosses have it. Moreover, companies might buy a whole car fleet for their employees as a special treat and relaxation tool. In this case, the product could be sold at a certain volume discount.

As described in the next section, a member club for everybody driving cars with custoMy will be established. Besides the creation of a strong customer relationship, the club will foster mouth-to-mouth communication among peers, i.e. peer-to-peer advertising. For example, in a special forum, the members can exchange their experiences with certain dimensions and give honest advice to each other. Moreover, members have the option to share their profiles so that other members with similar profiles can simply adapt the dimensions into their own car if they are convinced by them. This would be an especially popular approach if custoMy persuaded celebrities and lead users to promote the product and certain dimensions by sharing their profiles online. To give an incentive for customers to act as “ambassadors” of the product, custoMy could give a commission to people who have successfully promoted a package of dimensions to another person. It is also important to mention that the club serves as a B2C advertising channel because new dimensions of the product can be directly introduced to the club members at special member events and in the online forum.

### **Elderly people**

People who have retired usually spend a lot of time in front of the television and/or are part of a Senior Club[365]. Therefore, advertising spots are especially suitable for them, as well as advertisement on events or excursions organized by the Senior Clubs. custoMy could become sponsor of such trips or organize certain events tailored for people beyond the age of 60.

### **Disabled people**

People with disabilities can be reached through television as well as through certain organizations or centers for disabled people. Due to the broad scope of mental and physical disabilities, there is a very wide range of institutions which could be reached by representatives of custoMy.

## 9.2.4 Customer Relationships

As the name “custoMy” indicates, customers and their satisfaction represent the heart of the business strategy. In order to satisfy their needs, it is important not only to provide significant value for them but also to establish and maintain sustainable relationships so that they will stick to custoMy and its products in the long run and might act as intrinsically motivated promoters of the product (see 9.2.3) .

The core component of the customer relationship program is a dedicated 1-to-1 personal advisor for each customer and club member. The so-called “custoMyzer” gives every customer special and personalized advice about which dimensions would suit best for him or her. According to the needs of the different customer segments, he helps to create, choose and adapt the driver’s profile and suitable dimensions tailored to the respective customer. He thus has the role of a personal assistant and sales representative. If there is a specific question on one of the dimensions, the custoMyzer can always get advice from various experts but will report back to the customer himself.

Once the dimensions have been sold and activated, there is continuous, free customer support for every buyer. To give only a few examples, there will be a full four-year warranty on the whole product, free maintenance and software support as well as free updates whenever needed. If there is a software problem or maintenance task to do, the custoMyzer delegates the work to a software expert who will in turn take care of the problem himself. Figure 9.2 illustrates the role of the custoMyzer.

Another strong component of the customer relationship program is the custoMy community club. Its goal is to share experiences and to foster a certain – online and real-life – “get together” as well as discussions among customers who share same interests and hobbies. Section 9.2.3 describes how custoMy can use this club as a communication tool.

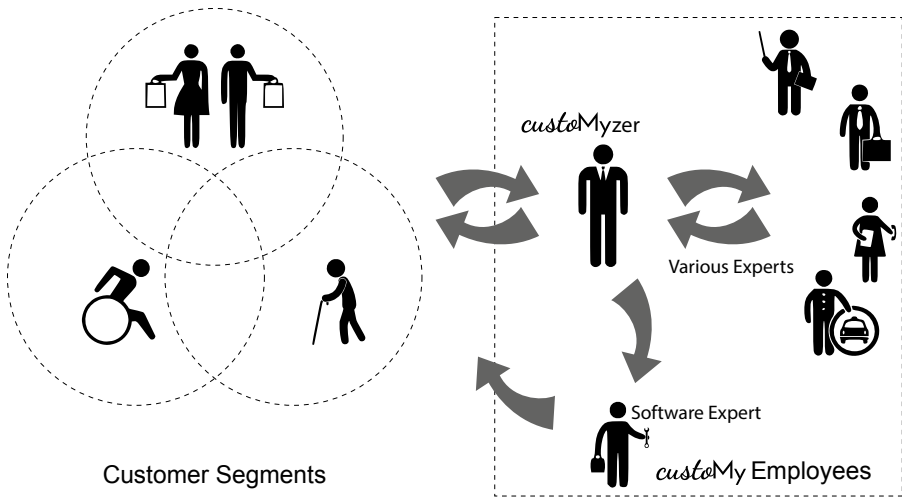


Figure 9.2: Customer Relationship Scheme  
Source: Own Illustration

### 9.2.5 Key Resources

custoMy works at the interface of a rapidly changing industry, that is on the verge of experiencing some radical changes with upcoming technologies like autonomous driving, or communication between cars. Therefore, in order to establish custoMy on the market and take the lead, valuable resources are needed to build upon and foster success.

The first and most important resource is the expertise custoMy has with this kind of systems, acquired by extensive research and user studies. The proficient and longtime experience enables to have highly trained experts that promptly react to the customers' demands. As a service, highly skilled custoMyzers are prepared to help their customers in any situation as the custoMyzers are backed-up by a pool of experts, which are specifically called in order to resolve the challenges of the users.

Another important resource is data. Different types of data are used by custoMy to develop and improve the system. Driver data is used to determine which profiles or dimensions fit best to which road or weather condition. Preferences data has a value in making the system more accurate. Combining the preferences and behavior of multiple users, custoMy can also determine which dimensions are most used and which still need more improvements to ensure a better experience. As customer can create shared profiles, custoMy wants to create an incentive for clients to experiment with different dimensions, which might bring custoMy to unforeseen usages and reach.

Last but not least, custoMy users are also an important resource. Since the system is effective on an emotional level, the best way probably is to advertise it between friends, creating network effects.

### 9.2.6 Key Activities

In order to achieve the value propositions and to create the desired customer relationship, certain key activities need to be accomplished. As custoMy is a user focused business, the customer relationship activities are important to keep current users satisfied, as well as to attract new ones.

As a first measure, custoMy has to ensure their services are well functioning. This is achieved by constant updates and maintenance. This activity ensures the product is always to the highest possible quality and that those updates are delivered to the users. Also the whole server infrastructure needs to be up to date enabling real-time processing of deliveries for upgrades, or profiles. Developing new upgrades or adding new dimensions to the portfolio of custoMy is also a key activity.

Furthermore, user support is a big part. Support and advise is present from the the buying, to the usage process. custoMy wants to maintain this important activity for the lifetime of the product so customers are certain to buy a always up-to-date and well supported product. Again, the custoMyzer is key in making sure his customers have their needs always met.

If the current users are satisfied, advertising and marketing is a key activity to keep them upgrading and attract new customers. This would focus mainly on promoting upgrades by targeting already existing customers. Raising the awareness about custoMy is also important and can be done by offering free usage of the system for a limited time, or doing social projects and offering profiles for disabled persons for free. Additional measures could be offering certain lead customers with a trial usage of custoMy. In return, these lead customers would share their experiences with many more possible customers.

### 9.2.7 Key Partnerships

In the context of key activities, partnerships should be established within the network of buyers, suppliers and distribution channels. Besides, as with any high technology, support from academia would be crucial to improve the product continuously. Other key partnerships can be established to enhance marketing channels and enable different industries to benefit from the technology.

#### **Mobility providers**

Among key partners, car manufacturers and car-sharing companies should be mentioned at first. They are prominent distribution channels of the product, moreover, they would raise awareness among end-users and gain competitive

advantage among their own competitors. Both car manufacturers and car-sharing companies can offer this premium feature to their customers, and earn commission per sale or implementation. Some might find this technology useful to create lock-in effects.

### **Automotive electronics manufacturers**

Most communication protocols within cars are mostly standardized today. In order to realize seamless integration with existing standards, the technology should be implemented in cooperation with automotive electronics manufacturers.

### **Data providers**

Further input dimensions would be calendar integration, weather and traffic conditions. Data providers for all those are considered key partners. All personal and corporate calendar providers should be among key partners to enhance user experience and offer complete integration, in contrast to traffic or weather data, where one key partner should be sufficient. At some point, social networks might become providers of user based emotional data, and then they would be considered as partners as well.

### **Media**

Tech blogs and magazines have been identified as key partners, since they would serve both as marketing channels and expectation management tools. Once the technology is mature and ready for market adoption, partners from mass media should be considered, in order to address customers on an emotional level, and to emphasize on safety aspect even further.

### **Academia**

To ensure continuous improvement of the technology, support from academia is substantial. Usability engineering, user interface design, voice and gesture recognition, as well as affective computing are all research areas within the technology's domain.

### **Insurance companies**

Considering the safety aspect of the technology, insurance companies are identified as key partners. The technology enables elderly and disabled people to drive more conveniently, so risk premiums for the users might be adjusted accordingly. Moreover, the driving style data collected might be used by the insurance companies for similar purposes, if that — at least for opted-in users — was legally possible.

### **Music streaming services**

Offering adaptive playlists for end-users would definitely enhance the customer experience, and therefore music streaming services (and maybe all kinds of intotainment providers) could be considered as key partners.



## 9.2.8 Revenue Streams

In this section, revenue streams are elaborated, and effects of the underlying business model are analyzed.

The key to understand the product itself is going through the dimensions which might utilized by the customers. On each dimension, best user experience would be provided. Other — non-adaptive — dimensions would be still customizable. Based on the driving style, mood (including stress level), schedule, traffic and weather conditions, adaptive output dimensions listed below would be available for end-users:

- Advanced driver assistance systems
- Voice output
- Gestures
- Colors
- Menus
- Seating
- Air conditioner
- Lighting settings
- Music

When purchasing a car, customers can choose to buy one or more dimensions making a lump sum payment (right) in Figure 9.3. Car manufacturers would then receive a commission per dimension sold. At any point of time, customers can decide to buy additional dimensions through the manufacturer, payment will then be made lump sum for each individual dimension, both to the manufacturer and to custoMy.

Car-sharing companies can implement any dimension as they would like to, and therefore they could create a unique selling proposition to retain their customers, as they provide the best possible driving experience of all sharing companies. Each dimension added would be charged based on usage by the customer (either distance or time, or both, pictured left in fig. 9.3).

Seasonality of the revenue streams mostly arise from the dimensions sold through car manufacturers, since those consist of one time payments. Thus, lower revenues should be expected on second and third quarters, in accordance with the seasonality in car sales. However, more emphasis on car-sharing models could streamline the revenue stream — thus leading to lower seasonality. Marketing efforts, moreover, could be useful to avoid seasonality in car sales, since customers can purchase upgrades (any additional dimension) when they would like to, and are not bounded to buy them upfront.

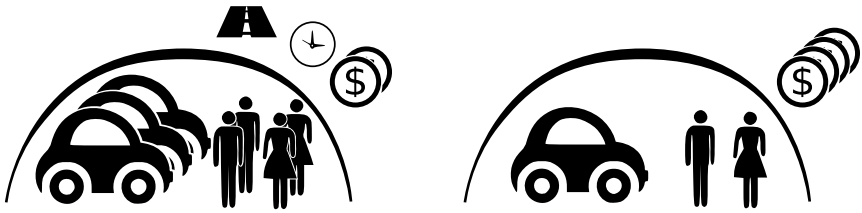


Figure 9.3: Revenue Streams Scheme: Pay little by usage of shared cars(left), pay a high lump sum on the acquisition of a car

Source: Own Illustration

### 9.2.9 Cost Structure

Various cost drivers are identified for the realization of the technology. From product development stage to market penetration, prominent cost drivers will be discussed in this section. Moreover, some financing options will be associated with each driver. In general, given that a cooperation with a mobility provider is established, asset backed securities might be the proper way to finance lump sum costs arisen during product development, since developed technology would then be sold through the mobility provider channel.

#### Research & Development and Technology access

The implementation requires large R&D investments, since custoMy is heavily dependent on recent innovations and state of the art technology. Cooperation with a car manufacturer enables access to an existing R&D network. By this, custoMy can focus on the implementation and commercialization, rather than on experimental technology.

custoMy should not neglect governmental incentives when investing in new R&D. Including social components into the value proposition, such as helping elderly or people with disabilities, can leverage the grants received by custoMy.

Technology access includes intellectual property which the implementation can build upon, as well as outsourcing hardware and/or software development. The extent of such costs is dependent on the expertise of the manufacturer, and on the bargaining power and nature of outsourcing agreements.

Bank loans and/or asset backed securities might be appropriate to finance costs driven by technology acquisition.

#### Marketing

Marketing costs would first come into the picture during market penetration stage. The initial expectation management has to be planned with experienced media partners, , e.g. technology blogs and magazines. After the initial expectation management, the strategy has to shift from selected expectation management to mass media, consequently marketing would become one of the main cost drivers. An underlying reason for the high expenses is be the need

to communicate with potential customers on an emotional level. This includes expensive channels, such as television or as in-app advertisement in technology gadgets.

The final marketing expenditure can still be influenced by different partnerships with car manufacturers and/or car-sharing companies. Depending on the negotiations about revenue sharing, custoMy can share its marketing costs with its partners.

## 9.3 Scenario Robustness Check

In the following section the Business Model of custoMy is checked against the scenarios regarding sharing and the degree of standardization. Communified and Car.me represent the scenarios with a high degree of standardization; regarding sharing, Communified is with sharing only, whereas Car.me is a no sharing scenario. In sequence, Autonomy and Patchwork Sharing represent the scenarios with a low degree of standardization. On the sharing dimension, they represent respectively the, no sharing and sharing only scenarios.

### 9.3.1 Communified

In the scenario Communified, custoMy has a good potential to be successful. As only sharing will be allowed, customers will have to constantly choose between different cars. They will share the same interfaces and connections, due to the high degree of standardization. Driving, however, still has to feel unique and that is where custoMy can fulfill the need of a unique feeling in a standardized car. The driver's profile accompanies the driver, so that each different vehicle feels like the own one.

From the demand point of view, there is a huge market for the custoMy solution. Even if owning a car was not allowed, people would want an individual driving experiences. The supply of those technologies is, however, rather difficult, as the high standardization of HMI dampens the freedom of innovation of different custoMy dimensions.

All in all, the need for the custoMy solution is given, but the implementation is fairly limited by the across industries standards imposed on HMI on all means of transportation.

### 9.3.2 Car.me

In the Car.me scenario people do not share cars and therefore drive their own individual cars. The high standardization enables the customer to BYOD and connect their media or work devices to the car or other means of transportation. Looking at the supply and demand for custoMy, the Car.me scenario is the least beneficial one regarding the proposed business model.

The no sharing characteristic determines the demand side. As more people have their own cars, it is expected that those cars are customized and pre-configured to fit the needs of the driver. The only fit for the custoMy product is in the change of configurations, as the driver gets older or changes habits. As a consequence the need for custoMy is lower than compared with the sharing scenarios. Hence the demand is lower.

Regarding the supply side, i.e., how well car manufacturers can offer and individualize cars, high standardization hinders the development of very innovative solutions and ways to customize the car, as all their innovations have to comply with global and across industries' standards. Compared to the low standardization scenarios, high standardization limits the supply possibilities of OEMs.

The focus of custoMy in this scenario would be to offer the continuous adaptation to the consumer in cars, but more importantly in the means of premium mass transportations, such as exclusive cabins in trains or airplanes.

The difficulties in this scenario are the low demand and options of supply for customization. The focus of custoMy has to be on the adaptation of already installed devices and dimensions in more means of transportation than the car. In those other segments, the acquisition of key partners are more difficult and the distribution channels are less prone to be influenced by the custoMy service provider.

### 9.3.3 Autonomy

This scenario describes a world exclusively accommodating single person vehicles, which are individually tailored to its owner. Due to the low degree of standardization of in-vehicle user interfaces and high competition in the industry, car manufacturers started offering fully customizable vehicles which are specially tailored to its owner. That means that the vehicle is already statically adapted to the habits and preferences of its driver. custoMy on the other hand would enable dynamic adaptation of the user's preferences which adds only little additional value. Therefore, there is only a small market given in that scenario.

An alternative for successful marketing of custoMy in this scenario would be the shift of the target customer segment to people offering car pooling. As nearly everyone has its own vehicle in this scenario the target customer segment is limited. An example for such people are families with young children. They have the need to drive their children from A to B, because they are not yet able to drive themselves with their own cars. In that case, custoMy can be used to give every passenger his own individual experience in the vehicle, independently of the preferred experience of other passengers. Children for example could enjoy interior lightning and car voices specially tailored for their age and their individual preferences. Additionally the seat settings could be automatically

adapted for these smaller passengers to increase their comfort and safety.

Since the above described customer segment is fairly small and the product has to be additionally promoted to this kind of customers, custoMy would not survive on the market and therefore the product is not well suited for this scenario.

### 9.3.4 Patchwork Sharing

In this scenario individual vehicles are prohibited by law and legal regulations to encourage people to use shared means of mobility. In fact, people do not own vehicles any more but there are various mobility providers on the market, which offer standard and premium vehicle fleets to customers.

The high degree of vehicle sharing prevents drivers from enjoying an individual driving experience like in their own car. People miss the feeling of their own and familiar vehicle they can use whenever they want to travel. This need would be perfectly satisfied by custoMy, because it enables the feeling of an individual and tailored vehicle while sharing. The additional low degree of in-vehicle user interface standardization can be streamlined to offer the user a wide variety of interfaces. Therefore the system is able to deliver a unique driving experience to the vehicle driver.

Additionally, mobility providers would also benefit enormously from a solution like custoMy to make their vehicle fleet more attractive by promoting a premium feeling in their shared vehicles. Especially premium mobility providers would gain competitive advantages compared to other mobility providers. As a consequence, custoMy is a value driven product and high profit margins are feasible due to a possible value driven business model.

Successful marketing of custoMy would require that mobility providers become aware of the system and that they embed it in their vehicle fleets. The high usage of these vehicles also results in a high valued revenue stream based on usage charging described in the business model. Therefore custoMy would be a huge success in that scenario, and it is considered the best fit.

## 9.4 Outlook

In the year 2018 the product custoMy launches on the market. Until then, various mobility provider companies are established on the market and people are used to possibility of using shared vehicles rather than their own vehicles. Due to the fact that custoMy is not physical product but rather a invisible solution running in the background, end customers will only become aware of the product very slowly and therefore sales are rather low at the beginning. At first, only early adopters will be interested in such an innovative aproduct with a steady but slow adoption to wider customer segments.

