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Strategic Scenario Planning for the German Carsharing Industry – 2025

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I Abstract

What happens when the Internet of Things[1], traditional mobility and the modern consumer coalesce? Nobody knows yet. The increasing uncertainty and complexity that result from the pace of technological progress, blurring boundaries between industry ecosystems and the volatile macroeconomic environment affect future mobility severely. Carsharing is at the forefront of an evolution that points towards a secular shift from individually owned-and-operated automobiles to mobility-on-demand. The purpose of this study is to develop four plausible scenarios for the future of the German carsharing industry in the year 2025 by applying the HHL- Roland Berger scenario development approach and to establish adequate core and optional strategies to aid strategic decision making of managers from companies in the carsharing ecosystem.

Key Words: Scenario-based Strategic Planning · Carsharing · Shared Mobility · Strategic Decision Making

[1] The Internet of Things (short: IoT) is a term coined for the network of and communication between all devices with enabled Internet connection (Morgan, 2014).

II Table of Contents

III Table of Figures

IV Table of Abbreviations

approx.	approximately
AV	Autonomous Vehicle
BCG	The Boston Consulting Group
BEV	Battery Electric Vehicle
BMW	Bayerische Motoren Werke
B2C	Business-to-consumer
EU	European Union
FCV	Fuel Cell Vehicle
FSP	Short for German: Fahrzeug-Sicherheitsprüfung, English: Vehicle Safety Inspection
GBit	Gigabit
GDP	Gross Domestic Product
HEV	Hybrid Electric Vehicle
hr	Hour
ICE	Internal Combustion Engine
ICT	Information and Communication Technologies
km	Kilometer
KPMG	Klynveld, Peat, Marwick, Goerdeler, which are the founder's surnames of the global audit and consulting firm KPMG
LTE	Long Term Evolution (designation for the fourth generation mobile communication standard)
Mbit	Megabit
min	Minute
msec	Millisecond
NHTSA	National Highway Traffic Safety Association
OEM	Original Equipment Manufacturer
OPEC	Organization of the Petroleum Exporting Countries
p.a.	Per annum
PESTEL	Political, Economical, Social, Technological, Ecological, Legal
PHEV	Plug-In Hybrid Electric Vehicle

P2P	Peer-to-peer
R&D	Research and Development
REEV	Range Extended Electric Vehicle
StVo	Short for German: Straßenverkehrs-Ordnung, English: general traffic regulations
TCO	Total Cost of Ownership
TÜV	Short for German: Technischer Überwachungsverein, English: Technical Inspection Association
UNECE	United Nations Economic Commission for Europe
USD	US-Dollar
V2I	Vehicle-to-infrastructure
V2V	Vehicle-to-vehicle
V2X	Vehicle-to-x (V2X stands for all V2V and V2I-related topics)
VW	Volkswagen

1 Introduction

“Mobility is a fundamental component to the advancement of freedom and innovation.” – Henry Ford

Our world is undergoing constant change. Complexity and volatility have increased. Societal norms and values alter more frequently and more radically than ever. Technological progress occurs more often beyond familiar cycles. Current crises indicate how fragile the new equilibrium has become. (Zollenkop/Krys, 2011: 7)

The uncertainty of the future of mobility is the subject of countless ongoing discussions in the business world. In the area of personal mobility, the consumption model centered on personal ownership of cars is fundamentally challenged by above factors and our current understanding of it becomes obsolete. Instead, society gravitates towards a model of personal mobility consumption based on pay-per-use rather than on ownership of a capital asset. (Corwin et al., 2015: 2)

The dawn of this new personal mobility was triggered by the economization of the sharing economy creating the new shared mobility. The new trend of shared mobility might be the potential future of personal mobility. It is accredited to having disruptive powers as indicated by the large investments made by automotive incumbents, new market entrants and the regulatory attention it is given (Winterhoff et al., 2015: 10).

Cars stand idle for 96 percent of the day on average. Hence, there are manifold ways to organize individual mobility. (Freese/Schönberg, 2014: 10) Carsharing is one of these and at the core of shared mobility. The advent of carsharing challenges current industry structures, existing business models of automotive companies, competitive dynamics, value creation and customer value propositions. The result might be an entirely new ecosystem of personal mobility. (Corwin et al., 2015: 2)

Germany is one of the source markets for the commercial success of the carsharing industry following the formation of “Stadt-Auto” in 1988 (Shaheen/Cohen, 2007: 81-82). The German carsharing industry accounts for more than 20 percent of all carsharing members worldwide and hosts two of the largest, most successful and innovative carsharing operators both nationally and internationally. With above average growth rates, its mature urban mobility system and economically as well as environmentally conscious consumers, it provides an interesting subject of analysis. (Briggs, 2015: 6, Van Audenhove et al., 2014: 24-25; Schlesiger/Seiwert, 2011)

Although carsharing is gaining momentum, it is still in its initial stage of adoption and growth. There remains uncertainty concerning the rate of adoption and usage in the future (Winterhoff et al., 2015: 11). Market structures are complex due to legal regulations and new competition from outside the automotive industry. Consumers are hardly predictable. To reach the mass market within a strategically relevant timeframe, current business models need to evolve and further professionalize while exploring economical and consumer viability at the same time. It becomes obvious in the few studies on this topic that the authors do not dare to make precise statements what a “carsharing 3.0” for the mainstream might look like (Van Audenhove et al., 2014; Freese/Schönberg, 2014: 25-26; Winterhoff et al.: 2009; Hawes et al., 2015; Xie et al., 2015: 18-19).

To evaluate and strategically plan ahead for futures of industries in uncertain, volatile and complex environments, scenario planning provides tools to envision and design scenarios for several plausible future states. The HHL-Roland Berger Scenario-based Strategic Planning Approach (Schwenker/Wulf, 2013) is specifically designed to manage uncertainties, volatility and complexity in the strategic planning process, to overcome the perceptual bias of managers and create realistic pictures of how industries could evolve in the future.

The objective of the study at hand is to apply the HHL-Roland Berger Scenario-based Strategic Planning Approach for the German carsharing industry. The final outcome will portray four distinct future scenarios for the industry in the year 2025, established based on two uncertain key developments and crucial industry trends,

which result from an extensive stakeholder survey. Based on these scenarios, strategic recommendations for the future of the German carsharing industry are given.

The study is structured as follows: after the introduction to this work in the first chapter, the second chapter outlines the theoretical framework to carsharing and scenario planning. Hence, the first part of the second chapter starts with a general overview of the German carsharing industry, delivering major definitions and differentiations as a basis for the later elaborations. Moreover, the German carsharing industry with its key players is distinguished from the overall industry, and recent main developments thereof in particular will be presented, establishing the basis for the later scenario building. In the second part of the second chapter the theoretical background to scenario planning elaborates on the industry's origin and importance of application as well as explaining the HHL-Roland Berger Scenario-Based Strategic Planning Approach. As part of the third chapter the aforementioned scenario development approach is applied step by step for the German carsharing industry. After establishing four plausible scenarios for the industry in 2025, final strategic recommendations are outlined. Chapter four then concludes the study with a final outlook.

2 Theoretical Foundation

2.1 Definition of Carsharing

In literature, a variety of definitions can be found that each encompass different contents and ranges of carsharing depending on whether it is defined in the narrow or the broad sense. So far, however, no universally valid definition of carsharing has been delivered, which is grounded in the fact that the term seems to be self-evident (LeVine/Zolfaghari/Polak, 2014: 3).

Baum and Pesch (1994) have delivered the first definition that can be found in German literature: carsharing is the “collective utilization of vehicles that are provided by independent organizations“ (Baum/Pesch, 1994: 1). This definition, however, is very general so that accordingly carsharing, taxis, ridesharing, car rental services and even public transportation fall into the same category. Therefore, Baum and Pesch (1994: 7) further distinguish between forms of collective vehicle utilization by considering the “degree of formalization” and the “type of cooperation”.

Type of cooperation differentiates between the central characteristics of serial utilization (carsharing) and parallel utilization (ridesharing), which comprises privately organized ridesharing but also publicly organized ridesharing (agencies) (Behrendt, 2000: 8).

Degree of formalization distinguishes between formal and informal types of carsharing. An example for informal carsharing is sharing a car within the family or a certain circle of friends or acquaintances. Formal carsharing, however, narrows the term carsharing down to organized carsharing, taxis, publicly organized ridesharing and car rental companies. (Wanner, 2003: 8)

This classification by Baum and Pesch (1994) however has only limited the scope of carsharing but has not led to a specific definition of carsharing. However, in 2013, the Committee on Transport and Digital Infrastructure of the German Bundestag developed the first legally valid definition for carsharing. It served as breakthrough for the industry to help establish and expand carsharing paving the

way for on-street parking, common road signs, taxation and planning incentives in Germany (Millard-Ball et al., 2005: 24). Accordingly, carsharing refers to automobiles, which are provided to an indefinite number of drivers based on a framework contract for independent use according to which energy costs with an inclusive time and/or tariff are offered[2] (Fischer/Jarzombek, 2013).

Other recent sources (LeVine/Zolfaghari/Polak, 2014: 3-4; Lawinczak/Heinrichs, 2008: 9; Loose/Mohr/Nobis, 2004: 19-20) avoid offering an all-encompassing definition of the term but rather specify certain general characteristics of carsharing that distinguish it from ridesharing, car rental services, taxi services, ridehailing and corporate carsharing.

Elaborating on available definitions, the following common denominators can be derived:

- Carsharing utilization only requires a one-time “pre-qualification process for verification of identity and driving-record” (LeVine/Zolfaghari/Polak, 2014: 3) followed by signing a (framework) contract only once while with common car rental services a new contract has to be signed every rental period (Loose/Mohr/Nobis, 2004: 19).
- Carsharing does not require interaction with others at car pick up and return with the exception of peer-to-peer carsharing. Vehicles can just be parked anywhere within pre-defined service areas or at stations. Access to carsharing vehicles is enabled either by using a key card or smartphone or by depositing the key in a nearby safe (again with the exception of peer-to-peer carsharing).
- The driver of a carsharing vehicle must be an end user (not a paid driver). With some operators such as Car2Go and DriveNow, the driver has to be the registered carsharing member (except for emergency situations). With other operators such as Flinkster and Stadtmobil at least one registered member of

[2] Definition translated from German. Original version: “Car-Sharing-Fahrzeuge sind Kraftfahrzeuge, die einer unbestimmten Anzahl von Fahrerinnen und Fahrern auf der Grundlage einer Rahmenvereinbarung zur selbstständigen Nutzung nach einem die Energiekosten mit einschließenden Zeit- und/oder Kilometertarif angeboten werden.“ (Fischer/Jarzombek, 2013)

the carsharing operator has to be present but must not be the driver of the vehicle (N.A., 2015a).

- Carsharing vehicles can be rented at short notice and outside business hours. Carsharing vehicles can further be rented for short amounts of time – such as less than one hour -, in contrast to car rental companies that often require a minimum rental period of 24 hours.
- Carsharing companies may charge registration fees, basic monthly fees and a deposit in addition to time- and distance-based fees as well as fees for the chosen vehicle class (LeVine/Zolfaghari/Polak, 2014: 4).
- Fuel costs are always included in the cost of carsharing in contrast to vehicles rented from car rental companies.
- Cleaning and servicing does not happen after each utilization but rather occasionally (LeVine/Zolfaghari/Polak, 2014: 4).
- Carsharing companies provide larger station networks in service areas in contrast to car rental companies or use the “free-floating” concept so that it is easier to return cars or use vehicles only one-way (LeVine/Zolfaghari/Polak, 2014: 4; Weicksel/Pentsi, 2015).
- Carsharing is subject to “serial utilization” while ridesharing in contrast is subject to “parallel utilization” (Behrendt, 2000: 8).

Hence, the subsequent elaborations will be based on a shortened version of the legally valid definition of carsharing, namely that *“carsharing refers to automobiles, which are provided to an indefinite number of drivers based on a framework contract for independent use”* (Fischer/Jarzombek, 2013). On the basis of this definition, ridesharing, car rental services, taxi services, ridehailing and corporate carsharing are clearly distinct from carsharing and thus not within the scope of this master thesis.

2.2 The Global Carsharing Industry

In the late 1940s, the first carsharing service “Sefage” started to operate in Zurich, Switzerland, followed by similar projects in other European countries and the U.S. between 1971 and 1985. However, none of these early established efforts at

organizing carsharing endured. It was not until two carsharing operations in Switzerland and Germany in 1987 and 1988, respectively, were established that the notion became popular. Both of these carsharing operations still exist today known as Mobility Carsharing (Switzerland) and StattAuto/Greenwheels (Germany). (Shaheen/Cohen, 2007: 81-82)

Although the historic roots of carsharing lie in Central Europe, economic scale and increased competition drive the expansion of the concept all around the world and for nearly two decades now participation in carsharing has been growing steadily. In October 2014, the worldwide carsharing market has counted almost five million carsharing users with a growth rate of 65 percent as depicted in figure 1 between 2012 and 2014 (Shaheen/Cohen, 2016: 5). In comparison, personal car sales grew by only four percent from 2013 to 2014 (Gomes, 2016: 2). Both supply and demand are increasing: the number of carsharing vehicles has grown 55 percent between 2011 and 2014 reaching more than 100,000 vehicles worldwide. This constitutes a member-to-vehicle ratio of approx. 46:1. (Shaheen/Cohen, 2016: 2-5)

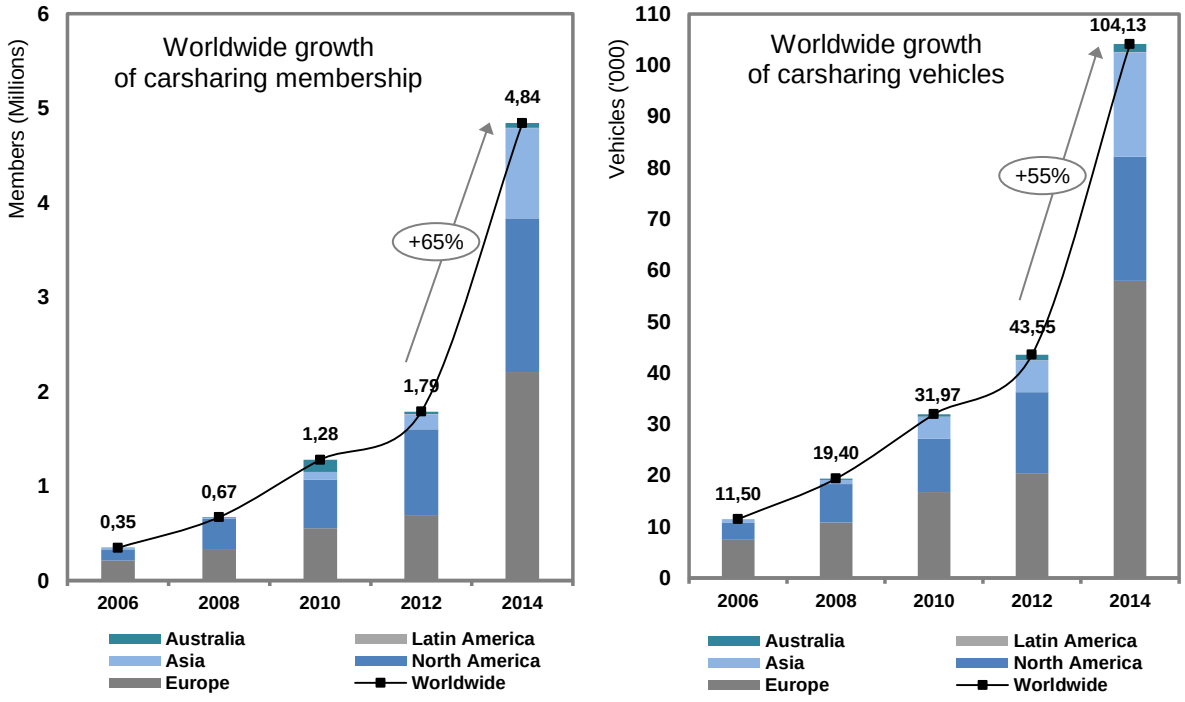


Figure 1: Members and vehicles in the global carsharing market, 2006–2014
Source: Own illustration, based on Shaheen/Cohen, 2016: 2-5

According to studies by Frost & Sullivan (Briggs, 2014) and BCG (Bert et al., 2016), the growth of the global carsharing industry is triggered by the carsharing

markets of Europe and Asia. Asian countries alone are set to expand their customer base to over 1 million customers in 2014. Japan constitutes the strongest market followed by Korea and China. In Europe, particularly Italy has shown rapid member adoption. Further growth comes from the established carsharing markets of the U.S. and Germany that are flourishing. Together with Japan they already consolidate half of the global carsharing membership base. (Briggs, 2014)

Though carsharing operations are heavily bundled in industrial nations, a growing number of carsharing operations in less-developed countries can be observed according to a report by Navigant Research (Mackie, 2015). The report indicates that a total of 40 carsharing operators provide carsharing services in 30 countries worldwide on five continents. The study also estimates that at the end of 2015, North America (U.S. and Canada) will have approx. 1.78 million carsharing members, the EU will have 1.77 million, and the Asia-Pacific region will have 1.15 million. (Mackie, 2015) These figures correspond to 0.5 percent of the overall North American population (base year for comparison is mid-2015), to 0.35 percent of the overall EU population and to 0,03 percent of the Asia-Pacific population (N.A., 2015b: 12-14). By 2024, global carsharing membership is projected to increase to 23.4 million (Mackie, 2015).

As depicted in figure 2, global revenue of carsharing services is predicted to reach 1.1 billion USD in 2015 with North America and Europe holding 83 percent of this revenue (peer-to-peer carsharing not included due to a lack of data). In 2024, total global revenue is anticipated to reach 6.5 billion USD with the Asia-Pacific region, particularly China, and Europe adopting carsharing more rapidly than North America. Hence, Asia-Pacific constitutes an enormous growth market occupying the largest share of 34 percent. However, Europe sustains its growth with a share of 32 percent representing the second strongest market. North America’s share is forecasted to decrease to 23 percent and Latin America, the Middle East and Africa are seen to lag behind in this industry. (Mackie, 2015)

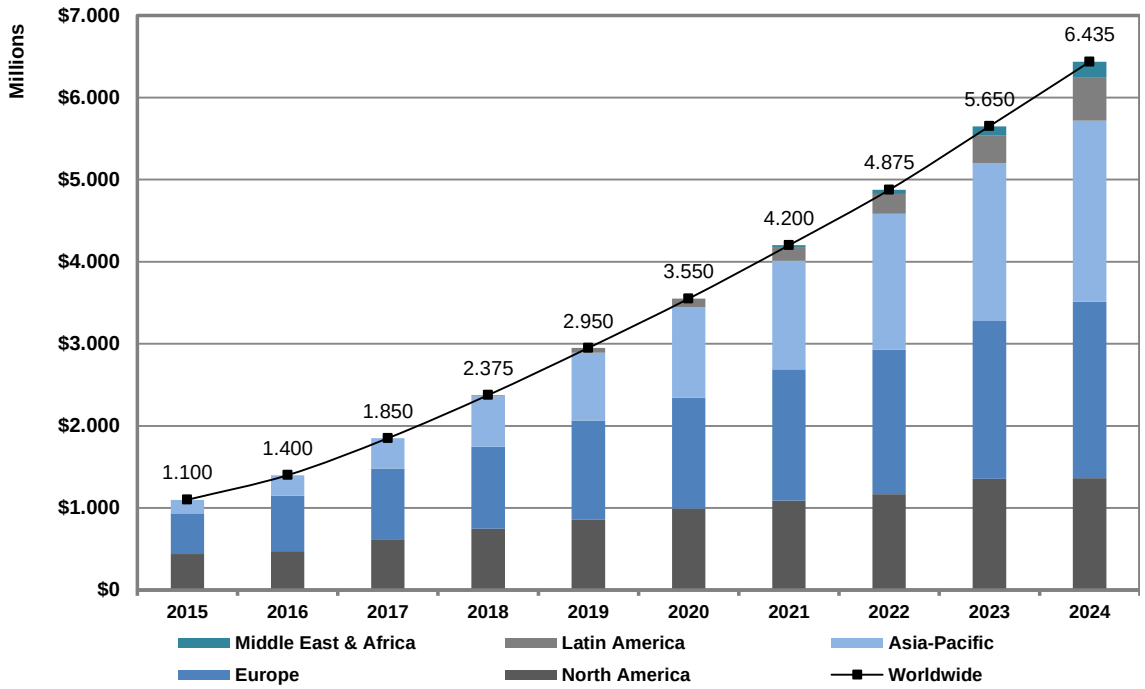


Figure 2: Annual revenue from carsharing services by region, 2015–2024
Source: Own illustration, based on Mackie, 2015

Similarly, in a recent study on carsharing, The Boston Consulting Group forecasts that carsharing will generate 4.7 billion EUR in revenues in 2021 with Europe as the largest revenue-generating region at 2.1 billion EUR, followed by Asia-Pacific with 1.5 billion EUR and North America with 1.1 billion EUR (Bert et al., 2016: 9-10). Accordingly, Roland Berger Strategy Consultants project a market growth of 30 percent p.a. until 2020 (Freese/Schönberg, 2014: 10). With regard to carsharing membership, Roland Berger predicts that carsharing members and vehicles will grow more than 70 percent p.a. reaching 50 million members and 0.5 million available carsharing vehicles in 2020 as compared to BCG that estimates a total of 72 million registered users by 2021 (Zhang et al., 2014: 6; Bert et al., 2016: 10).

A variety of carsharing models have evolved globally including both B2C and peer-to-peer (P2P) offerings. The largest carsharing player in North America and the second largest player worldwide is Zipcar, a subsidiary of car rental company Avis Budget Group, with more than 950,000 members that operates in the U.S. and Canada, Germany, Austria, France, Spain, Turkey, and the UK (N.A., 2015c: 18; Bert et al., 2016: 4). Players operating in the Asia-Pacific region include ORIX in

Japan with more than 100,000 members and PPzuche in China and Singapore with more than 120,000 private vehicles in offer (N.A., 2014a; Millward, 2014). In Europe, the largest players are Car2Go, a joint venture between Daimler and Europcar, and DriveNow, which is a joint venture between BMW and Sixt. Both offer their services globally and have built internationally recognized brands. Car2Go is the largest carsharing operator worldwide in terms of membership with more than 1.2 million customers and active in Europe and North America and soon also in Asia (Beringer, 2016). DriveNow is presumably the third largest carsharing provider worldwide with more than 580,000 customers in nine cities in Europe (Fischer/von Nauman, 2016: 1). Clearly, German carsharing operators possess a strong footprint in carsharing not only in their 'home market' but also globally in order to grow their businesses worldwide. Germany is one of the most important markets for carsharing with one of the highest adoption rates and an excellent growth outlook as well as point of origin for the popularization of carsharing (Shaheen/Cohen, 2007: 81-82).

2.3 The German Carsharing Industry

2.3.1 Market Overview

As mentioned in the previous chapter, one of the first projects to make carsharing popular worldwide was founded in Germany in June 1988 in West Berlin called 'Stadt-Auto'. Members had to put in a 1,000 Deutsche Mark[3] deposit and pay a monthly membership fee of 10 Deutsche Mark to share one eight year old Opel Kadett. Nevertheless, "Stadt-Auto" could secure 50 customers. Since then, 'Stadt-Auto' was renamed 'Statt-Auto' in 1998 and was taken over in 2005 by the large Dutch carsharing company CollectCar B.V., which now operates 'Statt-Auto' under the name of Greenwheels. (Majic, 2013) Today, Greenwheels is only one out of 150 carsharing operators in Germany that have a combined total of over 1 million carsharing customers (Nehrke, 2016a: 1).

[3] German currency until 1999/2002 before Germany and 10 other EU countries introduced a common European exchange currency, the Euro.

