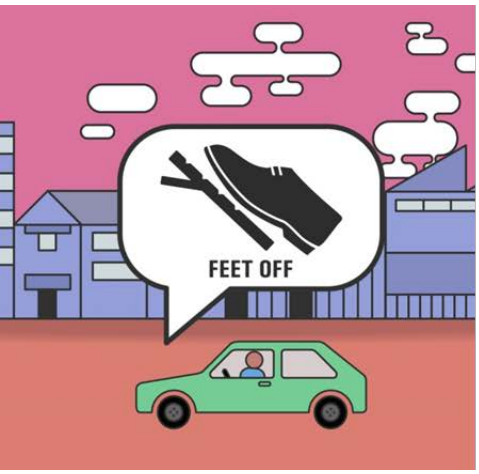
Fraunhofer IAO

HORVÁTH & PARTNERS
MANAGEMENT CONSULTANTS

"The Value of Time"

Potential for user-centered services offered by autonomous driving

Stuttgart, April 2016



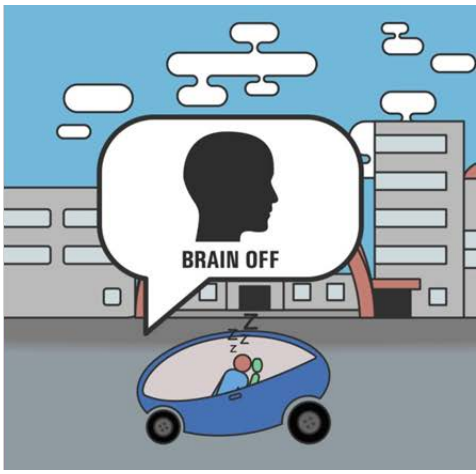


Image source: Fraunhofer IAO / Horváth & Partners 2016

Management Summary

Autonomous driving is set to alter the automotive world profoundly. Information technologies will take on a critical new role in the automobile industry. Ever since Google tested its own fleet of automated vehicles, there has been ongoing debate as to whether IT companies will also be involved in automobile manufacturing in the future. According to surveys, a considerable percentage of end customers could already envisage buying a car from an IT company (Prädel & Emenakoi et al., 2016). It is questionable, however, whether IT companies really perceive new business potential in the sale of passenger cars or whether it is really more a case for them of using future automated vehicles as devices for their services. A large number of end users and managers from the automobile industry, in particular, therefore regard it as likely that IT companies will compete with the automobile manufacturers for the customer interface (Becker et al., 2016). In terms of competition, attention is centering especially on the time gains offered by autonomous driving – in some cases being regarded as "the future capital for attractive services" (Abraham & Runge, 2016).

IT companies will compete with automobile manufacturers in the future to win the favor of end customers.

When cars can drive themselves, the occupants have the time and need to occupy themselves otherwise. "When not taken up with the task of driving, drivers have the time to use online services and thereby generate revenue for Internet service providers" (Wehinger & Cords, 2015). The time gained by the driver by automating the task of driving therefore becomes an important resource for offering new services. Future services can therefore far exceed what currently seems conceivable for vehicles. The automobile industry is already today showcasing completely new interior concepts in vision and concept cars, which will ensure considerable scope for secondary activities while driving.

Automated vehicles offer the potential to offer new services for (secondary) activities.

What is still not certain, however, is how the new "automobile" service world will look. Which services will be offered, which will be demanded? Are end customers willing to pay enough to allow lucrative business models to be developed? What influence does the level of vehicle automation have or the daily driving routes of the vehicle occupants? Are there cultural or age-related differences in terms of preferred activities on the part of vehicle users during autonomous driving? It was in order to find answers to these questions and to be able to structure, describe, and quantify the future market that the present study "The Value of Time" was produced. The study offers an initial look at the upcoming (secondary) activities during autonomous driving and can be used by interested stakeholders as a basis for anticipating the corresponding innovations.

Both the demand for services and the potential offers are still completely uncertain.

Management Summary

The study "The Value of Time" by the Fraunhofer IAO and Horváth & Partners provides an overview of the potential of service offers for enabling (secondary) activities during autonomous driving. A comprehensive user survey was conducted on three continents in this regard in fall 2015. The first part of the study looks initially at pending developments in vehicle automation and describes the options for performing (secondary) activities while driving. The derived service market is then structured based on various customer needs, which are fulfilled by activities. The survey design and key findings are then presented on this basis and an outlook of the market launch provided.

The study "The Value of Time" structures and quantifies the future landscape for service offers.

The study centers around a user survey carried out among 1,500 test subjects from Germany, Japan, and the U.S. Owing to the variety of conceivable activities and time horizons, six needs and 21 service groups were formulated for value-added services and the survey split into two scenarios "the highly automated vehicle" (hands off and feet off) and "the driverless capsule" (hands off, feet off, and brain off). The survey's findings show that 75 percent of users are prepared to pay for value-added services and that fundamental market potential therefore exists for chargeable service offers for both scenarios in completely different areas of activity. Users will want services even on short journeys. Differences in demand arise depending on the region and age group considered. Younger people in particular show a comparatively high level of interest in services as well as in vehicle automation. A basic willingness to pay in return for an hour of free time can be shown to exist across all respondent groups, with this "Value of Time" rated as highest among the under 25s at €29 per hour. Comparing the three countries, users in Germany would pay most for an additional hour of free time.

The survey conducted confirms the business potential of service offers.

The findings of the study provide an initial overview of upcoming opportunities for offers and market structures in the future "automobile" service world. Moreover, the data collected as part of the survey also allows other further-reaching analyses, which cannot be illustrated within the scope of the present study. Thus, for example, brand-specific evaluations or targeted investigations of individual service groups are possible with respect to their target groups. Interested parties are called upon to get in touch with the contacts named at the end of the study in order to discuss the findings of the study as well as possibly other joint research questions.

Based on the survey's findings, additional, further-reaching analyses should be performed.

Contents

Contents

Automated driving is altering the business model.

INTRODUCTION

Individual mobility is on the cusp of a new stage of development. "Autonomous driving" will be one of the dominant trends in the automobile industry in the coming decades. The self-driving car will not only impact the entire sector and means of travel, but will also sustainably alter our way of life. Cars that no longer need the driver's attention will be used in a completely new way than is currently the case. Apart from the technical aspects, the additional time that can be gained with autonomous driving will therefore be of immense importance. People will use their newly gained free time in the future for other activities, while accompanying in-car services will become increasingly more attractive. Companies in the automobile sector, and especially OEMs, will have to progressively develop their traditional business model in order to distinguish themselves still further from the competition and remain successful in the long term in the face of increasingly tougher international competition. Attention is centering in this regard on the opportunities and challenges offered by autonomous driving (Brauck et al., 2016). Initial analyses of the general market potential offered by the sale of automated vehicles as well as by additional business models relating to this technology have already been carried out in the framework of various studies. However, there are no detailed analyses and evaluations of the potential for user-centered services as yet.

Autonomous driving will alter our way of life.

Users will capitalize on the additional free time in the vehicle to carry out other activities.

The study therefore aims to identify and evaluate specific activities that users want to carry out during autonomous driving. The relevance attributed to possible activities and the willingness to pay were looked at in particular in this regard. The basis for this was a transnational customer survey conducted in Germany, Japan, and the U.S. (focusing on California), which allowed specific market potential to be identified at needs level. Interviews were conducted with selected industry experts in addition to the aforementioned end customer survey in order to address other issues covered by the research.

The aim is to identify and evaluate specific activities.

A number of categorization options are available at present for the various stages of development involved in autonomous driving. The study is based in this regard on the categorization of vehicle automation developed by the German Association of the Automotive Industry (VDA), which is explained in greater detail in the next section.