In order to increase the adoption and market penetration the help of one of the key partners — the mobility providers — will be essential. Due to a high degree of competition among them, they are interested in competitive advantages of their vehicle fleets. custoMy offers such an advantage by offering a premium user experience for vehicle drivers and therefore vehicle sharing get more popular. Through mobility providers, additional awareness of the product is generated for sharing customers, which speeds up the system adoption among customers buying cars.

The adoption of the system also promote the usage of community clubs, where people share their preferences. This fact and the high degree of big data usage by then encourages people to keep their profiles in the cloud and to exchange them.

Additionally, the success and intensive usage of custoMy may lead to similar solutions for public transport mobility. Public transport providers could therefore offer a similar premium experience for their premium passengers. As providers are getting interested in such an adaption of custoMy, a new business model has to be generated to exploit this opportunity.

A risk to the wide adoption of custoMy is a low initial penetration on the market.

## 9.5 Conclusion

As noted in section 9.2, custoMy addresses premium customer needs in individual mobility. Due to the growing density of complex electronics in vehicles and a growing elder society, there certainly is a need for dynamically adaptive user-centric interfaces. Well established mobility provider companies will even enhance this awareness and the need of such a system will increase. This development shifts the development from a more technological focus to more human centric innovations.

Regarding applicability of custoMy to the four scenarios (see section 9.3) the product is basically suitable in three of these four scenarios and therefore in most possible futures. Still, the most preferred future with the biggest market potential would be a vehicle sharing environment with premium customers owning their individual cars.

Despite all the benefits the system aims to offer, there are some drawbacks concerning initial and persistent customer acceptance. Initially, customers may not be aware of all the benefits and the value propositions that are applicable for them, due to the invisible nature of the product. Furthermore, the high degree of automation the system offers could offend drivers due to interference in his or her autonomy and privacy. As an example, the system takes away the decision taking process of whether the user is stressed and annoyed or when he is not.

Additionally there may be some technological barriers to overcome in order that the system delivers customer acceptable quality regarding the adaptation process. In the face of the uniqueness of every human being, the precise state detection of every individual is a challenge still to be tackled.

In conclusion, custoMy will certainly enrich the day-to-day life of people. At least, in respect to private automobile mobility.

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# 10

## Chapter 10

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# Turning a Car Into a Gym

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## Executive Summary

The concept of SportsCar+ is to integrate health and fitness equipment such as EMS or seated row machines into a car. Additionally, an included platform provides training instructions and nutrition information. The main value proposition of SportsCar+ is to enable users to use their driving time to improve their health and fitness performance by doing sports. Customers are segmented into individuals and corporate customers. Classical, non-classical and new media channels are needed while indirect and direct distribution channels are used. Customers can purchase SportsCar+ equipped upfront, sign a leasing contract or rent a car equipped with it. The integration of after sales services is crucial for SportsCar+. Both hardware and software checks are included for an extended period after the purchase. The SportsCar+ Premium Platform serves for building customer relationships. The SportsCar+ manufacturer cooperates with key partners such as well-known fitness clubs and equipment suppliers. In addition, know-how and investments have to be acquired for the initial technical development.

Finally, the concept of SportsCar+ is checked for its robustness in the four different scenarios. In case of low sharing and standardized interfaces, SportsCar+ has the highest perceived value. Hence, Car.Me turns out to be the best fit while Shared Patchwork is the worst.

## 10.1 Introduction

Since 1992 the amount of registered members of fitness centers rose from 2 mio. to more than 7.3 mio [375]. These numbers represent a current trend of the society towards health and fitness, going along with increasing revenues in the fitness industry [376]. An increasing amount of people trains in fitness centers [375] with different motivation, such as physical health, disease prevention, sports and even social aspects [373]. At the same time, companies realize the importance of employee health management, which can significantly reduce absence of personnel and related costs. Booz & Company calculated that each invested euro for health management pays back as 5 euro [368], which makes such programmes a worthwhile investment.

SportsCar+ picks up this development, by providing an opportunity for car drivers and co-drivers to perform workouts while driving. People who before have not had the chance or time to visit fitness centers are enabled to increase health and fitness while being underway and, in addition, now have a viable option to seize the time being in cars. Companies can use the product to support health programmes for employees that are often using cars and make their work environment more attractive.

In the following sections a more detailed overview about the product itself is given and the business model is analyzed in detail, by following the Osterwalder Business Canvas. Thereafter the business case will be checked for robustness in the four identified scenarios, followed by a conclusion of the product and analyzed business model aspects.

## 10.2 Business Idea: SportsCar+

The SportsCar+ exclusively turns cars of a premium car manufacturer into gyms, hence offering a new driving experience to customers. The concept is not to sell a gym-car as a stand-alone product but rather to equip existing premium cars with the amenities of a gym. As a result, SportsCar+ include two parts, the “SportsCar+ seat” and the “SportsCar+ premium platform”.

The first and most important part is the SportsCar+ seat. It consists of a regular car seat equipped with different training tools. Several concealable handles are integrated into the dashboard, the seat and the car top to enable exercises for arms, shoulders and back. Being able to both “unlock” the seat so that it can slide back and forth and to bend the back-rest will allow passengers to train the upper body and abs. Another promising equipment is the electromyostimulation (EMS), which trains the entire body by releasing electromagnetic stimuli. This enables the user not to sweat during the workout. Further training tools can be implemented in other parts of the car like the wheel, seat belt, armrest or arm grip.

A seat belt equipped with a heart rate monitor enables an effective and

professional training routine and success monitoring. The difficulty of the training tools is adjustable, allowing an effective training for both men and women, young and old and also well trained and beginners. This is implemented by using air pressure or hydraulics as resistant machines. As the driver should not be distracted too much by the workout whilst driving, the training devices are constructed in a way to only require small but at the same time effective movements. Then, the user will still be able to focus on the street whilst stimulating his muscles.

Additionally a sweat repellent covering the seat is manufactured and implemented into the cars interior in an unobtrusive way. As a result, the SportsCar+ seat is not recognizable as a training tool on a first glance. However, special brandings on seat belts and on the car body emit the uniqueness and sport image of the SportsCar+ to its passengers and its environment.

In fact, the SportsCar+ seat can replace any other seats in the car to allow all passengers to do their workouts. The SportsCar+ premium platform is the second component of the SportsCar+. Its purpose is to enrich the fitness experience of the SportsCar+ seat with information. It also enables personal interaction with and entertainment of the user. The platform is outsourced to a professional fitness agency, which acts as a partner (will be explained in further sections). It collects data from the user, processes it which finally can be retrieved by the user via the multimedia system of the car.

Individual training plans, instruction regarding different exercises, feedback on workout success, healthy diet information and entertaining motivational clips are also services of the platform. Being able to display information in the SportsCar+ allows a personalized interaction with the user. One possible option is that all users have their own real fitness coach who monitor the users' progress via the heart rate monitor and activity log from the car to instruct them personally. Being able to cheer up or applaud users adds another crucial value to the SportsCar+. The customers can decide whether or not to buy the SportsCar+ seat just by itself or combined with an enrolment for the SportsCar+ premium platform.

### 10.2.1 Customer Segments

SportCar+ focuses on customers who regularly spend time in cars and have a positive attitude towards a healthy lifestyle. In addition, they are willing to pay premium prices for mobility and for lifestyle products.

Customer segments can be divided into individual (Figure 10.1) and corporate customers (Figure 10.2). Individual customers include private consumers as well as one-man businesses, such as taxi drivers or freelance salesmen. Corporate customers include medium-sized and larger companies, which operate a company fleet.

### 10.2.1.1 Individual Customers

In Germany 15 million people are members of fitness centers [369]. As figure 10.1 shows, out of these, 12 million users are potential customers for SportsCar+ (Body Shapers + Individualists and Fitness Mums + Wight Watchers = 11,92). Based on the identified user groups in fitness centers from Deloitte [373], Body Shapers are focused on muscle building and body aesthetics. Furthermore individuals and Fitness Mums motivated to reach work-life balance when visiting fitness studios. Another large group is represented by Weight Watchers who do fitness mainly in order to lose weight. Physical health is especially important to the two latter mentioned groups.

In addition to existing fitness center users, non-fitness center users are potential customers. People working in the car, such as taxi drivers, truck drivers and salesmen will mainly profit from the ability to use the time spent in the car to stay fit. Motivations for solely private drivers can be extrapolated from fitness center users.

|                          | Customer Segment                | Size in Mio. | Age     |
|--------------------------|---------------------------------|--------------|---------|
| Fitness Center Users     | Body Shapers                    | 3,21         | 16-29   |
|                          | Individualists and Fitness Mums | 4,43         | 30-49   |
|                          | Weight Watchers                 | 4,28         | avg. 44 |
| Non-Fitness Center Users | Fitness-Interested Privates     | 24,33        | -       |
|                          |                                 | <b>36,26</b> |         |

Figure 10.1: Segments of Individual Customers

Source: Own illustration [369, 370, 377]

### 10.2.1.2 Corporate Customers

Health awareness in the society is increasing and spendings for health in Germany will double until 2015 [383]. At the same time, the awareness of companies for a healthy environment for employees increases [381]. As managers understand and are able to quantify positive effects from fit employees, health programs

become more and more a present part of company strategies [384]. Furthermore, such programs can also foster employer branding, making a business attractive for employees.

This trend promotes the segment of business customers for SportCar+. Specifically companies in which employees regularly use company-owned cars or work long time in their car get a totally new option to support the health of their personnel. Figure 10.2 gives an overview about the amount of trucks and passenger cars in companies in germany. More than 1 million truck drivers exist in addition to 25,000 passenger cars, which are mostly pooled and used by multiple employees.

|                               | Customer Segment  | Size             |
|-------------------------------|---|------------------|
| <b>Truck Drivers</b>          | <b>Bus Drivers (Long-distance, Local Transportation, Tourism)</b> | <b>120.000</b>   |
|                               | <b>Taxi Drivers</b>   | <b>49.992</b>    |
|                               | <b>Truck Cargo Drivers</b>  | <b>445.810</b>   |
|                               | <b>Others</b>   | <b>484.198</b>   |
|                               | <b>Total Amount of Truck/Bus Drivers</b>                          | <b>1.100.000</b> |
| <b>Amount of Company Cars</b> |   | <b>25.000</b>    |

Figure 10.2: Segments of Corporate Customers  
Source: Own illustration [374, 372, 371, 382, 379]

## 10.2.2 Value Proposition

The major goal of this business idea is to enable passengers to seize driving time and to deliver the following added values to the above characterized customers.

### 10.2.2.1 Sports and Body Shaping

The first important added value is the possibility to do sports and body-shaping in one's individual car. Different training tools enable the passenger to improve aerobic base fitness as well as maximum power.

Due to various workout possibilities, passengers are confronted with the issue of sweat. The first and easiest way to solve this problem is to adapt the user behaviour to the daily routine. For example customers might not want to train whilst commuting to work in order to prevent having to change clothes. In this case, they could do "Staying Fit – Exercises", which aim to preserve their fitness level with the aid of coordinative and recreational practises. On the

other hand, sweating is not much of a big issue on the way back home as the user is able to wear a training shirt and can easily take a shower back home right after the workout. Besides that, adjusting the cooling of the car towards the person working out and intensifying it at the same time reduces the level of aspiration. Furthermore, using antiperspirant and cleaning cloths for cleaning the seat afterwards is an additional considerable countermeasure. As a result these simple measures allow “Getting Fit – exercises”, aiming at challenging and fostering the condition of the driver.

Together with the SportsCar+ Premium Platform users can receive a holistic, entertaining, personal and effective training experience from a fitness agency and can even top off their fitness program from their regular gyms with exercises in the SportsCar+.

#### **10.2.2.2 Health**

Second, the SportsCar+ has a big impact on the health of its passengers. On the one hand, massage devices in the backrest and seat ease back pain and tensions in shoulder, spinal column and legs. On the other hand, a loose and inflatable seat with slight movements force the person sitting on it to constantly counteract by using the often untrained core muscles. This leads not only to a more stable pelvis but also to an increased body tension and agility. This value is especially beneficial for elderly people but also good for people who suffer from chronic body aches or drive home after a long working day with back pain.

In addition, improving one’s aerobic fitness and maximal power has a positive influence on one’s immune system and reduces several chronic diseases like cardiovascular disease, diabetes, cancer, hypertension, obesity, depression and osteoporosis. According to sport physicians “every additional step you take is good for us, acts as a fountain of youth and reactivates our self-regulating forces”[380].

Via the SportsCar+ Premium Platform users can also be reached with additional health information. Details about proper diet or about further (stretching) exercises can be provided which users can do in offices or homes in order to complement their training.

#### **10.2.2.3 Well Being**

Next to increasing physical performance and health, working out in the SportsCar+ regularly also has a positive influence on mind and soul. One’s well being is positively affected, hence SportsCar+ passengers reduce their stress level, improve mental acuity, strengthen self-confidence and simply add a lot of fun to the driving experience.

#### **10.2.2.4 Lifestyle**

Finally, since the SportsCar+ is most of all a premium training system, it will also enhance a customer's lifestyle. The high workmanship quality of the SportsCar+ itself clearly emits the sporting enjoyment and exclusivity at the same time. Especially busy and career-oriented people will furthermore appreciate the resulting time savings and the possibility to emit their career success, as the SportsCar+ will be a status symbol, mostly for high income individuals and families.

### **10.2.3 Channels**

In order to bring the value proposition to the market, communication as well as distribution channels have to be seamlessly integrated.

#### **10.2.3.1 Communication Channel**

The following channels help to create product awareness. Due to high product novelty, these channels are essential to help customers to overcome their uncertainty and enhance the SportsCar+ branding.

##### **Classical Communication Channels**

Similar to conventional cars, SportsCar+ can be advertised in well-respected newspapers like *Süddeutsche Zeitung*, *Frankfurter Allgemeine Zeitung* or magazines like *Auto*, *Motor Sport* or *Men's Health*. Figure 10.3 illustrates that print advertising made up approximately 37% of German car manufacturers' total expenditure on advertising in 2012. Hence, this approach should work for SportsCar+ as well. In addition to that, advertising on TV can reach the customers on an emotional level since they should be able to identify themselves with this product and link it with their healthy lifestyle.

##### **Non-classical Communication Channels**

SportsCar+ is demonstrated at various fairs such as International Auto Salon in Geneva or Auto Shanghai. Furthermore, several SportsCars+ can be displayed in front of fitness clubs. The exhibited cars allow customers to try out the innovation. This results in greater consumer acceptance and foster their enthusiasm. Profound public relations are essential for the success of SportsCar+. Maintaining a positive contact to journalists and newspapers enables a cheap and effective representation of the company, increasing the credibility and customer acceptance.

Product placement is another powerful means to anchor SportsCar+ in people minds. Researchers have shown that "60% of viewers felt more positive about

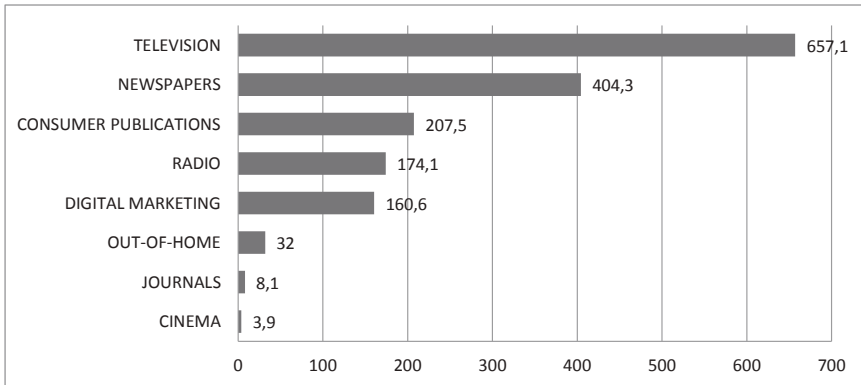


Figure 10.3: Gross advertising expenditure on different media of car manufacturers in Germany in 2012 (EUR million)

Source: Adapted from Statista

brands they recognized in a placement” and “45% said they would be more likely to make a purchase” [378].

## New Media

According to the Table 10.3 digital marketing accounts for approximately 10% of advertising costs. As the word is rapidly shifting from analog to digital, digital marketing is becoming more effective than traditional methods while staying affordable. “Nine out of ten auto shoppers start their buying process by doing online research. Auto shoppers and owners also use the Internet to browse vehicle inventory, apply for financing, search for specials, print out coupons, or schedule services.” [367].

Therefore, in order to attract new customers, a professional homepage is essential for the SportsCar+ manufacturer. Social media such as Facebook or Twitter allow viral spread of the SportsCar+ lifestyle and allow feedback and a dialogue with the customers.

Digital marketing opens up new opportunities for internet campaigns. Campaigns introducing a celebrity testimonial (e.g. Arnold Schwarzenegger) who shows how SportsCar+ has benefitted his health and fitness. Thereupon a competition can be launched animating SportsCar+ owners to submit a video or picture of how SportsCar+ has changed their health and fitness performance.

Search engine optimization enhances the visibility of SportsCar+. Email marketing and newsletters are affordable means to reach a high range of potential clients.



### 10.2.3.2 Distribution Channels

After raising the customer's awareness, the SportsCar+ manufacturer has to sell and deliver the product via direct and indirect trade channels.

One of the most important forms of direct distribution is the adaptation of its already existing branch network. This approach enables better customer focus since SportsCar+ is a high involvement product and requires attention of the sales staff. As a drawback, this method involves high investments. In the beginning, it is also essential to offer comprehensive test drives to reduce uncertainty among the buyers.

Indirect trade channels include authorized dealers who purchase and sell vehicles within their exclusive geographical regions. The advantages of this approach are faster market development and lower initial investment (e.g. there are no storage or logistics costs). An obvious disadvantage is a profit loss for provision payments. Another indirect distribution channel is over virtual car dealerships (e.g. [www.carneoo.de](http://www.carneoo.de)) which could eventually substitute authorized dealers. A higher range of customers and lower maintenance costs are strong reasons for this channel. However, SportsCar+ manufacturer has to bear in mind that purchasing vehicles via the internet has not been generally accepted yet.