In contrast to China with over four hundred mega cities and the U.S. where a vehicle is indispensible due to the widespread geography, Germany is a much smaller country with shorter distances between large cities. Crossing Germany along its largest expansion from North to South amounts to approx. 880 km (beeline) (N.A., 2016a). That is the distance between San Diego and San Francisco in the U.S. or three-quarters of the route from Beijing to Shanghai in China. However, Germans are comparably “auto-affine”: Germany ranks in the top spots regarding passenger cars in use in global comparison despite its compact geography (N.A., 2016b). The transport infrastructure is mature boasting a fully developed urban mobility system and consumers who are both economically and environmentally conscious (Van Audenhove et al., 2014: 24-25; Bouton et al., 2015). Taking also into account that Germany hosts three large and innovative automotive incumbents, i.e. VW, Daimler and BMW that are all actively pursuing carsharing, it provides ideal conditions for carsharing (Schlesiger/Seiwert, 2011).

The German carsharing industry is very heterogenous with the majority of the 150 carsharing companies and associations operating locally or regionally in 537 cities and municipalities as of 2016 (Nehrke, 2016a: 1; N.A., 2016c). Three different business models have evolved: station-based carsharing, free-floating carsharing and peer-to-peer carsharing (further detail is provided in chapter 2.3.2). DriveNow, a free-floating carsharing provider founded by BMW and Sixt, Flinkster, a station-based carsharer founded by the Deutsche Bahn, and Car2Go, a free-floating carsharer founded by Daimler and Europcar, dominate the German market with a combined 85 percent market share as illustrated in figure 3. These three providers operate particularly successfully in larger cities such as Berlin, Munich, Hamburg and Frankfurt.

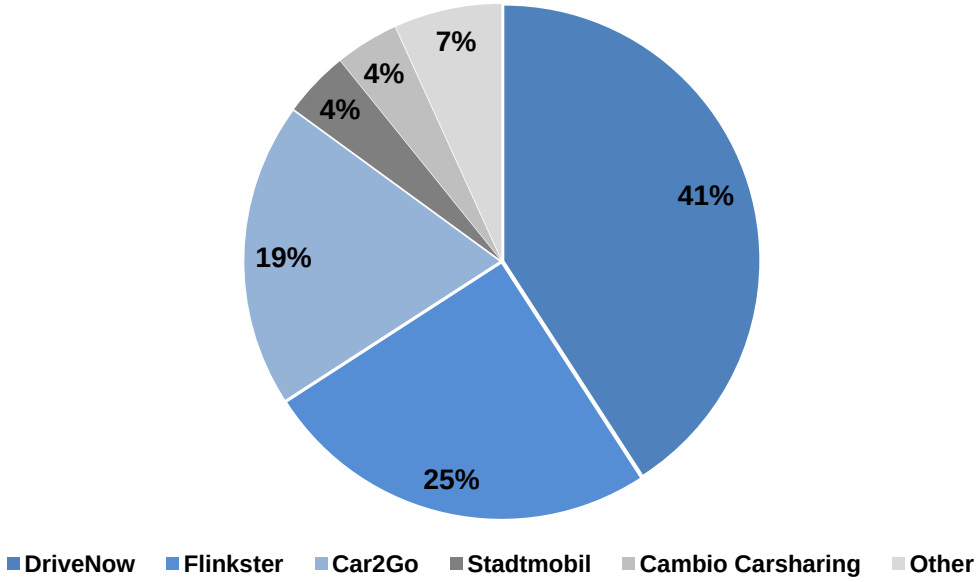


Figure 3: Market share of German carsharing operators, as of September 2015
Source: Own illustration, based on N.A., 2016d

The market is slowly consolidating: larger carsharing operators have begun to closely collaborate such as Flinkster and Car2Go to offer a larger carsharing network throughout Germany or have started to merge into larger carsharing organizations such as in the recent case of Greenwheels overtaking VW's Quicar.

Germany hosts half of the European carsharing fleet with 16,100 shared vehicles boasting more than 1.2 million subscribed carsharing members (Bert et al., 2016: 4; Nehrke, 2016a: 1). As depicted in figure 4, the strong growth in carsharing over the last five years has been facilitated by the rise of free-floating carsharing operators. Free-floating carsharing operators have grown at triple digit rates and captured large parts of the market. At the beginning of 2016, 830,000 users were registered with a free-floating carsharing program (up 26 percent from the previous year) sharing a total of 7,000 cars. Nevertheless, "traditional" station-based carsharing has flourished in the light of free-floating carsharing and increased the number of automobiles and members by more than 50 percent. Approximately 430,000 users were registered with station-based carsharing (up 13 percent from the previous year) at the beginning of 2016 sharing a total of 9,100 cars. Thus, on average 78 users shared a carsharing vehicle from a statistical perspective in 2015. (Nehrke, 2016a: 1-2)

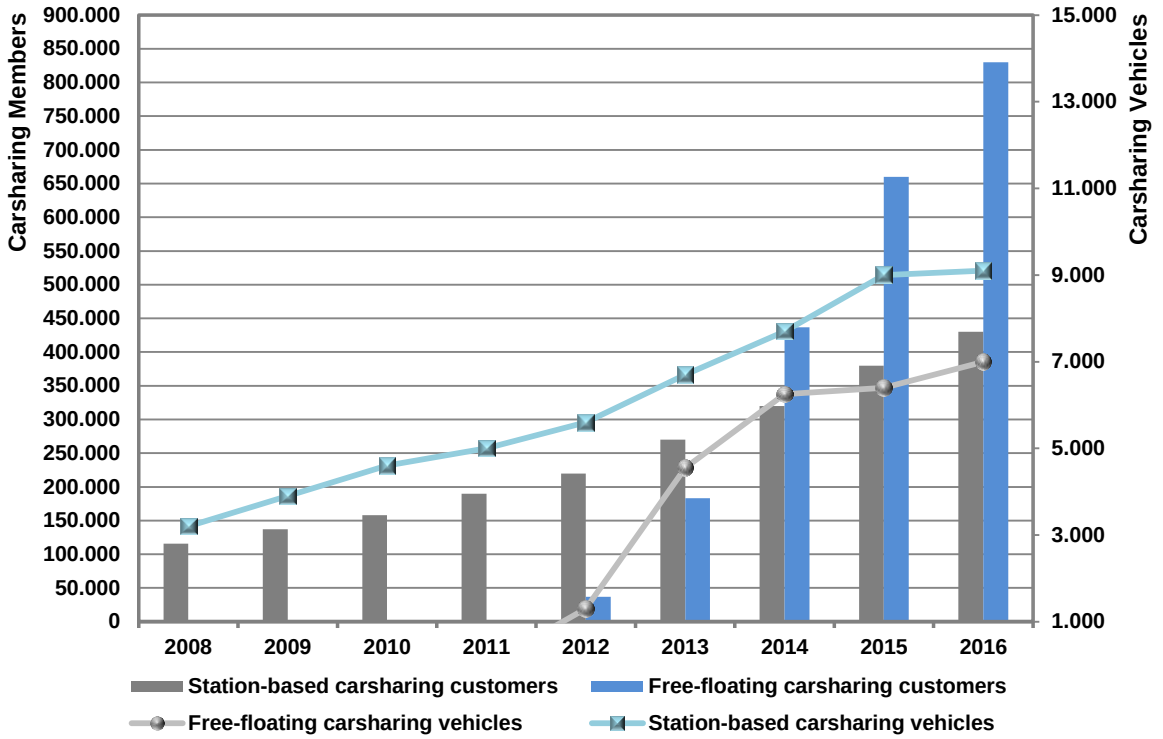


Figure 4: Development of carsharing demand in Germany, 2008–2016
Source: Own illustration, based on Nehrke, 2016b

Official numbers for comparison are not available for peer-to-peer carsharing. However, the largest European operator of P2P carsharing Drivy suggests that 5,000 vehicles are available in Germany shared by a user base of 100,000 registered users (Jakobs, 2016: 6). That constitutes a 20:1 member-to-vehicle ratio at Drivy.

The utilization of carsharing vehicles is an important topic but also an issue for profit-oriented businesses such as Car2Go and DriveNow: despite the promising customer numbers, both Car2Go and DriveNow had to downsize their operating areas already and give up business as in the case of Car2Go in its pilot city Ulm in 2014 (Dahlmann, 2016; König, 2014). This further emphasizes the importance of fine-tuning current carsharing business models, which are outlined in the following chapter.

2.3.2 Carsharing business models

Carsharing still operates in a relatively young and dynamic market, capable of innovating and evolving the business model steadily. Continued investments,

awareness and expansion have led to a diversified carsharing business model that caters to different customer groups and use cases and polarizes offerings based on price. So far, three different carsharing concepts can be distinguished in Germany: (round-trip) station-based carsharing (B2C), free-floating or station-independent carsharing (B2C) and peer-to-peer carsharing (P2P) (see figure 5), which differ with regard to ownership, maintenance, vehicle position and trip type (Zhang et al., 2014: 9).

<table>
<tr><th>Business differentiators</th><th>Free-floating</th><th>Station-based</th><th>P2P</th></tr>
<tr><td>Vehicle ownership</td><td colspan="2" rowspan="3">Provider</td><td rowspan="2">Private individual (renter)</td></tr>
<tr><td>Maintenance responsibility</td></tr>
<tr><td>Refueling / washing responsibility</td><td>Customer (hirer)</td></tr>
<tr><td>Vehicle position</td><td>Public parking within entire operation sub-area</td><td>Provider’s station or public parking within operation sub-area</td><td>Owner’s parking space or public parking near owner</td></tr>
<tr><td>Possible trip types</td><td>One-way and round trips</td><td colspan="2">Mainly round trips</td></tr>
</table>

Figure 5: Main characteristics of carsharing business models
Source: Own illustration, based on Zhang et al., 2014: 9

(Round-trip) station-based carsharing is the classical carsharing model provided by mobility service providers and non-profit organizations for 25 years in Germany. Customers rent a car ahead by smartphone, website or hotline for a certain time period, most commonly for several hours or the whole day. The cars are accessed at and returned to designated parking spaces or stations. Pick-up time and duration must be specified in advance. Only round trips are possible. A diverse variety of vehicle brands and classes is offered. Depending on the provider, customers are charged a monthly lump sum, a time-based basic fee for utilization that varies depending on driving or parking and on vehicle class and a distance-based fee. This carsharing concept is most comparable to classic car rental. The largest station-based carsharing enterprise in Germany is Flinkster. Station-based

carsharing is available in more than 490 cities and municipalities in Germany. (Lottsiepen, 2015; Loose, 2015: 1; Weicksel/Pentsi, 2015; LeVine/Zolfaghari/Polak, 2014: 5)

Car manufacturers, mobility service providers and car rental services offer *station-independent or free-floating carsharing* services almost exclusively in German metropolitan cores. Carsharing vehicles can be accessed and returned everywhere in a designated service area pre-defined by the respective carsharing operator. Vehicle reservation is typically spontaneous. Customers localize and reserve vehicles either instantly or several minutes in advance using their keycard or smartphone for reservation or (instant) access. One-way trips are possible. Often only small variety of premium vehicle brands is offered. Customers are charged a time-based fee for utilization that varies depending on driving or parking and on vehicle class. This carsharing concept is mostly used as substitute for or in addition to taxis and public transportation. Thus, rental times are generally short. The largest free-floating carsharing provider in Germany is DriveNow. Free-floating carsharing is available in 13 cities and municipalities in Germany. (Loose, 2015: 1-2; Weicksel/Pentsi, 2015; LeVine/Zolfaghari/Polak, 2014: 6; N.A., 2016e)

To be commercially viable, station-based and free-floating carsharing programs generally require a certain threshold of population density and a certain demographic profile. In contrast to commercial carsharing, P2P carsharing generally serves less dense populated and lower-income areas. (Viechnicki et al., 2015: 20)

Peer-to-peer carsharing is carsharing offered by private vehicle owners. As part of the concept private individuals register and rent their car to others on online marketplaces such as on Drivy, Tamyca or Opel's CarUnity. These platforms connect private vehicle-owners with prospective vehicle-renters. The car location is thus also the car pickup point and return location at the same time, while times of availability and costs are set individually online by the vehicle owner. Vehicle renters find a diverse selection of vehicle brands and classes. The online marketplace collects a percentage of each rental transacted and typically provides

a bespoke insurance product protecting the vehicle owner. (LeVine/Zolfaghari/Polak, 2014: 5; Lottsiepen, 2015)

Recently, *hybrid forms of station-based and free-floating carsharing* services (sometimes referred to as point-to-point carsharing) have emerged where station-based carsharing fleets are supplemented with free-floating carsharing fleets. This service is available in five regions in Germany: Hannover, Mannheim, Heidelberg, Osnabruck and in the Rhein-Main region with a combined total of 365 cars. Other carsharing operators have introduced “spontaneous or open-end bookings” to enable more flexibility and a more efficient fleet utilization for their station-based fleets e.g. Grünes Auto Göttingen and cambio carsharing in Aachen, Berlin, Bielefeld, Bremen, Hamburg and Cologne. However, the vehicles must still be returned to the original point-of-access station. (Loose, 2015: 2-4)

The free-floating carsharing concept has shown the strongest customer inflow and thus the greatest success in Germany so far. This service provides customers with a comparably high degree of flexibility but is also more expensive with regard to average cost per minute. The largest key players of the German carsharing industry are presented in the following chapter.

2.3.3 The supply side: Key players of the German carsharing industry

In Germany, a number of carsharing operators have become firmly established and are on steep growth trajectories. As depicted in figure 3, the five largest players in the German carsharing industry dominate 93 percent of the market thus constituting the backbone of the German supply side.

German premium car manufacturer BMW Group founded *DriveNow*, the largest player in the market, in 2011 in a joint venture with car rental company Sixt SE. Sixt provides rental expertise, premium services, IT systems and an extensive station network for customer registration, while BMW supplies cars and car technologies. (Fischer, 2011: 1-3) DriveNow was founded at a time when other carsharing players such as Flinkster were already established in the market. However, the concept added an innovative and disruptive new business model to the market that enjoyed immediate popularity. DriveNow has 490,000 customers in

Germany, is continually growing, and employs a fleet of 2,570 cars across the five German cities Berlin, Munich, Düsseldorf, Cologne and Hamburg (Fischer/von Nauman, 2015: 1). Electro cars make up for 20 percent or 800 BMW i3 of the German fleet (Fischer/von Nauman, 2016: 1). DriveNow has been continually expanding abroad since 2012 with ventures in Austria, UK, Denmark and Sweden and is a free-floating carsharing service (Fischer/von Nauman, 2016: 6). According to a study, DriveNow's success can be accredited to smaller operating areas with a higher utilization, more spacious cars and shorter vehicle replacement cycles (Schlesiger, 2014).

The second largest player in the German carsharing market is *Flinkster* more than 300,000 customers. Electro cars, called e-Flinkster, constitute approximately 16 percent of the fleet. In June 2015, Flinkster started to cooperate with Car2Go, the third largest player in the market, via the mobility platform Moovel. Together they combine over 7,000 vehicles Germany-wide easily bookable via a single app. (Tank, 2015) Flinkster also cooperates with Citroën's carsharing offering Multicity, which is completely electric carsharing and so far only available in Berlin (Mortsiefer, 2014). Flinkster is a venture of the Deutsche Bahn and operates in Germany, Austria, the Netherlands, Italy and Switzerland. Flinkster is a station-based carsharing service with 3,600 cars at almost 1,000 stations in Germany. (Tank, 2015)

The third largest German carsharing service *Car2Go* was introduced to the German market first as a pilot in 2008 by car manufacturer Daimler (now operating under the roof of moovel GmbH) but was soon established as a cooperation together with car rental enterprise Europcar (Leo/Poujol, 2014). The last official customer figure for Germany of 230,000 customers was published in 2014 but has very likely increased since then (N.A., 2016d). Car2Go employs 3,750 cars, both fuel and electric drive cars (minimum 13 percent of the fleet) in Berlin, Hamburg, Munich, Stuttgart, Cologne and Düsseldorf. Car2Go operates in eight countries around the globe: Germany, Italy, Spain, Netherlands, Austria, Sweden, USA, Canada and will launch its first Car2go service in Chongquing, China later in 2016 (Beringer, 2016).

Cambio Carsharing originates from a merger between the carsharing organizations Stadtteilauto Aachen, StadtAuto Bremen and STATTAUTO Cologne. Today, Cambio has approximately 48,000 customers in Germany and employs approx. 1,000 cars, partly electric cars. Cambio is a station-based carsharing enterprise serving 19 German cities as well as 31 Belgian cities. (Dannheim, 2015)

The fifth largest carsharing organization in Germany is the *Stadtmobil* group. Stadtmobil has united small carsharing companies from eight regional associations with more than 4,000 cars and more than 30,000 customers in total. Stadtmobil combines free-floating and station-based carsharing services serving 180 cities germany-wide at 1,600 stations with regional brands such as JoeCar in Mannheim and stadtflitzer in Hannover. (N.A., 2016f)

Annex 1 contains a more detailed illustration of the differences between the five carsharing operators regarding registration, price composition, rates and car return.

2.3.4 The demand side: Segmentation of carsharing customers

The most recent study published under the mandate of the electromobility development scheme “Erneuerbar Mobil” of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety has researched that on average 75 percent of all carsharing customers in Germany are male, only 25 percent are female. Most users are educated and earn above average: 80 percent have at least passed the Abitur, more than 70 percent of all users possess a graduate degree and 66 percent have a comparably high net income exceeding 3,000 Euro. The average carsharing user works and lives in urban neighborhoods and uses multimodal transportation. 51 percent of these users do not own a car but most of them (85 percent) own a bike. More than half of all customers (65 percent) are between the ages of 35 – 59. (N.A., 2015e, p. 10-11) According to another study by TÜV Rheinland, the affiliated FSP, a provider of technical services, and the consultancy BBE Automotive (Gent, 2015), 28 percent of all carsharing customers are registered with more than one carsharing service.

Finally, a survey by McKinsey (Cornet et al., 2012: 16) shows that a third of the German population living in urban areas (cities with >100,000 inhabitants) are prospective customers of carsharing as depicted in figure 6.

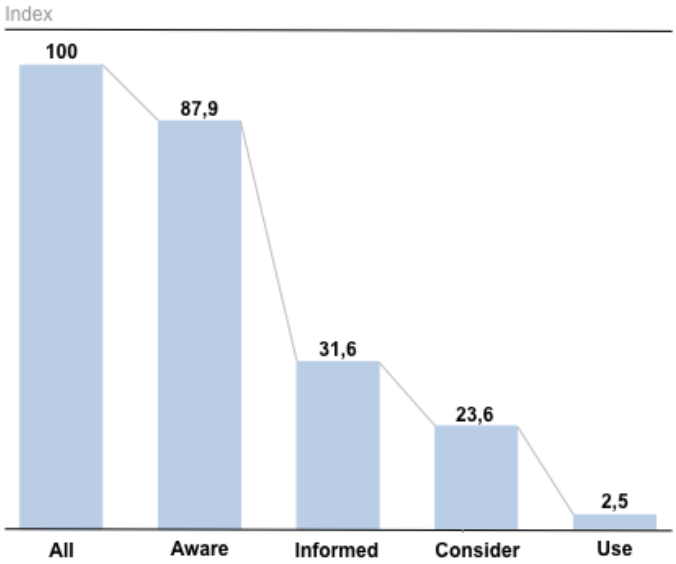


Figure 6: Carsharing readiness among German urban population
Source: Own illustration, based on Cornet et al., 2012: 16

Despite current low usage rates, 32 percent care to increase their carsharing usage in the next ten years while 24 percent of the urban population is “actively considering carsharing already today” (Cornet et al., 2012: 15). German consumers thus have a positive attitude towards the concept of carsharing indicating that strong growth potential exists.

2.4 Key trends and drivers for the German carsharing industry

Although once dismissed as part of an alternative economic system, carsharing has emerged out of its ecological niche and out of non-profit community market endeavors. The for-profit carsharing business has experienced a global diffusion and is proliferating now more than ever. Both customer figures and revenues are rising fast in the nascent carsharing industry. It has become a flourishing business sector with tangible benefits for providers and users alike that works essentially along the same principles as existing economic mechanisms. (Freese/Schönberg, 2014: 8)

The current and future development of the German carsharing industry is shaped

by five key trends and drivers that are outlined in the following in accordance with the study on shared mobility by Roland Berger Strategy Consultants (Freese/Schönberg, 2014). In this order, each trend will shortly be described and substantiated by data in the following paragraphs. Challenges and opportunities of each trend for the carsharing industry will be addressed. These key trends and drivers lay the groundwork for the later established scenarios in chapter three of this master thesis.

2.4.1 Urbanization and changing mobility behavior

In the past century, each transformation in urban form has been linked to some kind of transport revolution. The development of urban structure and transport systems are strongly interconnected. It is impossible to abstract the vision of cities tomorrow from that of the future architecture of their transport systems. (Safdie/Kohn 1998: xii; Alessandrini et al., 2015: 145-160)

The forecasts are explicit: cities are the anthroposphere of the future. In 1950, 30 percent of the world’s population resided in urban areas; in 2014, already 54 percent of the world’s population was urban and for 2050, an urban population growth of 66 percent is projected (N.A., 2014b: 1). Although, in absolute numbers, the growth of the urban population is concentrated in the less developed regions in Africa and Asia, also urban regions in industrial countries, where the overall population is shrinking and aging, are experiencing the same trend (Freese/Schönberg, 2014: 9). The proportion of the population living in urban areas in Germany is estimated to increase from 75 percent (2014) to 77 percent by 2025 and up to 83 percent by 2050, as depicted in figure 7.

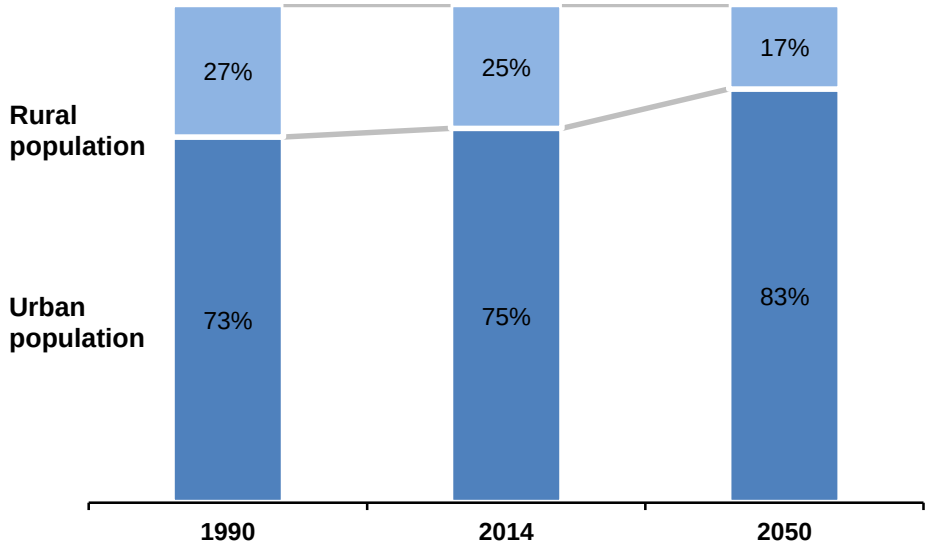


Figure 7: Urbanization prospects in Germany, 1990, 2014 and 2050
Source: Own illustration, based on N.A., 2014b: 23

This mushrooming in urban population as well as the growing number of single-person households will be followed by a massive increase in demand for individual mobility services ordered on a daily basis. At present, 64 percent of all travel kilometers are already made in urban areas. However, the number of urban kilometers travelled is projected to triple by 2050. Such explosive growth in urban mobility systems will pose new challenges and impact urban environments profoundly. Cities, particularly in Asia, will face enormous ecological and environmental challenges. A growing number of vehicles in urban areas imply increased traffic congestion, noise and noxious air pollution that negatively impact traffic safety and quality of life. (Van Audenhove et al., 2014: 9) Gridlock might obstruct the path of food, water and emergency medical aid (Green/Naughton, 2014). The existing infrastructure will reach its capacity limits in the course of the urbanization. Additionally, lack of parking space and city-level regulations to limit pollution and traffic will strain car owners and potential car buyers who may shun ownership on these grounds and boost usage of alternative modes of transport. The challenge thus lies in the improvement of existing structures and the establishment of innovative mobility concepts and their integration into the public transportation system.