Categorization of vehicle automation

The first level (Level 0) designates vehicles with no automated driving functions. The driver maintains full control of the vehicle at all times and is accordingly responsible for all possible consequences of his or her actions. Automation Level 1 describes vehicles with function-specific automation. The driver maintains overall responsibility for the car but is supported by a number of specific, individually controlled automatic functions for longitudinal and lateral control of the vehicle, such as lane holding and lane changes.

Fully automated driving is set to become a reality over the course of the next decade.

INTRODUCTION

Examples of technologies at Level 1 include lane holding assist, blind spot assist, proximity control, or pedestrian recognition. When such specific automation functions are now used in combination, such as for example simultaneous use of lane holding assist and blind spot assist, this is referred to as Level 2 technology ("combined function automation"). At least two control systems are operated at the same time for controlling longitudinal and lateral movement and the driver can pass control over to the control systems under certain circumstances. Responsibility still remains with the driver however. (German Association of the Automotive Industry (VDA), 2015)

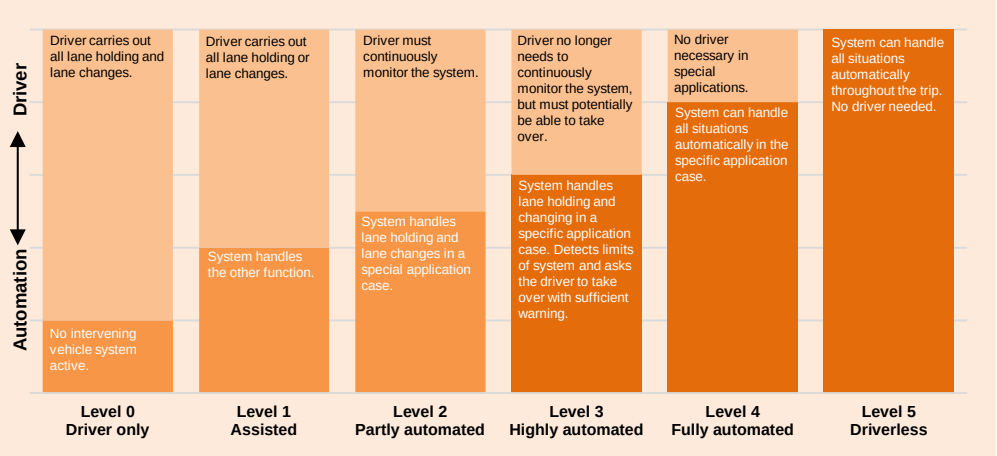
The level of automation increases by combining different assistance systems.

The next development steps on the road to highly and fully automated driving are categorized by the VDA as Levels 3 and 4. Highly automated driving (Level 3), where the vehicle can drive safely in autonomous mode and the driver can pass control of all safety functions to the automobile, is expected in a few years, between 2018 and 2020. Continuous system monitoring by the driver is no longer necessary in this case. However, the driver must be able to resume control if the system encounters a non-controllable driving situation. A highway driving assistant, active park assist systems, or emergency programs are examples of this development level (VDA, 2015). The final step toward fully automated driving will be taken between 2020 and 2030 according to an assessment by the National Highway Traffic Safety Administration (NHTSA). All vehicle functions will be controlled autonomously in this case and the vehicle will handle all safety-related situations independently. The driver will therefore become the passenger and will no longer have to intervene even in hazard situations.

Highly automated driving will still be possible in this decade.

The driver becomes the passenger with fully automated vehicles.

The VDA defines Level 5 "driverless driving" as the final development stage. The control systems can assess all traffic situations and respond accordingly. Driver presence in the car is therefore no longer necessary. The current technological status encompasses VDA Levels 0 to 3 (NHTSA, 2013; VDA, 2015).



Source: German Association of the Automotive Industry (VDA) *Levels of automated driving*

The VDA divides vehicle automation into five levels.

The legal requirements for highly automated driving are not fulfilled.

INTRODUCTION

Areas of action for the automobile industry

In addition to technological progress, legislation will play a critical role in the further development of autonomous vehicles. The technological innovations already achieved have to continue to be developed progressively in order to legalize fully automated driving (Level 4) fully. This challenge gives rise to several areas of action for automobile manufacturers (OEMs).

Precise real-time maps play a key role for automated driving.

Technological innovations in the area of vehicle location and recording of the vehicle environment are required in order to manage autonomous vehicles precisely (RAND, 2014). Moreover, accurate real-time maps are required, which precisely reproduce the environment in which the vehicle is traveling. The models that have to be developed for this purpose have to supply redundant topographical information so that the vehicle can plan the route and trajectory (Thrun, 2008).

The cognitive abilities of the human driver are used in manually operated vehicles to make predictions and decisions. However, the occupants are no longer drivers in an autonomous vehicle, rather passengers. Complex predictive algorithms and decision-making algorithms therefore have to be developed that interpret and predict the driving behavior of other road users and respond accordingly (Meck, 2015).

IT security and data protection are mission-critical factors.

Special attention is paid to the topic of security in (partly) automated vehicles. Firewalls and other systems that are relevant for IT security have to be adapted to the requirements of autonomous vehicles in order to ensure the security of the vehicles themselves as well as public transport in general in the sense of cyber resilience. It is not just data security that is a mission-critical issue, however, rather the reliability of the autonomous functions has to be ensured, for example by means of functional redundancies (Reschka, 2015; Wachenfeld & Winner, 2015). Because of the complexity of the many different assistance systems, the task of ensuring security becomes a major and unavoidable challenge for OEMs and supplier companies (Geyer, 2013). After all, it is only when fully automated driving is possible without interruption over longer distances that the technology and therefore value-added services will be able to win through on the mass market (Meyer, 2015).

Relevant markets – Features and legal situation

The sales markets differ greatly in terms of the requirements for automated driving.

The markets of Germany, Japan, and the U.S. (California) were selected for the study "The Value of Time – Potential for user-centered services offered by autonomous driving" owing to their specific characteristics in relation to autonomous driving. These markets are analyzed in the next section. Distinct national and even regional differences – as in the case of the U.S. – can be clearly identified. In order to be able to conduct the study in these sample markets and analyze the findings made in a country-specific context, it is essential to develop an understanding of the respective market characteristics.

Legislation is restricting the development of automated driving.

INTRODUCTION

Germany

Based on the number of passenger car registrations, the German automobile market is the fourth largest market in the world after China, the U.S., and Japan with a total of three million passenger cars in 2014 (Statista, 2015). Moreover, the automobile has a particularly high status among German car owners owing to the long tradition in the automobile industry in Germany. Germany is also regarded in general as one of the most competitive and innovative countries in the world (World Economic Forum, 2015), though Germans are regarded as rather skeptical at the same time when it comes to early adoption of innovations (Automobil Club Verkehr, 2015). However, innovations are accepted quickly by the German mass market once they have been successfully tested and their reliability proven. According to a current acceptance study on autonomous driving, 35 percent of those surveyed in Germany have no fear at present of traveling in a self-driven car. Young men (42 percent) and highly educated individuals (39 percent) show particular interest. 34 percent of respondents assume that autonomous cars will make driving safer in the future. Other advantages mentioned include improved mobility in old age and with disabilities, less stress driving, and better options for avoiding accidents (Automobil Club Verkehr, 2015). German consumers attach particularly high importance to the topics of data protection and data security. Automobile manufacturers therefore have to demonstrate the reliability and dependability of the technology with respect to the German market in particular (Automobil Club Verkehr, 2015).

Cars have a very high status in Germany.