## 10.2.4 Customer Relationships

Key targets within the context of customer relationship management for SportsCar+ are to maximize customers' perceived product experience, to bind them to the product and its manufacturer and to ensure their re-purchase of the product itself or its additional features. Therefore, the company's service range goes beyond a mere creation and implementation of the SportsCar+ seat. A corresponding premium platform as well as multiple other service options aim to ensure customers' optimal and individual utilization of the features within their car.

Within the scope of direct sales activities, customers purchasing the SportsCar+ are provided with a starting package including an in-depth product briefing as well as fitness consulting and a first individual fitness program for their car. This one-time starting package is provided to each customer for free. Hereby, first customer data can be gained and potentially used for further marketing or relationship-building activities. Direct contact between customers and fitness experts leads to an increase of customers' confidence in the product and its functions. Furthermore, results achieved by exercises within the SportsCar+ are considered to be better when being adjusted to customers' individual states of health and fitness. Whereas the product briefing is carried out by car dealers, health and fitness advice is provided by qualified fitness experts. These experts, who are working for an external fitness agency maintaining the SportsCar+ Premium Platform, can carry out acquisition of customers in the early stage.

Any time the customer decides to take advantage of the SportsCar+ Premium Platform service offer, his data is already stored and immediately available to the fitness coach.

After the purchase of the SportsCar+ all customers receive a basic hardware service that consists of an electronics and mechanics check, a yearly renewal of seat cover protections and a regular presentation of new product features or add-ons. Product data, including data about the system's condition is regularly sent to the manufacturer, which enables an automated customer information as soon as there is a need for maintenance or repair. Regular meetings between the car manufacturer's employees and car users foster the company's personal relationship to customers and enable the latter ones to give direct feedback on the product.

Besides hardware and software checks, after-sales activities furthermore focus on the creation and maintenance of a SportsCar+ Community. Within this community, customers of the same product having similar attitudes towards health and fitness can communicate with each other. The SportsCar+ Community is guided by a dedicated online blog which is maintained by the fitness agency and can be accessed by each SportsCar+ customer. Here, not only recommendations according to fitness and health, but also updates referring to the SportsCar+ utilization will be provided and completed by a monthly newsletter. A blog encourages both interaction between the manufacturer and its customers as well as the exchange among customers themselves. Furthermore, it offers a space for user co-creation while providing an online platform for the exchange of ideas and innovative product usage. This online platform differs from the SportsCar+ Premium Platform, which mainly focuses on providing individual and customized services and is also part of the customer relationship management.

The establishment of the SportsCar+ Premium Platform, although being mainly coordinated by the fitness agency, binds the customer to their product and manufacturer. Due to the permanent availability of real-time user-data, it is one of the most important channels of the customer relationship management. Customers are supported by feedback on their personal fitness progress either automatically via a software or by a real fitness coach. Data generated within the SportsCar+ Premium Platform may also be used to personalize newsletters and other marketing activities. In order to ensure this, continuous communication between the car manufacturer and the fitness agency must be guaranteed.

### **10.2.5 Key Resources**

For a car manufacturer, the establishment of the SportsCar+ mainly requires human, intellectual and financial resources, whereas the need for physical resources to huge extents can be covered by already existing facilities.

One key resource in order to launch the SportsCar+ is the domain know-how.

A challenge is to combine know-how from different knowledge areas such as fitness, health, technology and IT into the SportsCar+, which does not distract the user from driving. Since fitness- or health-specific knowledge is not part of a manufacturer's competences, it must be acquired from external sources. Thus, the necessity for know-how goes along with the demand for additional human resources from outside the company and new partnerships. The section about key partnerships elaborates more closely on this topic. After the product launch, the sales staff will need additional coaching concerning the product and its functions.

Due to high know-how requirements, the SportsCar+ will also require high financial resources for R&D. Besides the challenge to turn a car into a gym, additional questions like the issue of how to deal with sweat have to be solved. For this purpose, investments in the development of new, sensitive technologies may be required. The innovative character of the SportsCar+ will require additional investment for marketing and relationship management particularly at the very beginning of the product life cycle. New physical resources will not play an important role for the establishment of the SportsCar+ since production as well as the execution of additional services connected to the product will be outsourced to suppliers or partners.

### **10.2.6 Key Activities**

One of the main activities is to establish and maintain necessary core partnerships. This includes reliable partners who are able to co-design and construct the described SportsCar+ seat and the rest of the car interior. The biggest challenge is to design SportsCar+ in a way so that the seat is able to fulfil the desired functionality whilst remaining unnoticeable. It is also essential to find a professional fitness agency, which has the necessary financial, personal, and IT resources to create, maintain and develop the SportsCar+ Premium Platform.

The car manufacturer has to constantly re-develop the seat and the premium platform of the SportsCar+ together with partners. Particularly, autonomous driving will tremendously affect the possibility of seizing driving time. Hence, improving one's body, mind and soul will become even more attractive and further feasible.

Another key activity necessary for a successful product launch and its sales is marketing. In order to generate the upfront sales and continuous revenues, the SportsCar+ Premium Platform's added value need to be persuasively communicated to different customer segments. Different communication channels such as New Media are essential since the challenge is to convince customers that working out while driving offers great convenience with low distraction.

### 10.2.7 Key Partnerships

SportsCar+'s key partnerships will have the intention of maintaining a high standard of the product's attractiveness and trendiness throughout the time before and after the initial product launch. A car manufacturer does not have any in-house expertise in the fields of nutrition, pain-tackling exercises, psychological workout effects, human physique, coordination-oriented exercises or preventive methods, which would all be necessary for the creation and further development of a wide range of diverse and individualized content. Any research and development partner companies or technology suppliers do not count as key partners here.

A cooperation with a well-known, globally acting fitness club enterprise with a premium image goes beyond a mere supplier-relationship. The partner can benefit from the collaboration with SportsCar+, who would place the partner's brand in user contents displayed through inbuilt infotainment and navigation systems. Well-trained coaches included in the partner's workforce can – alongside with the automated platform – offer personalized training result assessments and exercise recommendations as well as on-demand trainer-customer-contact for medical or nutritional advice through phone or even video coaching as in-car internet technologies develop further.

In order to ensure reappearing boosts of the product's advertence and attractiveness, temporary partnerships with high profile personalities will offer the customer extraordinary and motivating fitness and health consultations. These personalities will mainly be found in four different domains – YouTube fitness stars, action and sport affine movie actors and actresses, active or retired professional bodybuilders as well as domain experts who are well-known in their respective fields. This richness in possibilities allows for regionally selected and therefore highly authentic and individual-oriented collaborations to maximize customers acceptance and their wish for reoccurrence. As an example, SportsCar+ users of a certain strongly urbanized region could be notified some days in advance that there will be a morning rush hour training session guided by a well-known body builder offering the customers a unique experience to get active while being stuck in an all-morning traffic jam.

Concerning key partners from the technical world, brand placement allows EMS (Electrical Muscle Stimulation) device suppliers for example to gain ground among new groups of health aware premium customers, whose acceptance towards this new approach is not yet consolidated. The same applies for conventional fitness hardware suppliers and the product developer in general.

Usually relationships between major premium car manufacturers and their suppliers are rather one-sided in terms of dependence as, for instance, the car manufacturer does not rely on his connector supplier. However in the case of fitness equipment, the relation is likely to be the other way around or at least not as one-sided as it used to be because a switch of the user content source created and managed by the partner's workforce is highly hurtful in terms of a

homogeneous usability perception by the customer. Therefore the car supplier's incentive for a fruitful, respectful non one-sided relationship will be higher than usual promising a better ground for cooperative developments.

Before-mentioned nutrition advice could be linked to a fitness aliment provider with a wide portfolio covering various customer needs and therefore being a reasonable partner.

Early product adaption will be reached through selected companies with long-hour driving employees such as taxi, bus and truck drivers. Hand-tight proof of the product's effectiveness and efficiency will follow soon through mouth-to-mouth testimonials and subsequently deep market penetration will be accomplished significantly faster.

### 10.2.8 Revenue Streams

The most important revenue stream of SportsCar+ is generated by the sale of SportsCar+ seats. A distinction is made between the health equipment version and body shaping equipment version. Depending on the customer's preferences, only one or both versions can be integrated in the SportsCar+ seat. High investment in development of SportsCar+ can quickly be amortized by applying the skimming strategy. Furthermore, a high price indicates high product quality and fits the company's overall strategy being a premium manufacturer.

Throughout the product life cycle, the pricing pressure sets in because of increasing competition on the market. Consequently, the price of SportsCar+ will decrease gradually.

Different from individual customers, favorable price conditions should be made for corporate customers. Companies are willing to purchase a vast quantity of SportsCar+ seats and platforms for their employees. Hence, quantity discounts and special payment terms are additional sale arguments to set an incentive for enterprises to buy SportsCar+.

As an alternative to upfront selling, leasing and renting are other attractive forms of revenue streams for SportsCar+. A leasing contract allows clients to use SportsCar+ in exchange for a periodical payment. After contract termination, customers can return the SportsCar+ seat or acquire ownership by paying the rest of the seat's value. Car Rentals can also equip their existing cars with the SportsCar+ seat to set an incentive for customers who don't have access to a gym.

Another revenue stream is generated by the SportsCar+ Premium Platform. SportsCar+ owners are able to subscribe to a personalized fitness coach in exchange for a monthly payment. Since coaching is conducted by a professional fitness agency, SportsCar+ will receive commission payment for providing the platform. Moreover, customers can conduct micro payments for additional services such as a customized nutrition plan or motivational songs for the work-out.

## 10.2.9 Cost Structure

The costs a car manufacturer that offers SportsCar+ as a special equipment in his premium vehicles, has to face, will mainly come from initial development costs and running costs, partly continuous and partly temporarily recurring.

The initial technical development, delivered by one or several suppliers from the domains of car seat technologies, fitness equipment and EMS solutions, will largely contribute to the break-even-distance. SportsCar+ will have to work closely together with suppliers in order to quickly reach an aesthetical, reliable and user-friendly integration into the existing and upcoming car models' construction packages.

As far as human resources are considered, fitness trainers, domain experts, internal dedicated quality management and IT content creation and maintenance will partly be carried out by the fitness company partner and partly by the car supplier himself. Furthermore before mentioned high profile collaborations might involve considerable costs depending on the level of publicity.

Initially, a more intense than usual marketing strategy will have to be developed and carried out as SportsCar+ is a rather unconventional and radical approach to innovate within the automotive industry and therefore customer acceptance might be significantly lower. Amongst others, additional minor costs will emerge from intellectual property protection – technical patents as well as design patents –, legal fees for putting through the concept at the technical supervisory association and proving its non-distracting nature for the driver's safety as well as common product-independent administrative operations.

Especially customer relationship and individualized content – training advice etc. – allow a great scalability in terms of costs. From mere automated algorithms with usual personal data inputs such as age, weight, gender generating unoriginal outputs all the way to personal on-demand trainer contacts the car manufacturer can relatively easily adapt the level of quality and premium feeling for different customer segments to their demands and willingness to pay.

Keeping up with technological and concept improvements – which will mainly not originate from the car manufacturer or the automotive branch but from the fitness equipment industry – will produce periodically recurring incisions into the income statement

## 10.3 Scenario Robustness Check

In general, the implementation of the SportsCar+ is possible in all of the following scenarios. Still, customer benefit is assumed to be highest when cars are not shared and interfaces are standardized.

### **10.3.1 Communified**

In a scenario where cars are shared and no longer owned, SportsCar+ as a premium product may encounter sales problems. Customers drive cars less frequently or even replace them with other modes of transportation, consequently valuing exclusiveness of car interiors to a lesser extent. Instead of private persons, car sharing companies are the main customers deciding whether or not to make SportsCar+ a part of their fleet. If customer acceptance is low, car sharing companies would need additional purchasing incentives. However, Communified illustrates a scenario where standardization is high, which in turn, may increase the products ease and scope of use also in car sharing. Personal user data of a SportsCar+ can easily be stored on and transferred to any technical device. Fast data retrieval enables personalization and adaptation of settings to any user, potentially giving a boost to customer product acceptance.

### **10.3.2 Car.me**

In a scenario where cars are owned instead of shared and standardization is high, the potential of SportsCar+ can be exploited to the maximum. When cars are owned and even regarded as a status symbol to a certain extent, this premium product has a strong appeal to customers. People use their cars more frequently, which is why demand for a private gym integrated in a car increases. Due to regular car usage, the perceived positive effects of the SportsCar+ are higher. Additionally, standardized interfaces simplify the data integration of personal car workouts into any other device like a cell phone, a tablet or probably even a cross trainer at home or at the gym. In this case, the usability of the SportsCar+ becomes even broader, since workout data can be used anytime on any device, optimizing the user's fitness schedule.

### **10.3.3 Autonomy**

Likewise within the previous scenario, SportsCar+ is well applicable when the future is characterized by the ideas of the scenario Autonomy. Personal car ownership strengthens buying decisions of the SportsCar+. However, due to non-standardization a complete and flexible integration of the car fitness schedule into everyday life outside the car may be limited. Since the car seat itself makes up the main part of the products' value proposition and possible applications or integrations are just a nice additional feature, the SportsCar+ still remains a successful product.

### **10.3.4 Shared Patchwork**

Assuming cars will be shared in future and standardization of interfaces is not given, the success of SportsCar+ is doubted. Sales are limited due to a general

decrease of cars on roads and low standardization and the resulting limited interconnection of the SportsCar+ with other devices results in a relatively low perceived customer benefit of the product.

## 10.4 Outlook

Even though the SportsCar+ system is already applicable to today's existing car models, autonomous driving will offer an even greater range of freedom. The seat could for example be equipped with further devices like a rowing machine, ergometer or even serve as an entire multi-functional training station with bench press, dumbbells or barbell for the upper arms and body.

But even for mid-term developments one can imagine that EMS solutions which today still require a moist and person-independent electrical contact from the electrodes to the skin will be able to adjust their operating point to the electrical resistance of the individual. In such a scenario it would have to be measured before every exercise. This would allow a highly effective workout independent of clothes, sweat state of the person or air humidity.

Another issue that if being solved in the future will highly increase the product's attractiveness is sweating which in most societies is considered highly undesirable and a great obstacle towards comfort.

One development which will have to be accurately observed is the trend towards car sharing and pooling. Several strangers sharing one and the same seat equipped with SportsCar+ will show low acceptance because of hygiene-related circumstances. On the other hand given that multiple seats in one car are provided with mentioned functionalities, the value of a multi-seat car would be highly increased. Most of all in largely urbanized cities of the future where outdoor sport activities are not feasible and time for fitness is often short in the case of premium mobility individuals.

In a nutshell, the car manufacturer will have to constantly be in contact with his suppliers and collaboratively enhance the customer experience without losing any scalability or the freedom of offering diverse contents.

## 10.5 Conclusion

The business model of SportsCar+ shows, that in general, the introduction of a SportsCar+ into the company's product portfolio appears to be very attractive to a car manufacturer. Its implementation goes along with only a few additional tasks and processes that have to be carried out after product launch. As soon as the product as such is developed, many additional service features mentioned within the business model can be outsourced to partners. Thus, the SportsCar+ is mainly a product innovation, whereas services and processes rather stay unaltered for a car manufacturer. However, as already mentioned



in the corresponding section, there are still some challenges to be overcome. Particularly, most important challenges refer to research and development activities involving dealing with issues like driver distraction or aspiration. The selection of suitable and reliable partners as well as human resources in general is a crucial element of this model to work.

From the customers' perspective, the perceived added value of SportsCar+ to today's car experience is tremendous. While turning a car into a gym, customers have the opportunity to train their body not being distracted from driving. SportsCar+ is expected to be well received by an increasingly health-aware society.

Finally, the SportsCar+ has great potential to trigger a groundbreaking change of car usage in early future.

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# 11

## Chapter 11

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# DoctorToGo

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## Executive Summary

The aging of the German population as well as the increase in obese people will result in an enormous increase of cardiac diseases and related conditions. Thus, there is a growing need for intensified medical surveillance. DoctorToGo enables the continuous monitoring of the health of a patient when he or she is on-the-go using a device that is installed in the vehicle. The recorded data is sent to a doctor via e-mail or regular mail, enabling a close-meshed medical surveillance.

Monitoring of the patient will be for free with the acquisition of the device, but the service of automatically sending the data to a doctor will cost a monthly fee. Moreover, the gained data can be sold to business clients such as research facilities, insurance companies and governmental institutions to improve their research. Consumers have to agree for their data to be used for research and only anonymized data will be sold.

To create the value for the end customers it is necessary to guarantee accurate measuring results for every DoctorToGo module. Moreover, the transport of the data from the vehicle to the back-end server has to be highly secure, since health data is very sensitive information.

Regarding the different scenarios DoctorToGo will work best in “Autonomy” and “Communified”. Although, there are a few obstacles in the remaining two scenarios the concept is still feasible.

## 11.1 Introduction

Around 15% of the vehicle accidents due to health reasons are caused by heart related ailments. [387] Indicating heart related ailments to the users in advance will make driving a safer experience. Today, the official number of diabetes patients is 7 million in Germany – but additional 3 million are not aware of it. [386] A low blood sugar can lead to irrepressible movements on the steering wheel or even to a blackout. Blackouts alone are causing thousands of car crashes a year. Helping diabetic patients by providing them with their health status will make driving a safer experience for them. Health consciousness in general, is on a rise, especially among the elderly and aging population. This opens up opportunities for providing health monitoring and healthcare as value added function in vehicles. This section introduces DoctorToGo module and its business model. Individuals, especially as one gets older, need regular health check-up, but it's a challenge to get these individuals visit diagnostic clinics at regular intervals. It is a challenge because some individuals could not find time for diagnostics. A few among others do not have the will as they consider diagnosis a dull task. A few others believe that they do not need health check-up. The list of reasons for not getting regular diagnosis keeps increasing as there are a number of reasons for individuals to skip regular chek-ups. This challenge can be addressed to the section of individuals who own cars by equipping the car with DoctorToGo modules. These users will get the benefit of their health being monitored although they might find it hard to visit diagnostic clinics at regular intervals. The captured health data when consolidated from all the user modules can be used to get the statistical health status of the users.

## 11.2 Business Idea: DoctorToGo

DoctorToGo. Close to your heart.

DoctorToGo is taking care of the most important thing in peoples' lives – their health. The on-board unit monitors the health state of the drivers. It can alert their doctor in emergency situation. It can keep a track of the criticality of user health and if health emergency is detected, it will drive the car safely to the side of the road. DoctorToGo is not only a on-board unit, but it comes with a service that will improve people's lives considerably. Furthermore, not only individuals can take advantage of it, but also institutions such as research centers and therefore this product has the chance to bring significant value to the health business.