Hence, cities have an increasing need for integrated mobility concepts that reduce overall congestion and emissions, run sustainably and increase quality of life also for new urban living areas. But cities lack the space and financial resources to substantially expand and invest into new traffic infrastructure. The development of new bus or railway infrastructure, for example, takes years. Carsharing, however, allows leveraging economic potential without massive investments in infrastructure based on the high diffusion of smartphones as well as data processing in the cloud (Rossbach et al., 2013: 7). Carsharing thus provides a rather simple opportunity to connect the periphery faster. However, as cities further expand their city limits due to urbanization, potential business areas for carsharing enlarge. This, of course, adds additional revenue potential for carsharing provider but it also makes room for the establishment of other competitors. Furthermore, to connect the suburban areas to the city center, an adapted carsharing scheme or at least an optimized fleet management is required that makes those areas profitable for providers. Operating areas are currently small in size and concentrated on city centers to ensure high utilization. Suburban areas exhibit an “intrinsic barrier” (Winterhoff et al., 2015: 15) to shared mobility due to greater distances between locations causing longer waiting times and farther unoccupied trips (Winterhoff et al., 2015: 15). To bring carsharing into the periphery, the premise is of course that people of all ages embrace carsharing as a concept for personal mobility. The preference of access over ownership has particularly been witnessed among younger generations, but the population of Germany is ageing and a silver society will emerge in the upcoming years that must adopt the sharing mentality to make carsharing a success and profitable for operators.

2.4.2 Shift in mobility preferences: Demotorization and the preference of access over ownership

Despite the globally increasing demand for personal mobility, the car has lost its desirability as mobility concept. This phenomenon becomes particularly apparent among the younger generation in metropolitan areas of mature industrial nations according to a study by Roland Berger Strategy Consultants (Kalmbach et al.,

2011: 4). Despite the increasing total cost of ownership (TCO)[4], the progressing urbanization (as discussed in chapter 2.4.1), the scarcity of resources and particularly the change in preferences and values between generations, a new economic and environmental rationality, not merely the need for thrift, has led to a devaluation of individual car ownership among younger generations (Kalmbach et al., 2011: 53). As a result, the significance of the car as a status symbol has eroded. Manifesting material wealth through conventional status symbols is becoming less important, especially for Germans younger than 25 years. Consumption of younger people has shifted towards new symbols of independence such as towards consumer electronics, travel and freetime. (Kalmbach et al., 2011: 26-27) The trend towards lower demand for individual car ownership has already become evident in industrialized countries and is anticipated to slowly arrive in major urban areas of emerging markets by 2025 as well. Car ownership rates are already moderately low among under 30-year-olds (Kalmbach, et al., 2011: 53). Due to the so-called cohort effect[5] a declining trend is expected to become perceptible by 2025 and onwards. In contrast, the number of driver's license holders is at least in Germany predicted to increase with regard to the total population: almost 80 percent of the German population is anticipated to hold a driver's license by 2025. In total, these are 7 million people more than in 2015. (Kunert et al., 2008: 39-41, Kalmbach et al., 2011: 53)

The cultural shift away from ownership towards sharing is referred to as sharing economy. The "sharing economy" is growing and disrupting the way people think about space and ownership. Over the last years, the global annual investments in start-ups of the share economy have risen from 300 million USD in 2010 to 6 billion USD in 2014 (Zobrist/Grampp, 2015: 4).

[4] The TCO is the sum of all costs that incur for purchase, maintenance and, if applicable, disposal of an asset during its complete lifecycle (Werner, 2014: 145-147).

[5] A cohort is a group of individuals that are exposed to the same cultural, social and historic influences. However, it is not directly bound to age. The cohort effect shows when a cohort exhibits particular personal traits unique to the group. This is then often classified as a generation. (Haderlein, 2004: 211)

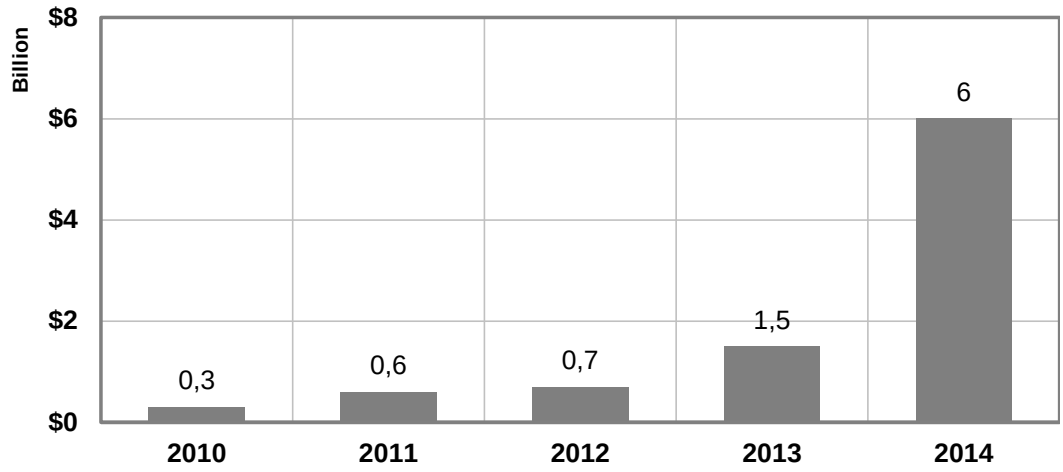


Figure 8: Global annual investments in sharing economy start-ups, 2010–2014
Source: Own illustration, based on Zobrist/Grampp 2015: 4

New business models and businesses surrounding accommodation, money, services, goods and mobility have emerged out of the share economy that has produced share econonmy giants such as Airbnb and Uber. Pooling resources in multiple ways is becoming essential to urban life and is likely to impact the future of cities (Kasriel-Alexander, 2015: 12). The trend towards sharing and the fundamental shift in preferences towards access over ownership have caused the mobility ecosystem to expand beyond traditional modes of transportation to include bike-sharing, ride-sharing and carsharing. These alternative solutions for personal mobility have gained new grounds and are steadily strengthening their competitive position relative to the car bridging the first mile/last mile connectivity gap in congested urban areas (Freese/Schönberg, 2014: 8). Carsharing in particular has experienced a steep rise in usage. Start-ups, tech and rental companies have entered the markets realizing first mover advantages and capitalizing fast on the market trend; established automotive companies have waited until the tipping point to enter the market or are in the progress of developing mobility services similar to carsharing such as Audi with their pilot projects: Audi on demand, Audi unite and Audi at home (Huber, 2015; Stertz, 2015). Clearly, carsharing has not reached its creative boundaries and exhausted its full market potential yet.

Despite the many new players from fields outside of the automotive industry, carsharing is an attractive business model that German carsharing operators such as Car2Go and DriveNow can easily scale and that can easily be expanded abroad. Initially feared by OEM's, studies by PWC (Hanna/Kuhnert/Kiuchi, 2015) and Roland Berger Strategy Consultants (Freese/Schönberg, 2014) suggest that carsharing does not necessarily imply less consumption but only changes the nature of consumption and might even increase the number of cars sold due to higher utilization and increased wear-and-tear of the vehicles (Freese/Schönberg, 2014: 8; Hanna/Kuhnert/Kiuchi, 2015: 10). The rise of the share mentality of young urbanites opens up new opportunities for the shared mobility sector, challenges existing business models and creates new ones. The carsharing industry is just now in the initial phase of evolution and it remains to be seen which shared mobility concepts (B2C, P2P) reach market penetration and gain mass acceptance. German carsharing operators should closely monitor market developments and carefully refine their business models and business strategies.

2.4.3 Customer expectations towards connectivity and sustainability

Besides the trend towards demotorization and access over ownership, another change in consumer behavior relevant to the automotive industry can be observed that impacts the future of the German carsharing industry. As described in the paragraph above, a new outlook on personal mobility preferences among consumers has emerged. As sharing is preferred to owning, people are leaning towards collaborative consumption that itself constitutes new value priorities that center on community, innovation and green values with digitalization as a facilitator (Kasriel-Alexander, 2015: 12). Digital "mobility" is replacing personal mobility as priority among younger people. With the digitalization at the center of the development towards collaborative consumption more and more possibilities to link products and processes are arising. Information, booking and ticketing processes are becoming increasingly comprehensive, faster, more intuitive and more individual. Smartphones, tablets and laptops are becoming central control panels for people's private and professional lives and this applies not only to

younger generations. Being able to access mobility information, plan, book and pay in real-time essentially constitutes a new longing for speed, comfort and convenience. (Freese/Schönberg, 2014: 9) In this fast-moving world, consumers are time lacking and expectations towards comfort and quality of life are thus rising. The demand for increasingly convenient, fast and predictable as well as sustainable modes of travel has surged. The carsharing industry thus needs to provide a product that encapsulates all these customer preferences and constantly keep up the pace since competition is entering the market to play a role in the extended mobility ecosystem.

Moreover, people want to spend their time wisely, decide flexibly, and increase quality of life to the upmost. This becomes evident in highly urbanized areas, where the notion of landscape is changing and shifting. What was once perceived as pristine nature outside city limits has become an integral part of the inner city, enhancing the quality of life and the urban climate (Kondert et al., 2016). The new orientation toward ecology constitutes sustainability and efficiency even in concepts of mobility. What has been the concern of minorities in the last decades is now entering the mainstream because younger generations, who have been taking in information about climate change, natural disasters, pollution and sustainable living since childhood, have come of age and have developed sensitivity to environmental concerns (Gott et al., 2014).

The mainstream attitudinal shift towards environmental awareness and an ‘always-on mentality’ are two groundbreaking consumer trends that have aided the rise of car-sharing, among other factors. The ease with which consumers are using phones and tablets to meet their needs facilitate the use of shared vehicles tremendously, since they expect experiences both outside and inside the vehicle that leverage technology to integrate with their connected lifestyles (Giffi et al., 2014: 59). Looking further, the integration of multiple modes of transport, the exponential distribution of smartphones, and the provision and processing of data in the cloud allow further linking to all offerings that integrate car-sharing into one multi-modal personal mobility chain. However, the widespread adoption of digital communication via mobiles and other devices also means that consumers are able

to shop anytime, anywhere, and are becoming increasingly demanding in terms of speed and convenience. With time lacking consumers, the appeal of using carsharing is probably already gone if consumers have to waste time finding the respective vehicle, registering in car or completing the booking. Consumers likely expect an experience with carsharing that goes beyond the mere service transaction. These expectations towards personal mobility require a redesign of mobility services but they also induce enormous potential for the trendsetting evolution of private/public transportation concepts.

2.4.4 Re-inventing the wheel: Autonomous driving

Autonomously driving vehicles are the future of mobility. “While high levels of uncertainty currently surround the issue, the ultimate role that AVs could play regarding the economy, mobility, and society as a whole could be profound” (Bertoncello/Wee, 2015). The dawn of autonomous vehicles implies a radical paradigm shift for mobility. Among all other trends, it is probably the one with the highest transformative or disruptive potential. The automotive industry is already going through the initial phase of adopting autonomous mobility. Vehicles with basic automated capabilities such as adaptive cruise control and lane keeping assistant from several established automotive manufacturers can already be found on the roads. (Bernhart et al., 2014: 3-4, Shanker et al., 2013: 6) Experts estimate that full self-driving automation of vehicles will be ready by 2025 – 2030 (Bernhart et al., 2014: 6). Leading technology firms such as Google, Tesla, Apple and even ridehailing service Uber as well as start-ups such as Faraday Future are competing alongside automotive companies in the race fostering an accelerated development of AVs. They are constantly testing and refining their prototypes that are already on the roads. However, the adoption process until full self-driving automation is incremental. According to the Federal Ministry of Transport and Digital Infrastructure, the evolution of automated vehicles runs through five stages terminating in autonomous driving (see figure 9). Stages 0 – 2 with basic automated capabilities in vehicles are already underway today but drivers still have to be in control at any time. Part of Stage 3 will see the introduction of

semiautonomous vehicles where drivers can delegate vehicle control in certain situations. In stage 4, which is in two to four years, a driver has to present but the system is autonomous to a great extent. In the final stage, autonomous vehicles without drivers are anticipated to be available by beginning of 2020 and deployed gradually by 2025 to 2030. (N.A., 2014c; Bernhart et al., 2014: 6)

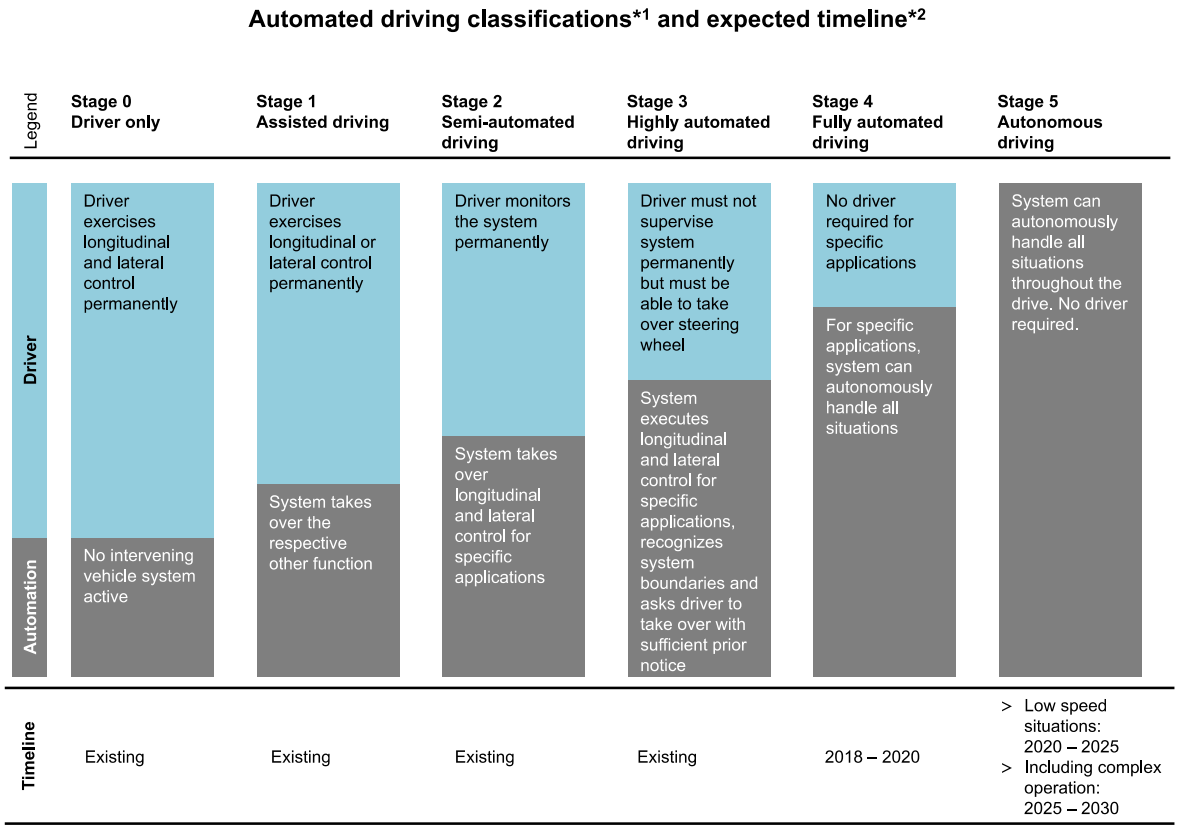


Figure 9: Stages of automated driving
Source: Own illustration, based on N.A., 2014c and Bernhart et al., 2014: 6

Autonomous vehicles (Stage 5) will have a significant impact on on-demand mobility services such as carsharing. The status quo of carsharing as well as the carsharing business models we know today will probably change dramatically in the future. New mobility models will emerge, blurring the distinction between car- and ridesharing as well as private and public vehicle ownership further (Claudel, 2015, Bert et al., 2016: 12). Although unlikely in the short-run, the opportunities for carsharing operators would be immense. Operators would be able to cut down on insurance costs, vehicles could pick up customers autonomously, self-park and self-charge if electric. In closed areas and lower-speed situations such as office

complexes, autonomous vehicles could further bridge the first-and-last mile connectivity gap in public transportation networks. (Shaheen/Galczynski, 2014: 2) According to a study by KPMG (Hawes et al., 2015) a transition might occur from cars-on-demand to vehicles-as-a-service reducing road congestion but increasing utilization at the same time (Hawes et al., 2015: 10). Thus, carsharing could complement or probably even compete with public modes of transportation as pay-as-you-go small-scale public transportation being similarly or even more economical. Researchers from the Centre for Transport Studies at the Imperial College London (LeVine/Zolfaghari/Polak, 2014) see especially large potential of AVs for the automated repositioning of carsharing vehicles in urban spaces “to where and when demand is likely to be high” (LeVine/Zolfaghari/Polak, 2014: 15) in the long-term. In consequence, this would cause carsharing, ridesharing, rental car and taxi services “to merge into one driverless mobility-on-demand offering” (Bernhart et al., 2014: 17). Scenarios like this are currently virtually tested providing evidence that such a system would be effective and efficient especially in peak times (Cardinal, 2014). However, investments into new mobility solutions have soared in the last years rising from a mere 44 million USD in 2010 to 5.1 billion USD in 2014 (Hattrup, 2015). The ecosystem in the automotive industry is expanding constantly to include among traditional OEMs technology start-ups such as Uber, high tech companies such as Google and Apple, emerging OEMs such as Tesla and automotive venture capitalists that have access to enormous funding pools and have reduced go-to-market times of new technologies massively (Silberg et al., 2015: 4-5). But, Germany’s largest carsharing providers BMW with DriveNow as well as the carsharing service Car2Go with the backing of the Daimler enterprise are already investing heavily in R&D for the new technologies surrounding autonomous driving. Nevertheless, it will be a challenge for those companies to fend off competition and to constantly optimize their carsharing business model.

2.4.5 Vision Zero: the search for alternative propulsion technologies

Whatever happens, mobility needs of the society in the 21st century will further

increase and cars will remain the No.1 mode of transport for the foreseeable future. In concordance with the earlier mentioned environmental rationality of consumers (see chapter 2.4.3), the automotive sector is experiencing a radical ecological rethinking towards sustainable use of resources and environmental relief. In the past decades the traditional internal combustion engine (ICE) has been the dominant automotive powertrain. Only the scarcity of resources such as crude oil driving up energy prices, the increasing awareness for environment and pollution and the stipulated climate protection as part of the Kyoto Protocol amongst others have fostered the diversification of the powertrain portfolio by increasing the demand for efficient, low-cost mobility technologies and services. Associated with the Kyoto Protocol from 1997 were the conjoint EU targets for the reduction of the CO2 emissions with the binding agreement to cut back carbon emissions by at least 20 percent by 2020 (based on the level of carbon emissions in 1990) (N.A., 2014d). The German federal government, however, has set the goal to act as trailblazer and to reduce carbon emissions by 40 percent by 2020 in Germany. This target mark can only be achieved if OEMs heavily invest into new technologies and reinforce sales of alternative propulsion vehicles since according to experts improving the fuel-efficiency of vehicles will not be sufficient to adhere to the strict fleet emission regulations in the long-term (Kalmbach et al., 2011: 57). So far, it is still uncertain which powertrain solution will dominate the automotive industry in the future. But, a shift towards the electrification of the automotive powertrain can be witnessed as OEMs increasingly electrify their product portfolios. As part of its long-term zero emission mobility vision, Germany aims to become the lead market in EV uptake and also lead provider for electric mobility by 2020. The clear target of the “National Electromobility Development Plan” is to have one million electric vehicles on Germany’s streets by 2020. (MacDougall, 2015: 1)

Until 2016, almost 26,000 vehicles with electric powertrains (excluding hybrids) were registered in Germany, which corresponds to a market share of 0,1 percent (Status quo of 01.01.2016). Compared to the previous year (01.01.2015) the share of EVs (without hybrids) has soared by 35 percent. (N.A., 2016g) For 2020, figure

10 shows that according to expert forecasts approximately nine percent of new vehicle registrations in Germany will be electric vehicles, of which five percent are Plug-In Hybrids (PHEV) and less than two percent will be Battery Electric Vehicles (BEV) and Range Extended Electric Vehicles (REEV) respectively. Eight percent will account for not rechargeable Hybrids (HEV). For 2030, the share of electric vehicles among new vehicle registrations is estimated to double as compared to 2020 to more than 19 percent. Of this, 10 percent are anticipated to be PHEVs, 4 percent will account for BEVs and REEVs respectively. The percentage of HEVs (not rechargeable) is projected to decrease to 6,5 percent as compared to 2020. (Proff/Kilian, 2012, p. 287)

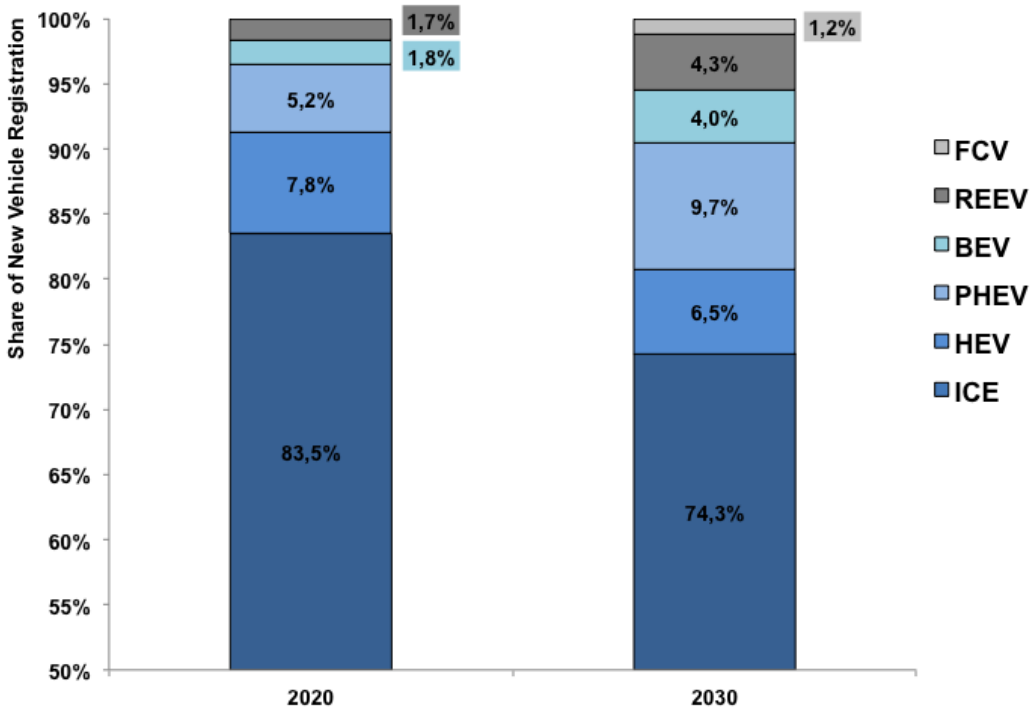


Figure 10: Electric vehicle registrations in Germany, 2020 and 2030
Source: Own illustration, based on Proff/Kilian, 2012: 287

The shift towards electric powertrains will play an important role in carsharing in mobility going forward because the carsharing boom has a huge impact on the market development of electric vehicles. Currently, carsharing services predominantly use vehicles with an internal combustion engine but the proportion of electric vehicles in carsharing fleets is increasing driven by an imperative to address air quality issues in cities (LeVine/Zolfaghari/Polak, 2014: 13). Car2Go, DriveNow and Flinkster already operate EVs as a small part of their fleet (up to 20

percent in case of DriveNow) (Fischer/von Nauman, 2016: 1). In some cities their fleet even entirely consists of electrically powered vehicles. However, from a carsharing operator's perspective electric vehicles are more complex to operate and less economic. (LeVine/Zolfaghari/Polak, 2014: 13) This is because the charging infrastructure is only insufficiently developed although Germany boasts the highest number of charging stations in Europe. According to estimations the costs of the electric powertrain will only measure up to the ICE by 2020 to 2025 (Borgmann/Kuhnert, 2015; Rother/Eisert/Böhmer, 2015: 39). However, new mobility business models centered on carsharing provide an opportunity to remove barriers for EV adoption at scale e.g. regarding range limitations by eliminating the obstacle of a high initial purchase price. Since driving a carsharing vehicle essentially constitutes a "test drive" carsharing acts as a lever for electric mobility stimulating EV demand and market penetration. Automotive incumbents such as BMW and Daimler may use their electric carsharing fleets to facelift their overall emission balance sheet. Many small players from outside the automotive industry have already entered the pure EV carsharing market in competition to the mainly ICE equipped carsharing fleets of the large carsharing operators due to the simple technology used in electric vehicles. However, the operation of EVs in carsharing fleets will also depend on the further maturation of the electric powertrain technology as well as on the cost competitiveness with ICE on a TCO basis. (N.A., 2014e: 53–57)

2.2 Theoretical Background of Scenario Planning

After delivering an overview of the German carsharing industry, the following chapter now conveys the fundamentals of scenario-based strategic planning. First, the origins of scenario planning are examined. Second, the importance of strategic scenario planning for decision making today is established. Third and finally, the six steps and related frameworks of the HHL-Roland Berger scenario-development process are introduced to back the subsequent elaborations.