Data protection and data security are extremely important for German users.

The current regulatory situation in relation to autonomous driving in Germany is still very restrictive. According to German law, autonomous vehicles are not permitted (Para. 1.2.2 ECE Rule 79, No. 0.2. Directive 70/311/EEC and Section 2.1.7. BMV/StV (Directive on braking systems of vehicles with hydrostatic drive system) 33/36.25.10-06), whereby exemptions exist for research vehicles under German Road Traffic Licensing Regulations (Section 70 StVZO Road Traffic Registration Regulation and Section 46 StVO Road Traffic Regulation). European law is comparable with German law in this respect. It should also be stressed that fully automated driving conflicts with international legislation (Vienna Convention) and therefore also cannot be legalized purely by German laws. The safety and reliability of autonomous and teleoperated vehicles as well as the integration of all stakeholder groups in the regulatory discussion are again cited as factors determining successful legalization (Lutz et al., 2012; Schroers & Steuwer, 2015).

Fully automated driving is only possible with special approval.

Japan

The Japanese automobile market is also interesting in many respects for the study to hand. With 4.7 million passenger car registrations in 2014, the Japanese market is one of three largest single markets in the world. Furthermore, Japanese OEMs like Toyota, Nissan, and Honda play an important role in the global automobile market. According to the Competitiveness Report of the World Economic Forum, the Japanese economy is also one of the most competitive and innovative in the world (World Economic Forum, 2015).

California is the world leader in the area of autonomous driving.

INTRODUCTION

Japanese consumers can be described in general as having an affinity for innovation. Requirements for product and service quality are extremely high at the same time, however, which is also reflected in the high sense of quality awareness on the part of both the automobile manufacturers and Japan as a global leader in this area. The Japanese government has allowed the testing of automated vehicles on public roads since 2013. In addition, a variety of programs were launched aimed at promoting the development of new types of mobility. The objective here is to find solutions for the growing traffic burden in Japan. Local public transport is already the most important means of transport in Japan today. Autonomous driving could considerably relieve the pressure in this respect (Focus Online, 2013; Hofacker, 2013).

Autonomous driving should contribute to reducing the traffic burden in Japan.

U.S. (California)

The study also looks at the automobile market in California in addition to the German and Japanese markets. The U.S. market as a whole is not considered in any greater detail owing to the comparability with the other two markets.

California is of special interest for this study for many reasons. Apart from the pure size of the American domestic market – the U.S. is the second largest automobile market in the world after China with 16.4 million passenger car registrations in 2014 – the Californian region is set to influence the future of the automobile like scarcely any other region in the world (Pander, 2012).

The strong start-up culture in California offers the perfect circumstances for business models related to automated driving.

The Competitiveness Report of the World Economic Forum regards the U.S. as one of the most innovative countries in the world. Technology companies based in Silicon Valley in California, in particular, have continued to blaze a trail for a long time and impact the way we live in a not insignificant manner. In addition, American universities and research institutions are investing vast sums of money in developing new technologies. Thanks to their bundled efforts, the U.S. and California in particular have managed to establish themselves in recent years as technology leaders and radical innovators in the area of vehicle automation.

Compared with Germany and Japan, the regulatory situation is less restrictive and therefore promotes technological advancements. Individual states, including California, Florida, Michigan, and Nevada, have already legalized autonomous driving, while further states have announced legislative initiatives. Conducive to this development is the fact that while the national road traffic regulations do not explicitly allow autonomous driving, they also do not prohibit it. (RAND, 2014).

Legislation encourages the development of automated vehicles.

The study differentiates between two possible development scenarios.

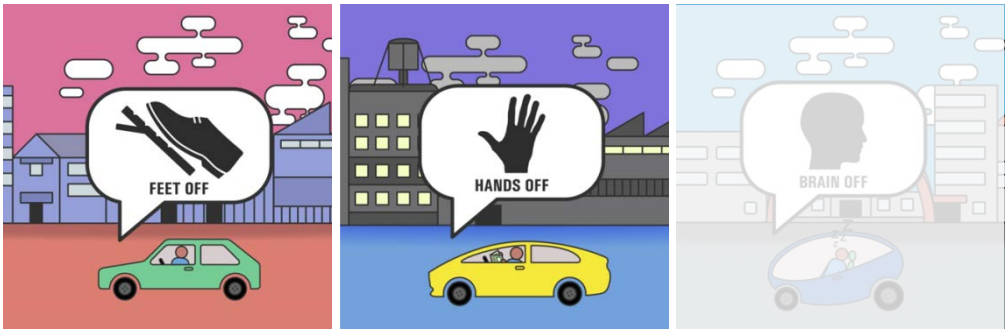
INTRODUCTION

The study differentiates between two possible development scenarios for autonomous driving and analyzes the potential for user-centered services assuming these two respective scenarios. Both will be outlined briefly below.

First development scenario: the highly automated vehicle

Fully automated (Level 4) and driverless driving (Level 5) are not fully achieved owing to different factors, which only leaves highly automated driving (Level 3). In this scenario, the vehicle's occupants can pass control of the vehicle as well as all safety functions to the vehicle, which can then drive safely in autonomous mode. They can therefore use their hands (hands off) and their feet (feet off) for alternative activities. It must however be ensured at all times that the driver can take back control of the vehicle within a few seconds if dangerous situations arise that require human cognitive abilities.

The driver's attention is still required during highly automated driving.



Second development scenario: the driverless capsule

Driverless driving (Level 5) is legalized and is penetrating the mass market. The vehicle's occupants no longer need to intervene in this scenario. In addition to hands off and feet off, the driver can also switch off any thoughts concerning driving and take a mental break (brain off). The driver therefore becomes the passenger of his or her autonomous vehicle. This gives rise to additional possibilities for using the freed up time during driving.

The driver is no longer obliged to pay attention to the traffic.

Automated driving allows a variety of activities to be performed during the journey.

MOTIVATION AND DESIGN OF STUDY

Automation allows (secondary) activities

Automating driving functions means that tasks for controlling the vehicle can be passed from the driver to the vehicle. This gives the driver levels of freedom that he or she can use to perform (secondary) activities. Depending on the level of automation or development scenario, activities of different scope can be performed. While teleconferences are already being conducted today from vehicles, the "highly automated vehicle" development scenario will also allow the reading of e-mails in the future. Longer handover times have to be ensured however in the case of activities such as comprehensive editing of a presentation.

The complexity of the possible in-car (secondary) activities depends on the level of automation.

A large variety of different (secondary) activities are conceivable in principle. These can be traced back to fulfilling underlying needs. Possible (secondary) activities were first classified as part of the study in order to examine and assess the service potential. Service groups, which in turn contain concrete activities, were derived on the basis of six underlying needs. For example, the service group "Work" can be found under the need "Productivity". Conceivable (secondary) activities in this case include reading an e-mail during the journey or editing a presentation document. If an activity requires technological support, for example in the form of a license or a visual medium, or if it is supported in this way, services can be offered that build on this and generate revenue potential. To reach a starting point for identifying, evaluating, and later developing services, however, it is necessary first of all to examine the wealth of conceivable (secondary) activities in a structured way.

A total of six needs and 21 service groups were formulated for the (secondary) activities.

The study uses the needs "Communication", "Productivity", "Basic Requirements", "Wellbeing", "Information", and "Entertainment" to provide as complete a schema as possible for classifying (secondary) activities. A bidirectional process based on intense literature research and reconciliation with existing classification approaches was used as a foundation for the approach. (Secondary) activities and services were thus identified and analyzed with respect to how they fulfill the respective needs. These were finally split into service groups based on this and assigned to higher-level needs. Potential service groups and (secondary) activities were in turn implied inversely based on these needs. This approach allowed a comprehensive description of the service world.