The module captures health parameters of the user and can send this data over to back-end server where it can be processed and sent to the personal doctor on user request. It captures health parameters like heart rate and blood pressure. It shall also integrate an alcohol sensor, in order to warn the driver if their alcohol level is too high for driving, depending on the legal regulations from

the country. Sugar level check using micro chip and electrocardiograph recording represent great opportunities in the future as research institutions try to make them a reality. As seat belt and steering wheel are the closest equipments to the user's body while the user is driving the car, it could be integrated with sensors and a data capture module to monitor the health parameters of the user.

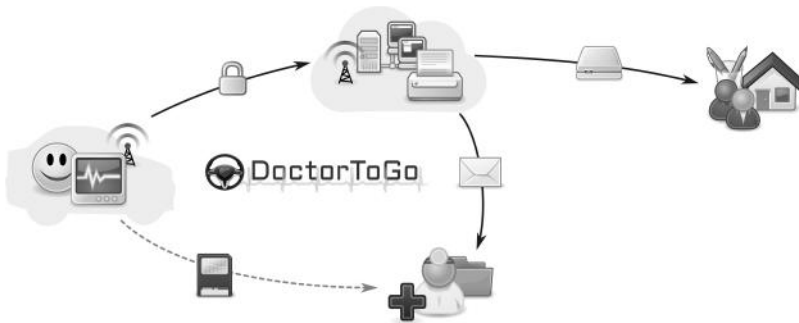


Figure 11.1: System overview of DoctorToGo  
Source: Own illustration

DoctorToGo constantly monitors the human body and stores this log in the vehicle. This data could also be stored in the cloud if the user configures DoctorToGo to be connected to the cloud storage. The module analyzes the data based on parameters like blood pressure thresholds and heart rate variability. If analysis results indicate health issues, a warning message is displayed to the user and the user gets the option to either send the collected data to his/her doctor via a back-end infrastructure or the user can transfer the captured data onto a storage device and report it to a doctor personally. In some cases, users may need to send their health data to Doctor on a regular basis, for instance in case they suffer from a chronic disease. This can be configured by the user on a subscription basis and the back-end infrastructure will take care of sending reports to the user's personal doctor regularly. The system design is depicted in figure 11.1.

The users can independently decide to have their data used for research purposes. It will be important to anonymize the data in order to prevent privacy and legal issues. The following sections describe a business model for the idea and present a robustness check for this idea in various scenarios.

In order to understand how the business will work, the blocks of the business model canvas and the connections between them are analyzed below.

### 11.2.1 Customer Segments

The customers can be divided in two main categories with regards to the value that DoctorToGo creates for them. Therefore, it can be differentiated between the users of the on-board unit – drivers or passengers of the vehicle and institutions interested in the anonymized data of the users.

#### End-users

Users from different segments might be interested in using such an on-board unit in order to monitor their health state. These users can be divided in three groups, as follows.

Risk patients are patients that have already suffered from a life-threatening event or patients who are predisposed to such an event. Heart attacks, strokes, panic attacks are events that put the lives of the driver and of the other traffic participants into great danger. Elderly individuals are patients with high risks, for instance. Furthermore, there is lack of awareness about their disease or about their high risk of having a heart attack and, therefore, do not take additional measures for preventing such an event. A second group of risk patients are individuals who already had such a life-threatening event in the past. In this case, such an event is more likely to happen again.

Chronical disease patients are patients who suffer from a long-lasting disease that can be controlled but not cured. These patients have to regularly monitor different health parameters and report them to their doctor. Examples for such diseases could be diabetes – where insuline level has to be measured up to three times per day, heart diseases – where blood pressure, pulse and weight have to be constantly monitored or asthma – where attacks can be predicted in advance. These users will be continuous users and will probably use DoctorToGo as a service for sending the data to their doctor on a regular basis. The service will also provide them and their doctor a complete history of monitoring their disease.

(Semi-)professional and professional athletes will use DoctorToGo in order to monitor their life signs, for instance blood pressure and pulse to track their physical condition and their health, not because of a basic necessity, but because their occupation or their high interest in their health and physical state.

#### Institutions

Different public and private institutions will be interested in the high amount of data provided by DoctorToGo. For the segments below, it is critical that the data will be provided anonymously and that under no circumstances the identity of the users will be made public.

Health insurances will be interested in statistical data. For instance, they might be interested in statistics about heart attacks that happened while driving, in order to determine which segment is predisposed to such events. Car Insurance companies will be interested in DoctorToGo data so that they can offer better



deals to users whose health data promises good health.

Research institutions and pharmaceutical companies will require specific data on demand, depending on specific studies they are conducting. For instance, a study focused on diabetes might need data belonging to patients suffering from that disease, while another study might need statistics about driver distractions after a period of intense physical effort (e.g. after physical training in case of athletes).

Governmental institutions will need the data at different periods of time, for instance for annual reports with regards to the health state of the population.

### 11.2.2 Value Proposition

The value proposition of DoctorToGo is many sided. Still, one of the biggest advantages for private users is the monitoring, prevention and improvement of their health. As the blood pressure, sugar, heartbeat are monitored, processed in the car and additionally send to the their doctor of trust, the users can have a much better overview about their personal health condition. This has a high positive impact on the health state itself: before diseases spread out or events such as heart attacks can hit someone, DoctorToGo will monitor their leading signs, sends them to the personal doctor, who can then help the patient to prevent such events. If for instance the driver knows that he or she is suffering from diabetes, DoctorToGo will remind the user to take insulin at appropriate time. If a diabetic user is unaware of being diabetic (which is far more dangerous for one's health) the system can make the user, respectively the doctor discover it. Taking the right medicine at the right time is of highest importance for the elderly people and risk patients and DoctorToGo reminds its users to take their right medicine at the right time (e.g. every morning while commuting to work).

Another benefit of DoctorToGo is that not only the end-users but also the government and insurance companies can profit from the much higher safety of individual mobility. It can be seen from figure 11.2, it is estimated that 30% of fatal car crashes are caused by micro sleeps or fatigue. [385]

Figure 11.2 shows that many people drive even when they are overtired, which can lead to a dangerous situation or even to a car crash. Heart attacks or black outs caused by sugar shocks can cause fatal crashes. DoctorToGo reacts on two ways: If the driver falls asleep or suffers a blackout it will try to wake him up by playing a loud sound or alternatively it can give the user a mild shock on the steering wheel. If the driver does not wake up, it will take the control and it will autonomously drive the car to the emergency lane and at the same time make an emergency call. Assuming that if all the cars are equipped with DoctorToGo, almost one third of deadly car crashes can be prevented. The safety advantages of DoctorToGo can go even further, as it can measure the alcohol or drug level of the user and indicate if the user is still eligible to drive

the car.

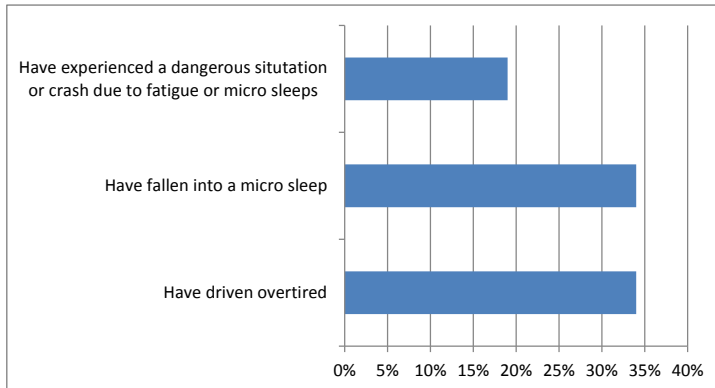


Figure 11.2: The safety risk of micro sleep  
Source: Adapted from [385]

The system can provide regular health status of the user without disturbing the day-to-day schedule of the user. When health related problems are detected then the users and their doctors will be notified immediately. By reducing the risk of car crashes and reducing the visits to hospital it helps the users to live a comfortable, safer and a healthier life. It is known that prevention is better and most often cheaper than cure, health insurance companies may provide additional benefits to their insured customer who use DoctorToGo. As both health and car insurances would profit from such a system, they will take DoctorToGo into consideration for offering discounts on insurance premiums.

Furthermore, DoctorToGo can sell anonymized health data to research wings of institutions such as government, research facilities, pharmaceutical companies and health insurances companies. The government can get an overview of health status of their people and compare them by region, age etc. Another important service can be provision of specific data. Institutions requiring health data could ask for a customized set of data according to their need. For example, a heart research institute may ask for health data of a specified age group, coming from a specified region or belonging to a certain gender.

Besides the safety benefits of DoctorToGo, it is also a useful health gadget. For professional athletes the data can be of significant interest for them to check

their health parameters regularly and to compare it over a period of time.

### 11.2.3 Channels

The channels have to be differentiated according to the product. First, channels are described that are used for the in-vehicle device and the associated services. Then channels are discussed that are used to sell the anonymized data to business clients e.g. research facilities.

It has to be differentiated between vehicles that are sold to end customers directly and vehicles that are sold to other mobility providers such as car sharing companies or car rental firms.

To raise awareness about DoctorToGo, multiple channels have to be used. In car dealerships the device and its benefits will be promoted and customers can test it in exhibition cars. Moreover, partners such as insurance companies promote the feature and the affiliated possible insurance savings. Thereby it could reach the end-customers and mobility providers as the benefits of the system are manifold.

The device itself will be sold in existing car dealerships similar to other add-on features such as a navigation system. To reach a broader customer segment and provide elderly people who may not buy new cars, it will be possible to upgrade the car with DoctorToGo later on in car service centres.

The service of regularly transferring the measured data is directly to a doctor could be done on several channels such as an online platform, a phone service or in a car dealership. For shared cars it will also be possible to buy the service on-demand, since it is likely that the consumers will refrain from paying a periodical fee when they are not in a vehicle on a regular basis.

Spare parts and maintenance services will be done in the car repair shops adjacent to the dealerships. Replaceable components such as sensors will be stocked at different working station to provide a convenient access for costumers.

To reach business clients for example car rental companies, health insurance companies or any other institution interested in DoctorToGo, sales agents will go directly to them to raise awareness about the new source of data. The data itself will be distributed with an online platform either in regular intervals or just on-demand.

### 11.2.4 Customer Relationships

Customers from different segments have to be treated in different ways. Therefore it is important to differentiate between the end-users of the on-board unit (the drivers and the passengers) and the institutions which are interested in the anonymous data collected by DoctorToGo.

After choosing DoctorToGo as an option when purchasing the vehicle, the end-user can subscribe to the service, upgrade or pay for on-demand delivery of

the measured health data. Therefore, self-service and automated services will be provided and a possibility to manage the data online. However, a customer service on multiple channels (online, telephone, in-store) might be necessary to enhance the credibility, user experience and support of DoctorToGo modules.

Institutions such as health insurances, research institutes and governmental instances will represent a lower number of customers, but their buying power will be much larger. Therefore it is important to maintain the relationship with them through dedicated personnel (hired employees).

### **11.2.5 Key Resources**

In order to provide the health advantages and safety to the end-user and statistical data to institutions, DoctorToGo will need to maintain important infrastructure. Firstly, especially for providing the convenient distribution of health data to doctors and to research facilities, an ICT infrastructure which is dedicated for DoctorToGo has to be maintained. This is of importance not only for storing all the user's health information but also for processing it. In order to upload health measurements onto the cloud, the car has shall have internet connection. The DoctorToGo ICT infrastructure needs to provide a stable and sufficiently fast connections. Furthermore, the system has to be capable of sending the sensitive health information to a private doctor or facilities in a secure way. To accomplish all this, investments are needed in the beginning and staff and resources are necessary for maintaining the infrastructure and keeping it secure.

The developers of the product will ensure the long run of the system. They will play key role in further development of the system along with providing the support for fixing the faulty products if any. The intellectual property generated during the development of the product shall be registered so that it will protect the technology and the business.

In order to bring DoctorToGo to the customer a good distribution network is needed. Purchasing the on-board units in a new car or even upgrades from an old one has to be supported. Especially the spare parts (e.g. sensors etc.) have to be easily and quickly replaceable. The components of DoctorToGo shall be stocked in dealerships and car service centres. Partnerships with car service companies (e.g. with Auto-Teile-Unger GmbH) have to be maintained, in order to provide an easy access to the components for the users.

### **11.2.6 Key Activities**

There are several key activities that are necessary to provide our value. First, activities are described that are essential to provide value to our private clients and afterward the measures needed to create value for business clients are discussed.

Firstly, with regard to product quality, it is necessary that the measurement accuracy of the DoctorToGo is very high, since error-prone results would upset the customers. Especially, if the measured life signs indicate a possible bad condition, which then turns out to be solely due to a faulty measuring. This can be ensured by thorough testing of the device with the standard norms.

Secondly, health data is very sensitive, thus, its transport from the vehicle to the doctor has to be very secure and it must be ensured that always the correct dataset reaches the respective doctor. Thus, the whole communication between the back-end infrastructure and the vehicles has to be encrypted. Moreover, the datasets have to be regularly checked and saved to prevent a potential loss of data.

Thirdly, we have to present to insurance companies the benefits of the DoctorToGo. It has to be made clear to insurance companies that users of DoctorToGo will not only improve their health but will also make driving a safer experience for them.

These are the steps that are necessary to provide good value to DoctorToGo clients. However, a dedicated team of sales personnel shall sell anonymized data to business clients such as research facilities, insurances and the government. To effectively reach those clients we have to convince them of the value that our data creates for them.

As every of those different clients uses the data for a different purpose e.g. government wants to have general data regularly, whereas research facilitations want to have specific data on demand, we have to provide them an online portal where they can get the required data by paying online for it. Such a portal shall be maintained and kept updated regularly.

### **11.2.7 Key Partnerships**

In order to successfully implement and maintain the system DoctorToGo key partners are needed. The partner network will contain specialized institutions in the medical field – health insurance companies, research facilities, medical devices manufacturers for producing the DoctorToGo and companies for providing and maintaining the infrastructure – such as telecommunications companies for connectivity and cloud computing companies for procuring a reliable data storage facility.

Health insurance companies are very important for DoctorToGo. Their knowledge in the health business will be useful especially when it comes to determining the needs of the drivers in terms of health. Also, they might give their customers discounts on their insurance plans when they use DoctorToGo, as prevention is much more cheaper and effective than treatment. Thus, health insurance companies will even add value for the end-user customer segment. Furthermore, they will not only be partners, but also customers, as they need the anonymous data provided by DoctorToGo. Therefore, health insurance

companies are one important entity in the business model.

As the DoctorToGo is new in the medical field, a tie-up with a medical device manufacturer for producing the system is needed. This partner would act as a producer and supplier for the on-board unit and spare parts. A possible approach to ensure the continuity in production is to acquire a medical equipment producer.

Research facilities (either public or private) can help develop the product. Also, their brand and good reputation can be used in advertisement to build trust on the customer's part, e.g. "Developed in cooperation with Fraunhofer Institut". This is very important as DoctorToGo is dealing with sensitive medical data. Finally, research facilities will also be customers that will buy anonymized user data for research purposes.

DoctorToGo is not only a product, but comes with a service based on a complex infrastructure. The car will have to be permanently connected and therefore telecommunication companies will be key partners. For storing the data, DoctorToGo needs a data storage infrastructure which can be provided by cloud computing companies.

### 11.2.8 Revenue Streams

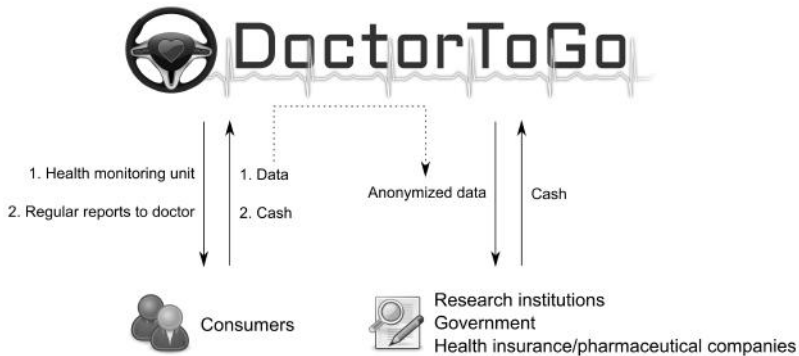


Figure 11.3: Revenue streams of DoctorToGo

Source: Own illustration

From the product module and from the data captured by the module a number of revenue streams can be generated. Revenue generation starts from the sale of the asset (DoctorToGo module). There is also after sales market, the sale of spare parts of the module. Primarily the sensors used to capture data are replaceable, as their lifetime is shorter than that of the data capture module. These are in addition to the one-time revenue generated from the sale of product. If a user wants to send the data to the doctor, there will be

fixed cost to send the data on user request. User requests are not certainly continuous. Therefore, a subscription based model would generate continuous revenue in which user's data is sent to their trusted doctor at regular intervals.

There will be consumers who do not want to initially invest on the module and rather are willing to try the module or use it for a period of time when they feel necessary. Hence, rental service of the module could generate significant revenue and enhance availability of the module in field.

The module could be sold to the car sharing companies for their fleets which is also a source of marketing. As shared cars will be used by a larger number of people, it will be a significant source of subscription based revenue. It will be a source of differentiation for car sharing companies.

The captured data is valuable and when this data is anonymized and filtered then it could be sold to other businesses generating additional revenues. Potential customer sources would be pharmaceutical companies, health insurance companies, research and government institutions. The data could be sold one-time or on a subscription based model so that it generates continuous revenue. Ideally there would be need for latest health data collected from the users in the above mentioned institutions. Hence it is also in interest of the above mentioned institutions to place a subscription based business. Figure 11.3 depicts the sources of revenue graphically.

### 11.2.9 Cost Structure

This section describes the structure of the cost for research and development, production of the DoctorToGo and affiliated services in detail.