2.2.1 The Origin of Scenario Planning

Scenario planning techniques emerged first in a military context out of the need to develop different perspectives for futures full of uncertainty (Chermack, 2011: 10). Herman Kahn, a military strategist of the Research and Development Corporation (RAND Corp.), is accredited to being the godfather of scenario planning using storytelling to describe hypothetical futures in detail for decision-making purposes for which he has coined the term ‘scenarios’ for post-Second World War military strategic planning (Chermack, 2011: 10; Hiltunen, 2013: 115; Van Notten, 2005: 17). In 1961, Kahn founded the Hudson Institute, a think tank, to help people “think about the unthinkable” (his publication about scenarios has the same title) through which companies such as oil giant Royal Dutch Shell were exposed to this approach. Subsequently, Shell deployed scenario planning to guide business strategy for the first time in the early 1970s in the corporate context. Shell’s scenario director, Pierre Wack, successfully applied scenario planning to prepare for and overcome the 1973 oil crisis and others to come. (Hiltunen, 2013: 115) It superseded traditional economic forecasting methods by incorporating uncertainty and volatility into the strategy process (Schwenker/Wulf, 2013: 14). Since then Shell and other enterprises have been using scenario planning to anticipate global economic, social and political changes and their likely impact on business.

2.2.2 The Importance of Scenario Planning

Uncertainty determines the business world today. Factors such as the globalization of markets, rapidly changing customer demands, shortening product

lifecycles and economic disruptions like the 2008 financial crisis leave companies and management exposed to more volatile, complex and dynamic business environments than ever (Schwenker/Wulf, 2013: 12-13). These factors make forecasting of future developments extremely difficult and unpredictable.

Uncertainty can be understood as “an individual’s perceived inability to predict something accurately” (Miliken, 1987: 136). According to Schwenker and Wulf (2013: 22-29) three core determinants govern uncertainty: volatility, complexity and ambiguity.

- *Volatility*. Two types of volatility can be distinguished that are interlinked with each other: “firm-level volatility” and “aggregate volatility”. Firm-level volatility refers to sudden changes in a company’s situation such as in its manpower, its sales, earnings and its capital expenditure or in the price of natural resources (Schwenker/Wulf, 2013: 24, Comin/Philippon, 2006: 168). Aggregate volatility, in contrast, concerns extensive changes in parameters of the macroeconomic environment such as in GDP growth on various levels. Heavily interlinked sectors can cause aggregate volatility such as the impact of the financial sector on the overall economy as in the financial crisis (Schwenker/Wulf, 2013: 25).
- *Complexity*. Complexity often results from interrelated factors such as information overload, product variety, increasing global presence, a broader range of stakeholder interests and network effects that companies often need to consider simultaneously in their decision making and strategy development (Schwenker/Wulf, 2013: 27-29). Complex systems exhibit the following five key characteristics according to Snowden and Boone (2007: 70):
    - connected and interacting elements
    - minor impacts can result in disproportionately major consequences
    - the whole is greater than the sum of its inputs and assets
    - hindsight does not lead to helpful implications for the future as external conditions are constantly changing

    - agents and the system constrain one another
- *Ambiguity*. Ambiguity refers to a lack of clarity e.g. regarding which variables are involved and their exact roles in situations. This lack of clarity results from the nescience or the uncertainty as to whether all relevant information is known, whether or not it was interpreted properly, whether it discriminated between relevant and irrelevant data or whether it was included in the process of decision making. It can also result from a lack of knowledge about the relationship between actions and results ('causal ambiguity') making decision making very risky (Schwenker/Wulf, 2013: 29).

Uncertainty is omnipresent in the overall environment and industries, too (Schwenker/Wulf, 2013: 22). These conditions pose unforeseen challenges for management and strategic decision-making. Traditional strategic planning methods and future prediction techniques to manage uncertainty have reached their limits because they fail to cope with complexity, fail to reflect volatility, do not consider different perspectives and are based on the untenable assumption of constant growth (Schwenker/Krys, 2013: 7). Further, traditional approaches are generally also very complex with regard to time und resources due to a lack of standardization and comprehensiveness (Schwenker/Wulf, 2013: 45). Finally, traditional instruments have relied on single future projections so far instead of considering different potential future scenarios to increase flexibility for planning (Schwenker/Wulf, 2013: 44-45). Despite the increasingly uncertain business environment the planning questions for companies and management remain constant (Schwenker/Krys, 2013: 8). Therefore, companies and management are in need of a strategic planning instrument that is able to overcome those shortcomings to deal with the uncertainty and dynamic of a company's environment, characterized by complexity and volatility (Schwenker/Krys, 2013: 9; Wulf/Meissner/Stubner, 2010: 13). Hence, the following paragraphs briefly outline the HHL-Roland Berger Scenario-Based Strategic Planning Approach.

2.2.3 HHL-Roland Berger Scenario-Based Strategic Planning Approach

The HHL-Roland Berger approach to scenario based strategic planning, developed as part of an academic cooperation between the Handelshochschule Leipzig (HHL Leipzig Graduate School of Management) and Roland Berger Strategy Consultants, integrates scenario planning and strategic planning and offers a structured process based on six consecutive process steps and correlated tools. As a result, four distinct detailed scenarios specific for the industry or company in concern are established. From these scenarios a core strategy is derived that is supplemented by a set of different strategic options to implement if the environmental development leans towards one of the established scenarios (Wulf/Meissner/Stubner, 2010: 2). Figure 11 provides an overview of the process. The six steps of the scenario-based approach to strategic planning, including the tools that guide each process step, are described in the following.

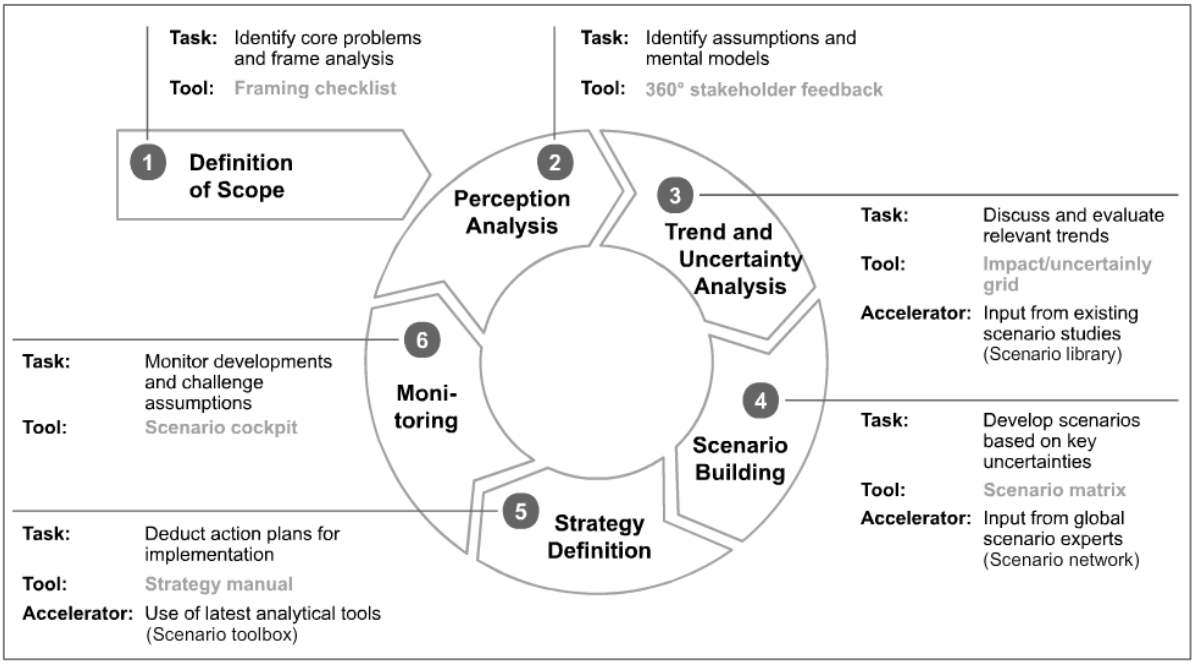


Figure 11: The HHL-Roland Berger scenario development process
Source: Center for Strategy and Scenario Planning

2.2.3.1 Step 1: Definition of Scope (Tool: Framing Checklist)

In the first step of the scenario development process, the overall scope of the project is defined to create a common understanding of the goals among all involved in the project. The “Framing Checklist” tool helps to specify key

parameters of the project by asking five basic underlying questions regarding the goal of the scenario project, the strategic level of the analysis (industry level, corporate level, business unit level, etc.), relevant stakeholders to involve in the 360° Stakeholder Feedback, the participants and the time horizon of the project. (Schwenker/Wulf, 2013: 51-52)

2.2.3.2 Step 2: Perception Analysis (Tool: 360° Stakeholder Feedback)

The goal of the second process step, the perception analysis, is to identify and challenge the perception (assumption and mental models) of selected internal and external stakeholders using a tool called the 360° Stakeholder Feedback. This instrument essentially contains a two-part survey (both online and offline) that is conducted among internal and external stakeholders. The assumptions and underlying mental models of internal stakeholders are then compared to the perceptions of external stakeholders to identify so-called blind spots and weak signals.

2.2.3.3 Step 3: Trend and Uncertainty Analysis (Tool: Impact/Uncertainty Grid)

As part of the trend and uncertainty analysis, the influencing factors from the 360° Stakeholder Feedback are structured and prioritized according to their potential performance impact and their degree of uncertainty for the future using the “Impact/Uncertainty Grid” tool. The “Impact/Uncertainty Grid” organizes the influencing factors into three areas: secondary elements, predetermined elements/trends and critical uncertainties. Secondary elements have a low potential impact on the industry’s future development and are thus neglected in the further process of the project. Predetermined elements or trends have a comparatively high performance impact and show low to medium uncertainty so that they are relevant for the industry’s future and are considered in the description of the scenarios later on. (Schwenker/Wulf, 2013: 55-56) Critical uncertainties are highly important since they score both high in potential impact and uncertainty of future development meaning that regardless of their development, these factors

will have a strong impact on the industry's future development (Wulf/Brands/Meissner, 2011: 6). These factors are then clustered if closely related in order to elect two scenario dimensions that guide the establishment of the scenarios (Schwenker/Wulf, 2013: 56).

2.2.3.4 Step 4: Scenario Building (Tool: Scenario Matrix)

The objective of the scenario building step is to develop and describe four different future scenarios for a company or industry. The "Scenario Matrix" tool is complemented by the "scenario influence diagram" and the "scenario fact sheet" to deduct the scenarios. (Schwenker/Wulf, 2013: 100-101) The Scenario Matrix builds and visualizes the four scenarios that are based on the two key uncertainty factors from the previous step of the trend and uncertainty analysis (Schwenker/Wulf, 2013: 105). Four sub-steps are required to design and describe the scenarios:

1. *Identify the scenarios*. The scenarios can be identified when arranging the two identified key uncertainty factors along the axes of the four-quadrant scenario matrix and defining an extremely negative and extremely positive outlook for each. The four distinct scenarios automatically generate themselves this way. (Schwenker/Wulf, 2013: 105-106)
2. *Create an influence diagram*. The influence diagram builds the basis for the scenario description as it pictures the cause-effect relationship chain between selected trends and critical uncertainties from step three and portrays strategic levers leading to the end states described by the scenarios. (Schwenker/Wulf, 2013: 107-108)
3. *Describe the scenarios*. On the basis of the interdependencies established in the influence diagram, the scenarios are holistically depicted in narrative prose as part of this step (Schwenker/Wulf, 2013: 108-109).
4. *Create a fact sheet*. Finally, a brief fact sheet providing an overview of each scenario including a short description and relevant numbers and key indicators to watch out for in the future should be compiled (Schwenker/Wulf, 2013: 109-110).

Following this four-step approach ensures a consistent, plausible and holistic scenario development process.

2.2.3.5 Step 5: Strategy Definition (Tool: Strategy Manual)

In the fifth step, the four scenarios are transformed into action plans for implementation using the “Strategy Manual” framework. The aim of the strategy manual is to extract a core strategy for the strategy corridor by defining focal points for the different scenarios. Focal points form the boundaries of the scenarios and constitute those elements that must be implemented depending on which scenario is realized. (Schwenker/Wulf, 2013: 134) The core strategy, however, “can be implemented regardless of which influence factors dominate the four scenarios” (Schwenker/Wulf, 2013: 134) because it is independent of concrete future developments. The Strategy Manual further yields strategy options that have to be considered in the company’s planning in addition to the core strategy (Schwenker/Wulf, 2013: 134). These options will only be implemented if the actual environmental development points towards the direction of one particular scenario of the four (Wulf et al., 2012: 37).

2.2.3.6 Step 6: Monitoring (Tool: Scenario Cockpit)

Finally, in the monitoring stage of the HHL-Roland Berger scenario development approach, a strategic controlling system indicating which strategic measures to implement is established using the “Scenario Cockpit” tool. Overall, the aim is to identify which previously determined strategic options to implement and when. (Schwenker/Wulf, 2013: 137-138) The “Scenario Cockpit” monitors the volatility of the external environment, i.e. fluctuations within the critical and key uncertainties, through quantitative indicators (Wulf et al., 2012: 38). These indicators are then used to establish a ‘monitoring corridor’, which provides a value range for each indicator and scenario (Schwenker/Wulf, 2013: 141). This in turn indicates which of the four scenarios corresponds most likely to reality and which strategic actions should be executed (Wulf et al., 2012: 38).

3 Application of the HHL-Roland Berger Scenario Development Approach

After providing the theoretical fundament of the HHL-Roland Berger Scenario Development approach, the concept and its tools will now be applied to the German carsharing industry in order to establish four future scenarios for 2025.

In the following paragraphs process step 1 through 5 will be executed; process step 6, however, will be omitted in this context due to the restricted scope of this master thesis.

3.1 Definition of Scope

In order to create a basic common understanding of the project, the scope of the scenario development project has to be defined. The framing checklist delimits the scope by specifying five central parameters: the goal of the scenario project, the strategic level of the analysis, the stakeholders of the 360° Stakeholder Feedback, the participants in the project and the time horizon of the project.

1. The focus of the scenario analysis is to develop four realistic future scenarios for the carsharing industry in Germany between now and 2025 and accordingly develop a strategy for the players of the German carsharing industry.
2. The scenario planning process is conducted for the industry level since this study focuses on developing future scenarios for the whole German carsharing industry and no particular company is part of the scenario description.
3. The participants in the scenario development process comprise a student of Philipps University Marburg in cooperation with Prof. Torsten Wulf, Head of the Chair for Strategic and International Management and Academic Director of the Center for Scenario Planning and Strategy of HHL Leipzig Graduate School of Management.
4. Internal and external key stakeholders are involved in the 360° Stakeholder Feedback. The group of internal stakeholders consists of representatives from carsharing companies working in senior positions in corporate

development, strategy and operations as well as in mobility services department of OEMs. External stakeholders comprise consultants, scenario specialists, researchers, politicians, and active users of carsharing.

5. The time frame of the scenarios is defined from 2015 until 2025.

3.2 Perception Analysis

In the perception analysis stage, the participants in the 360° Stakeholder Feedback identify key influence factors for the development of the German carsharing industry in the next ten years, which are then clustered and rated in terms of their performance impact and the level of uncertainty to identify weak signals and blind spots.

3.2.1 360° Stakeholder Feedback

The 360° Stakeholder Feedback contains a two-step survey process that was conducted both online and offline among internal and external stakeholders. In the first step of the survey, participants were asked to pinpoint influencing factors that will shape the future developments of the German carsharing industry. These factors were based on and structured along the PESTEL dimensions: political, economic, societal, technological, ecological and legal factors. The questionnaire was provided online on a website and provided offline as a Word document via email. In total, 34 stakeholders participated in the first step of the survey. Before conducting the second part of the survey, the influence factors from the first step were clustered. In the second step, these factors were redistributed among stakeholders in a closed questionnaire asking the participant to rate each factor regarding their impact (importance for and influence on future industry development) and level of uncertainty (occurrence probability within 5 years) on a scale from 1 (low/weak) to 10 (high/strong). In total, 31 stakeholders answered the second part of the survey.

3.2.2 Result Analysis

A complete overview of the clustered and synthesized influencing factors is provided in Annex 2. In total, 33 influence factors could be determined. The next step after executing the 360° Stakeholder Feedback is the analysis of the results from the two surveys. In the following paragraphs, the rated influence factors, which were graded in terms of performance impact and uncertainty, are mapped to identify blind spots and weak signals, respectively.

3.2.2.1 Blind Spot Analysis

First, blind spots were visualized in a spider diagram (see Annex 3 and 4) that contrasts the external and internal perspectives on the performance impact and degree of uncertainty of the influence factors. In this context, blind spots are those factors, which "external respondents consider to have a significantly greater impact or greater uncertainty than internal respondents do" (Wulf/Brands/Meissner, 2010: 10). Generally, blind spots are the developments that are consciously or unconsciously disregarded by internal experts of a company (Schwenker/Wulf, 2013: 53).

For the dimension of impact, five blind spots could be identified as shown in Annex 3. These include the following *(the letter in brackets after each factor indicates the respective PESTEL dimension)*:

1. Evolution of new mobility concepts & mobility requirements and the sharing economy (S)
2. Generation Y and its preferences (S)
3. Evolution of ICT regarding connectivity & multimodality and its consequences, such as IT security, etc. (T)
4. Technological advancement of in-car technology, e.g. personalization through smartphones, improved navigation systems, social interaction etc. (T)
5. Investment into innovative technologies & capabilities to foster carsharing evolution (T)

For these factors, external experts estimate a higher impact on the German carsharing industry than members of the carsharing industry themselves. Particularly regarding the technological factors, which were not assigned significant impact from the internal stakeholders but from external experts. Annex 3 also shows that internal stakeholders are very aware or maybe “over-aware” of many other factors since they assess a much higher impact for many factors than external experts.

As for the uncertainty dimension, six blind spots could be identified as depicted in Annex 4 and pinpointed in the following *(the letter in brackets after each factor indicates the respective PESTEL dimension)*:

1. Economic benefits and ease of carsharing utilization and the sharing economy for the individual (E)
2. Development of alternative propulsion technologies, in particular electromobility and –technology (T)
3. Environmental awareness of society and its consequences for mobility (S)
4. Technological advancement of in-car technology, e.g. personalization through smartphones, improved navigation systems, social interaction (T)
5. Subsidization of carsharing (P)
6. Evolution of ICT regarding connectivity & multimodality and its consequences, such as IT security etc. (T)

These blind spots show a stronger divergence in the mental models of internal and external experts for the uncertainty dimension. Once again, particularly in terms of technological factors the perception of internal stakeholders deviated strongly with regard to the assigned uncertainty from that of external experts.

3.2.2.2 Weak Signals Analysis

Secondly, after identifying the blind spots, a weak signals analysis was conducted. Weak signals are first indicators of future alterations in a company’s environment or in established business models (Schwenker/Wulf, 2013: 80). These signals can be detected when factors named by only a small percentage of respondents in the first round of the 360° Stakeholder Feedback are rated high in terms of impact and

uncertainty by all the experts in the second round (Schwenker/Wulf, 2013: 95). Hence, the frequency of occurrence of each factor mentioned in the first survey round by experts was determined in order to distinguish frequently named factors from only rarely named ones. All factors from the first survey round that were mentioned by 10 percent or less of the group of respondents were selected. The analysis revealed the following factors:

- Political development in Germany
- Restrictions on data utilization
- Promotion of regulations for data security & consumer rights

Afterwards, these factors were checked against the evaluation of the experts regarding their level of impact and uncertainty for the German carsharing industry: none of the three aforementioned influence factors was rated high in terms of impact and uncertainty. This indicates that no crucial developments have been overlooked or ignored and that the internal and external stakeholders share a common understanding of what factors are relevant for the future of the industry.

However, these factors must also be checked for whether they exhibit both high impact and low uncertainty. This would indicate that although only a small percentage of respondents mentioned these influence factors in the first round of the 360° Stakeholder Feedback, the experts in the second round think that these factors would affect the carsharing industry and that they are likely to show in the next ten years. But, all of the factors show a fairly low impact and fairly high uncertainty for the industry's development and were additionally only mentioned by 10 percent or less of the experts. Hence, these can be categorized as secondary elements.

In summary, the weak signal analysis has demonstrated that all experts understood the relevant indicators for the carsharing industry's future and that all relevant factors were heeded. However, two of the three weak signals were identified as trends. The analysis thus also indicates that many stakeholders were not fully aware of two crucial influence factors. Once again, this underlines how important it is to challenge a company's existing perceptions and mental models to

encourage thinking ‘out of the box’ in order to “effectively and efficiently detect future opportunities and risks at an early stage” (Schwenker/Wulf, 2013: 79).

3.3 Trend and Uncertainty Analysis

Based on the findings of the 360° Stakeholder Feedback, the next step of the scenario development process, the trend and uncertainty analysis, is to evaluate trends and critical uncertainties. To identify the two key uncertainties needed to construct the four scenarios for the carsharing industry, the impact/uncertainty grid is applied in the following paragraphs.

3.3.1 Impact/Uncertainty Grid

The impact/uncertainty grid framework is applied to comprehensively and systematically visualize the experts’ ratings of the influencing factors in terms of impact and uncertainty from step 2 of the 360° Stakeholder Feedback and categorize these according to their relevance for the future of the carsharing industry. The grid is thus divided into three sections: secondary elements, trends and most importantly, critical uncertainties. The results of the analysis are depicted in figure 12 below.