The bidirectional approach allows a comprehensive description of the service world.

Future value-added services can be bundled into service groups based on needs.

MOTIVATION AND DESIGN OF STUDY

Categorizing the (secondary) activities in the service world

The possible (secondary) activities have to be identified first and classified to allow an holistic appraisal of the market potential of the service world. The diagram below shows the breakdown of the service world elaborated as part of the study as well as concrete examples of (secondary) activities.

Need	Service group	Examples of (secondary) activities	
		Scenario A 	Scenario B 
Communication	Social networks / interest groups	Activity with conventionally displayed social media content	Activity with social media content as a virtual experience (VR)
	Consultations	Simple consultations	Complex consultations
	Private communication	Chatting	Meetings in virtual rooms
Productivity	Work	Reading documents	Creating presentations
	Training	Language courses	Virtual auditorium
	Organization	Online banking	Tax declaration
	Shopping for daily requirements	Online shopping via website	Online shopping in virtual supermarket
Basic requirements	Washing / cleaning	Polishing shoes	Ironing
	Eating / drinking	Breakfast	Preparing food
	Sleep	Resting	Deep sleep
	Dressing / undressing / changing clothes	Knotting tie	Changing trousers
Wellbeing	Wellness	Meditation	Autogenic training
	Beauty	Applying make-up	Total body care
	Health	Consultation	Measuring blood pressure
	Fitness	Dumbbell training	Treadmill
Information	Surrounding / route information	Mobile apartment search	Virtual sightseeing
	Product information	Product price comparison	Virtual product sample
	Online information search	Consumption of conventionally presented news	Consumption of information as a virtual experience (VR)
Entertainment	Games	Playing smartphone games	Playing active games
	Artistic activities	Painting	Playing music
	Passive entertainment	Watching a movie	Entertainment in virtual reality

Case study: Increasing automation is set to change the way we spend time in the car.

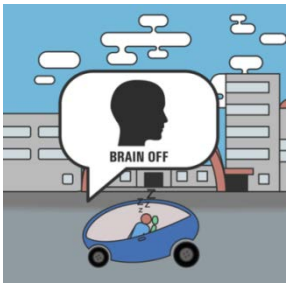
MOTIVATION AND DESIGN OF STUDY

Ms. Today got up early as she has a long journey to her place of work. She bought herself a car with lane holding assist and blind spot assist so as to make the daily commute that little bit more pleasant. She usually brings a take-away coffee with her in the car, which she drinks on the way. Ms. Today often listens to vocabulary training or an audio book when on the road in order to spend her time productively. If possible, she also prefers to take teleconferences during the journey to ease the burden on the working day. She habitually checks her e-mails in-between on her smartphone, although this is strictly not permitted, so she is not unprepared when she arrives at the office. Shortly before she reaches the office parking lot, she refreshes her lipstick and finally launches into the working day.

Today: Simple stress relief for the driver with the car.

Mr. Tomorrow has a little further to travel. He has therefore opted for a highly automated vehicle that allows him to organize the journey pleasantly. He typically starts off the day with a round of dumbbell training. Then he peels a kiwi and an orange and cuts these into his muesli, which he enjoys for his breakfast. He has a half-hour language training session with his French teacher three times a week, which – in addition to vocabulary – is displayed on the head-up display. If necessary, Mr. Tomorrow also reads a presentation or a document in order to prepare for the day. It goes without saying that he will answer e-mails. Shortly before he reaches the office parking lot, he knots his tie and finally launches into the working day.

Tomorrow: More complex secondary activities are enabled.



Ms. Future has the longest journey. This doesn't really bother her though as her car is a driverless capsule. She generally dozes for a while during the journey until she is properly awake. She then cycles her recumbent bicycle to get her circulation moving. She brews herself a fresh coffee next and prepares some bread – the kitchen unit in the capsule is very small but meets her needs. She also likes to use the early hours to escape to the artificial world with her 3D glasses where she can meet her friend from Singapore. If her friend doesn't have time or an eventful day lies ahead, Ms. Future opens up her small desk, connects her laptop, and starts working. She even prefers to leave activities that require quietness and concentration to the time in the car. Shortly before she arrives at the office, she changes her comfortable clothes for a business suit, leaves the car, and starts her working day brightly and alertly. Her car meanwhile looks for a free space in the parking lot.

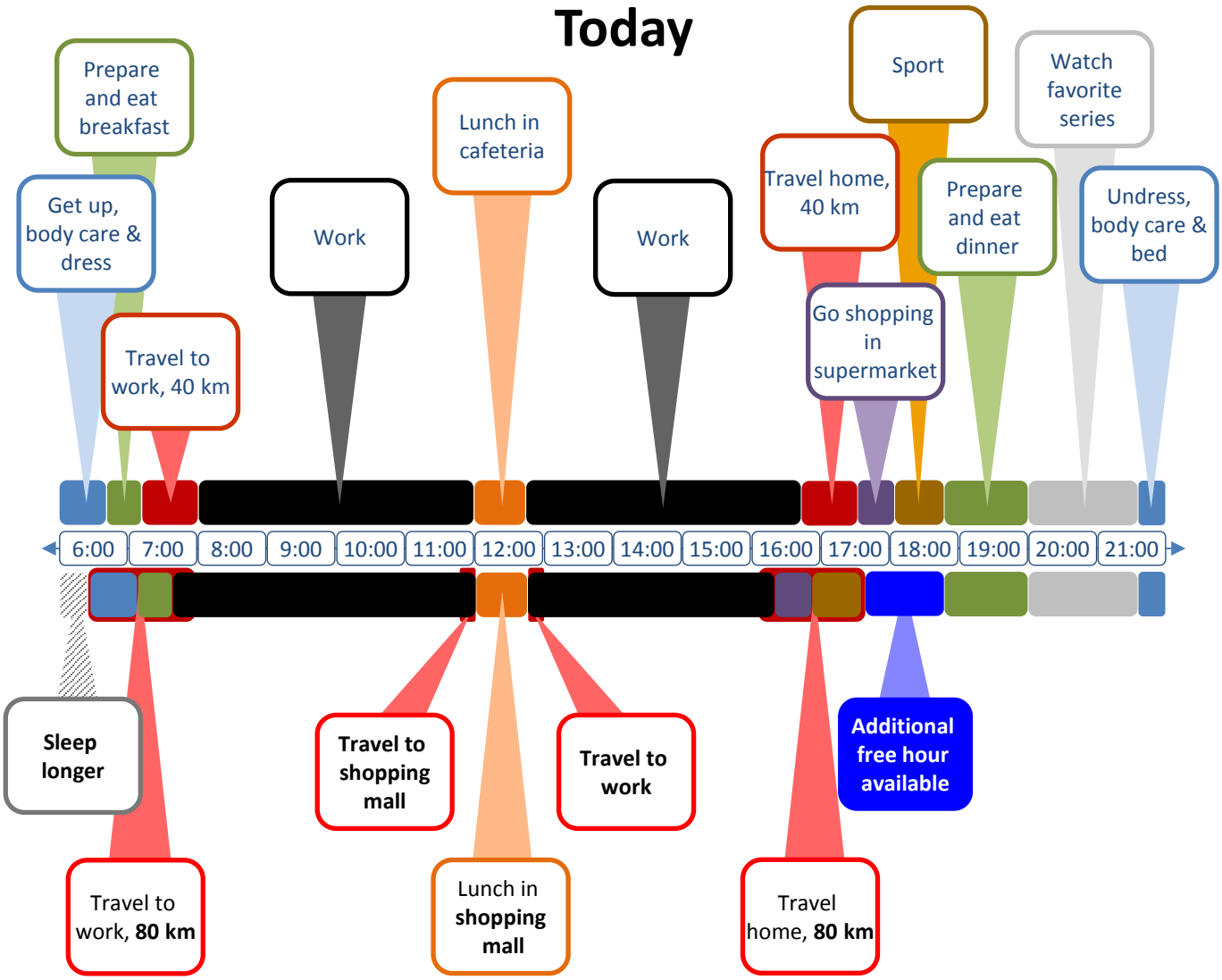
Future The driver becomes the passenger.