Firstly, fixed costs are discussed. DoctorToGo is a product at the intersection of the medical and the automotive industry and thus the research and development of the product will need significant amount of resources, cost and time. For the same reason high effort and resources need to be put in place to ensure the security of the confidential data. There will be costs to make the product suitable to vehicle environment and to make the product independent of external factors including the type of clothing and physical parameters of the user. To maintain the database and provide connectivity to the users, costs for setting up of a dedicated back-end infrastructure for DoctorToGo will also be a significant part of fixed costs. A part of the budget would be needed for the production factory whose cost could be reduced if the facility could be set up in China, Thailand or India. Software development, which includes cost for the research center, software tools, software developers and the management hierarchy would add up to the costs. Another major investment will be for marketing the system, which includes advertisements and test results from various top automotive magazines to gain confidence of the users.

Secondly, variable costs are discussed in detail. Variable costs are linearly correlated with the number of manufactured modules. Variable cost comprise

of the procurement cost for the raw materials, labor costs, energy cost and production cost such as deterioration of the production machinery.

The rental business model would require an increased amount of capital to pre-finance the devices for the consumers, which as a result will increase capital cost. Assuming that car sharing companies will not finance the full cost, there is a need to finance the remaining part, which increases capital cost as well. In this case revenues from subscription play a greater role in the overall revenues. Economies of scale would reduce the per unit costs especially the percentage of back-end infrastructure and software update costs.

## 11.3 Scenario Robustness Check

In order to evaluate the potential of DoctorToGo and its success, the business model is analyzed in each of the four scenarios separately. The two axes – standardization and sharing – influence the customer needs, opportunities and challenges for DoctorToGo.

### 11.3.1 Communified

In “Communified” there is high standardization and sharing only. This scenario holds several obstacles, but also creates possibilities for the DoctorToGo. First the challenges and afterward the opportunities are discussed.

Privacy issues arise due to the sharing, since all the monitoring is transferred to the back-end servers when everybody shares cars. This also creates higher costs for the back-end infrastructure. Moreover, it is ensured that there is no data saved permanently on the on-board unit, which can be accessed by random people afterward.

Similar problems occur with regards to hygiene. Medical devices are often directly attached to the skin, which results in traces of sweat and old skin to stay on them when not being cleaned properly. Some people refrain from using the DoctorToGo when they have to share it with others if it is not guaranteed that it is clean and germ-free.

Another challenge is that after sales is not as profitable, because all sensors are standardized and, thus, spare parts can be bought in any shop and not just in the affiliated brand dealerships. Maintenance services are offered by all car repair shops. Both these things are convenient for the customers but hinder the establishment of vendor lock-in effects, which results in lower profit margins.

These are the challenges arising in this scenario, now the benefits will be discussed.

One benefit is that the insurance savings shift from end customers to business clients, because not the end customers themselves will pay for car insurance, but the sharing companies and other mobility providers. Thus, the savings



potential is communicated only to mobility providers and not to every end customer, which would have been more time and resource consuming.

Another opportunity in this scenario is that the on-board service is given to car sharing companies for free and that the revenue is created solely by subscriptions, which means that cash flows are more stable. The benefit of this approach is that the DoctorToGo is available on a large scale and entry barriers for consumers to use it are lowered. However, the pre-financing of the devices for shared cars is a risk and has increased the need for investment capital.

Sharing accelerates the spread of new features such as DoctorToGo, because car sharing companies have upgrade their fleets to provide their customers with additional services. As a result many people are confronted with the opportunity to use DoctorToGo, which results in two developments emerging from this. First, there is more user data from a more diverse customer base. Because in a no sharing scenario it is likely that only people would buy a DoctorToGo for their vehicle who already have health problems or who are more likely to have health problems in the future e.g. elderly people, which would have resulted in a quite homogenous user base. Thus, the anonymized data is more valuable for research as it provides a better picture of the overall distribution of a certain condition. Secondly, there is immense progress in the field of medical diagnostics, which allows to early diagnose diseases with devices that are integrated in newer versions of the DoctorToGo. The detection of upcoming diseases is a huge advantage in sharing scenario, since the people who feel healthy are also likely to use the DoctorToGo there.

As a result the “Communitified” scenario with its high standardization and sharing creates some obstacles for DoctorToGo with regards to privacy and hygiene. However, the opportunities that are created such as the easier communication of possible insurance savings and the greater usage of the detection of upcoming, unexpected diseases outweigh the disadvantages.

### 11.3.2 Car.me

“Car.me” is a scenario of high standardization and no sharing of mobility means. It implies that individuals own vehicles and as a consequence the number of vehicles on the road is very high. The idea is quite robust in Car.me scenario. Higher number of vehicles directly correlates to market size, hence this scenario has a huge market size. Buying a car equipped with DoctorToGo increases the car price and buyers sometime resale from higher initial investment. To overcome this barrier the business model includes a possibility to rent the module. Among the cars which have DoctorToGo equipped, a significant portion of it have the system on rent from service stations or DoctorToGo dealers.

Privacy issues regarding the health data is not an issue in this scenario as people own the vehicle and decide themselves if they are willing to share and store data in the back-end infrastructure of DoctorToGo. The module is intelligent

as it has the present and past data of the user of the vehicle which is used for diagnosis of diseases. There is reduced complexity of connection between the vehicle and cloud storage and the complexity of database management is as well reduced in no sharing scenario when compared to sharing scenario. Standards set up for DoctorToGo and the sensors used in it helps create a homogeneity in the acquired health data. This data obtained from various users can be merged together without additional processing as each of them is obtained from a similar system. As a result, it is easier to provide the institutions requesting data regularly without delay.

Standardization also helps to simplify market access as the module doesn't have to be customized for different vehicle manufacturers. It is a challenge to standardize the module in a way that it fits onto the users owning any vehicle . Considering above factors, the business is robust and would fare well in this scenario.

### 11.3.3 Autonomy

“Autonomy” describes a world where mobility is characterized by no standardization and no sharing, meaning that everybody has and uses a private vehicle.

The fact that everybody possesses his or her own vehicle has both advantages and disadvantages. On the one hand side, individual cars mean that the driver and the usual passengers of the vehicle can customize the DoctorToGo unit according to their own needs, even in the pre-sales stage, meaning that the module will fulfil their needs completely. Additionally, offline processing of the data will be possible, because the car will not be shared with other people, therefore, no offline privacy issues have to be considered. However, privacy issues for data storage in the cloud and for sending it to the doctor have to be further dealt with. On the other hand, having all this offline processing, the users might not find it that valuable to use DoctorToGo as a service. On the other hand side, users will have to procure their device themselves, so the prices should be kept lower in order to leverage the sales. If this challenge is overcome, sales will rise, as in this scenario there is a high number of vehicles. In case the challenge cannot be overcome, the option of renting the module to private users might be interesting, but then issues might occur because of the low standardization.

Although no standardization can bring problems regarding data format and interfaces, in DoctorToGo this might be an advantage, as each driver will be able to customize the on-board unit. The customization would be not only regarding the functions of the module, but also in-car sensors and other medical equipment. In case the driver wants to change to a different car manufacturer, the format of the data of his medical history might not be compatible with the new format. However, car manufacturers can take advantage of this challenge

and use it in order to prevent drivers from purchasing new vehicles from other manufacturers.

In conclusion, the advantage of the scenario is that due to no sharing, everybody will be able to customize DoctorToGo according to his or her own needs and due to no standardization the unit will be able to fit the customer's characteristics, but the price should be kept as low as possible in order to leverage the sales. All in all, DoctorToGo fits very good in the "Autonomy" scenario.

### 11.3.4 Shared Patchwork

As in "Shared Patchwork" scenario there is no standardization of HMI and no private owned cars exist, no private customers can buy DoctorToGo. Therefore both the product, as well as the business model have been adapted to the scenario, in order to overcome the challenges and leverage the advantages.

Car sharing is omnipresent and it is the only way to have access to the on-board unit. A great advantage is that people moving by shared means of transportation have the opportunity to use DoctorToGo because there is a high probability that shared vehicles are equipped with DoctorToGo. They do not have to pay for the purchase of the unit. Moreover, some people pay on pay-per-use basis and others pay for subscription over a defined period of time, offering them a higher flexibility.

On the other hand, it also means that private people do not have the chance to buy their own DoctorToGo and individualize it to their own needs (e.g. special sensors, setting for diabetes patients, etc.). Maintaining hygiene, especially when blood samples are taken for measuring the blood sugar of the user, is a challenge and is addressed by providing disposable replacements.

Another aspect of sharing is that the information processed and stored in the car can be hacked more easily, which will again lead to privacy issues. Nevertheless, these security problems are partially overcome: DoctorToGo does not save the data on the car's internal computer system, but just processes it on it and then transfers it to the user's smart phone. By this, every user has their own personal health data on their own mobile device from which they distribute it further to their doctor of trust. However, since there is minimum level of standardization, the module is capable of communicating with any smart-phone which increased the product's complexity.

Additionally, no standardization in connection to the "shared only" scenario has many other problems. In the market there are various car sharing providers, who do not easily come to a common ground regarding which features of DoctorToGo they want to offer. Consequently, different providers have different versions, features and sales models of DoctorToGo. This leads to opacity for customer. Hence a virtual assistant is present in each DoctorToGo module to help the users. Furthermore, some users consider regular health check-up

extremely important to them and they need important and they comparable health data and medical history of their self for a period of time, therefore, they are locked in at a certain car sharing company. This is an advantage for various car sharing providers as they differentiate from each other based on the add-ons they provide, but for the users it leads to many inconveniences such as the lock-in effect explained above.

Taking everything into consideration in this scenario DoctorToGo does not completely reach to its potential market, as it is followed by many inconveniences. As written above, the system as well as the business model had to be adapted to the new circumstances. But still, in order to use DoctorToGo with all features and to its full potential, the end-users stick to one provider. In a scenario in which only car sharing is offered, such a lock-in does not make sense, as one of the great advantages provided by “only sharing” is that the driver can take any vehicle that fits his needs at a certain moment.

## 11.4 Outlook

Within the next years, DoctorToGo will develop further, being more discrete and precise in measurement and offering much more possibilities.

As medicine technology will develop enormously, DoctorToGo will have more capabilities and less body touching sensors for its measurement. For instance, instead of using blood samples for measuring the blood sugar, every patient could carry a micro chip in his or hers wrist measuring not only blood sugar but also erythrocytes, inflammation etc. Then the data are sent to the on-board unit wirelessly, making it more convenient for the driver and solving the hygiene problems that would occur otherwise.

Furthermore, due to more technical capabilities the processing of information within the car will change, offering a kind of automated first aid. If a passenger suffers from a heart attack or blood sugar shock the car itself can remotely give him lifesaving electroshocks or injections through the seats to help until emergency arrives. When automated driving is realized, the car will be even capable of driving the patient to the next hospital. It will lead to less emergency calls and faster medical care of patients in hospitals.

But also the ways the user’s information are used by the doctor will change. As all the medical history will be available, the doctor will be able to set a whole differential diagnosis which can be discussed with the patient via for instance video conference. If necessary, the doctor can even send prescriptions to the car, making it easier for all participants. Consequently, DoctorToGo will develop from a useful feature to a whole medical check-up, transforming every car to a small ambulance and making medical care more efficient and wide spread.

## 11.5 Conclusion

Due to improvements in health monitoring technology and possibility of automatic analysis of the captured health data, it is now possible to monitor health parameters in the harsh (vehicle vibrations, interference from other on-board devices) environment existing inside vehicles. Additionally, increased connectivity helps to store this data in the back-end and then process it for the diagnosis and report the results back to the consumer. Aging population, growing health awareness and increasing safety consciousness opens up new business opportunities in the automotive industry as well. Therefore, automotive manufacturers can gain competitive advantage by integrating health care in vehicle along with obtaining additional revenue from monitoring the health of the users. DoctorToGo precisely addresses this opportunity. As the data is stored in the back-end it opens up market for additional revenue streams by selling the valuable data anonymized to research and governmental institutions. Hence DoctorToGo addresses various customer segments which increases the market size. DoctorToGo does not only look financially profitable, it increases safety and health consciousness amongst its user base. Additionally it will be able to provide various institutions with valuable health data to assist research, development and statistics.

The robustness check of the idea and business model in the various scenarios of standardization and sharing yielded positive results although in some scenarios it suits better than in others. In the case of “Autonomy” scenario the product can be tailored to individual needs which is quite important in medical field. In the “Shared Patchwork” scenario it will be difficult to design a product which suits the users in shared cars as every user might take multiple types of car in this scenario. In the “Car.me” scenario standardization poses the challenge to make the product suitable for the whole consumer base. By addressing the challenges arising from the privacy issues and considering the opportunities in the sharing scenarios this idea is equally or even better suited for the “Communified” scenario.

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# 12

## Chapter 12

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# The Genie

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### Executive Summary

The idea of the Genie Company is to combine human senses and emotions in order to create a unique premium experience for customers willing to customize the appearance of their car.

This is to be achieved by developing display technology so far as to be able to cover a car body with a display surface, the Genie Surface. Premium end customers could then visit highly individual Genie Lounges in order to choose a fashion-like professionally designed theme – a Genie – for their car. After a sensually accentuated purchase, they bring the new Genie to their car and transfer it onto it.

While the display technology itself would be sold with little margin, charges for the Genies would create the main revenue stream. Strategic partners of the Genie Company would be car manufacturers willing to enhance their premium car offers by adding the Genie Surface as a feature as well as suppliers of the raw display technology. End customers would be individualistic, fashion-conscious buyers of premium cars originating from the upper social class.

The Genie Company would maintain connections to professional designers. These designers are continuously creating new themes. New themes attract customers to continuously re-customize their cars. Moreover, an active network in the fashion world would enable the Genie Company to invite customers to exclusive events featuring, among others, new Genies.

## 12.1 Introduction

The niche that the Genie Company is striving to fill is offering not simply a new technology, but a very personal experience – to a specific premium group of end customers.

The initial issue of the premium car market is the limited adaptability of external car appearance; most cars, especially vehicles of the same series, are highly uniform and indistinguishable from each other.

However, another aspect in need of improvement is even more important. The currently available method of customizing one's car is a dry process that is not repeatable, highly inflexible and nearly fully deprived of human emotions. These are the reasons why the size of the car customization market is considerably smaller than the size of the fashion market, although both markets are comparable in terms of their potential utility to end customers: individualization.

The goal of the Genie Company is to direct the development of the outer car customization market in such a way as to unfold its great potential.

## 12.2 Business Idea: The Genie

Many premium car manufacturers face the challenge to keep up with the customization demands of their customers. Most manufacturers are extending their model portfolio by adding new series in order to address different target customers. In most cases only the appearance differs between the series. The underlying technology is often the same. Although customers spend a lot of money on superior product quality, brand reputation and advanced functionality, they are lacking options to individualize the outer appearance of their car.

The Genie company targets the issue by offering the Genie Surface for car bodies - a flexible display technology which can be integrated in the outer body of vehicles. Genie emerged out of the idea to add individualization to this prominent part of the vehicle. The Genie Surface enables cars to change their appearance by displaying vivid themes and animations. Genie supports car manufacturers integrating the Genie Surface technology to their vehicles. Furthermore it offers a memorable design experience to the customers through the Genie ecosystem. This experience mainly takes place in the Genie Lounges and Genie Corners. Genie Lounges are sales floors in form of stores with an exhibition space and seating lounge. Genie Corners, located at official car retailers, are operated by Genie in joint efforts with the car manufacturer. Sales advisers consult potential Genie customers and familiarize them with the concept and its benefits. In the Genie Lounges and Genie Corners, the Genie are exhibited, advertised and sold. Genies are design themes that can be displayed on the car with the Genie Surface technology. Genie themes are created in close cooperation with well-known artists and designers from various



fields like fashion or industrial design. Most Genie themes come limited in quantity, which emphasizes the exclusiveness of these designs. All customers together form the Genie Circle - an exclusive club with access to fashion and other events.

Once the customer has ordered a car equipped with a Genie Surface, he receives a special vehicle key. This key is a symbol for unlimited access. Access to the car itself but also to the Genie Circle - the exclusive design club associated with the technology. The key holds the vehicle profile and is equipped with a small display. It offers access to exclusive areas in all Genie Lounges. In these areas customers are served with refreshments and can start finding new Genies for their vehicles. By putting their keys on a touch-sensitive table, the vehicle profile is loaded and a digital projection of the customer's car appears on screens throughout the show room. The process of loading the vehicle profile is accompanied by sound effects, illumination and visually appealing animations. It resembles the idea of waking up a genie in a bottle. Customers can now start exploring the design world. Digital interfaces allow the customer to apply designs he is interested in to his car. If the customer wants to purchase a design, he virtually drags it and puts it onto his key. The process can be pictured like putting the Genie back into its bottle. Once the design is locked inside the key, a small circle of coloured, rotating matter appears on the key's screen. Furthermore the key starts pulsating as if the Genie wanted to get out. The key serves as a physical representation of the digital theme and gives the customer the satisfaction of carrying home a tangible good. In order not to hamper the experience in the store, payments are automatically charged to the account of the customer.

The release of the Genie is an experience in itself. Whenever the customer desires to dress his car with the newly purchased theme, he can start the transfer by rubbing his Genie key in proximity to his car. With a playful animation the outer appearance of the car starts to change and culminates in an explosion of colours and sounds, before it settles with the chosen Genie theme. To make the unleashing even more vivid, music associated with the Genie theme starts playing.

The entire process is demonstrated in figure 12.1.

The business model describing the idea of Genie is described in the following section. It is structured after the Osterwalder Business Canvas.

### 12.2.1 Customer Segments

Acquiring the Genie Surface and thereby becoming member of the exclusive Genie Circle is much more than buying a product. It pairs individualization opportunities with an experience that touches all senses. Therefore Genie customers are willing to pay a premium. Thus the segment consists of design affine customers with a strong desire for individualization and self-fulfilment.