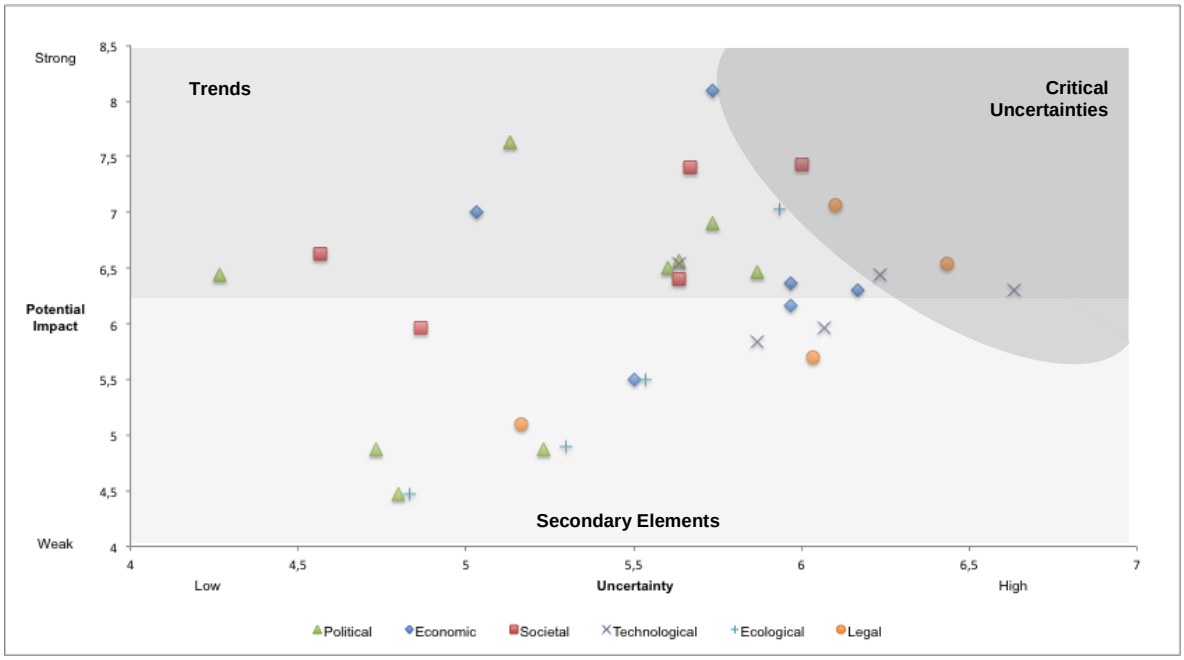


Figure 12: Impact/Uncertainty Grid for the German carsharing industry
Source: Own illustration

The secondary elements section of the impact/uncertainty grid contains those factors that have a weak potential impact and can have low or high uncertainty on the carsharing industry's future. This section is located in the bottom half of the grid. In total, 13 factors classify as secondary elements, including the following: "restrictions on data utilization", "political development in Germany" and "stricter CO2 emission regulation" (see annex 5 for the complete list). Since these factors only have a weak impact on the future development of the carsharing industry, they will not be considered further into the scenario development process.

The trends section contains the predetermined elements/trends, which are those factors that have a comparatively higher potential impact on the carsharing industry and are more certain to occur in the next ten years until 2025. In total, 15 influencing factors classify as trends including the following: "development of the relevance of car as a status symbol", „environmental awareness of society and its consequences for mobility", „increasing total cost of ownership (TCO) and price sensitivity of customers" and „awareness for sustainable mobility e.g. e-mobility, environmental zones, recultivation of parking space" (see annex 6 for the complete list of trends). These factors will be considered in the scenario development process because their future direction is reasonably certain and they might have a strong impact on the carsharing industry.

The critical uncertainties, which are those few factors that have a particularly strong impact on the industry's future and are exposed to high uncertainty, are located in the upper-right half of the impact/uncertainty grid. Due to their placement, these factors take priority in the scenario development and serve as the basis for electing two scenario dimensions. In total, 5 factors from the dimensions "legal", "societal" and "technological" were determined as critical uncertainties *(the letter in brackets after each factor indicates the respective PESTEL dimension)*:

1. Promotion of legal framework and regulations for autonomous driving (L)
2. Promotion of legal framework and regulations for carsharing e.g. insurance, parking issues, taxes (L)

3. Evolution of new mobility concepts & mobility requirements and the sharing economy (S)
4. The development of autonomous driving (T)
5. Evolution of ICT regarding connectivity & multimodality and its consequences, such as IT security, etc. (T)

3.3.2 Key uncertainties

The development of the two guiding scenario dimensions, also called key uncertainties, is based on the five identified critical uncertainties above. These are clustered into meta-categories, if closely related based on common topics or elements, and then grouped to obtain two key uncertainties that are the foundation on which the scenarios are constructed in the following step.

The two critical uncertainties in the first scenario dimension are “promotion of legal framework and regulations for autonomous driving“ and „promotion of legal framework and regulations for carsharing“. It is clear that, both factors share a legal component. Changes in each of these factors would have a significant impact on the diffusion of both mobility concepts as well as on companies’ innovative efforts. Thus, these two factors can be consolidated in the first meta-category „regulatory environment for new mobility concepts in Germany“.

The other three critical uncertainties „evolution of new mobility concepts & mobility requirements and the sharing economy“, „the development of autonomous driving“ and „evolution of ICT regarding connectivity & multimodality and its consequences“ can be grouped into the second meta-category. They have a common element, which is the technological component these three key uncertainties refer to. The pace of the technology industry meaning the advancement of capabilities of information and communication technologies (ICT) enables the development of new mobility concepts as well as new requirememements for personal mobility. Hence ICT are to a large extent innovation engine and pivotal requirement for (shared) mobility and the development of autonomous driving. The second meta-category can thus be summarized as “the level of evolution of mobility ICT”.

These key uncertainties cannot only significantly affect the German carsharing industry but the carsharing industry as a whole.

3.4 Scenario Building

After classifying the influencing factors into secondary elements, trends and critical uncertainties and determining the scenario dimensions, four scenarios are established as part of this process step. To do so, the four sub-steps are executed as depicted in section 2.2.3.4. Hence, the scenario matrix tool is applied first, followed by the influence diagram that illustrates the mesh of interrelations between trends. Finally, the four distinct scenarios are described in detail and displayed using the scenario fact sheet.

3.4.1 Scenario Identification

The scenario matrix framework is based on the two key uncertainties developed in the previous step that are arranged along the x- and y-axes of the scenario matrix and given an extremely negative and extremely positive outlook. The four distinct scenarios automatically generate themselves this way. The scenario matrix represents thus the “core of scenario identification” (Schwenker/Wulf, 2013: 105).

Hence, “regulatory environment for new mobility concepts in Germany” is placed on the x-axis of the matrix, while “level of evolution of mobility ICT” is placed along the y-axis of the matrix, as depicted in figure 13.

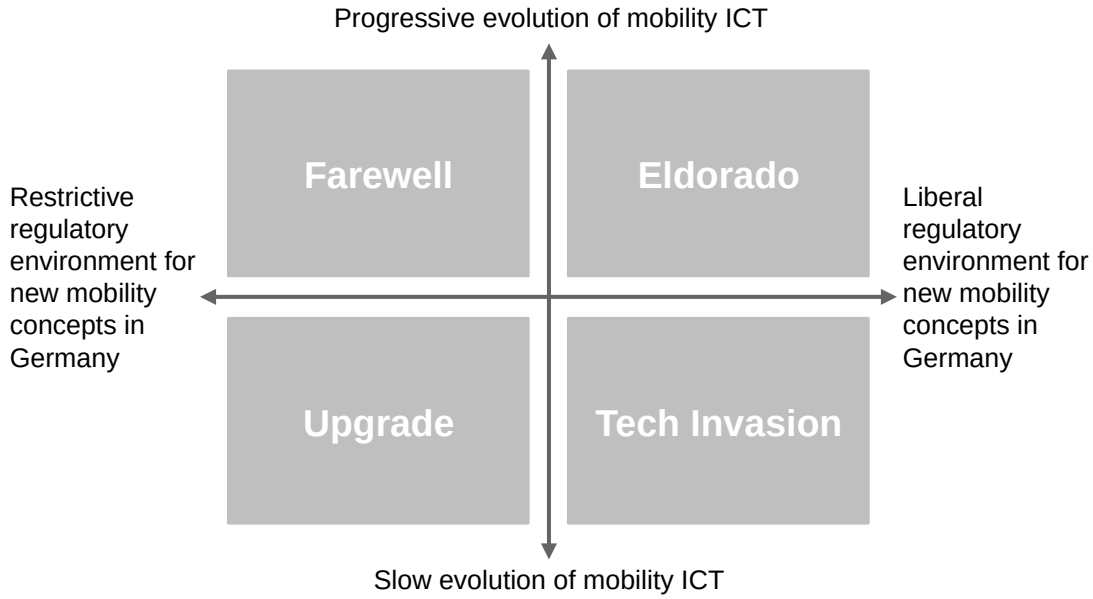


Figure 13: Scenario Matrix for the German carsharing industry
Source: Own illustration

In terms of the “laws and regulation of new mobility concepts in Germany”, the negative development is “restrictive regulatory environment for new mobility concepts in Germany”, while the positive outlook is “liberal regulatory environment for new mobility concepts in Germany”. In terms of “level of evolution of mobility ICT”, the positive development is “progressive evolution of mobility ICT”, while the negative outlook is “slow evolution of mobility ICT”. Finally, each scenario was given a memorable and expressive name.

3.4.2 Influence Diagram

In the next step, the influence diagram is build illustrating the developments that must occur for the two key uncertainties or scenario dimensions to develop in one way or another. These developments are depicted as a chain of causes and effects leading to the key uncertainties. The influence diagram thus helps to establish authenticity and consistency among the four scenarios (Schwenker/Wulf, 2013: 116). Figure 14 shows the influence diagram that was built based on the most important trends and uncertainties identified as a result of the 360° Stakeholder Feedback leading to the key uncertainties.

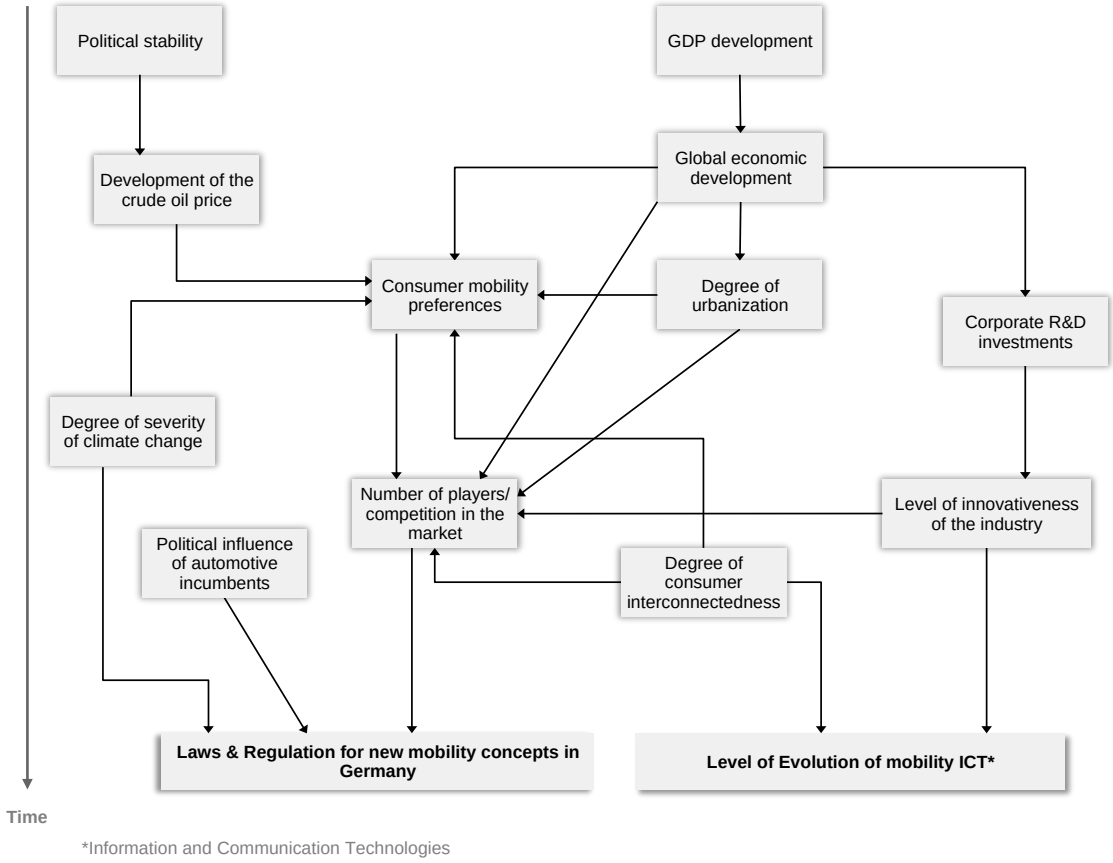


Figure 14: Influence Diagram for the German carsharing industry
Source: Own illustration

3.4.3 Scenario Description

Following the definition of the key uncertainties as well as the display of the developments that would have to take place by 2025 for the key uncertainties to develop in one way or another in the influence diagram, this section outlines the four plausible scenarios for the German carsharing industry in further detail.

For each scenario, a narrative describing the German carsharing industry in 2025 in the respective scenario is provided first. Second, the six PESTEL dimensions are used to concretely depict the developments towards each scenario. Third, each of the scenarios is concluded with a scenario fact sheet. The outline of the four scenarios lay the groundwork from which the strategic options for the players of the German carsharing industry can be inferred in the next step of the approach to scenario-based strategic planning (Schwenker/Wulf, 2013: 129).

However first of all, the four extreme outlooks of both axes forming the scenario matrix must be precisely defined to ensure a coherent approach and a common understanding when describing the scenarios for the German carsharing industry until 2025.

Level of evolution of mobility ICT

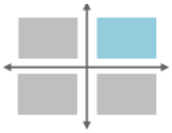
Information and communication technology in the mobility sector take the form of electrics, electronics, and software in and around the vehicle. The more mature these technologies are, the sooner progress is made regarding V2X communication, automated as well as autonomous driving and electromobility. Hence, *progressive evolution of mobility* ICT assumes that the ICT has reached maturity, while this is not the case for *slow evolution of mobility ICT*. Here, ICT becomes an impediment to innovation over time.

Regulatory environment for new mobility concepts in Germany

The regulatory environment for new mobility concepts describes all legal and regulatory actions taken in favor of or against the development of new mobility concepts in Germany. This comprises research, education and funding policies for innovation, purchase or tax incentive schemes, investments in the transportation infrastructure, legislation regarding autonomous driving, liability, data security and privacy, and CO2 regulations, as well. In the state of a *liberal regulatory environment for new mobility concepts in Germany*, there are no or few legislative or regulatory barriers to new mobility services and the market is open for foreign competition. In the state of a *restrictive regulatory environment for new mobility concepts in Germany,* legislative and regulatory barriers are installed to shield consumers and to protect indigenous companies from foreign competition.

These extremely positive and negative outlooks of the axes determine the further description of the four scenarios that are outlined in the following order:

1. Eldorado
2. Tech Invasion
3. Upgrade
4. Farewell



3.4.3.1 Eldorado

18.03.2025: Thanks to a spectrum of innovative solutions, German carsharing has earned global praise and diffusion across Germany

The German Carsharing Industry in 2025

„Nowhere in the world, is carsharing as popular as in Germany. This year, ten percent of the German population are registered with carsharing companies in Germany. These figures exceed all expectations and forecasts from ten years ago. German carsharing business models enjoy an outstanding reputation that extends far beyond German borders. No other carsharing network in the world is as user-friendly and close-meshed.“ stated an industry expert from a reputable international newspaper in a recent interview.

The prospering economic circumstances, huge investments and the collective efforts of German OEMs, telecommunications businesses and politics have made the unthinkable possible in the past decade. Germany has become the pioneering hub for innovations centering on automotive technologies. Nationwide, full network coverage with high-speed internet connections is provided along highways and in densely populated areas. Hence, OEMs were able to enormously accelerate technological progress with regard to autonomous driving capabilities as well as electromobility.

Carsharing was exploited as a catalyst for the market acceptance of these new vehicle technologies and has flourished but also transformed in the process. Not only do shared vehicles today operate fully in electric mode, tremendously reducing air pollution and emissions caused by traffic, carsharing has also thrived in the autonomous driving sector. Although ‚robot-like’ cars without steering wheel, accelerator or brake pedal are not allowed in Germany since some areas are still cleared for autonomously driving vehicles, autonomous parking is allowed. So far, shared AVs operate mainly in densely populated areas and on highways.

Furthermore, a range of new services and solutions around shared vehicles was developed in the past. Platforms have eased the overview and comparison of

carsharing services for consumers in the race for the new „Amazon of Mobility“. Applications tell users how to leverage various transit options to get from A to B while taking into consideration preferred mobility and supplementary services, the use case, availability, traffic situation and fuel or charge level in case of car-based mobility. Only a single customer account is needed to access cars of almost all available providers and across brands in Germany. Private vehicle owners can make their car available to the public at the push of a button.

Hence, the offering by players in the German carsharing industry ranges from very economical but less flexible options (mostly peer-to-peer and station-based) to the more costly but also more flexible free-floating shared AV providers that offer an array of customizable value added services around the car with regard to entertainment and connectivity services as well as autonomous driving capabilities. Flexibility, efficiency and the new technology comes at a cost. But consumers have started to embrace the shared AV concept. They have recognized that the time spent while travelling can be put to good use and that despite using a public mode of transportation, the intimacy of a private vehicle can be preserved. However, consumer surveys have indicated that Germans highly trust and value the expertise and reputation associated with the brands of the German OEMs. Hence, foreign shared AV players have not yet dared to enter the market. However, this has prompted Car2Go and DriveNow to expand their offering from the well-established short-haul market in urban centers to the long-haul carsharing market to promote their new technologies intensively in the German market.

Foreign competition could be kept at a distance from Germany in light of the strength of indigenous firms. Instead, the competition centers on Asia where the urbanization and pollution have driven people to live more consciously and care for their health and favorable regulations for carsharing were installed. By using a franchising model, DriveNow scaled and expanded their carsharing business early on to Asia. Car2Go, however, has heavily and aggressively expanded from within the company. Both succeeded with their complementary approaches to carsharing and have emerged as major global players.

Developments by 2025

Politically

The European Union has stabilized after all the controversies in the EU regarding the migration crisis and the aftermath of the financial crisis and the recession. The UK's EU referendum on the country's membership of the European Union resulted in the British population's vote to remain a member. Financial and political reforms finally stabilized the crisis-stricken economies of Spain, Italy, Greece, Portugal and Cyprus. Migration finally came to a halt after a successful deal was made with Turkey to take in refugees starting mid-2016.

Efforts to combat Islamist terrorism and radicalization were pooled. Together, the parties actively intervening in the war in Syria and neighboring countries recorded a win against the Islamic State by cutting off its financial supply and eliminating important leaders resulting in the stability of the region. .

However, the oil market did not stabilize. The worldwide oil surplus keeps prices at a low level. Following a slight rise in the past decade, the oil price has settled at 45 USD per barrel.

Economically

Despite the demographic change, the German economy proved rock-solid in the past decade. Due to the substantial migration flows, the population has not diminished. Employment is high and the national lack of skilled labor is hardly noticeable. Elderly people continue working to secure their economic status and the female employment rate has soared.

The cheap oil has deteriorated the economic situation in oil-exporting nations such as U.S., Russia and Iran. However, the economies of China, India and Germany profited from the lower crude oil price level. Costs for production have heavily decreased. This boosted the global economy in consequence, which resulted in rising corporate budgets. Accordingly, global GDP rose on average 5 percent annually since 2016.

Nevertheless, smartphone ownership and 5G mobile internet subscriptions have risen worldwide indicating high levels of digitalization among the population. The high degree of digitalization has benefitted consumers and the economy at large. German industries have retained their market leadership in many areas by intensifying their R&D efforts. The transportation sector in particular is the world leader regarding technology-intensive products such as highly efficient internal combustion engines, batteries, driver assistance and safety systems culminating in autonomously driving vehicles, sensor-guided traffic management and the interconnectedness of transportation systems. Driven by digitalization, migration and the low oil price the economy has stayed innovative and competitive. Accordingly, the German GDP increased by 1.8 percent p.a..

Socially

The good economic condition of Germany and strong employment figures have led to a positive income development and increased purchasing power. In addition, costs for heating and fuelling decreased due to the low oil price. Private spending among all age groups has increasingly gone into purchases of the newest consumer electronics e.g. to be able to utilize the new ultra-fast 5G mobile communication network. Not only native digitals but also older generations have embraced the advantages of the digitalization.

Accordingly, smartphone subscriptions as well as 5G subscriptions associated with smartphones have strongly increased. People across all age groups are now constantly connected to access a wide range of digital services and receive personalized and localized information on the go.

The drivers behind the open attitude towards innovative technologies including electromobility and autonomous driving were revealed as part of a survey conducted among the German population in urban and suburban areas. Reasons cited include increasing safety, convenience, ecological responsibility and peer pressure. In fact, ecological behavior has become a lifestyle trend supported by the considerable technological thrust in the industry. The public awareness for the importance of climate protection and the consequences of global warming has

drastically increased in Germany. Hence, the willingness to use and share is ‚hip' and ‚cool' now and a part of the new urban lifestyle. One respondent even commented: „I find that the current attitude has started to change to recognize private automobiles as an unsustainable solution for personal urban mobility". This emphasis on environmental matters constitutes a new form of self-portrayal among society and indicates that societal resistance towards electromobility but also autonomous driving solutions has been swept away.

Technologically

In 2018, Europe finally enforced its much more compatible and scalable version of the 5G network structure after a lengthy international race for dominance in the 5G development against the USA and Japan. The 5G broadband network enables much shorter latency periods as well as a significantly higher throughput with which it caters to a wide range of new use cases related to the communication of billions of devices in the 'Internet of Things' (IoT). The market readiness of 5G was among the last pivotal requirements for the realization of autonomous driving on German roads and the superior efficiency of the electric propulsion.

To make use of the faster data connections, network coverage and connectivity in the transportation infrastructure were optimized so that vehicles can communicate with other vehicles (V2V) and with the surrounding infrastructure such as traffic lights (V2I).

Besides the technological readiness of the infrastructure, the ICT in vehicles evolved further due to the collective efforts of the OEMs by promoting cooperative ventures or by acquisitions and by companies' actively participating in standardization processes. Corporate venture initiatives such as BMW's iVentures, BMW Startup Garage and Audi Electronics Venture gave OEMs access to innovative thinking as well as cutting-edge technologies and innovations. For German OEMs, these ventures have proven to be strategic levers and pivotal with critical value for the development of new mobility services. Together, the decision was made to standardize the ICT architecture and integrate a single platform where new functions are integrated not in the form of a large number of control

devices, but as software over-the-air. New functions can thus be not only easily integrated at lower costs but are also customizable. This leap forward ensured that future standards were not set mainly in America and Asia and that OEMs can offer products that meet connectivity standards at an early stage to stay competitive. Concerning the ICT, these were the essential steps that resulted in the maturity and introduction of autonomously driving vehicles.

Moreover, the ICT-supported smart traffic systems and intelligent on-board navigation systems have contributed to a considerable driving range increase of electric vehicles. In combination with simplified and standardized access, payment and reservation systems employed in an ICT-supported intelligent and interconnected charging infrastructure, which constantly communicates with vehicles and drivers alike, reduced costs and complexity have aided the breakthrough of electromobility.

The evolution of automotive ICT has enhanced and diversified the customer driving experience. Companies now employ an omni-channel strategy to ensure customer centricity throughout all customer interaction channels of which the connected car has become a part. That means that customer preferences for convenience, safety, entertainment and easy access of information across media and devices are reflected in a seamless and coherent customer driving experience. Drivers of connected cars can customize their driving experience by connecting with their personal technology and accessing other web-based information and entertainment services such as mail or social media accounts creating a new form of customer intimacy. In-car telephony has emerged to enable video telephony via the navigation monitor or integrated into the front pane. Customers are further provided personalized content regarding in-car customer service, location-based services and information and advertisements based on data generated from multiple customer touch points and movement, which has led to the existence of a new automotive m-commerce sector. In turn, this has decreased the cost of utilization as it is increasingly financed by applications. Matured RFID technologies have also increased speed and ease of utilization:

identification, access and transactions are performed in a contactless manner using matured RFID technologies via the smartphone.