Case study: Our daily routines will change significantly as a result of autonomous driving and in-car services.

MOTIVATION AND DESIGN OF STUDY

As we can see, increasing automation allows additional and more complex activities to be performed on the road than are possible today. Some activities therefore lend themselves to being performed in the vehicle, in particular activities from the areas of "Productivity", "Basic Requirements", and "Wellbeing", which otherwise have to be performed today outside of the vehicle during working or leisure time. Groceries can be pre-ordered online for example from the vehicle and then collected on the way home or independently. Performing these activities in the vehicle frees up additional time outside of the vehicle, meaning that automation will have a significant impact on our daily routine. Moreover, automation also goes hand in hand with significantly increased flexibility. For example, by working on the road, lunch can be taken further afield. The next diagram shows a possible change in the daily routine by way of example.

Automation will change our daily routine and create greater freedom.



Scenario: The driverless capsule

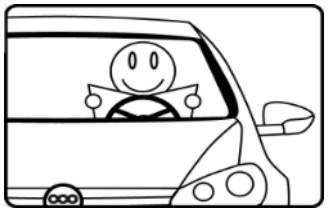
A user survey was carried out on three continents as part of the study as well as an industry survey.

MOTIVATION AND DESIGN OF STUDY

The study is based on two surveys: a user survey and an industry survey. Two future scenarios were developed initially for both surveys, which differ in terms of the technological maturity of the vehicle automation. In Scenario A ("highly automated vehicle"), highly automated driving is possible, though the driver has to be prepared to intervene spontaneously at all times in certain situations and take back control of the vehicle. In Scenario B ("driverless capsule"), the vehicles support fully automated driving without restrictions.

The study includes a user survey and industry survey based on two technological scenarios.

Scenario A



The highly automated vehicle

Scenario B

The driverless capsule

More than 60 potential activities or services during the automated journey were identified for both scenarios on this basis and a total of 21 different service groups derived from this. Six higher-level needs were formulated in turn from these service groups, which are to be fulfilled from the customer's perspective during the journey by carrying out activities.

The services were grouped according to higher-level service groups and needs.

Need

Service group

Service

The user survey was conducted online among 500 German, 500 U.S. (California), and 500 Japanese participants, each holding a passenger car driving license. The objective was to identify consumer preferences and willingness to pay in terms of carrying out activities during automated journeys. Confirmation was sought at the beginning of this survey that all participants were in possession of a driving license. Demographic data on the participants was then queried, such as gender, age, occupation, income, type of vehicle used, and driving habits. The two future scenarios relevant for the survey were then described in detail.

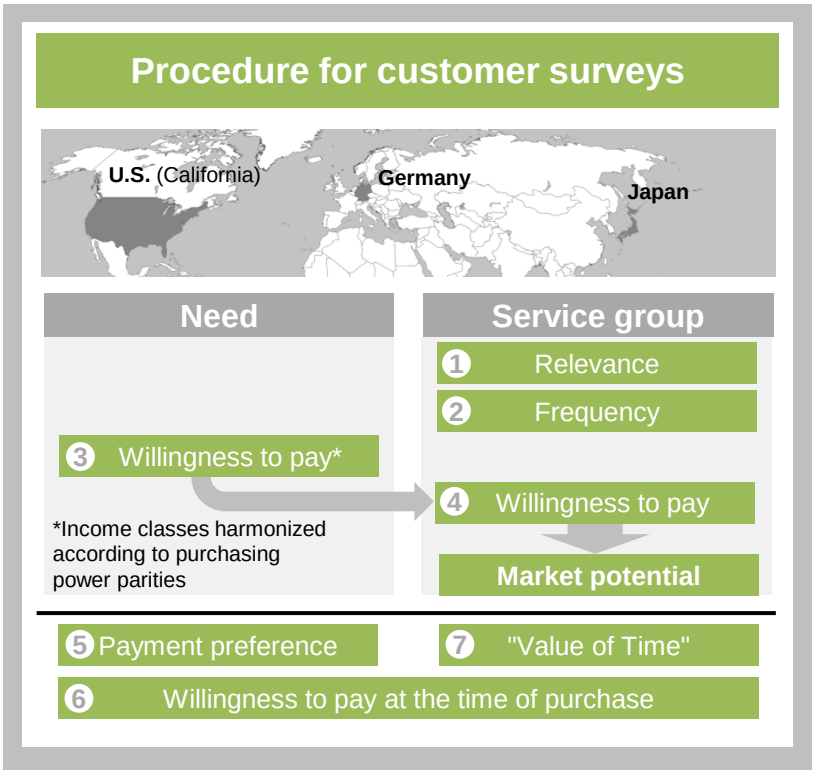
The customer survey was conducted among 1,500 participants on three continents, each in possession of a driving license.

The surveys ascertained preferences, willingness to pay, and service ratings.

MOTIVATION AND DESIGN OF STUDY

Quoting service examples from specific scenarios, the relevance and frequency of use of service groups were queried for each scenario. The respondents were then asked to state their willingness to pay for the specific scenario on a monthly basis at a needs level and to distribute this as a percentage to the underlying service groups. Finally, the respondents were queried as to their scenario-specific payment preferences for using the services, their willingness to pay a one-time surcharge for the basic provision of the "automated driving" function on purchasing a new car, as well as their individual "Value of Time".

The customer survey ascertained preferences and willingness to pay for services.



The industry survey was performed among experts from the automobile industry as well as related sectors in order to create an understanding from the provider perspective in relation to the technological development and customer preferences. High-ranking managers were asked to give their opinion on future development of automation technologies in the framework of individual interviews as well as to state the focus of their development work in this area. Moreover, they were asked to rate the importance for the customer of performing the described service groups and how much the customer would be willing to pay. The findings of the customer survey were then finally discussed with the industry representatives.

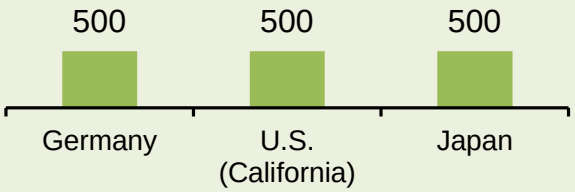
Managers were asked as part of the industry survey to rate customer preferences and technological development.

The surveyed consumers show a representative distribution of sociodemographic characteristics.