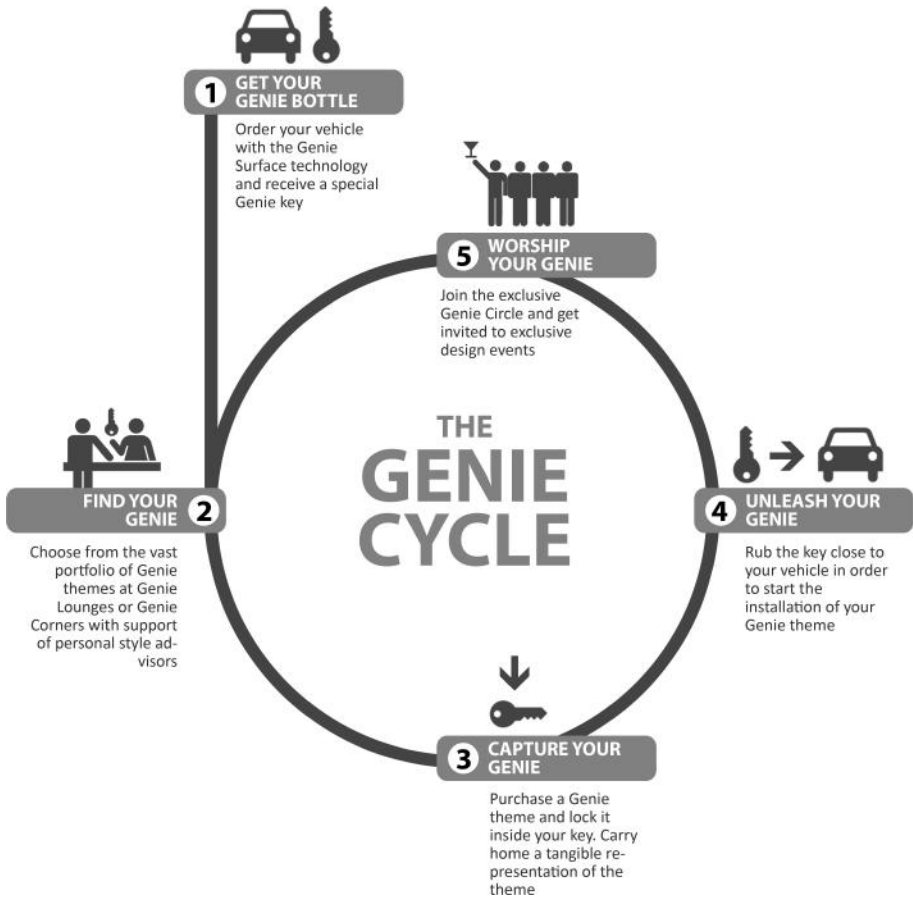


Figure 12.1: Genie experience in five steps

Source: Own Illustration

The targeted customer segment has a high standard of living. Ownership and status are expressions of self-realization being a fundamental part of life. Customers of Genie have a strong urge for exploring new things and being unconventional. The entire segment can be split into three sets of customers. First, a high-income group which does not hesitate to spend money for the sake of being exclusive and special. This segment is willing to pay significantly more for products that are not accessible to the mass market. Secondly, there are design affine customers who enjoy personalizing their appearance corresponding to their respective mood, character and preferences. Customization is considered as a form of self-fulfilment. Designer clothes and luxury products are in general of importance to this group. The third segment consists of pioneers and challengers. Owning and experimenting with new products is part of their lifestyle. They consider themselves as trendsetters and “fashionistas”. Genie as a premium product provides its customers an additional level of differentiation and enables them to show off their exclusivity and style - even on common premium cars.

Setting yourself apart from mainstream is part of the Genie experience and highly important for the success of the entire business model. The traditional milieu as well as the conservative milieu are not directly addressed as a target customer segment, as shown in Figure 12.2.

### 12.2.2 Value Proposition

Genie creates an exciting design experience appealing to all senses of the customers. Design-oriented customers tend to perceive their cars as an expression of their personality. Therefore customers buying new fashion outfits for themselves have a desire to reflect their newly acquired styles on their cars as well. Genie offers a unique experience of finding, purchasing and using personalized vehicle designs. Each Genie theme is accompanied with distinctive ambient music and illumination scheme inside the vehicle. In addition to the aspect of customizing vehicles, the Genie experience offers access to an exclusive design club, which enables its members to stay informed about the latest car fashion trends and get access to special design-oriented events.

In the past, people were only able to choose the colour of their cars. Even though the design of cars became more sophisticated - in contrast to luxury cars - there was no opportunity for premium car owners to differentiate themselves from the mass. Luxury cars however do have a certain individualization factor, as they are very rare and come with distinctive designs. With Genie though, premium vehicle customers are now entitled to a form of individualization themselves. Genie gives them the option of having many colours, ambient animations as well as visual effects on their car. Premium mobility customers are offered a platform on the exterior of their cars to show off their personal style.

Choosing the Genie Surface technology and associated Genie themes is an

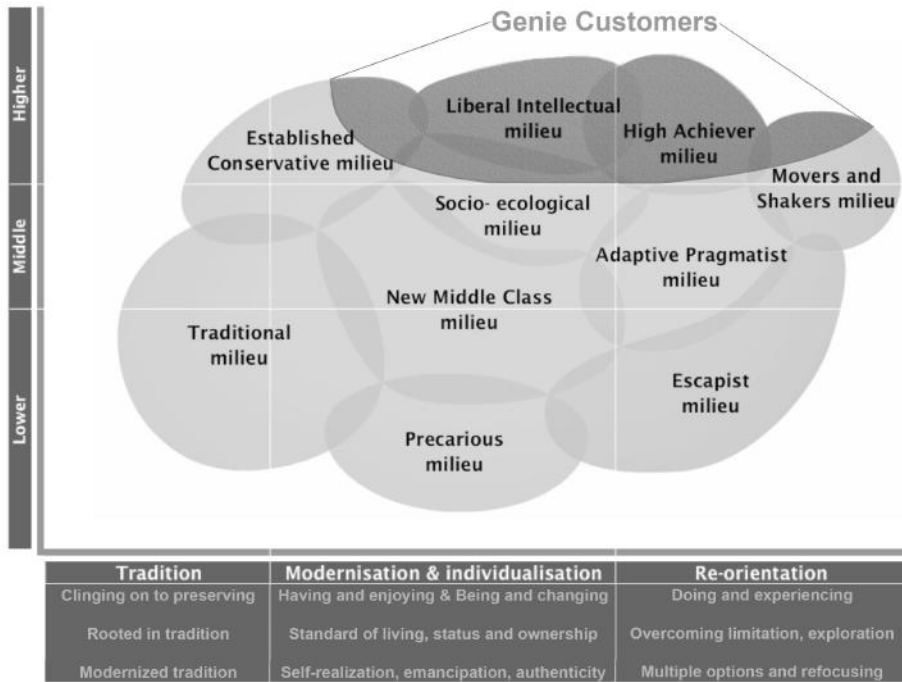


Figure 12.2: Customer Segment

Source: Based on: SINUS market and social research

expression of personal style and taste. Each theme is highly limited in quantity to underline the exclusivity of each Genie. Customers are not only offered the technological functionality of individualizing their cars, but a tangible and liveable experience.

### 12.2.3 Channels

The acquisition of Genie starts with the vehicle purchase process at a point of sales. The dealers' sales staff actively promotes the Genie Surface. Most dealerships have a small dedicated Genie Corner - operated in cooperation between the Genie Company and the car manufacturer - which is visually separated from the main dealership. Trained staff has the opportunity to demonstrate Genie, its benefits and advantages to interested customers. When ordering a new vehicle, Genie Surface can be selected as one option on the vehicles' feature lists. The vehicles get equipped with the Genie Surface technology and come with three built-in Genie Themes. Furthermore the customer can already start selecting and purchasing additional themes from the Genie ecosystem,

right at the dealership's Genie Corner. By integrating Genie into the sales process, the manufacturer can raise additional customer attention and Genie can furthermore already sell the first themes. Dealerships are incentivized by offering a commission for every newly acquired Genie customer.

After a customer has placed a vehicle purchase order equipped with Genie Surface, special design stores, named Genie Lounges, become the main channel for future theme purchases. Genie Lounges are located at certain dealerships as well as other strategic places, such as expensive shopping places (e.g. as shop-in-shop). It is important to create a consistent atmosphere throughout all Genie Lounges, which fosters the development of the perception of Genie as a brand. All Genie lounges are set apart from their surroundings.

High-income customers tend to perceive their cars as an expression of their personality. Therefore customers buying new fashion outfits for themselves might also have a desire to reflect their newly acquired styles on their cars as well. A customer that bought a new evening dress for a very special event searches for a matching look for his car. To address this desire the manufacturer operates flagship stores in proximity to luxury fashion outlets. In these flagship stores, customers receive a premium treatment in order to create a memorable Genie theme purchase experience. Success of creating this vivid and memorable experience is the key element to establish long-term customer relationships with reoccurring customers. Flagship stores primary address existing customers. Flagship stores are directly operated by the Genie company. Therefore it is not possible to order new cars.

All Genies are solely digital products and thus in theory, easily distributable via digital channels like web platforms etc. Since most customers are reluctant to spend money on digital and intangible products, it is a key challenge to create a customer experience, which justifies a premium price from a customer's point of view. As it is difficult to create this kind of experience outside of Genie Lounges, a digital distribution via internet is not desirable. Customers should perceive a real and memorable shopping experience. Furthermore digital products can be replicated any number of times. To ensure an exclusive perception by the customers, all premium themes are either highly customizable or limited in quantity.

#### **12.2.4 Customer Relationships**

Customer relationships are based on the Genie experience as shown in figure 12.1 which takes place in five basic steps derived from section 12.2. First, a customer has to purchase a vehicle equipped with the Genie Surface, with which comes the vehicles key serving as the Genies bottle. Once the customer acquires the key, he has to find his individual Genie, selecting it from the vast portfolio of Genie themes. As soon as the customer makes his choice, he captures the Genie and stores it in the Genie bottle. Whenever he pleases, the customer

can unleash his Genie. This refers to the process when the Genie theme is transferred from the key to the car. Lastly, customers are encouraged to engage with a process of worshipping their Genies, meaning that they get regularly invited to design events exclusive to members of the Genie circle.

Throughout those five steps of the Genie experience, customer relationships have to be cultivated differently.

Before getting a Genie bottle, potential customers are mainly reached via advertising campaigns and flagship stores that are accessible publicly. However, when the Genie Surface technology is acquired, potential customers turn into actual customers and the relationship is fostered and nurtured more actively. Finding and capturing the Genie mainly takes place in flagship stores or Genie Corners at car dealerships where the customer will find a dedicated personal support. Personal advisors serve him and ensure a comforting as well as exciting Genie experience. Thus, the relationships are of a rather personal nature, which is costly. However, this is a necessary investment as the Genie is about selling an experience and not a solely digital good.

When the Genie is unleashed, the customer is already associated with his personal service hot line assistant. Whatever questions or issues he has, he can directly contact his assigned Genie employee who will help him from there.

For the last part of the Genie experience – worshipping your Genie – relationships with all Genie Circle members are cultivated. External and internal events enable an exclusive access of Genie Circle members to fashion and design events as well as insights to car manufacturers prototyping etc. Those events are intended to build up a long-term and more personal relationship with the customer to integrate him as far as possible into Genie.

Overall, the cultivation of intense customer relationships on a very personal is a key success factor for the business model and it's sustainability.

### 12.2.5 Key Resources

The essential ingredients to create the memorable Genie experience are summarized in figure 12.3. They are comprised of activities as well as of resources. In this section, key resources that make up the respective ingredients are presented.

In order to provide a sophisticated technology enabling an aesthetic presentation of the Genies, several resources have to be at hand. A research and development laboratory adapting display technology to the proportions of a vehicle is one essential resource. The suppliers of the display technology represent a further important resource. Their superior technology will differentiate the Genie Surface from eventually emerging competitors. However, it is also important to legally protect the display technology. One key resource is therefore a patent that is filed for the adaptation and integration of displays to the specific proportions of a car body. Besides the hardware, the software interface has to be protected as well. Transferring a design file on the displays of a car should

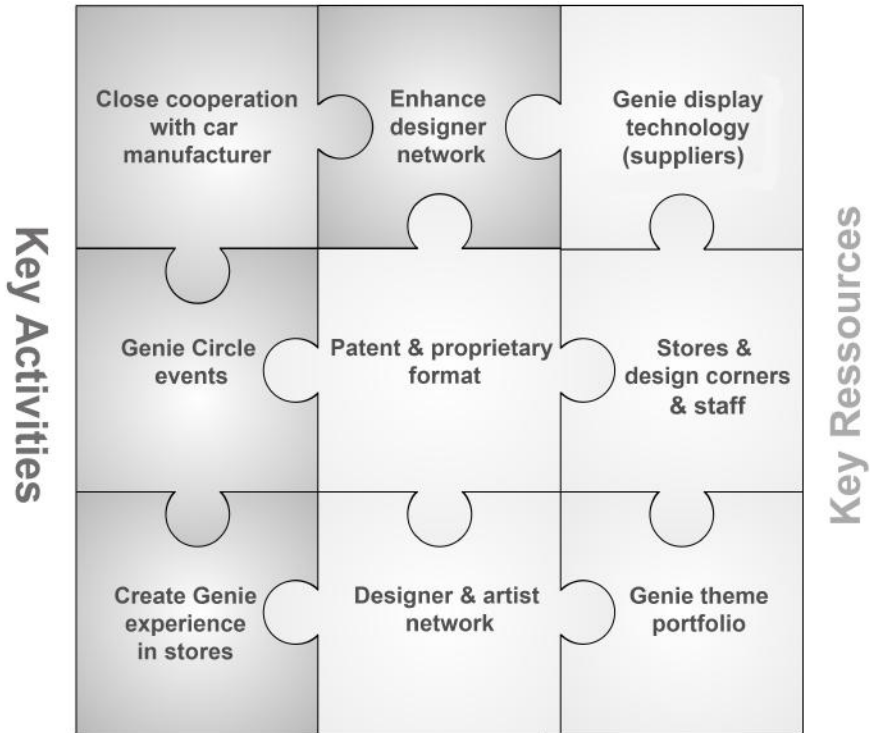


Figure 12.3: Key Resources and Activities

Source: Own Illustration

not be feasible for just anyone. It is thus important that the design themes are converted to a specific format, which is proprietary to the Genie Surface.

The key resources for providing the Genie Surface all together consist of technology to adapt displays to a car body, its intellectual protection and the suppliers of the displays.

Examining the resources required for the Genie experience and themes, one can list the network of cooperating designers and artists creating a rich and diverse portfolio of themes. The list is completed by the infrastructure of places to serve customers, as well as an internal server infrastructure.

Taking a closer look at the network of cooperating designers and artists, once established, this only forms a key resource, if it is maintained, enhanced and refined on a regular basis. The resource is essential to the idea, as popular names of designers will make the Genie experience more luxurious and attractive. Furthermore, only a variety in designers has the potential to create the rich and diverse portfolio required to enable a customer to individualize and self-fulfill

with Genie. Thus, commanding such a portfolio forms an essential resource with the ability to differentiate from potentially upcoming competitors. It also ensures a unique and desirable experience for the customer himself.

Ensuring the smooth transfer of chosen Genies from the back-end server to a customer's car is the infrastructure of the company, comprising another important resource. Seamless connectivity of the devices<sup>1</sup> that are linked to Genie is important to enrich a customer's experience. A Genie theme is not only found on the car, but also on the respective key or smart devices of the Genie's owner. As a main part of the Genie experience takes place in stores, the Genie Lounges as well as Genie Corners at retailers form another key resource. Styled in corporate design, such stores are luxury sale floors where the customer's experience is realized.

In conclusion – key resources to enable a Genie experience are the display technology along with its protection and suppliers, and the ingredients required to realize the Genie experience, such as the designer network, portfolio and the actual stores along with their staff.

### 12.2.6 Key Activities

Activities complement the resources required to create the Genie theme, technology and experience. They form an essential part for the ingredients required to generate a vivid Genie adventure for the customer as shown in figure 12.3.

Integral parts of the operations of Genie are activities, centered around the well-being and pleasure of the customer. It is mandatory not only to create pleasant events and exciting experience on a regular basis, but also to improve and innovate the Genie concept itself. Activities are split up into operations, which focus on fulfilling the business needs today and strategy, dealing with chances and challenges of the future.

Considering the business needs today, key activities consist of creating a rich design portfolio, offering exclusive events and nursing the network of cooperating designers. Furthermore, an active cooperation is necessary with display suppliers and car manufacturers in order to facilitate the adaptation of Genie Surface to the car body. Operations should focus on essential ingredients to comfort a customer. Applying this generalist rule to the business model being presented, this results in three main tasks for operations:

First, the provider has to ensure that all requirements for a memorable Genie experience are fulfilled. Those requirements consist of the display technology itself, which has to be reliable and working properly.

Further, a rich and diverse portfolio has to be created and maintained in order to offer the customer a satisfactory choice and individualization opportunity. In turn, to create and constantly update the rich portfolio, a diverse network of cooperating designers and artists has to be managed actively. (The second

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<sup>1</sup>such as the car board computer or the mobile personal devices



requirement is primarily concerned with the Genie Experience itself – the actual purchase of the design in the store, welcoming customers in the stores and serving them with dedication represents an important part of the activity). The staff therefore needs to be well trained and constantly monitored. However the Genie experience does not only consist of the purchase but also of all the events and activities of the Genie Circle. It is important that these events are hosted or organized on a regular basis and that they have an exclusive character. One could imagine the Genie Circle being invited to Paris Fashion week or an internal “behind-the-scenes” prototype presentation.

Lastly, a key activity of operations focuses on the after-sales and back office service. The well-being and comfort of the customer has to be ensured at all times; his or her questions and technical issues need to be addressed instantaneously. For this purpose, customers are assigned a personal “care taker” whom they can contact whenever they want to.

Thus, operational key activities are the preparation, realization and continuous support of the Genie experience.

On the other hand, future activities center around improving the display technology itself, enhancing and refining the portfolio of the themes offered, as well as constantly augmenting the Genie experience. All together, these strategic activities ensure that the customer is offered an experience that is memorable and does not bore him over time. Innovation of the technology itself is essential as competitors will likely emerge in the market. To remain the most attractive provider for adaptive exterior appearances of vehicles, it is thus important to be and remain the owner of the dominant design in the market. This can be aided by intellectual property protection: Patents, proprietary standards and other means of protection have to be maintained actively.

### **12.2.7 Key Partnerships**

Applying the same distinction as in section Key Activities, one can distinguish between key partners that are mandatory for the Genie Surface and partners that are essential to the Genie experience and themes.

Regarding partners that are mandatory for the creation of the Genie Surface, suppliers as well as car manufacturers can be identified. Suppliers of superior display technology ensure a high quality product and are therefore important partners. However the technology also has to be implemented into the vehicle, which happens on the car manufacturers side. Thus car manufacturers are prerequisite partners to enable Genie after all. Without their active cooperation, Genie can't be implemented physically into a car or sold at their retailers' store. Establishing partnerships with multiple premium car manufacturers is thus important to capture a higher market share.