Ecologically

In 2016, it became obvious that Germany would not be able to meet set targets of the Integrated Energy and Climate Protection Program after the Federal Environment Agency issued a warning that carbon dioxide emissions had not diminished as needed in the previous years. In addition, the increasing frequency of natural disasters attributed to global warming put governments globally under alert. Politicians of all parties demanded tougher restrictions from governments regarding the CO2 emission.

Legally

The calls for stringent politics dedicated to environmental protection led to the introduction of tougher restrictions regarding the CO2 emission by the German government, which Germany managed to implement as part of a new climate agreement within the EU countries. With the majority of natural disasters hitting the U.S. and Asia hard more often than ever, the U.S. and China as major emitters of CO2 decided to take action by signing dedicated climate regulations and by becoming major spokespersons for climate protection alongside Germany.

Despite initial hesitance, the German government gradually removed legislative and regulatory barriers to new mobility services focusing on automated vehicles. They understood that political initiatives, investments and legislative actions regarding the infrastructure and standards needed for autonomous driving as well as the spread of electromobility were essential to remain competitive. Research in ICT for electromobility was promoted and so too were close cooperations with the energy industry for smart grids and the traffic industry for smart traffic. A solution for the installation of the infrastructure was found when telecommunications companies and network operators partnered up with companies whose products are dependent on the technology. The German government also immensely subsidized research and testing around autonomous driving. Initial regulatory

initiatives started already as early as 2015 when the federal highway 9 and the city center of Ingolstadt were converted and accepted test-drive fields for automated driving. German politics and legislative worked closely with automakers and academics to enhance the regulatory framework and facilitate Stage 5 of autonomous driving. Major cornerstones in the process were the amendment of the 1968 Vienna Convention on Road Traffic by the UNECE that defines traffic regulation throughout most of the EU, many parts of Asia, South America, and other jurisdictions as well as the modification of general traffic regulations (StVo) in Germany in favor of the facilitation of Stage 5 autonomous driving. During the process, regulatory bodies also agreed on safeguarding policies for privacy as well as security standards and liability issues.

Also, German regulators and policy makers decided to adopt a new approach to homologation to accelerate the deployment of automated vehicles by setting minimum safety standards and environmental standards before vehicles reach the market. The shift is intended to limit manufacturers' liability uncertainty as well as to ensure safe vehicle operation with increasingly complex technologies. But also for consumers, cars must thus be fully equipped with safety features such as collision prevention, danger warning signals, emergency call functionality and fatigue protection as well as real-time ICT systems.

Finally, the European Commission's Digital Agenda finally reached one of its key objectives to cover 100 percent of the population in Europe with fast broadband access first in Germany. After the revocation of the legal principles of the so-called ‚Störerhaftung' (liability as a co-liable party) for the provider of wireless Internet and the alteration of the ‚German Telemedia Act', Germany also enabled the provision of an extensive public free-of-charge WLAN infrastructure.

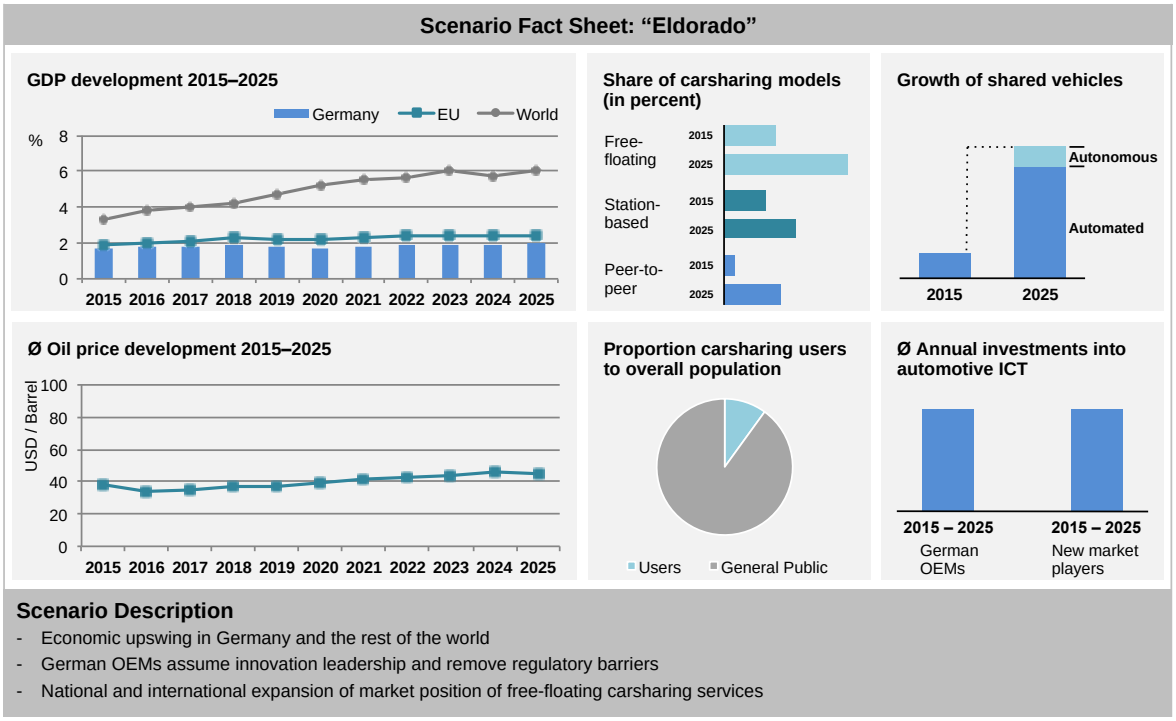
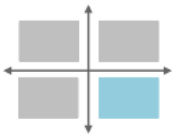


Figure 15: Scenario Fact Sheet: "Eldorado"
Source: Own illustration



3.4.3.2 Tech Invasion

18.03.2025: Traditional carsharing operators struggle as new market players invade the German carsharing market

The German Carsharing Industry in 2025

Since 2015, rumors have persisted that emerging market players might launch autonomously driving vehicles by pushing forward into the carsharing space. Aware of the increasing appeal of carsharing as testing field for new vehicle technologies, German OEMs and governing as well as regulatory bodies ramped up innovative efforts and pace on creating attractive mobility services and removing regulatory barriers to be able to oppose the increasing menace of U.S. cross-industry businesses venturing into the automotive arena.

However, incumbents eventually had to succumb to the financial strength, ‘rapid prototyping’ culture and software competence of non-traditional players, which could not be overtaken in making the first move into the self-driving era using carsharing. In consequence, the locus of automotive innovation is moving away from Germany to Silicon Valley. Silicon Valley companies are at the vanguard of the autonomous driving and electromobility evolution. Moreover, the merchandise brand ‚Made in California’ has started to have relevance and status among the technic-savvy consumers. It has become a brand on its own synonymous of technological reliability and quality and carsharing has accelerated this advancement. Brands such as Google and Uber have thus proceeded to launch so-called robo taxis, which are however not yet approved in some countries such as Germany because more complex traffic situations as can be found in city centers are not cleared yet for cars without steering wheels.

Tesla however chose the approach to provide self-driving capabilities but keeping the steering wheel to familiarize consumers first with the technology. After launching in the U.S., Tesla was thus able to introduce its self-driving electrically propelled vehicle portfolio in one of the markets with the highest affinity for cars,

liberal regulations for new mobility concepts and technological maturity of the digital and physical infrastructure: Germany.

With its premium AV offering ranging from the Model 3 to Model S, Tesla has entered in direct competition to free-floating carsharing services, particularly DriveNow, decreasing margins and pushing prices for free-floaters downwards. Furthermore, Tesla could win market shares from indigeneous carsharing firms particularly in the business segment. The majority of their shared AV models are used for short-haul business purposes or commuting in urban areas as they save time and money for corporations in these fraught economic times. BMW was reported to entertain the idea to purchase a license for Google's system of autonomous driving capabilities to keep up with the market pace of innovation.

But overall carsharing utilization for private purposes has also increased in Germany due the larger offering and price pressure that have met consumer preferences for a cost-effective but flexible personal mobility. The increasing TCO as a consequence of rising fuel prices has further stimulated consumers to forego ownership.

Developments by 2025

Politically

The migration crisis and the aftermath of the financial crisis and the recession have afflicted the EU tremendously over the past decade. Fortunately, the U.K. decided in the EU referendum in 2016 to remain part of the EU but the financial instability of many EU member states has persisted. The EU parliament attempted to distribute the financial burden of the migration among the EU states, but did not fully succeed. As a result, relations between Greece and the states along the Balkan routes became further strained. Negotiations with Turkey to take in refugees proved fruitless when Turkey did not honour the jointly agreed terms and actions. Russia and the Ukraine were also not able to solve the crisis concerning the annexation of the Krim. War-like conditions still prevail in the borderland.

Although the economic conditions have deteriorated in both countries, up until the present, so far negotiations have still not been successful.

Finally, an agreement concerning the handling of the IS could not be reached at the consent of all states leaving the Western sphere in fear of islamization and terrorist attacks due to increasing power of the Islamic State in the Middle East.

However, the oil market has stabilized in the meantime. The OPEC and other oil-exporting nations have reduced the oil surplus. Accordingly, the oil price sharply increased to the current 85 USD per barrel.

Economically

The global political instability led to global economic distress. Growth rates stagnated in many world economies and not only in the EU. Despite contrary predictions, the global GDP grew very moderately at 3.5 percent p.a..

In a globalized world, slowing growth rates affect all economies. Hence, also the growth rates of the German economic output declined to 0.6 percent annually. Exports and demand for German products have decreased. Employment has regressed in consequence. The proportion of the workforce relative to the overall population is shrinking. Despite hopes and aspirations, the high migration of young refugees to Germany in 2015/2016 could not compensate for the aging population and the lack of skilled labor. Instead, Angela Merkel's ‚open borders'-policy from 2015/2016 resulted in additional financial burden to the country. Reinforced by the national lack of skilled labor, the income divergence grows. Innovative technologies, however, are only introduced following political pressure and regulations. The competitiveness of German products and the resonance of products ‚made in Germany' have diminished, which indicates decreasing innovative capabilities of industries.

The manufacturing industry in Germany has suffered from the increasing oil price after some years of cheap oil. On the contrary, the oil-exporting nations such as the U.S., Russia and the Iran have strongly profited.

Socially

Demographic change is increasingly apparent. Employment has slightly but continuously decreased since the end of 2015. Only the smaller share of the elderly population is still employed. Among the younger population, many people work part-time jobs or use sabbaticals to create space and time for other passions. Work-life balance has become a new lifestyle with people actively sacrificing their income in exchange for more leisure time. Despite more flexible working hours and telework, businesses and politics did not succeed in exploiting additional workforce potential by creating attractive jobs. However, the swell of migration was also unable to remedy this deficit.

The urbanization trend is stagnating. But the mobility behavior has changed, less for reasons of climate protection than for financial reasons. Private households dispose of less financial resources due to the modern work ethic. Also due to the rising costs for heating and fuelling, overall consumption has regressed. Sharing instead of owning makes sense for many people, especially in urban centers with high costs of living. The attitude towards more efficient and innovative products and technologies is thus generally positive. People derive much of their sense of status and freedom from social media, which constitute a safe haven for people. Concerns about data privacy and security are less apparent and are neglected if money can be saved. Smartphone utilization and subscription rates have stayed on a high level.

Technologically

The U.S dominates the era of ultra-fast data connections and transfer periods. Despite scarce financial resources, progress was made regarding network coverage and overall connectivity and the infrastructure, traffic management systems and the interconnectedness of the transport offering were adapted to the new standard.

However, the key German OEMs had to focus on cutting spending in light of the economic situation. The means to further advance research and development of innovative technologies were scarce. Although the OEMs could have bundled

resources through horizontal and vertical cooperations, they relied on the conventional approach that has worked for them in the past. Hence, the innovation capability of German industries diminished due to the lack of financial leverage.

Therefore, vehicle connectivity and improvements of the fuel efficiency of vehicles reached its limits at one point. Hence, the synergy and convergence potential between electromobility and vehicle connectivity could not be exploited. Had this happened, modern assistance and infotainment systems would have contributed to decrease the shortcomings of electric vehicles where range and charging duration were concerned. Furthermore, the charging infrastructure was not expanded sufficiently and advances in battery technology failed to materialize resulting in further range and flexibility issues.

The slow evolution of information and communication technologies has also impeded innovation and inhibited progress with regard to automated driving. OEMs were not able to agree on a collective standard for the system architecture in the vehicle that would have been vital to solve interface issues as well as the increasing complexity in cars, which made the integration of new functions more costly. Evidently, the fundamental revision of the ICT architecture has long been overdue. A technological leap has also been sorely lacking. Hence, Daimler, BMW and VW were not able to advance the development to enable autonomous driving before 2025 contrary to new market players from Silicon Valley.

Environmentally

The stagnating urbanization and the increasing number of fuel-efficient or electrified vehicles have decelerated air pollution and CO2 emissions in the past years. The climate change has come to a halt as visible in the reduced number of natural disasters.

Legally

Accordingly, a liberal approach was assumed with regard to CO2 regulations. The EU members decided in a climate conference in 2016 that until 2025 no further adaptation or tightening of regulations for fleet emissions is needed. The more

moderate than expected urbanization and the slight decline in the occurrence of natural disasters were cited as reasons. Furthermore, the lobbies of energy-intensive industries had warned politicians of the consequences of such regulations in times of the stagnating world economy.

In these fraught economic times, regulatory bodies decided to allow technological development to play out with minimal interference, cautious to avoid proposing policies that could inadvertently block the development of promising technologies. Hence, regulatory and governing bodies paved the way for autonomous driving by modernizing and digitalizing the physical infrastructure and amending the 1968 Vienna Convention on Road Traffic by the UNECE and adapting the general traffic regulations in Germany. With exceptions, most highways and urban centers are cleared for autonomous driving. Accordingly, vehicles with an autopilot still had to have a steering wheel, accelerator and brake pedals so that the driver can take over in areas without clearance.

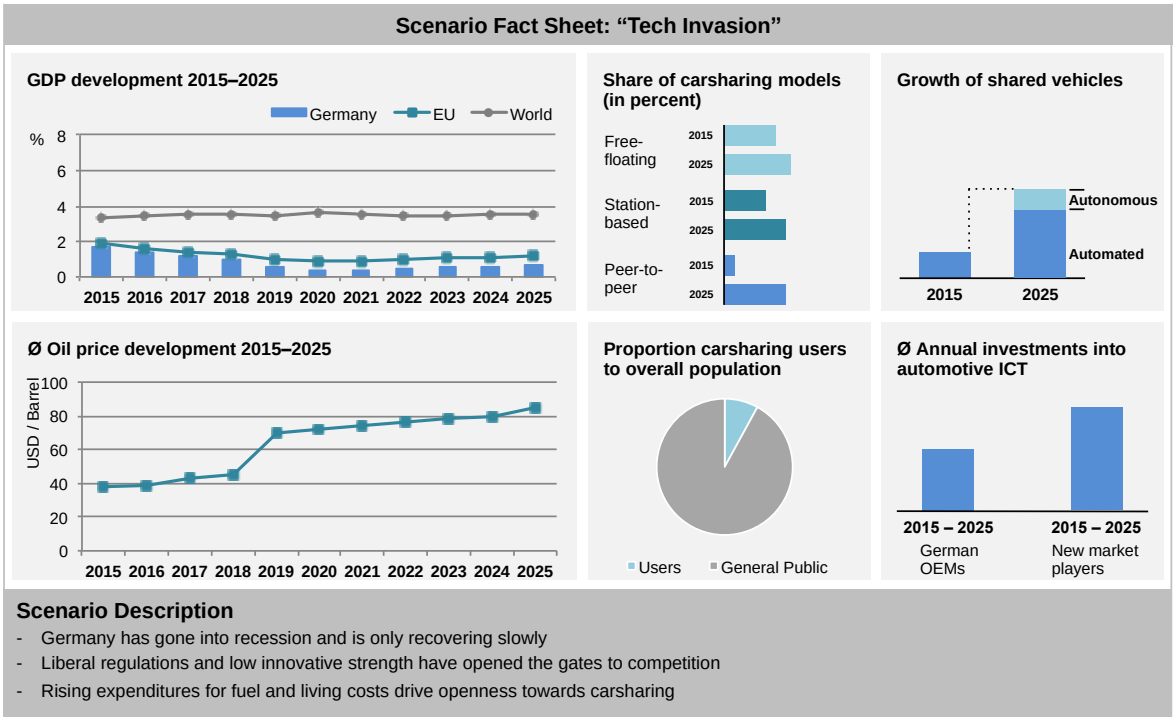
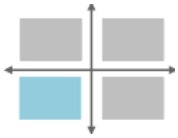


Figure 16: Scenario Fact Sheet: „Tech Invasion"
Source: Own illustration



3.4.3.3 Upgrade

18.03.2025: Carsharer incentivize shared mobility utilization following stagnating membership rates

The German Carsharing Industry in 2025

In a period of economic recession, carsharing membership in Germany has not significantly grown in the past and has been falling short of expectations. Carsharing firms have thus taken different approaches to tackle the issue and win customers.

The first established premium carsharing service in Germany has announced its an extensive corporate frequent user program, which is interlinked with the frequent flyer program Miles & More, in response to the stagnating membership figures in the premium segment. “Although our market share is still sizeable despite reduced utilization for private purposes, we are confident that our new strategy to provide incentives for business customers will further enhance the attractiveness of our carsharing service and further revenue potential can be realized”, stated the CEO of the premium carsharing service at a press conference.

The program launch marked the first premium carsharing service’s response to the integration of a major station-based carsharing network into public transit through cooperations with municipal transit authorities, which led to the launch of a ‘Mobility Card’ in larger cities in Germany. The offering integrates carsharing further with the public transit in urban and suburban areas. Subscribers for the ‘Mobility Card’ can use a range of local transportation modes such as trains, trams, buses, bikesharing and carsharing, as well, at a preferential price on a single payment system. At the presentation of the new subscription service, a spokesperson commented: “Seamless multimodal transportation is the new norm, as greater system interoperability enables consumers to get from point A to point B more conveniently. Naturally, we expect a positive impact and increase in the utilization of all integrated modes of transportation.”

Despite compromised flexibility, station-based carsharers integrated in the Mobility Card network have increased their market shares. Costs clearly set off flexibility in fraught economic times. Since consumers are increasingly turning towards public modes of transportation, the integrated carsharing offering appeals to their lifestyles and mobility preferences.

Free-floating carsharing services have lost market shares in the course of these developments. Although their state-of-the-art fleets once appealed to consumers, people of all age groups have become increasingly skeptical about connectivity despite being knowledgeable of the advantages of digitalization as a consequence of frequent news about successful hacker attacks. If possible, many consumers try to avoid giving away or even producing data and are less open to innovative technologies. Despite turning to business customers in consequence to whom carsharing appeals in times of cut corporate travel budgets, free-floating carsharing could not gain much more traction so far.

The car is now perceived and defended by consumers as the last bastion of privacy. Hence people are reluctant to share their private vehicles, which explains why peer-to-peer carsharing using commercial platforms has not increased. In contrast, low-cost free-floating carsharing services have registered the strongest growth in the past years as they appeal to the price-sensitive consumers. Premium carsharing services have hence narrowed their focus to target business users and frequent travelers, which is why the integration of Lufthansa's frequent flyer program to increase market share in the business segment seemed to be the next logical step.

These developments were tough on the automotive sector: automated driving and autonomous driving remain constrained by a combination of regulatory issues, consumer skepticism, technology development and cost. Lack of interconnectivity and other technical deficiencies in vehicles constitute the reason as to why the transition to electromobility also only takes place slowly. In 2025, still less than five percent of all passenger cars are battery powered – and a critical part of it is employed in carsharing fleets. The insufficient evolution also impacted the tech companies that set out to challenge OEMs. Despite their head start on

autonomous driving, they hit a technological wall in proceeding with their development of artificial intelligence in vehicles.

Developments by 2025

Politically

The migration crisis was the final impetus to trigger the decline of the EU. Turmoil in the Balkan states and Austria due to violations of the 1951 international Geneva Convention of Refugees caused the situation in Greece to worsen. Ongoing disagreement on how to deal with the refugees divided the EU. Negotiations with Turkey to take in refugees and stop the influx into Central Europe eventually failed when Turkey did not honor the jointly agreed terms and actions. Furthermore, the British population decided in a referendum in 2016 to resign as EU member and other countries such as Austria threatened to do the same. Also, the crisis between Russia and Ukraine could not be settled, even years later. The political situation stagnated and negotiations were fruitless. Furthermore, an agreement concerning the handling of the IS could not be reached at the consent of all states leaving the Western sphere in fear of islamization and terrorist attacks due to increasing power of the IS in the Middle East.

Furthermore, the OPEC and other oil-exporting nations have reduced the oil production to increase prices. After some years of crude oil prices at 30 USD per barrel, the price has settled at 85 USD per barrel nowadays.

Economically

The political instability reflected on the global economic development. The political tensions between European countries set the stage for economic downturn. Economic growth rates diminished but not only in the EU. Also China, the U.S. and emerging nations such as Brazil recorded moderate growth rates due to the global interdependence. Overall, the global GDP grew far below previous growth rates at 3.5 percent annually.

Due to the persistently disturbed relationship between Russia and the Ukraine, trade relations were further revoked and more economic sanctions were imposed on Russia. However, the increased oil price has benefited the economy of oil exporting nations such as the U.S. and compensated for the European economic sanctions on Russia. Industrial nations such as Germany, but also China and India, which are both reliant on low prices for resources to propel their enormous economic growth, have suffered. In particular, the economic slowdown of China has not improved much since and growth rates for the Chinese economy have only varied slightly, which has impacted the overall global economic situation.

These developments caused recession in Germany, too. Higher than expected multi-billion investments accrued for the provision of resources and refugee integration. Despite the strong migration rates, the demographic decline did not come to a halt and started to affect the market by 2020 acting as a barrier to growth. Employment regressed. Reallocation of expenditures due to the refugee crisis led to diminishing funds for trend-setting industrial or R&D projects. Additionally, the automotive sector highly depends on China's well-being: incumbents such as Daimler, VW and BMW recorded declining sales and worse still, they were, for example forced to invest less in R&D. Hence, the innovative strength of Germany's industries slowly abated hindering the introduction of conceptually new technologies. The rising crude oil price further hurt industrial activity in Germany. The GDP grew hence only moderately at 0.6 percent p.a.

Socially

Due to the demographic decline, unemployment rates have grown in comparison to 2015. Only a small share of the elderly population is still employed. The integration of the mass of refugees succeeded only in part and was thus far insufficient. As real incomes decrease due to the economic situation and the oil price increased costs for heating and fuelling, private households had to cut spending and consumption. Higher unemployment rates in rural areas have caused people to migrate in closer proximity of urban prospering areas due to the better employment conditions. The share of the urban population grew quicker

than estimated resulting in increased time in traffic and longer distances travelled from suburbs to inner cities.

Cost-efficiency is key today for consumers as budgets are tight. This has driven general mobility preferences towards using multiple modes of transportation to get from A to B. However, the car remains an important part of personal living space. Thanks to the revelation of global espionage and surveillance affairs, hacker attacks on data clouds and the increasing interest of countries in personal information since the beginning of the 21st century, people do not value the benefits of new ICT higher than their data security and privacy concerns. A certain fundamental skepticism and great reluctance against the communication of objects, which permit conclusions as to personal peculiarities and behavioral patterns, has burnt itself into people's minds. And the fear of the ‚glass human being/driver' or passenger is no exception. Accordingly, skepticism against automated driving remains undiminished. The majority of consumers oppose autonomous driving because they do not trust the abilities of the new technology. They perceive the manipulation risk as too high or have general ethical concerns. Many perceive even partially transferring the responsibility to the vehicle as a loss of control.

Technologically

In light of the economic situation, financial means to promote the development of alternative propulsion technologies as well as automated driving were short. R&D budgets were cut due to financial restrictions.