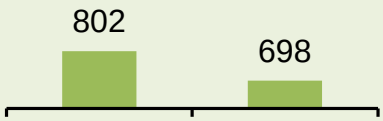
MOTIVATION AND DESIGN OF STUDY

Origin

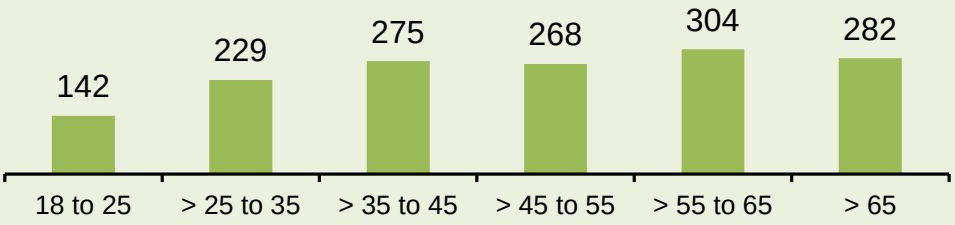
Number of respondents



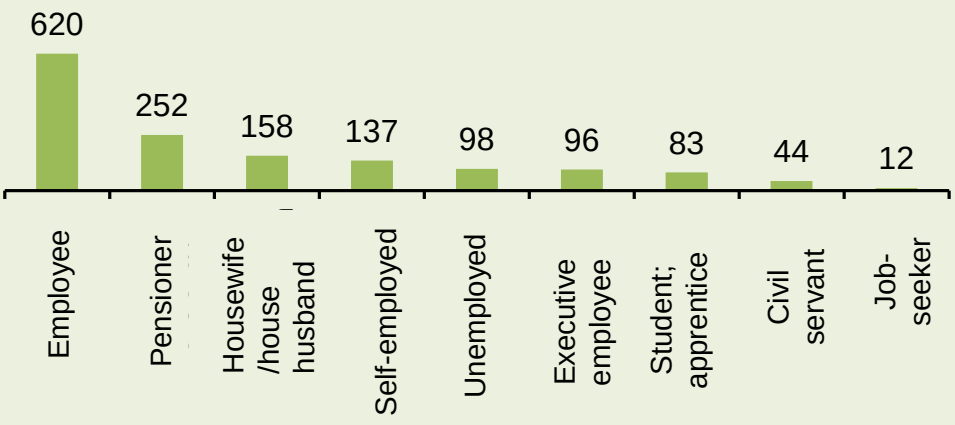
Gender



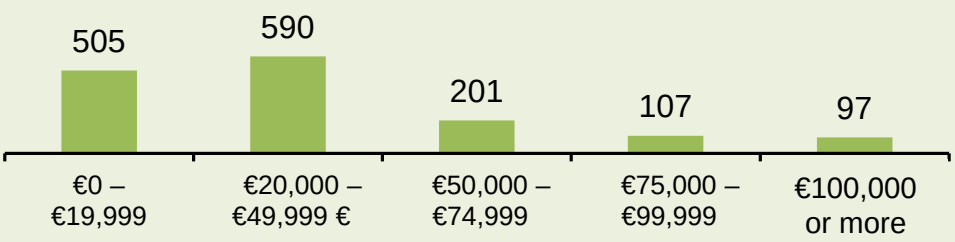
Age



Occupation



Annual gross income

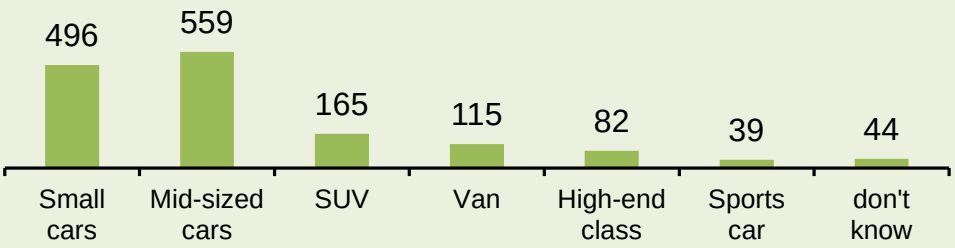


The surveyed consumers show a representative distribution of mobility-related characteristics.

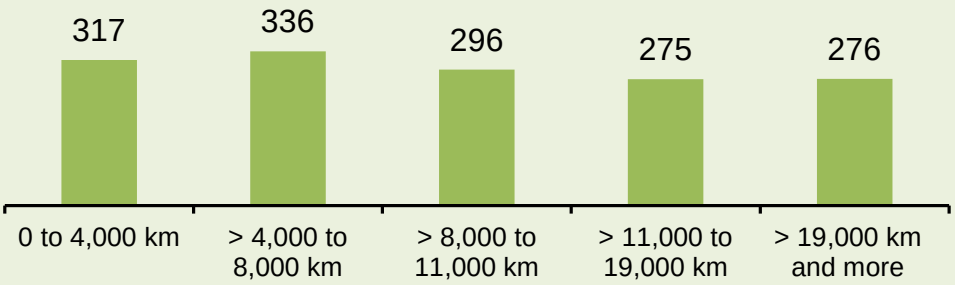
MOTIVATION AND DESIGN OF STUDY

Number of respondents

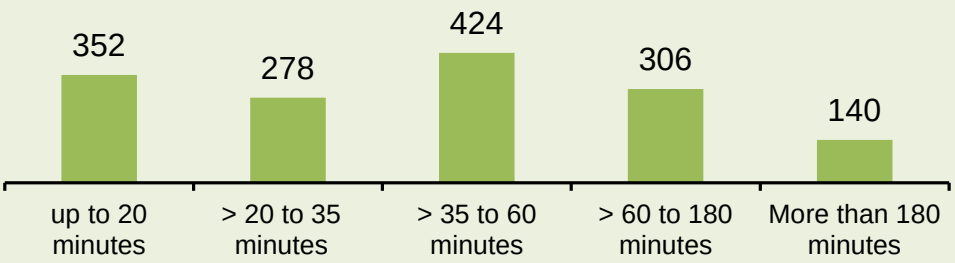
Primary vehicle used



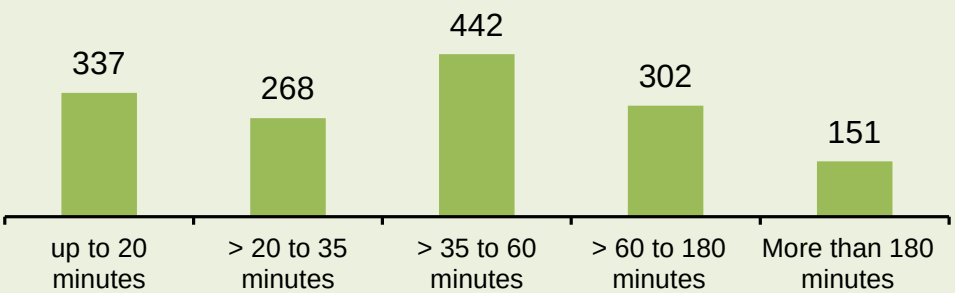
Annual mileage



Average travel time on a weekday



Average daily travel time at weekend



Nine key findings were made in the framework of the study in relation to future service potential

FINDINGS OF SURVEY

In order to fulfill one of the primary objectives of the study, that is to identify specific activities that a future user would like to perform during autonomous driving, the study design described was applied purposefully in the user survey. Nine concrete findings were successfully derived as part of the survey, which assist in answering the higher-level research question.

When deriving the findings described here, particular attention was paid to gaining a general perspective of the activities that users would like to perform during autonomous driving. The activities identified were examined for their specific relevance for users in the individual markets covered by the survey. The willingness to pay for in-car value-added services was analyzed both by country and by type of service. This allows an initial fundamental assessment of the future business potential of individual services as well as the market potential in the countries examined.

Additional findings were derived to provide further details, which relate especially to the ratio between willingness to pay and demographic characteristics of the user as well as to the intensity of future use by the user of value-added services in the autonomous vehicle. In addition, both the willingness to pay for value-added services and to pay a surcharge for highly automated vehicles was considered in relation to the user's vehicle segment. This allows an initial evaluation of the business potential with respect to specific users and therefore customer groups.

The nine findings made as part of this study are each explained in detail in the next section, documented by the results of the survey, interpreted, and examined in terms of their importance.