For Genie themes and experience, designers, artists, fashion labels as well as big event organizers represent key partners. The more well-known designers

and artists partner up with Genie, the richer in content the Genie portfolio collection could be. And by consequence, the more attractive it could be to end-customers. Depending on the bargaining power of the designers and artists, they can be offered a contract based on commission, a basic fee or a combination of both to pay for themes they are creating. It is desirable to establish long-term partnerships with design creators to have a certain level of continuity for the portfolio set-up. Another key partner are fashion labels. They could either serve as theme creators – in creating an entire spring collection for example – or as event partners. As event partners, they cooperate for events such as a fashion show, hosting a sport event or anything similar. Those activities are intended to extend the Genie experience from the stores and a customer's home to an exclusive circle. Partners that enable and guarantee access to those attractive events are therefore valuable partners for the business.

Summed up, key partners adding value to the Genie business model are technology suppliers and car manufactures on the one hand side and designers, labels and event planners on the other side.

### **12.2.8 Revenue Streams**

Revenue streams come from two different angles of the Genie product: First from the initial sale of the Genie Surface technology, second from the purchase of single Genies.

The first revenue stream is generated by an asset sale. The technology feature is integrated by the car manufacturer into their portfolio in order to better meet a customer's customization demand. Car manufacturers have an interest of actively promoting the Genie Surface technology as they receive a commission on each sold unit. Genie Surface is sold at a standard list price, which is discriminated only by the underlying car model.

A secondary revenue stream, yet to be expected higher in the long-run, comes from the sale of single Genies. The primary target group of luxury car owners will be considered in the following. It is assumed that a car remains in the possession of its owner for three years, and that the owner buys 10 Genies a car on average. Depending on their exclusivity and originality, designs will be priced between 500 and 5.000 EUR. This results in sales per customer of 5.000 to 50.000 EUR every 3 years. The customers are paying for the entire experience that is associated with Genie.

This experience includes on the one hand the individualization opportunity coming with the choice of the design. On the other hand, the experience is formed by the purchase itself and events hosted by the exclusive Genie Circle. A merely digital good is thereby transformed into an experience that brings along a product and adventure; the customer is willing to pay more for. Payments as such are made as convenient as possible. Customers have an account with Genie that directly charges their credit card. A digital signature is sufficient to

confirm a purchase. Enabling the experience to be hassle-free hereby is essential for warranting the revenue stream stated..

### **12.2.9 Cost Structure**

Creating the Genie experience and technology comes with significant costs and initial investments. Costs can be broken down to four main areas: first the purchasing and adaptation process of the Genie Surface technology itself, second the creation of the Genie themes, third the infrastructure required and lastly marketing and branding expenses.

Genie Surface is composed of flexible displays, which cling to the car body. The adaptable displays are purchased from suppliers. The know-how and technology to cling them onto the car body is developed and delivered by Genie itself. The business therefore faces costs for research and development as well as the purchase of displays.

For the creation of Genie themes, designers and artist have to be paid. Depending on the contract, costs occur based on a fixed fee or as a commission of sales.

Another significant cost position consists of the infrastructure, required to provide the Genie theme and experience. Part of the infrastructure are the flagship stores, as well as design corners that are rented at car retailers. The stores have to be owned or leased in rather expensive areas – like shopping zones in the inner city. The stores themselves need employees for sales and services. Hence, they make up a significant cost position. Another cost position related to infrastructure is the IT structure with backend server, maintenance and support hotline.

As already mentioned before, Genie is an exclusive experience, which does not only take place at the store but at prestigious events. It is thus costly to manage, host and promote those events. Also the Brand of Genie has to be formed and promoted, to attract and lock in customers. Marketing and Branding of Genie is thus a significant expense.

Purchase and adaption of the technology, the creation of Genie themes, the infrastructure, marketing and branding required for Genie, all together make up the cost structure of Genie.

## **12.3 Scenario Robustness Check**

To assess the pertinence of the business model Genie, its compatibility to the four scenarios Communified, Car.me, Autonomy and Shared Patchwork is evaluated. Reflecting on the proposed ideas, strengths and weaknesses and the possible performance of the Genie Business Model are assessed. In each of these extreme environments, the potential and robustness are tested.

### 12.3.1 Communified

The scenario Communified is characterized by highly standardized and exclusively shared means of transportation.

A purchased Genie would thus fit vehicles of different manufacturers equally well, possibly even different types of vehicles. On the one hand, this is likely to substantially lower costs. One-fit-all solutions remove the need to continuously reinvent the wheel and allow to lower efforts in research and development as well as during production processes without compromising the end result. Instead, all resources can be invested in creative processes and to further optimize the product itself in order to maximize its appeal to the end customers.

In a world dominated by highly standardized and almost exclusively shared means of transportation, vehicles are likely to lose their importance as status symbols and it might become difficult to reach customers on an emotional level. Vehicles equipped with the Genie Surface and custom Genie themes provide a way for customers to customize their means of transportation. In this way acquiring and owning a resource would again be both possible and attractive.

On the other hand, the high standardization might make it easier for competitors to enter the market. Single solutions which are usable by a large customer base might invite low-cost competitors striving for gains through economies of scale. Upholding the essential premium aspect would be substantially more difficult under these circumstances.

### 12.3.2 Car.me

In case of the scenario car.me, a high level of standardization is assumed while the means of transportation predominantly remain in private ownership.

The implications of the high standardization previously discussed for the scenario Communified remain valid also for Car.me. One of the most important implications might be relatively low production costs. They are expected to be lower due to the possible re-use of single solutions for vehicles of different manufacturers, maybe even different types of vehicles. Also, the cost for research and development might be lower due to the large field of application for its outcomes. The expected result would be a highly sophisticated technology which could be offered to interested customers at a reasonable price.

However, the threat of low cost competitors as the major downside of the high level of standardization remains present.

In a world of little to no shared means of transportation, the ownership of vehicles might be sufficient to preserve their importance as status symbols. Genies would certainly further enhance this aspect and reinforce the emotional value attributed to vehicles by their respective owners. However, unlike in a scenario dominated by shared means of transportation, Genies would in all likelihood not be at the very core of what makes the vehicles valuable status symbols. The high level of standardization with its expected high competition

in the field could make the Genies obsolete. A higher importance on revenue generated through licensing and selling the technology itself instead of exclusive reliance on income generated by the sale of an exclusive experience might be a good strategy in this environment.

### 12.3.3 Autonomy

In a future dominated by private ownership of means of transportation combined with a very low level of standardization, the technological solutions developed by Genie would fit only one type of vehicle of a specific manufacturers. Therefore, the cost for research and development as well as for the actual production are at risk to become extremely high.

Similarly as with the scenario Car.me, Genies would not make vehicles a status symbol, but rather reinforce their importance as one. The major difference between the two scenarios lies in the lack of possible economies of scale. No economies of scales translates into a small number of Genies sold at a high price. A scenarioa, in which Genies thus would likely be best positioned as very exclusive premium products close to the luxury segment. A possible remedy to prohibitively high costs of development and production could be a model where the sale of Genies is subsidizing the high technology cost. The upside of the low level of standardization could be the relatively high entry barrier for competitors. Price-driven competition would be highly unlikely and the premium aspect of the business model much easier to defend.

Finally, the business model could profit from strong vendor lock-ins. First, manufacturers of vehicles would need to cooperate closely with Genie. Switching costs for them would thus be very high. Similarly, on the business to customer level high loyalty can be expected. Customers who decided for a vehicle with the respective technology would, due to the lack of interoperability, be bound to a certain ecosystem. Building a strong brand should be much easier under these circumstances.

### 12.3.4 Shared Patchwork

Fully shared means of transportation with a low level of standardization translate into high technological costs. Cars as means of transportation are not perceived as strong status symbols.

Although at first impression a horrible scenario – high costs and an unsecured market potential – this scenario could very well reveal to be one of the most promising of the four scenarios tested. As it is the case in the scenario Communitied, Genie would transfer shared vehicles into status symbols and provide emotional appeal to its customers. However – other than in the future envisioned in Communitied – in Shared Patchwork, this high value added is unlikely to be forced to compete with and prevail against possible low cost rivals.

Instead, the core function of Genie is to foster a vehicle's function as a status symbol. This would go hand in hand with the exclusivity of the product which is enforced by its high cost of implementation. Shared Patchwork would allow Genie to provide exclusive products to loyal customers willing to differentiate from the majority through a classy appearance.

## 12.4 Outlook

Genie could have a great impact on the customization aspect of the car industry. If premium customers were to adapt to perceiving cars not only as traditional status symbols, but also as fashion items, an entirely new industry could emerge. An industry with a potential which could evolve to be comparable to the luxury fashion market.

The realization of the Genie idea strongly depends upon the scenario about to unfold in the future. After adjusting to the situation, the idea remained robust and its potential high. Therefore, the chances for success depend mainly on customer acceptance – which can be influenced heavily by adequate means of marketing. However, in the scenario Car.me with a high level of standardization and private ownership Genie might have problems to establish itself. Low price competitors could utilize the lower market barriers due to the high level of standardization to offer products on eye level.

Nevertheless, the outlook for the Genie idea appears to be promising, and the potential variation in the car industry creating a new market is very lucrative.

## 12.5 Conclusion

In conclusion, one can state that the Genie idea is a large leap in the evolution of car design and customization.

On the one hand, the idea comes with certain risks, as its implementation would require huge investments. A major one is developing the display technology itself in order to make theming cars possible in the first place. Currently, there are a few candidates for such a technology, but none of them is advanced enough yet. Moreover, it will be necessary to improve the production process up to a point where economies of scale help to make the displays affordable.

Another major requirement are mandatory investments to create a well-cooperating network of designers and developers as well as store advisors and event organizers, as these are essential for creating a new car fashion market, encompassing products of great value to premium customers.

On the other hand, should such a large leap succeed, the result would be all the more rewarding. Establishing car customization as a new market on a scale similar to the fashion market would indeed be revolutionary and would create numerous opportunities to which the Genie Company could adapt – just as

fashion designers have been adapting to fashion trends – and which it could shape, make use of and benefit from.

This would enable it to obtain a higher position in the fashion world, and in turn, this would lead to added value to the customization products. As soon as such a system reaches a certain level of critical mass, it becomes a positive feedback circle, steadily reinforcing itself.





# 13

## Chapter 13

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# AirP2P

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### **Executive Summary**

AirP2P is a platform that enables travelers at the airport to easily let their privately owned car to incoming travelers during their time of absence. This has multiple advantages for the car owner as well as for the renter: the owner does not have to pay a parking fee during his absence, the car even lets him earn some money. For the renter, AirP2P is an affordable way of renting a car. Moreover, AirP2P improves the occupancy rate of cars and thereby supports “green” individual mobility. Revenue is generated by deducting a portion of the renting fee the car renter has to pay to the owner. Key challenges for AirP2P are the acquisition of partnerships and customers. Airports are vital partners for setting up the necessary parking space and the AirP2P service desk. To build a large customer base, AirP2P advertises on flight and travel booking websites. A strong sharing mentality is vital to the success of the business model, whereas a scenario of high technical standardization is not required, but more convenient for the AirP2P customers.

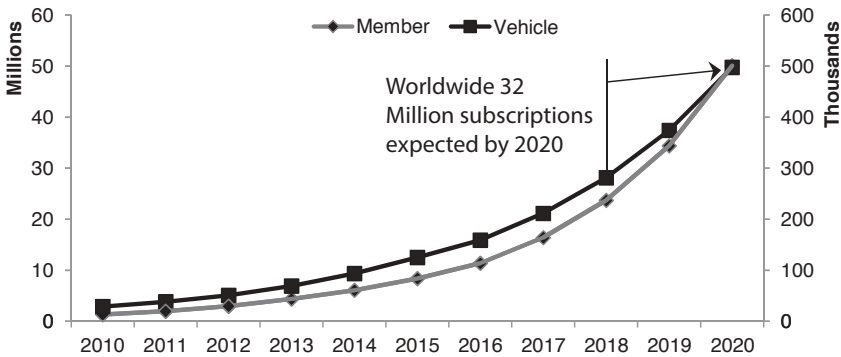


Figure 13.1: Members (left axis) and vehicles (right axis) of car sharing companies.

Source: Adapted from [388]

## 13.1 Introduction

With a growing demand for a more sustainable mobility, one prominent trend is sharing cars between multiple persons to achieve higher utilization (see figure 13.1) and lower costs for each individual. In the field of car sharing, two general business models prevail: firstly, many car sharing companies allow customers to rent cars from their proprietary fleet on a per-minute basis and park them anywhere within a certain area of operation. On the other hand, there are peer-to-peer (P2P) car sharing providers that act as intermediaries between private persons, enabling car owners to share their vehicle with others when they do not make use of it. However, the latter approach still faces major problems: the cars cannot be parked anywhere, but need to be picked up at and returned to a certain location. Furthermore, the car keys have to be exchanged personally. These fringe conditions significantly constrain the renter and limit the viability of P2P sharing. The business model of AirP2P elaborates on the trend of P2P car sharing and solves the problems mentioned above by specializing on airport rentals. Since the start and end points of every journey are the same, car owners can let their cars to arriving visitors during their trip. In the following sections, key aspects of the AirP2P business model are elaborated. Moreover, the feasibility of AirP2P is analyzed in the context of different future mobility scenarios.

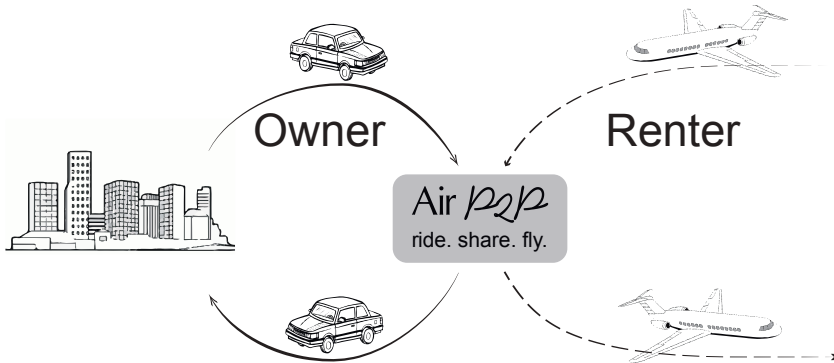


Figure 13.2: Simplified illustration of AirP2P's business model  
Source: Own illustration

## 13.2 Business Idea: AirP2P

AirP2P is an airport-based P2P car sharing service. The company acts as intermediary between car owners and renters. Based at the airport, AirP2P loans out cars of departing travelers to arriving travelers (see figure 13.2), therefore generating revenue for the owner of the car, saving parking spaces at the airport and offering a more affordable alternative compared to conventional car renting providers for arriving travelers. It generates revenue by keeping a fraction of the rental fees. To facilitate borrowing, it not only handles the transaction of the keys and the payment, but also offers a clear legal framework for the transaction and suitable insurances. It also performs background checks of renters and can act as neutral mediator in case of a conflict between both parties.

The procedure of an average AirP2P transaction would be as follows: A traveler who departs at the airport hands in his car keys at the AirP2P desk at the airport and specifies whom he is comfortable letting the car to, how he wants to insure his car and whether he would like to book additional services. He then departs from the airport and does not have to get active again. AirP2P then checks the car for damages and does a quick cleaning of the car. Another traveler arrives at the airport and wants to rent the aforementioned car. He signs the renting agreement and decides on insurance, duration of the car rental and his preferred kind of payment. After some background checks, he gets the keys at the AirP2P desk and can use the car. When the rental period is over, the renter returns the car and hands in the keys. AirP2P checks the car for damages and cleans the car interior. When the owner of the car returns from

his travels, he reclaims his keys at the AirP2P desk. AirP2P takes a share of the fees paid by the renter. The remaining money is paid out to the owner of the car.

Alternatively to renting/offering the car at the airport, it can also be done via internet in advance, which increases the chances of finding a suitable time slot and enables more choices.

The following sections outline the business model of AirP2P according to the business model canvas by Osterwalder [389].

### 13.2.1 Customer Segments

AirP2P addresses two customer segments, both on the renter and on the car owner side. Individuals in both segments are rather young and familiar with the idea of sharing. They are willing to lend their car to others, provided a trusted entity acts as intermediary.

#### **Low-budget air travelers**

Generally, the high flexibility and convenience of individual mobility is expected to be beneficial for every traveler. Therefore, choosing between public transportation and a rental car is not a matter of personal preferences, but depends on the rental fee and the travelers' individual budget. The sharing concept of AirP2P makes rental cars affordable for a large group of low-budget air travelers including students, young couples, working class families and independently travelling business men, who previously had to rely on public transportation due to the high rates of regular rental cars.

Young families derive a high benefit from having their own car during vacations, because using means of public transportation with children can be exhausting and dangerous. Since tickets often have to be purchased for every member of the family in public transportation, the price spread compared to renting a car with AirP2P is expected to be rather low. An important challenge for AirP2P regarding this segment is their low number of trips per year, which leads to a lower revenue per customer.

Whereas premium business travelers employed by large companies are expected to prefer the reliability and convenience of conventional car rental services, independently traveling businessmen might choose a more affordable solution, since their expenses are not covered by the company. Due to the higher number of trips per year, this customer segment is very promising for AirP2P.

#### **Environmentally aware consumers**

Across various income and budget ranges, the growing segment of environmentally aware consumers is another promising target group for AirP2P. Through peer-to-peer car sharing, the existing stock of vehicles is utilized more efficiently, which leads to a reduced demand for dedicated rental cars. AirP2P might be an attractive option especially for the growing segment of LOHAS customers

(“Lifestyle of Health and Sustainability”), who call for both environmental sustainability and convenience.

### **13.2.2 Value Proposition**

#### **Renters**

For the renter, AirP2P offers two key benefits: firstly, renting a car from another private person is more affordable than renting from a dedicated company. Secondly, P2P car sharing utilizes the existing stock of vehicles on the road more efficiently and therefore conforms to the willingness of many customers to behave ecofriendly.