Although the German government has almost reached the target of one million registered electric vehicles in 2025, the anticipated breakthrough of electromobility has stayed away despite heavy employment in urban carsharing fleets. A probable reason is the insufficient vehicle connectivity. This is relevant because of the synergy and convergence possibility between electromobility and vehicle connectivity: modern assistance and infotainment systems can contribute to decrease the shortcomings of electric vehicles regarding range and charging duration. Yet major advances in battery technology fail to materialize and also the

charging infrastructure has still not expanded sufficiently to compensate for range and flexibility issues.

Apart from the declining innovation capabilities of the automotive industry, regulations have complicated further advancement of information and communication technologies. Both OEMs and emerging new market players have reached deadlock in advancing the development of artificial intelligence and autonomous driving. Thus, by 2025, autonomous driving was not yet feasible.

Ecologically

The poor economic situation has accelerated urbanization all around the world. Contrary to expectations, CO2 emissions increased only very slightly. One factor contributing to this development may be the elevated oil price. Overall, climate change indicators have reported stagnating figures and the frequency of natural distasters has also not accelerated in the past.

Legally

A tight regulatory environment addressing data protection and privacy issues was established over the past years in response to consumer concerns. An increasing number of espionage affairs and successful hacker attacks not only on automated vehicles but also on official institutions fueled user's privacy concerns that put pressure on the governments to further protect their data. In light of the increasing aversion of the population, Europe's data protection authorities reformed the archaic data protection guidelines and set new uniform standards. Many voices were raised in other developed countries demanding that similar standards to those of the European approach be implemented. This is expected to be happening soon.

Despite data security concerns, the general public and politicians have remained generally supportive of automated driving and acknowledge it as an effective means of achieving policy aims such as the elimination of traffic fatalities, reduction of congestion and air pollution, control over infrastructure costs and promotion of economic growth. Although the data protection debate has slowed

down progress with regard to automated driving, small actions were taken such as removing legal boundaries to V2V communication and amending the 1968 Vienna Convention on Road Traffic to permit full automated driving. However, the driver must be present and capable of resuming control within a reasonable time when so requested by the car.

Finally, the EU decided not to aggravate regulations around fuel efficiency until 2025 at a climate conference in 2016. The U.S. government and Asian countries decided to follow this approach aware of the damages this would cause to industrial activity in light of the stagnating global economy.

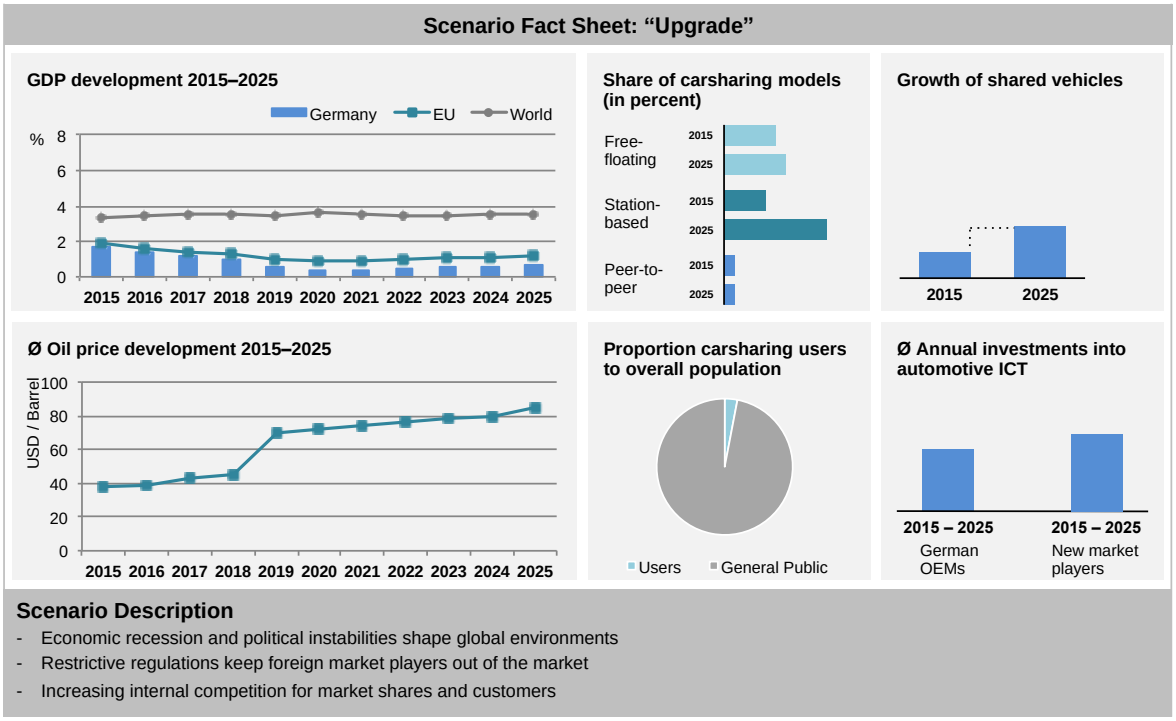
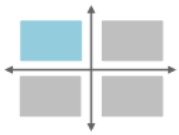


Figure 17: Scenario Fact Sheet: „Upgrade“
Source: Own illustration



3.4.3.4 Farewell

18.03.2025: Carsharing relegated to a niche existence in Germany

The German Carsharing Industry in 2025

The issues of parking and availability in urban areas have persisted. Factors for this development were the constant low fuel prices and the EV uptake, which has caused car ownership to stay at high levels. Although people embrace the idea of protecting the environment as indicated by the increasing EV uptake following range improvements of EV's that are attributed to the progress in ICT, sharing has not become part of that idea. On the contrary: people feel that the additional amount of vehicles on streets worsens traffic and worsens the parking situation, particularly in urban areas. Consumer associations have begun to lobby politics against carsharing. A representative of the movement was quoted in TV saying "It is only logical that an additional number of vehicles on streets worsens traffic and parking in cities. It goes against our understanding why carsharing vehicles should occupy public parking spaces if a positive effect on car ownership could not be proved yet. The only thing that we could notice to date was that we could not park anymore near our apartments and houses. Why should we take the burden for these new mobility concepts to unfold in cities?".

In consequence to the lobbying efforts and protests, the policies that allow municipalities to grant permanent and exclusive parking spots were revoked. Parking for carsharing vehicles was constrained again, for example by raising the fees for parking licenses in cities. Negotiations with private owners of parking space returned unsatisfactory results: private parking spots incur higher costs that would significantly decrease the margins. Furthermore, an insufficient number of private parkings spaces were available in lucrative city centers to provide a coherent network. Thereby, availability has become an even larger challenge to overcome for carsharers.

Initially, OEMs had hoped to launch self-driving vehicles soon to solve the parking issue. However after a series of fatal accidents in Germany and the U.S.,

regulators could not pave the way for AV's so that players were coerced to withdraw their plans of an early launch.

Therefore, carsharing providers have mainly withdrawn their services from urban centers and try to establish themselves as 1st and last mile connectors in addition to public transit in suburban areas and smaller cities. Flinkster was relatively successful in this respect due to its association with the Deutsche Bahn but margins in the commercial carsharing business are hardly economically viable due to the much lower utilization of the vehicles in these areas. Instead local non-profit associations have gained traction. Due to the progress in ICT, most cars are equipped with keyless access so that private carsharing utilization is convenient. To some extent carsharing has thus returned to its origins. However, the large providers Car2Go and DriveNow decided to quit business for the time being in Germany and have re-focused on manufacturing to further optimize fuel efficiency and electric drivetrains as well as autonomous driving to relaunch their carsharing services as soon as possible with a carsharing 3.0 that has disposed of all issues of carsharing 2.0.

Developments by 2025

Politically

At the beginning of the past decade, Europe's political situation was fragile. The migration crisis threatened to divide Europe, the U.K. held a referendum on the country's membership in the EU, there were ongoing conflicts at the Russian-Ukraine border and the Southern European countries such as Greece, Italy and Spain were still weakened by the debt crisis. The European Union was put to the test.

Fortunately, the EU persevered and is politically more stable than ever. Consolidated efforts and the introduction of major reforms could overcome the crises. In a close vote, the British people decided to remain in the EU. Furthermore, peace was enforced in the Middle East through a joint stroke of the Western nations against the IS. Negotiations with political leaders in the war zone

were positive thereby calming the situation down. The influx of refugees slowly ran dry after an agreement with Turkey from 2020 onwards. Institutional reforms and actions against corruption in Italy, Greece and Spain were successful so that from 2020 on signs of economic recovery became perceptible. A peace agreement at the end of 2016 helped dissolve the Russia-Ukraine crisis. As a result, the sanctions from Germany against Russia and vice versa came to an end. Trade between the countries slowly resumed.

The oil price has barely risen in the past and has settled at 45 USD per barrel. Supply has remained consistently high due to the global exploitation of unconventional wells in the U.S. and the ‘oil war’ that broke out mainly between the U.S. and Saudi Arabia. As a result, many oil producing countries plunged into a severe crisis and not only the Middle East was further destabilized but also African, South Asian and Latin American countries.

Economically

Germany’s economic development has done well in the past ten years despite poor forecasts in 2015. The migration crisis finally subsided. Despite high financial investments and the barriers of the right of political asylum, the integration of migrants was successful. Well-educated young migrants have actually compensated for the lack of skilled labor and the demographic change.

The political stability resulting from the economic upswing of the Southern European countries has spurred the European economy. China and India have profited from the low oil prices and were able to keep strong growth rates but the U.S. has struggled due to its engagement in the ‘oil war’. Overall, global GDP growth rose by 6 percent p.a. since 2016. The overall economic well-being has propelled spending and investments.

The German GDP also grew continuously at 1.8 percent annually in the past decade. The German economy is highly competitive on the global markets with innovative technologies such as highly efficient ICEs, lightweight construction, battery production, driver assistance and safety systems culminating in AVs, sensor-based traffic management and networking technologies for mobility

systems and industrial policies that committed to foster promising growth sectors. In light of the growing world economy and the increasing prosperity of individual countries, new technologies from Germany quickly disseminate. This boosts overall prosperity as well as innovative spirits throughout the country. The German economy prospers.

Socially

Due to the stable political and economic situation, prosperity has also increased among the German society in the last decade. The term ‚mobile working' was coined to describe the coalescence of work and private life. Jobs and working times are more flexible than ever. Offices can be set up everywhere due to new technological options – this way of working was advocated for by companies and politics alike to tap into additional work force potential. Hence, employment is at an all-time high. Private households dispose of higher real incomes and purchasing power. Private spending has increasingly gone into consumer electronics such as smartphones and other smart devices. Particularly, adoption rates for 5G-enabled smartphones and mobile internet subscriptions have soared, which advocates for consumer's interest and affinity for new innovative technologies and use cases.

Living in urban centers is sought-after and accompanied by altered mobility preferences among consumers. Efficiency is key when getting from A to B. Hence, depending on the traffic situation, mobility needs, purpose or costs, people use different modes of transportation. Users have become far more demanding expecting not only a convenient and connected vehicle fit out with modern driver-assistance systems but a pleasurable and cost-effective mobility experience.

Additionally, the feeling of environmental responsibility in society was already high years ago but is growing steadily. Particularly, in social elites ecological behavior is a conscious lifestyle choice that enriches life but has also redefined the conception of prosperity. Nobody wants to be deemed a ‚polluter'.

This societal attitude towards environmental responsibility has also reflected upon the development of urban areas. More green spaces can be found in city centers making cities much more livable, less polluted and congested. The overall quality

of life has increased. Far fewer people leave the city to move into the countryside due to exhaust emissions and noise pollution. However, this has caused people to migrate in closer proximity of urban areas due to better living conditions.

Technologically

In the past decade, governmental bodies have made large upfront investments in the technological progress to enable an intelligent traffic infrastructure along highways and in urban centers. OEMs, telecommunications and the IT industry established closer ties to achieve progress with regard to information and communications technologies. Together they managed to advance the ICT infrastructure and architecture further so that functions can be updated and newly integrated over-the-air. The 5G mobile communication standard has also finally matured to enable ultra-fast data connections between interconnected ‘things’. Vehicles constantly communicate with each other as well as with the infrastructure. Technically, autonomous driving (Stage 5) is feasible today as far as the technological requirements are concerned.

The technological advances have benefited the customer driving experience tremendously with regard to shared vehicles. Access, payment and reservation systems are simplified and standardized. Vehicles can be personalized according to customer’ preferences regarding appearance, in-car settings, entertainment and services.

The agreement of the EU states to cut back fleet emissions by 50 percent between 1990 and 2025 (10 percent more than previously agreed) got OEMs back on track to further improve the efficiency of the internal combustion engine and the electrically propelled engine. In addition, the German government accelerated its efforts and further increased funding of research on electromobility and investments into the expansion of the charging infrastructure. But also the advancements in digitalization have impacted the development of electromobility tremendously. Smart traffic and on-board navigation systems and an improved battery technology have positively affected the driving range of electric vehicles. An interconnected charging infrastructure, which constantly communicates with

vehicles and drivers alike, was established. Costs and complexity were further reduced. Subsequently, consumer acceptance rose and drove electric vehicle demand leading to the long-awaited diffusion of electromobility.

Ecologically

A report of the German Federal Environment Agency issued a warning in 2018 that the concentration of carbon dioxide had increased again in Germany over the past five years. Especially in the densely populated Rhine-Ruhr area with its heavy traffic volumes and industrial activities, noxious air pollution figures are high. This development is not surprising taking into account increasing mileage, which entails heavier congestion and the upward trend of fuel consumption due to the increasing urbanization.

In addition, the frequency of natural disasters attributed to global warming increased and has put governments globally under alert. Politicians from all around the world started to demand more stringent fuel economy and emission requirements.

Legally

Following the alarming increase in greenhouse gas emissions and the growing sensitization of society for environment concerns, the Environmental Committee of the EU parliament reviewed legislation in 2018 and proposed stricter regulations concerning the reduction of CO2 emissions by 2025. The proposal to cut back carbon dioxide emissions further than in the previously stipulated targets was agreed on by all member states including Germany. Concerning the automotive industry, “institutionalizing tougher targets is a reasonable and temporary incentive to innovate alternative propulsion technologies that would otherwise have a hard time reaching commercial viability“ as the president of the EU parliament commented afterwards. This had become necessary because first of all crude oil prices have remained low, only incremental steps towards increasing the driving range had been made so far and the German government had also already heavily invested into the roll-out of an extensive network of charging stations.

In contrast to the encouragement of research and development for electromobility, tight regulations were installed that hindered bringing autonomous or self-driving cars onto the streets after a series of fatal accidents in the U.S. and Germany that were caused by self-driving cars. These events further triggered heated public debates about liability and insurance so that all projects regarding the development of autonomously driving cars were coerced to slow down. Nevertheless, research on automated driving was expedited due to extensive investments of authorities in test fields for automated driving on federal highways and in selected urban centers. Legal boundaries to V2V communication were removed. To build momentum, the 1968 Vienna Convention on Road Traffic was revised by the UNECE that applies to more than fifty countries worldwide and national general traffic regulations were modified accordingly to permit fully automated driving. However, the driver must be able to take over driving at all times when requested by the car.

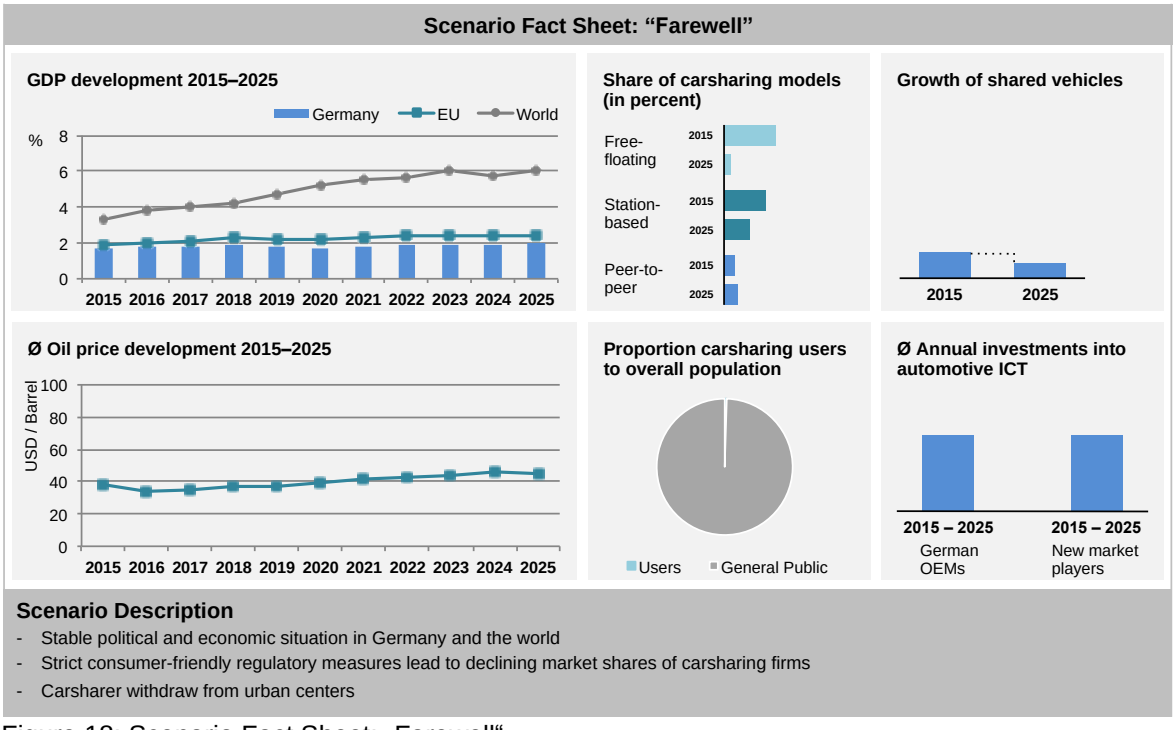


Figure 18: Scenario Fact Sheet: „Farewell"
Source: Own illustration

3.5 Strategy Definition

3.5.1 Strategy Corridor

The strategy manual is based on the assumption „that companies always strive toward the most positive scenario“ (Schwenker/Wulf, 2013: 134). The two factors shaping the development of this most positive scenario are the two axes of the scenarios. Together, these axes create the corridor that directs the development of the core strategy (Schwenker/Wulf, 2013: 134-135). In the case of the German carsharing industry, the most positive scenario is “Eldorado” where the information and communication technology has evolved progressively and service providers can operate in a liberal regulatory environment for new mobility concepts. Then, the factors that drive the two axes as determined in the influence diagram are transferred to fill the strategy corridor, as depicted in figure 19.

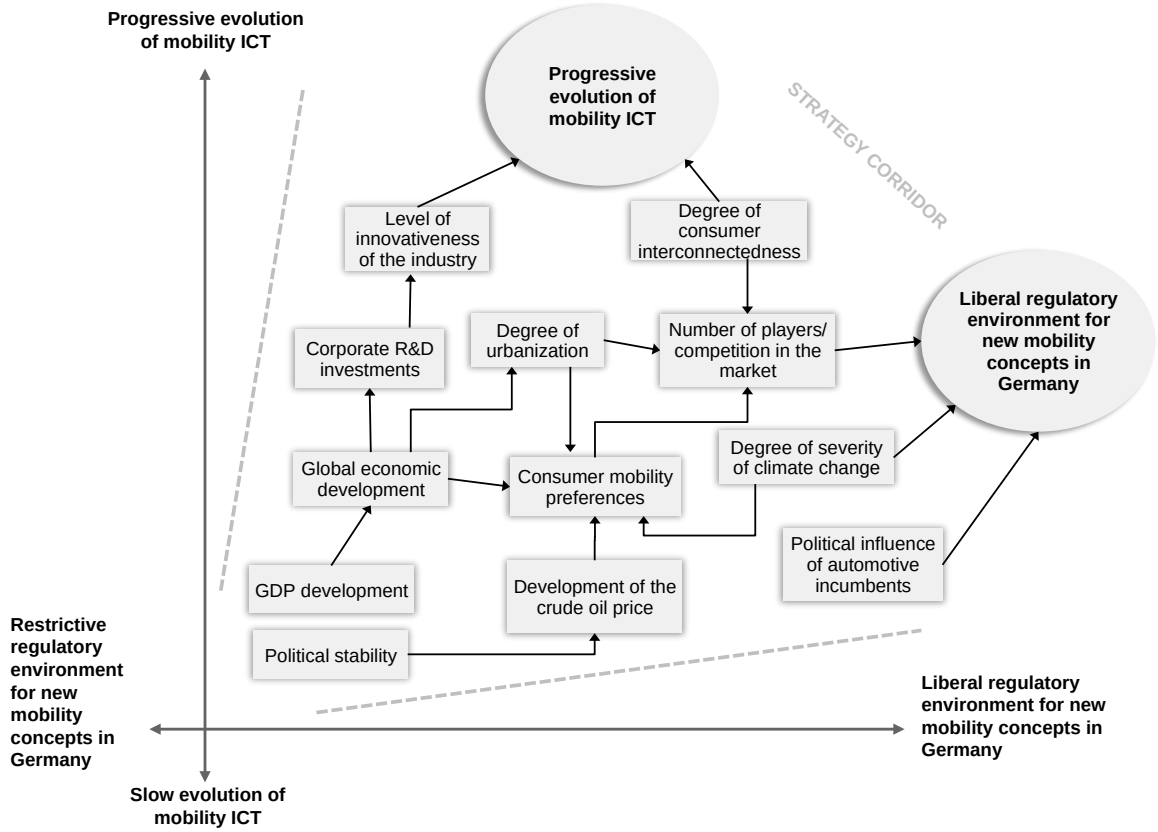


Figure 19: Strategy Corridor for the German carsharing industry
Source: Own illustration

These trends and uncertainties build the basis of the strategy manual and should be included when deriving strategic actions and recommendations in the subsequent step.

3.5.2 Core Strategy

The core strategy for the German carsharing industry comprises general strategic actions and recommendations that apply to all of the four future scenarios described previously but position the company towards the best-case scenario.

Customer centricity. The first recommendation for carsharing companies in Germany is to focus on improving the customer experience to build an attractive offering empowering the brand. Positive customer interactions are the „lifeblood of shared mobility“ (Freese/Schönberg, 2014: 16). Registration, booking, access and payment are contact points that should be designed as simple and convenient as possible as convenience can constitute a competitive advantage. Outstandingly consistent high service and quality levels can create a network effect[6]. Delivering a customer-centered service requires to anticipate consumer preferences and behavior and to constantly innovate and refine the product for consumer viability.

Integrate to provide an end-to-end mobility solution. The digitalization and evolution of mobility paired with the increasing willingness of people to use multiple modes of transportation have yielded a spectrum of transport modes from traditional public transportation to carsharing and bikesharing that are available to each and everyone with a connected device. To allow customers to maintain an overview, carsharing businesses have to link their service to other modes of transportation with the use of technology by integrating into public transit applications, by offering joint ticketing or by establishing horizontal network cooperations with other carsharing companies, for example.

Lobby authorities. As depicted in the scenarios, alterations in the regulatory environment can have a critical impact on the German carsharing industry.

[6] A network effect occurs when a product or service gains in value the more people are using or joining it (Easley/Kleinberg , 2010: 15).

Regulations can act as a kickstarter or as barrier to success. Clearly, the backing of the national and local governments is essential to a smooth integration of carsharing into the mobility network and infrastructure. If the integration takes too long, the momentum is lost. Hence, carsharers must cultivate a close relationship with governmental bodies by lobbying efforts to secure a politically and legally harmonized framework e.g. regarding parking. Monitoring regulators is a top priority for carsharing businesses to ensure a fruitful competitive landscape for the industry.

Develop agility. Finally, the scenarios indicate that the future of the German carsharing industry and of personal mobility preferences highly depend on the global political and economic development. However, these factors are naturally hard to influence. Thus, their development must be closely observed to be able to cope with any sudden changes in the factors and to react swiftly. For example, companies can develop a set of indicators that depict changes in the environment such as global, European and German GDP growth.