75 percent of users are prepared to pay for value-added services.	The **greatest willingness to pay** is demonstrated by users to meet the needs of **communication**, **productivity**, **and basic requirements.**	The **countries differ greatly** in terms of relevance and ranking of service groups.
Users from California (U.S.) exhibit the greatest willingness to pay for services.	Even in case of a short travel time per day, end customers are prepared to pay for value-added services.	**Younger users are prepared to pay more** than their older counterparts.
The **willingness to pay** is largely **independent of the vehicle segment**.	The **willingness to pay a surcharge** for an automated vehicle is significant across all vehicle segments – it is **highest in the small car segment**.	The "Value of Time" varies according to country, age, income, and vehicle segment.

75 percent of users are prepared to pay for value-added services.

FINDINGS OF SURVEY

The users were queried in the framework of the survey as to whether they would be prepared to pay for value-added services, and how much, assuming the respective Scenario A or B. The findings of the survey show that 75 percent of users on average across all regions are prepared to pay for chargeable value-added services. The findings on willingness to pay are compared with the "Value of Time" ascertained in the survey for further analysis and verification.

75 percent of users are prepared to pay for value-added services.

The initial evaluation describes the distribution of monthly willingness to pay in the two Scenarios A and B across all needs, with the willingness to pay being split into seven major areas. There is a clear concentration of answers here in the €0 to €50 range. The distribution of the willingness to pay between the two Scenarios A and B is not significant. The respondents tended to be more willing to pay higher amounts under the premise of Scenario B. The average monthly willingness to pay across all needs is approx. €150 in Scenario A (median approx. €50) and approx. €190 (median approx. €55) in Scenario B. Of particular note is the high level of willingness to pay for value-added services by users in under 40s age group as well as users from Japan. The willingness to pay in these two groups is 86 percent and 88 percent.

Up to as many as 88 percent of users in Japan are prepared to pay for value-added services.

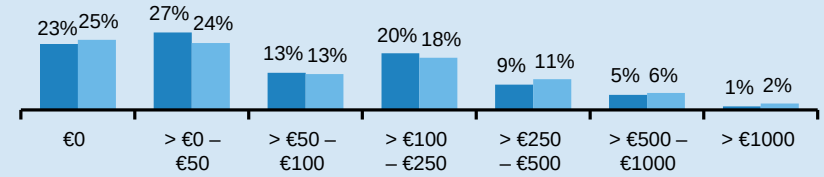
If the value attributed to an additional hour of free time ("Value of Time") by the respondents in the different willingness to pay clusters is considered, it is clear that the willingness to pay among the user groups increases significantly with the "Value of Time". The average value of the "Value of Time" is approx. €16 across all regions.

The willingness to pay correlates with the "Value of Time".

Average monthly willingness to pay for all needs

Distribution of willingness to pay

n=1500



"Value of Time" (value attributed to an additional hour of free time)

n=1500

Scenario A Scenario B

Data source: Fraunhofer IAO / Horváth & Partners | November 2015

There is little difference between the distribution of willingness to pay between the scenarios.

75 percent of users are prepared to pay for value-added services.

FINDINGS OF SURVEY

The findings of the surveys show that the majority of users across all user groups are prepared to pay for in-car value-added services. The high level of willingness of 75 percent suggests large acceptance among consumers. This clarifies the future relevance and the potential of business models on the basis of in-car value-added services.

Users regard in-car value-added services in the future as relevant.

The differences between the scenarios in terms of the distribution of willingness to pay are negligible. A possible explanation for this could be that on average the users surveyed only see minimum added value up to now in the additional or higher-quality activities that are possible owing to the higher level of automation. Moreover, Scenario B illustrates a much more abstract usage situation for the user, which makes any evaluation or comparison difficult.

The differentiated analysis of the willingness to pay according to age groups as well as the origin of the respondents shows that there are clear differences in the willingness to pay depending on demographic influencing factors. Further evaluations in terms of differentiating between user groups based on demographic characteristics (for example age, gender, professional group, etc.) are possible on the basis of the survey findings.

The willingness to pay differs greatly between the user groups.

The survey findings clearly reflect the excellent potential and high level of acceptance of chargeable value-added services in at least highly automated vehicles. The values established have to be qualified to a certain extent however in terms of their absolute manifestation or scope. The major differences between the average value and the median value indicate an unbalanced distribution or a small number of high "outlier" values. The willingness of potential users to pay for value-added services, which may not be familiar to them at present in their everyday lives, is highly abstract at present and therefore difficult to assess realistically. Nevertheless, the proposition that 75 percent of all users are prepared to pay for value-added services is a decisive conclusion in terms of future market development for in-car value-added services.

Significant importance will be attributed to value-added services in the framework of autonomous driving.

The greatest willingness to pay is demonstrated to meet the needs of communication, productivity, and basic requirements.

FINDINGS OF SURVEY

Users were queried as part of the survey regarding the needs for which they would be prepared to pay the most. In addition, the relevance of the service groups assigned to the needs and the associated willingness to pay were also surveyed. The findings of the survey suggest that the greatest willingness to pay exists for the needs "Communication", "Productivity", and "Basic Requirements".

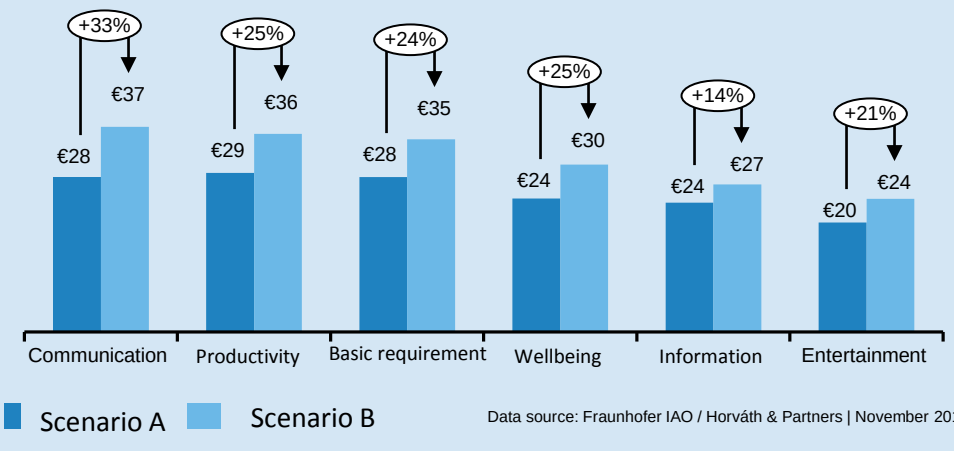
"Productivity" scores the highest willingness to pay in Scenario A at €29 per month. Meanwhile in Scenario B, users are prepared to pay the highest monthly amount for "Communication" at €37. The least willingness to pay in both scenarios on the other hand was attributed to the need "Entertainment". The value in Scenario A in this case is €20 and in Scenario B €24. The comparison between the scenarios suggests that the willingness to pay across all needs is higher in Scenario B than in Scenario A. A comparison in terms of the relevance at the service group level on the other hand shows that only minor differences exist between the scenarios in terms of the respective relevance of the service groups. The service group "Private Communication" is rated as most important by respondents in both scenarios. The findings of the customer survey confirm that users are prepared to pay higher amounts across all needs for Scenario B as opposed to Scenario A.

Users are prepared to pay the most for the need "Productivity" in Scenario A.

Average monthly willingness to pay per need

Distribution of willingness to pay

n=1500



Data source: Fraunhofer IAO / Horváth & Partners | November 2015

The willingness to pay for Scenario B is higher than for Scenario A across all needs.