#### **Owners**

For the car owner, the most relevant reason for lending his vehicle to another private person is the financial benefit: airport parking fees are saved and the owner even generates “passive income” with his car while traveling. Since a free interior as well as an optional exterior car cleaning is conducted by AirP2P, the car owner experiences an additional degree of convenience and time-efficiency. Furthermore, offering one’s private car for rent appeals to environmentally aware car owners.

### **13.2.3 Channels**

Marketing and sales channels describe the way a company communicates its value proposition and delivers its product or service to the customer.

#### **Marketing channels**

The most important marketing channel of AirP2P is online advertising on travel and flight booking websites, where the need for airport car rentals is expected to be high. Furthermore, AirP2P directly advertises its service at every airport that has an AirP2P office in order to address last-minute renters and create awareness among travelers who do not know the service yet. This is achieved through poster advertisement and commercials on airport media screens.

#### **Sales channels**

The main sales channels are staffed AirP2P desks at the airport, through which AirP2P personnel organizes the car key transfer between car owner and renter. The desk conducts payments, new customer sign-ups and last-minute rentals. It also functions as a point of information, where interested customers are introduced to the service by AirP2P staff.

The AirP2P web platform enables departing travelers to list and schedule their private car. Rewards are granted to customers if they list their car far in advance. Moreover, the website enables renters to browse through available vehicles and book a listed car in advance. The website also informs customers

about the legal conditions of AirP2P and the obligations customers have to comply with.

To complement the airport desk, a customer service hotline is available on a 24-7 basis. Besides checking for available vehicles and making reservations in advance, the hotline is supposed to support customers involved in an accident by providing information about insurance issues and guiding the customer through further steps.

### **13.2.4 Key Resources**

The following section outlines important tangible and intangible assets AirP2P has to acquire to succeed as a business.

#### **Parking lots close to the airport**

Parking lots are needed to park cars that have been entrusted to AirP2P by their owners. Parking spaces must be close to the airport and should be easily accessible for the cleaning service. Therefore, AirP2P needs to enter into a contract with the airport operator, who wants to maintain revenues generated through parking fees.

#### **Trustworthy brand**

Trustworthiness is crucial in order to convince car owners to entrust their cars to AirP2P. To build up this trust, AirP2P employees must always behave with integrity. Furthermore, a good customer service needs to be provided, especially in case of accidents with a rented car. High penalty fees determined by contract assure that renters bring back the car on time.

#### **Legal framework**

A clear legal framework between AirP2P and its customers is needed. Besides regulating the relation between owner, renter and AirP2P, it should also cover any occurring incidents, e.g. when cars are returned late or get damaged.

#### **IT-infrastructure**

AirP2P has to roll out an IT system with the following functions:

- database containing all private cars available for sharing at a specific airport, along with their period of availability (i.e. departure and arrival time of the traveling car owner)
- storage of rental requests made via the AirP2P website
- matching between car owners' travel schedules and rental requests to facilitate P2P rentals
- maintaining user profiles of car renters including personal data and user ratings from past P2P rentals

- space management: prevent that the number of parked vehicles exceeds the number of available AirP2P parking lots at any airport and any point of time

### 13.2.5 Key Activities

The following key activities have to be conducted in order to set up the AirP2P business model.

#### **Contracting with Airports**

First of all, AirP2P has to cooperate with a significant amount of airports in order to set up AirP2P desks close to the customers' point-of-need (e.g. baggage drop-off zones, arrival hall). A high number of AirP2P subsidiaries on different airports creates network effects and higher incentives for travelers to sign up.

#### **Contracting with Parking Space Providers**

Parking space providers can be either the airport itself or an external third party provider close to the airport. In order to provide secure parking lots for shared private cars, AirP2P has to partner up with the respective providers, either by paying parking fees directly or by negotiating revenue sharing agreements based on the P2P rental fees.

#### **Renter Check**

In order to create trust among car owners and to manage the aversion against lending one's private car to unknown persons, AirP2P has to register and check each customer when he initially signs up for the service. This includes verification of identity, age, gender, driver license and data from the traffic penalty register<sup>1</sup>. Minimum requirements for age and possession of a driver license apply.

For every rental, online ratings given by respective car owners after past rentals on the AirP2P website are taken into account (e.g. cleanliness and intactness of the rented car and timeliness of its return).

In a future scenario, personal information about the renter might be complemented by data on the renter's driving behavior, which is retrieved via standardized on-board diagnostics (OBD) devices. Harmful maneuvers like burn-outs can be detected and influence the renter's future rating. The goal is to create a single, discrete "renter integrity score" that enables car owners to exclude certain persons from driving their car in advance. Renter ratings across different car sharing services might be taken into account to determine the driver's integrity and applicability as a P2P renter.

#### **Car Condition Management**

In order to avoid conflicts between car owners and renters, AirP2P has to capture and check the state of each car when handed in by the owner and when

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<sup>1</sup>might be retrieved via the new electronic passport and the holder's consent

returned by the renter.

In both cases, the car must be filled up by the driver. The interior is cleaned by AirP2P personnel before and after the rental period. In order to prevent insurance fraud and malicious collaborations of owner and renter, the state of the car exterior (varnish, chassis etc.) is captured by an AirP2P employee when the car is parked.

### **Marketing**

AirP2P relies on a large number of customers on its supply and demand side to guarantee instant car availability and a seamless experience. To build up a customer base, significant advertising efforts have to be made in advance both at the airport and on third party websites.

### **13.2.6 Key Partnerships**

As stated in the key activities section, the most important partners are large airports and parking space providers in and around the airport. In order to conduct the optional premium cleaning, AirP2P partners up with an external company like MyCleaner, which offers location-independent and ecofriendly car cleaning services on demand. AirP2P may act as a broker for these services and charge MyCleaner a revenue share for every facilitated cleaning order. Alternatively, AirP2P can employ in-house cleaning personnel.

Other important partners are large insurance companies that provide additional liability insurance and vehicle damage insurance for both the owner and the renter during the time of the rental.

Travel and flight booking websites serve as advertising partners: customers can be addressed with the AirP2P service when they face the highest need for a rental car (i.e. prior to going abroad). Furthermore, AirP2P has to partner with a payment processor to offer the renter cashless payments and an escrow account for rental fees (compare AirBnB). In spite of being competitors at first sight, companies like Sixt or Europcar might qualify as channel partners for AirP2P, since they address a totally different customer segment: AirP2P could use the rental firm's existing offices and customer relationships at the airport to explicitly address low-budget travelers.

### **13.2.7 Revenue Streams**

AirP2P generates revenue by collecting a share of the fees paid by the car renter to the car owner (see figure 13.3). In order to assure competitive prices and an appropriate revenue share, AirP2P determines a price range for every car that depends on the model and condition of the vehicle. Within that given range, the car owner may determine the exact rate.

Additional revenue is generated through optional insurance packages for the renter that reduce the maximum co-payment sum in case of an accident.



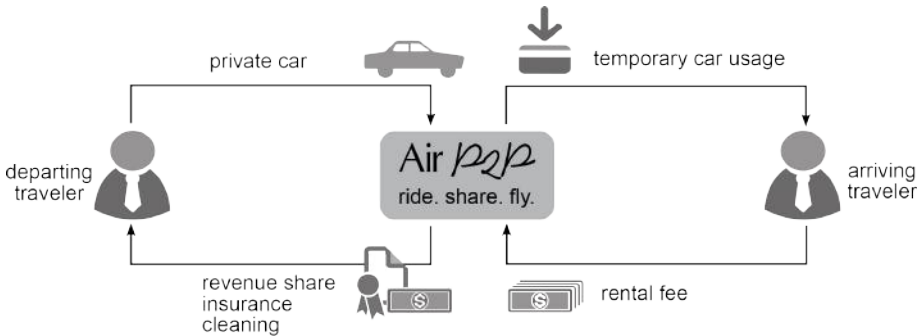


Figure 13.3: Schematic illustration of AirP2P's revenue models

Source: Own illustration

In exchange for an extra fee, AirP2P offers premium services like exterior cleaning, removing weather crackings and dealing with paint damages which are conducted during the owner's travel period. Two related revenue models can be imagined: either AirP2P employs cleaning staff itself and thus directly profits from eventual cleaning assignments. Or AirP2P partners up with an already existing mobile car cleaning company like MyCleaner to offer car owners their service catalogue. AirP2P might then claim a share of the payment to MyCleaner in exchange for the acquisition of customers.

### 13.2.8 Cost Structure

As a brokerage model, many operational costs are variable and tied to a related revenue payment (e.g. payment processing, parking fees). Overhead is kept small by carefully assessing personnel requirements and preferring revenue sharing agreements over fixed rental rates for airport facilities. However, the initial set-up of a legal and insurance framework is expected to be complex and time-consuming. Therefore, significant up-front investments are required. The remainder of the section summarizes AirP2P's most important expenses:

#### Booths at the airport

In order to acquire customers directly at the airport and handle the transactions of keys and payment, a booth at every supported airport is necessary. The main costs will consist of rental payments to the airport and salaries for the staff, which will be responsible for handling customers, cleaning the cars and checking the cars for damages.

#### Parking spaces

Besides the booths, parking spaces are needed at every branch to store the entrusted cars while they are not rented out. Since space is very limited at

airports and the operators of car parks demand for compensation in exchange for parking spaces, the costs might be considerable.

### **Legal advice and insurance**

In order to set up a reliable legal framework and the necessary insurances, lawyers as well as insurance companies have to be consulted. In particular, there is a need for lawyers when legal issues arise after a car accident or inappropriate use of a rented car

### **Online platform and advertisement**

An online platform is needed to allow registration, booking of cars, customer information and advertisement. Costs will incur for the setup and maintenance of the platform. To acquire customers in advance, online marketing is also necessary, which will cause further considerable costs.

## **13.3 Scenario Robustness Check**

In the following section, the feasibility of AirP2P in the environment of the four different scenarios will be discussed. Since AirP2P's business model relies on private cars, it is not feasible in scenarios that feature the eventual prohibition of privately owned cars, such as Communified and Shared Patchwork. In these two scenarios, however, it can succeed as a transitional business model between today and the final scenario.

In the two opposite scenarios, car sharing is assumed to remain a small niche market. However, due to the special location of AirP2P's business, the airport, and its focus on travelers, AirP2P might still find a niche where its car sharing business model can function.

While a high degree of standardization enables AirP2P to offer more comfortable services to its customers and therefore raise its attractiveness, a high degree of standardization also carries the risk of making the business model obsolete.

### **13.3.1 Shared Patchwork**

One of the key values of the Shared Patchwork scenario is the complete lack of privately owned cars. Therefore, P2P sharing is not possible and the business model of AirP2P cannot succeed. However, AirP2P can be seen as a feasible business model in the course of events that lead to the scenario. On the way to the eventual complete prohibition of privately owning cars, Shared Patchwork is characterized by the need to lower the number of cars in cities due to urbanization and air pollution, while at the same time the willingness of people to share their car is rising. Here, AirP2P might very well find its niche and succeed. However, Shared Patchwork is also characterized by a low degree of standardization. This has two major drawbacks: firstly, no historical data will

be available in order to rate the driving skill of a customer, and secondly, the huge variety of human-machine-interfaces will hamper the customer's willingness to rent a car he or she is not accustomed to. Therefore, AirP2P can only rely on user ratings as well as data it collects whenever a customer is using the service. To sum up, AirP2P cannot succeed in the final scenario of Shared Patchwork, where the ownership of privately owned cars is prohibited. Yet, it is a viable business model in the course of events that lead to this scenario.

### **13.3.2 Communified**

Just as in Shared Patchwork, Communified is also characterized by a complete lack of privately owned cars, rendering the business model of AirP2P obsolete. Again, however, AirP2P proves itself to be viable in the time before privately owned cars are eventually forbidden. Both the limit of the number of cars in cities all over the world and the rising environmental awareness increase the attractiveness of the value AirP2P has to offer. The growing willingness to share and pool over time further contributes to AirP2P's viability. Furthermore, with a high degree of standardization, it is realistic to assume that historical driving data of every customer can be made available across different sharing services. Therefore, customers can be rated according to their historical driving data, user ratings and additional data collected on every AirP2P trip, thus contributing to the trust of AirP2P's customers.

It is further realistic to assume that a high degree of standardization makes it possible to unlock vehicles remotely using a mobile app, which enhances the convenience and feasibility of P2P car sharing. This can be both a chance as well as a danger for AirP2P. On the one hand, keyless access to cars makes it easier for AirP2P to broaden their offer, e.g. to train stations and other transfer sites. On the other hand, better access to cars makes it possible to rent cars to others without the need for intermediaries. In this case, AirP2P's value proposition reduces to the provision of a web platform and a legal framework.

Again, AirP2P is not feasible in the world characterized by Communified. As in Shared Patchwork, however, AirP2P can be seen as a transitional step between today and the final scenario.

### **13.3.3 Car.me**

Due to the lack of willingness to share, it is highly unlikely for AirP2P to gain customers. Yet, as AirP2P concentrates on travelers who would have to rent a car anyways, it might still prove to be a feasible model, as the step from renting a car at a large car renting company to renting a car from a private person is not as big as the step from owning a car to only sharing cars. The high degree of standardization means a standardized interface for mobile devices and cars, i.e. the possibility to grant third-party access to the car via the internet. As

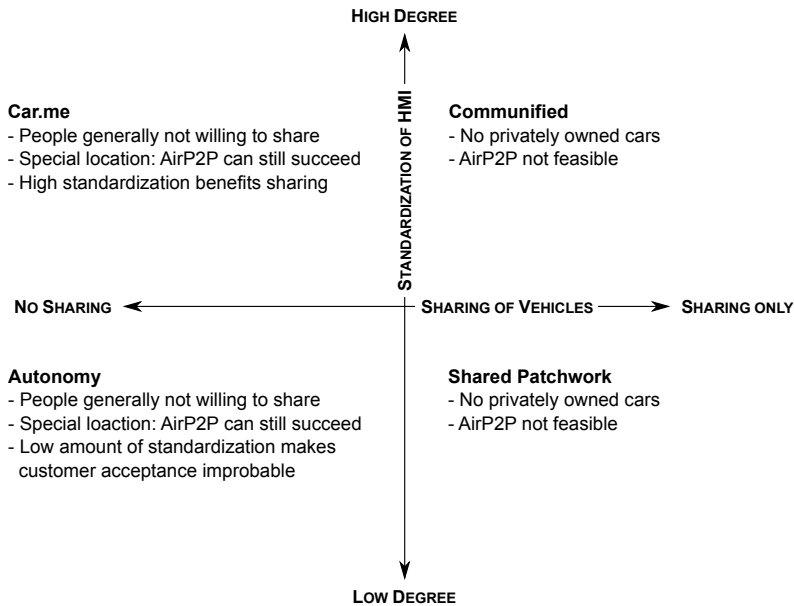


Figure 13.4: Driver implications for AirP2P

Source: Own illustration

described in Communified, this can be a chance as well as a danger for the AirP2P business model, as on the one hand side the brokerage of cars becomes more easy, but on the other hand side the need for an intermediary decreases.

When testing the robustness of AirP2P against the final scenarios, Car.me provides the greatest chance for AirP2P to succeed - the attractiveness of AirP2P over conventional car renting companies at airports is guaranteed by a much lower price, and the high degree of standardization makes it easy for customers to adapt to an unfamiliar car.

### 13.3.4 Autonomy

Due to the lack of willingness to share, it is rather unlikely for AirP2P to gain customers. Yet, as AirP2P concentrates on travelers who would have to rent a car anyway, it might still prove to be a feasible model, as the step from renting a car at a large car renting company to renting a car from a private person is not as big as the step from owning a car to only sharing cars. The low degree of standardization forces AirP2P to be airport-based in order to transfer the car keys and forces customers to adapt to a new user interface every time they change their car.

## 13.4 Outlook

In the basic phase, two important social trends in individual mobility were identified: the increasing willingness to share and pool as well as the rising demand for ecofriendly mobility. AirP2P clearly addresses these trends with a sharing model that is set up at a very suitable location and utilizes cars that would otherwise stay unused for days or weeks. Furthermore, ongoing globalization leads to a need for middle-income businessmen to travel in order to acquire new customers or visit business partners. These business travelers are a relevant customer segment of AirP2P, rendering globalization a contributor to the AirP2P customer base. Last but not least, it is highly probable that car ownership will become more and more expensive in the near future (see the legal discrimination of car ownership in Beijing). This might very well lead to an interest of car owners to improve the utilization of their own car and thereby earn money, which further improves the viability of the P2P sharing business model. If AirP2P proves to be profitable, it offers a clear insight into the development of future trends and customer needs. The success of AirP2P can be seen as a confirmation of the increase in sharing and pooling - thus, a successful AirP2P is a signpost for the right hand side of the scenario matrix. As discussed in the trend analysis, customers do not want to adapt to a new user interface every time they change their means of transportation. If AirP2P proves to be successful, this need for consistent interfaces gains momentum and might eventually lead to a strong demand for standardized interfaces in individual mobility. AirP2P thus can be seen as a signpost for the scenario “Communified”.

## 13.5 Conclusion

To sum up, AirP2P offers values that are already demanded by customers today and has the potential to become a profitable business. However, in order for AirP2P to be successful, three main challenges have to be overcome. Firstly, large parts of AirP2P’s customer segment are not frequent travelers which makes advertisement harder and decreases the lifetime value of each customer. Secondly, the competition at airports regarding mobility services is already very high. And lastly, AirP2P needs to set up a number of partnerships before it can effectively conduct its operations.

When testing the robustness of AirP2P in the scenarios Communified and Patchwork Sharing, the very core of the AirP2P business model - P2P sharing - is rendered obsolete, as privately owned cars are forbidden in these extreme cases. However, AirP2P can be seen as a viable business model in the course of events that lead to the establishment of those scenarios, as environmental awareness and a high willingness to share and pool make the value proposition of AirP2P more attractive. In the final scenarios though, Car.me proves to be

the most beneficial scenario for AirP2P, since the high degree of standardization, AirP2P's competitive rental rates and its unique location at the airport make it attractive even though car sharing is not a prevalent trend.

Taking these factors into account, AirP2P proves to be a feasible business model of the near future, if not necessarily for the scenarios where privately owned cars are forbidden. If AirP2P succeeds, however, individual mobility might become a lot more convenient and affordable for travelers.

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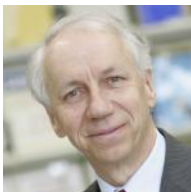
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