3.5.2.1 General strategic recommendations for peer-to-peer carsharing

In addition to the core strategy, it is particularly crucial for peer-to-peer carsharing to radiate trustworthiness in its business activities and offering as well as in its customer contact points. A good reputation for transparency and reliability from business processes to insurance and liability are essential to attract a larger customer base. In contrast to a recognized automotive OEM where trust is established by the brand, P2P carsharing services have to build a reputation and trust through other ways such as through peer-to-peer reviews after each transaction and consumer reviews, for example.

3.5.2.2 General strategic recommendations for station-based carsharing

In conformity with the core strategy, vertical as well as horizontal cooperations are of particular importance for station-based carsharing businesses. What station-based carsharer lack in flexibility, they can offset by establishing a tightly knit

network with other carsharing services and lower costs as compared to free-floating carsharing services.

The scenarios and the core strategy have both emphasized the importance lobbying. Since the majority of the station-based carsharer in the German industry are not backed by large corporations, bundling interests is vital. The German Association of Carsharing (Bundesverband CarSharing e.V.) can help to strengthen the political position of smaller carsharing providers by acting as the political lobby for traditional carsharing organizations.

3.5.2.3 General strategic recommendations for free-floating carsharing

Complementing the core strategy, free-floating carsharing services, which are backed by automotive incumbents Daimler and BMW in Germany, should incorporate in their strategy to leverage their brand and mobility promise to transition smoothly to mobility service providers, to hone their understanding of future mobility and to close the technological gap to tech companies.

Throughout the scenarios it has become clear that autonomous driving is a realistic constituent of future mobility and will transform the carsharing industry. Until then, Daimler and BMW have to be vigilant about the customer driving experience because otherwise cars are reduced from constituting a status symbol to a utilitarian mode of transport. When a car's mere mobility function is only relevant factor for people to get from A to B, it does not matter what brand the car is or what image it conveys. Similarly, the customer interface i.e. the integration of the automobile in the digital ecosystem will play a critical role in the future and might constitute a decision variable whether to use one or the other car. Hence, OEMs must invest in digital platforms and engage in alliances to participate in the development of new standards.

It is likely that emerging players Apple, Google, Uber and Tesla will initially make inroads on the automotive market through carsharing to make their products available to a wide public. All four companies experiment with self-driving capabilities, and Tesla has already relegated incumbents in terms of electromobility. These tech companies are way ahead regarding key (software)

competences for the technological evolution of intelligent mobility solutions such as data acquisition and processing. This makes them superior over traditional OEMs in key future business areas. To regain innovation leadership, part of their core strategy must be to seek subsidization and invest heavily in research and development in order to achieve technological progress and make up leeway to competitors from cross-industry sectors. Being among the first to achieve a breakthrough in areas such as autonomous driving and electromobility is one of the preconditions for playing a role in future urban mobility and maintain leadership in the automotive industry. Offering a technologically advanced product acts as a protective shield against competition and sparks customer interest and relevance to customers.

To be able to close the technological knowledge gap between OEMs and disruptors, OEMs must seek a balanced ratio of software engineers to others in R&D departments and new networks to relinquish their weaknesses. Cross-sectoral and intra-industrial cooperations can accelerate the development of open platforms and fast and flexible soft- and hardware updates to be agile. New networks will help to catch up in the area of machine learning and artificial intelligence. If OEMs adhere to their OEM-specific insular applications the speed of innovation at competitors cannot be kept up with. Therefore, OEMs should focus their strategy on achieving digital maturity and cultural change within the company – from supply-driven to customer-driven, from analog to digital and from stiff to dynamic.

3.5.3 Strategy Options

The strategy options complement the core strategy by providing strategic recommendations for each specific scenario. Changes in the company's or industry's environments can be detected early on while the strategy options provide guidance as to how to react.

The first scenario "Eldorado" is the most positive or best case scenario for the German carsharing industry. The strategic options or recommendations are consistent with the core strategy. Hence, carsharing businesses should focus on

establishing customer-centric processes, seeking cooperations to provide an end-to-end mobility solution for customers that integrates well in the new mobility ecosystem, lobbying authorities to harmonize the political and legal framework and develop agility in order to accomplish favorable conditions for German carsharing businesses to flourish and be competitive.

In the second scenario “Tech Invasion”, the ICT progress has been slow while the regulatory environment for new mobility concepts has remained liberal, which led to the market entry of foreign competitors. Carsharing businesses will only survive such an attack if they have built up a strong unique selling proposition that differentiates them from the competition. They should further capitalize on their expertise and customer insights to optimize the utility of vehicles. The OEMs are recommended to accelerate their investments in R&D and pilot testing, strengthen their premium approach to autonomously driving cars and enhance the brand world to persist or even prevent matters from reaching such stage.

The third scenario “Upgrade” is characterized by slow progress in ICT and a restrictive regulatory landscape for new mobility concepts. Although this scenario is certainly not the worst case, it is not desirable either. To avoid ending up in such a scenario, carsharing companies should constantly refine and enhance their mobility offerings for customers. Automotive incumbents are recommended to seek the dialogue with policymakers and regulators to foster innovation and create a favorable environment where innovation can flourish to prevent standstill. Finally, to ease consumers’ security concerns automakers should embed and emphasize security in every aspect of their vehicle design to win over customers’ trust.

The fourth and final scenario “Farewell” is shaped by the progressive evolution of ICT but a restrictive environment for new mobility concepts. The developments in this scenario are hard to be prevented. Protests against carsharing parking allowances cannot be averted but lobbying regulators as well as educating consumers that carsharing reduces ownership and replaces private cars, which in turn actually creates more total parking space is crucial. Furthermore, a fatal accident for which a self-driving car is to blame will happen eventually the more kilometers autonomously driving cars are logging. Carmakers thus have to

influence expectations by communicating that autonomously driving cars are not 100 percent safe but can significantly reduce the number of deaths in accidents in comparison to the human-driven alternative. If something like this happens, clear communication and diligent processing of the case(s) are key.

4 Conclusion

The purpose of this master thesis was the development of four plausible scenarios for the German carsharing industry in the year 2025 using the HHL-Roland Berger scenario-based strategic planning approach. The first chapter of this thesis has outlined the German carsharing industry in context and elaborated on relevant drivers and trends. As part of the second chapter, a survey was conducted among internal and external stakeholders, whose feedback was thoroughly analyzed providing the foundation for the scenario description process. As result, four distinct scenarios were defined depicting how the German carsharing industry could evolve in the future if described and assumed developments occur by 2025. Based on the four outcomes, a core strategy for present actions on industry-level was derived as well as general strategic options for each scenario. However, every firm must evaluate the implications of these recommendations individually when developing strategies to prepare for a period of accelerating change.

V Table of Annexes

VI Annexes

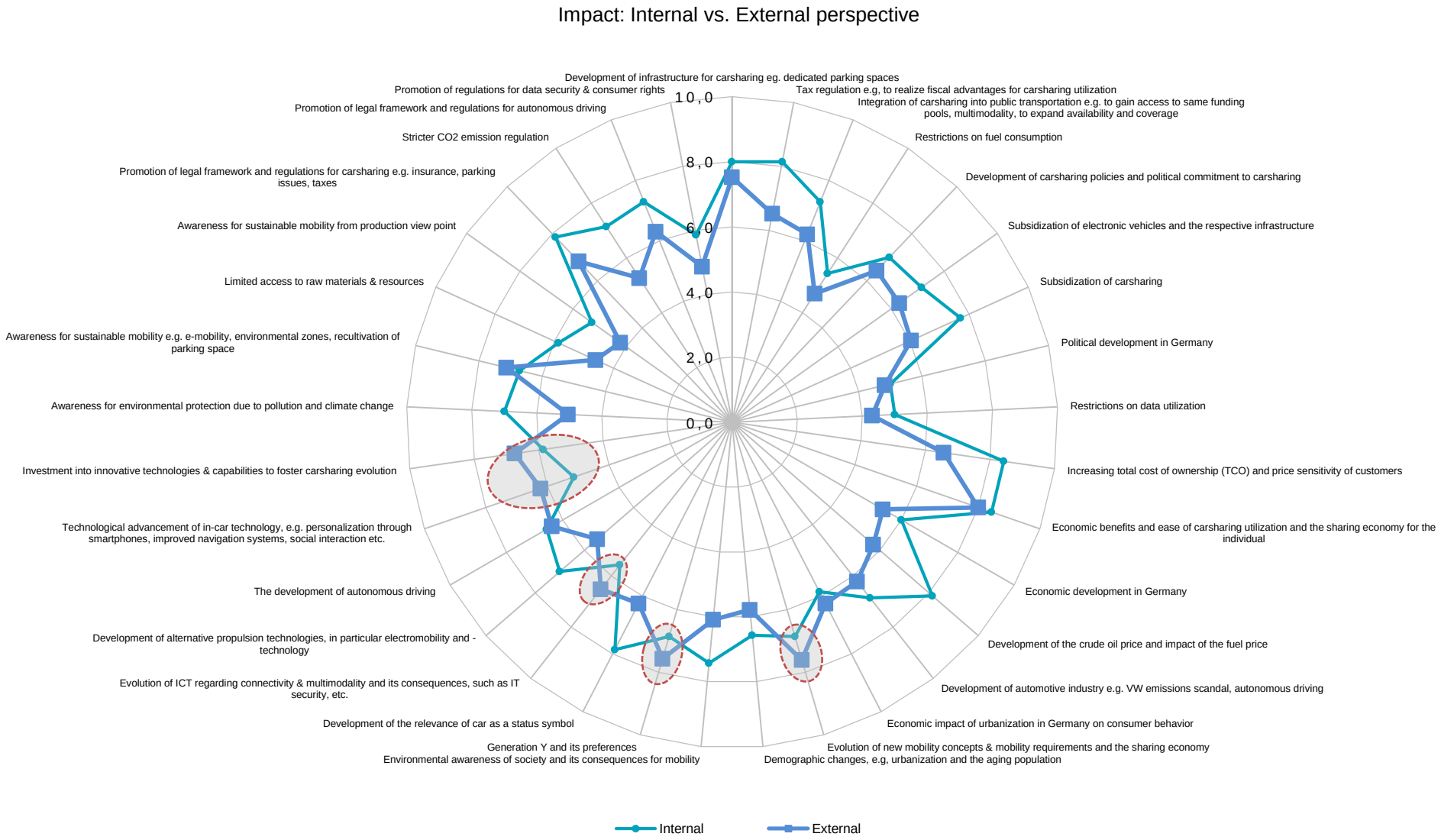
	Registration	Price composition	Rates	Car return
DriveNow	Online registration or via Smartphone App, then legitimization with driver's license and identity card at designated DriveNow registration stations, which are often Sixt car rental stations, to receive a DriveNow customer card that also functions as key card. Registration with DriveNow costs a one-off fee of 29 Euro, but no monthly basic charge and no deposit required. Minimum customer age is 20 years and driver's license possession for at least one year.	DriveNow is a so-called short-distance concept. Thus, billing is made on a per-minute basis.	Only two rates: > 0,31 Euro/min for basic vehicle classes such as all MINI and BMW 1 Series (as well as the MINI Cabrio during winter times (from 01.11. – 31.03.) > 0,34 Euro/min for BMW i3, BMW X1, BMW 2 Series Active Tourer and 2 Series Cabrio as well as the MINI Cabrio during summer times (from 01.04 – 31.10.) Parking during the rental period costs 0,15 Euro/min. From 200 km onwards, 0,29 Euro per additional kilometer. DriveNow also has hourly packages with a 3 hr minimum.	DriveNow is a free-floating car-sharing service. Thus, the car can be rented and returned everywhere within a pre-defined service area in a city.
Flinkster Mein Carsharing	Online registration and legitimization at DB sales counters (in every train station) with driver's license and identity card to receive a Flinkster customer card, which functions as key card. Registration with Flinkster costs a one-off payment of 50 Euro, not applicable to BahnCard customers. No monthly fee, no deposit. Minimum customer age is 18 years.	Flinkster cars can be rented on an hourly basis, with the first hour being charged fully and subsequently in half-hourly intervals. Thus, the price for a trip is composed of a time-based charge, a consumer lump sum per driven kilometer and the chosen vehicle class. The prime time ranges from 8 a.m. to 10 p.m. and the downtime from 10p.m. to 8a.m.	Flinkster distinguishes between a nationwide rate without a monthly basic charge and a local rate with a monthly basic charge of 10 Euros but reduced time-based and distance-based fees.	Since Flinkster is a station-based carsharing service, returns occur at designated stations. Depending on the city, one-way rents are possible (such as in Berlin) and in Munich, it is possible to return the car in designated service areas or quarters called parking space quarters.
CAR 2GO	Online registration and legitimization at a Car2Go Store or at all Europcar outlets with driver's license and identity card to receive a Car2Go customer card that also functions as key card. Registration with Car2Go costs a one-off fee of 19 Euro (no monthly basic charge, no deposit). Minimum customer age is 18 years.	Car2Go is a short-distance concept. Thus, billing is made on a per-minute basis.	Car2Go only offers one vehicle class: the Smart Fortwo as fuel or electric option. > 0,29 Euro/min while driving > 0,19 Euro/min while parking during the rental period > 1 hr driving costs a fixed price of 14,90 Euro > From 50 kilometers onwards, 0,29 Euro per additional kilometer instead of per minute.	Car2Go is a free-floating carsharing service. Thus, the car can be rented and returned everywhere within a pre-defined service area in a city.

cambio	Online registration and pick up of member card during a local Cambio information meeting. Driver's license and a positive credit assessment are obligatory. Drivers under 25 years and with less than 2 years possession of a driver's license are obliged to provide a deposit and purchase a security package (SiPack). Registration fee of 30 Euro except for the "Abo Aktiv" rate.	The price is composed of a basic monthly fee (except for the "Campus" rate), a minute-based and a distance-based charge and the chosen vehicle class. For the rental period, the first hour is charged fully and after that in 15-minute intervals. There is also the option of a PartnerCard with a monthly basic fee so that friends, family members or affiliates can rent Cambio cars as well.	> Five rates: Campus, Start, Aktiv, Abo Aktiv and Comfort. > Varying basic monthly fee from 0 Euro ("Campus") to 25 Euros ("Comfort"). > Varying time-based fee for an hour during day time (7 a.m. to 11 p.m.) ranging from 1,10 Euro to 4,90 Euro and during night time (11 p.m. to 7 a.m.) 0,5 Euro. > Varying distance-based fee up to 100 kilometers starting from 0,22 Euro up to 0,36 Euro and from 101 kilometers onwards ranging from 0,16 Euro to 0,21 Euro.	Cambio Carsharing is a station-based carsharing sevice. In contrast to the other services, there are two different locking systems: vehicles can either be locked with the member card or the key has to be taken from or returned to a safe.
stadtmobil carsharing	Registration only possible in local Stadtmobil customer centers. Driver's license, identity card and a positive credit assessment are obligatory. Depending on the association and on the rate chosen, registration fees apply. Depending on the associations, deposits apply. Monthly fees, registration fees and deposits vary from association to association.	The price is composed of a basic monthly fee (if applicable), a minute-based and a distance-based charge and the chosen vehicle class.	Different rates apply for different associations of the Stadtmobil group.	The Stadtmobil group combines a free-floating and a station-based carsharing service, depending on the association used. Stadtmobil uses two different locking systems: vehicles can either be locked with the member card or the key has to be taken from or returned to a safe.

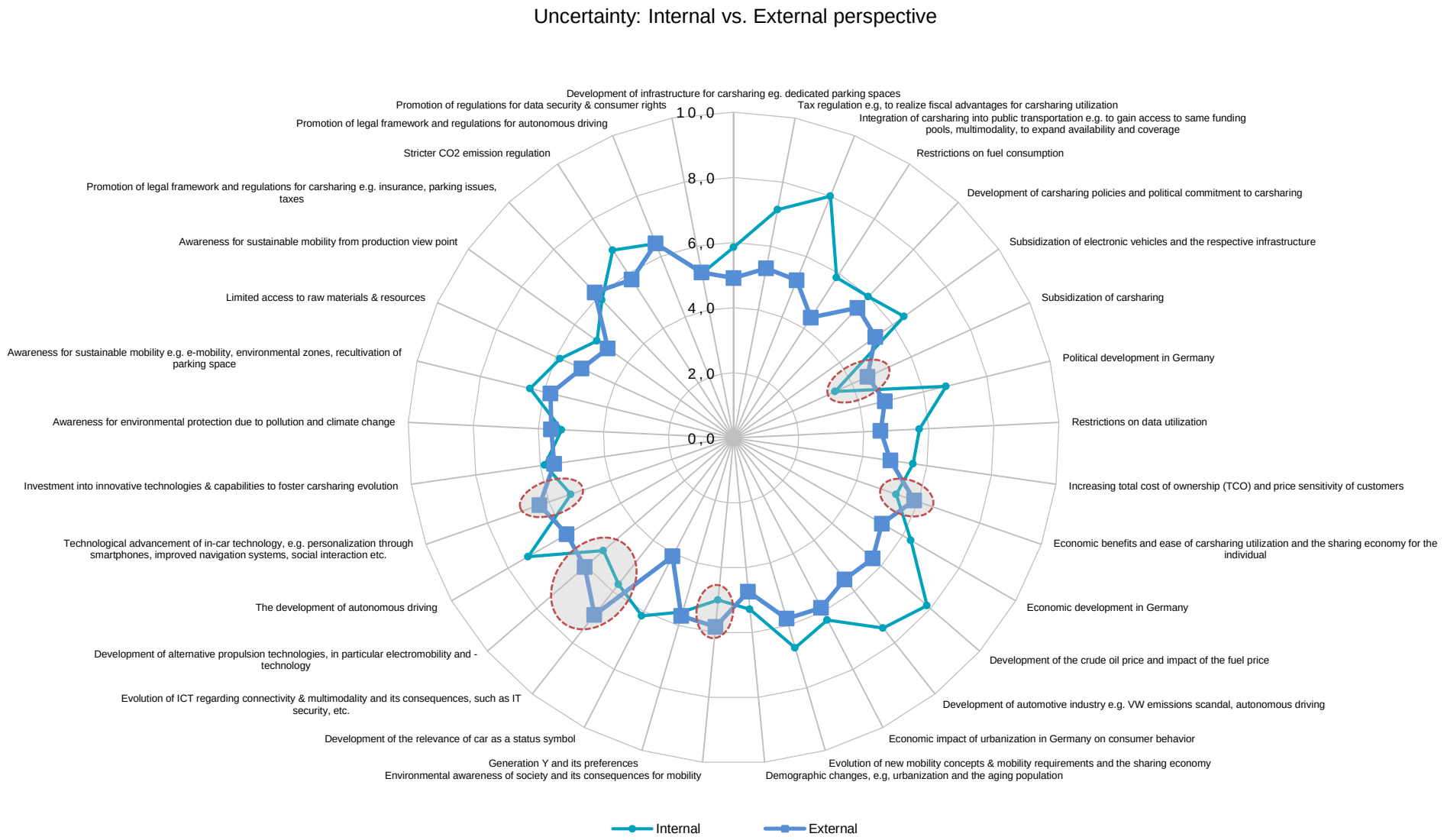
Annex 1: Distinctive features of the Top 5 German carsharing companies
Sources: Artisiik, 2016; N.A., 2015f; N.A., 2015g; N.A., 2015h; N.A., 2015i; N.A., 2015j; N.A., 2016h; N.A., 2016i

Dimension	#	Influence Factor
Political	1	Development of infrastructure for carsharing eg. dedicated parking spaces, zoning in cities for public transport/carsharing only, obligatory designated carsharing parking spaces in new housing development areas, designated carsharing lanes
	2	Tax regulation e.g. for company & private cars, to realize fiscal advantages for carsharing utilization
	3	Integration of carsharing into public transportation e.g. to gain access to same funding pools, to foster multimodality, to expand availability and coverage
	4	Restrictions on fuel consumption
	5	Development of carsharing policies and political commitment to carsharing
	6	Subsidization of electronic vehicles and the respective infrastructure
	7	Subsidization of carsharing
	8	Political development in Germany
	9	Restrictions on data utilization
Economic	10	Increasing total cost of ownership (TCO) and price sensitivity of customers
	11	Economic benefits and ease of carsharing utilization and the sharing economy for the individual
	12	Economic development in Germany
	13	Development of the crude oil price and impact of the fuel price
	14	Development of automotive industry e.g. VW emissions scandal, autonomous driving
	15	Economic impact of urbanization in Germany on consumer behavior
Societal	16	Evolution of new mobility concepts & mobility requirements and the sharing economy
	17	Demographic changes, e.g, urbanization and the aging population
	18	Environmental awareness of society and its consequences for mobility e.g. alternative propulsion technologies and efficient use of resources
	19	Generation Y and its preferences: connectivity, social interaction, technology, flexibility & individualization
	20	Development of the relevance of car as a status symbol
Technological	21	Evolution of ICT regarding connectivity & multimodality and its consequences, such as IT security, etc.
	22	Development of alternative propulsion technologies, in particular electromobility and -technology
	23	The development of autonomous driving
	24	Technological advancement of in-car technology, e.g. personalization through smartphones, improved navigation systems, social internaction etc.
	25	Investment into innovative technologies & capabilities to foster carsharing evolution
Ecological	26	Awareness for environmental protection due to pollution and climate change
	27	Awareness for sustainable mobility e.g. e-mobility, environmental zones, recultivation of parking space
	28	Limited access to raw materials & resources
	29	Awareness for sustainable mobility from production view point
Legal	30	Promotion of legal framework and regulations for carsharing e.g. insurance, parking issues, taxes
	31	Stricter CO2 emission regulation
	32	Promotion of legal framework and regulations for autonomous driving
	33	Promotion of regulations for data security & consumer rights

Annex 2: List of Influence Factors
Source: Own illustration



Annex 3: Blind Spots in Impact Dimension
Source: Own illustration



Annex 4: Blind Spots in Uncertainty Dimension
Source: Own illustration

Secondary Elements		
Political	1	Restrictions on data utilization
	2	Restrictions on fuel consumption
	3	Political development in Germany
Economic	4	Economic impact of urbanization in Germany on consumer behavior
	5	Economic development in Germany
Societal	6	Demographic changes, e.g, urbanization and the aging population
Technological	7	Development of alternative propulsion technologies, in particular electromobility and –technology
	8	Technological advancement of in-car technology, e.g. personalization through smartphones, improved navigation systems, social interaction etc.
Ecological	9	Limited access to raw materials & resources
	10	Awareness for environmental protection due to pollution and climate change
	11	Awareness for sustainable mobility from production view point
Legal	12	Promotion of regulations for data security & consumer rights
	13	Stricter CO2 emission regulation

Annex 5: Secondary Elements for the German Carsharing Industry
Source: Own illustration

Trends		
Political	1	Development of infrastructure for carsharing eg. dedicated parking spaces
	2	Tax regulation e.g, to realize fiscal advantages for carsharing utilization
	3	Integration of carsharing into public transportation e.g. to gain access to same funding pools, multimodality, to expand availability and coverage
	4	Development of carsharing policies and political commitment to carsharing
	5	Subsidization of electronic vehicles and the respective infrastructure
	6	Subsidization of carsharing
Economic	7	Increasing total cost of ownership (TCO) and price sensitivity of customers (Econ)
	8	Economic benefits and ease of carsharing utilization and the sharing economy for the individual (Econ)
	9	Development of automotive industry e.g. VW emissions scandal, autonomous driving (Econ)
	10	Development of the crude oil price and impact of the fuel price
Social	11	Development of the relevance of car as a status symbol
	12	Environmental awareness of society and its consequences for mobility
	13	Generation Y and its preferences
Technological	14	Investment into innovative technologies & capabilities to foster carsharing evolution
Ecological	15	Awareness for sustainable mobility e.g. e-mobility, environmental zones, recultivation of parking space

Annex 6: Trends for the German Carsharing Industry
Source: Own illustration

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