In this context, they place particular emphasis on the needs "Communication", "Productivity", and "Basic Requirements". On the other hand, users are prepared to pay the least on average for the need "Entertainment". One possible explanation for this could be that the respondents would like to utilize the time spent in the car – for example when traveling home from work – on professional work and daily activities so that they have more leisure time when they finish work.

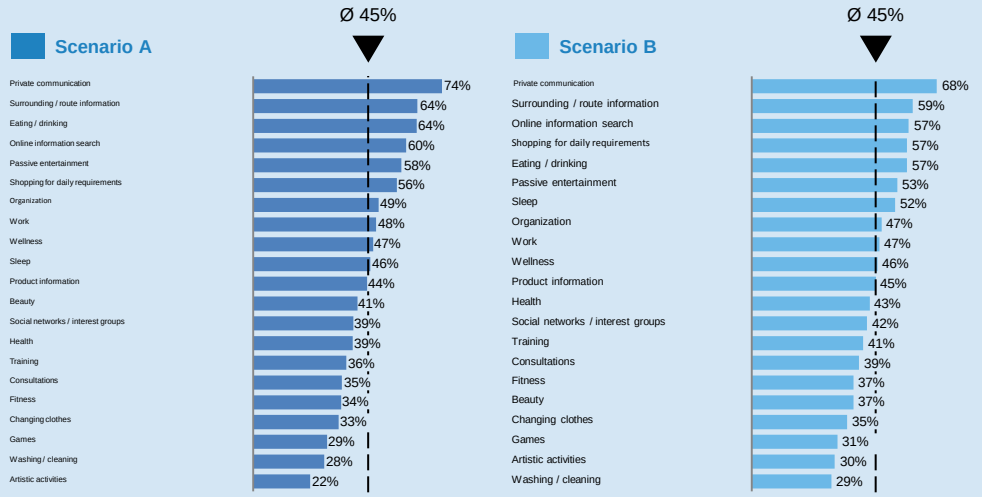
The greatest willingness to pay is demonstrated to meet the needs of communication, productivity, and basic requirements.

FINDINGS OF SURVEY

Average relevance per service group for all countries

Relevance of service groups per scenario

n=1500



Data source: Fraunhofer IAO / Horváth & Partners | November 2015

The diagram shows the relevance of the service groups depending on the scenario.

It can be derived from this that the type of activities users would like to perform in the car are those mandatory and typically value-adding activities, which could not previously be performed in the car. Users are prepared to pay more for these activities than for non-mandatory, entertaining activities. The increase in users' willingness to pay for the needs or service groups in Scenario B can be explained to an extent by the possibly more demanding activities in this case. It is only here that the services can be carried out in full. Particularly when it comes to "Sleep", the users in Scenario B are prepared to pay over 50 percent more than in Scenario A. The absolute manifestation or scope of the willingness to pay for the individual needs has to be examined critically however in all analyses since the users had to rate needs and associated conceivable in-car value-added services, which to a large extent cannot be offered as yet in vehicles. The financial evaluation is therefore abstract and difficult to estimate.

The willingness to pay is higher in the case of mandatory and value-adding activities than for entertaining activities.

Some activities can only be carried out in full in Scenario B.

The question of willingness to pay at the needs level offers the opportunity to set priorities for the future development of in-car service offers. Together with the surveyed relevance of the service groups, conclusions can be drawn – independently of the willingness to pay – with respect to the requirements for an autonomous vehicle in the future. In addition, the evaluations indicate that users have a different perspective depending on the different automation levels. Significant market potential can be deduced based on the findings of the survey, which is not just relevant for the OEMs. Automobile suppliers or IT companies that specialize in different needs or service groups can also profit from this market. The providers therefore have to differentiate the relevant value-added services according to the level of vehicle automation.

Value-added services have to be differentiated according to the level of vehicle automation.

The countries differ greatly in terms of relevance and ranking of service groups.

FINDINGS OF SURVEY

Users were surveyed as to the relevance they attribute to each service group in comparison with the other service groups. The findings were evaluated on a country-specific basis for the markets under review. It can be deduced on this basis that the relevance of the respective service group as well as its ranking varies greatly from country to country. When the figures for relevance of the service groups are compared directly between German and Japanese respondents, pronounced differences can be seen in many areas. With a relevance of 69 percent, the service group "Private Communication" is regarded most highly by German users. A high relevance is likewise attributed to the service groups "Surrounding / Route Information", "Eating & Drinking", and "Online Information Search". German users rated "Artistic Activities", "Washing & Cleaning", or "Games", for example, as not relevant. When it came to the Japanese users surveyed, however, the service group "Washing & Cleaning" is rated as much more relevant at 47 percent. Moreover, "Sleep" is more important to them than "Work". The use of social networks is also much more important to Japanese users than their German counterparts, being rated at 64 percent. All in all, the average relevance across all service groups is much more pronounced in Japan at 59 percent than in Germany at 37 percent.

Japanese users show greater acceptance of in-car service offers than German users.

Relevance of service groups compared by country

Average relevance per service group in Scenario A

Data source: Fraunhofer IAO / Horváth & Partners | November 2015

The diagram shows the relevance of the service groups for Scenario A in Germany and Japan.

A comparison of the relative change in willingness to pay between Scenarios A and B for Germany and Japan at the service group level likewise shows significant differences between the countries. While the largest relative increase can be observed in Germany for "Fitness" (+59 percent), the greatest willingness to pay by respondents in Japan in this context is in the area of "Training" (+71 percent). When comparing the average relevance and the monthly willingness to pay per service group for Germany and Japan, the distribution of the data cloud is striking. This indicates a high correlation between the two parameters "relevance" and "willingness to pay".

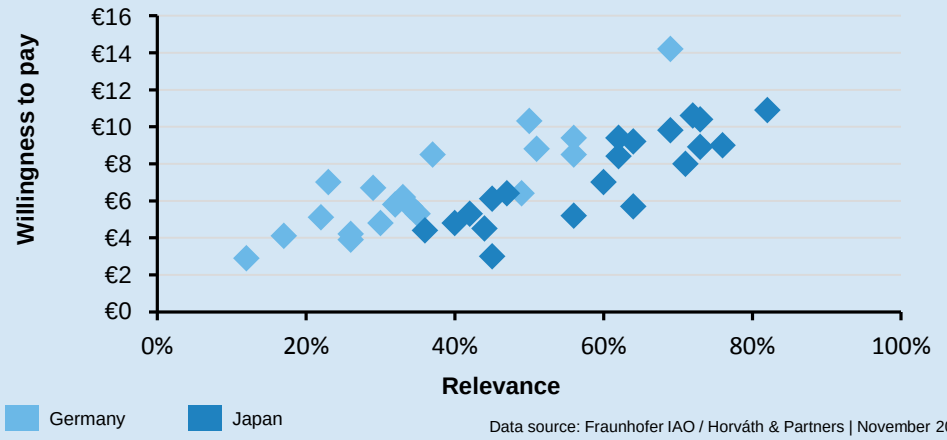
Correlating relevance and willingness to pay for in-car services.

The countries differ greatly in terms of relevance and ranking of service groups.

FINDINGS OF SURVEY

Average relevance and monthly willingness to pay per service group

Comparison of service groups in Scenario A
n=1500



Data source: Fraunhofer IAO / Horváth & Partners | November 2015

The willingness to pay for a service group correlates with the respective relevance.

Relevance of service groups and associated willingness to pay vary greatly between the respective countries and thus represent potentially different preferences among consumers in the different markets in terms of the use of value-added services with autonomous driving. One possible explanation for this is the different affinity for new technologies as well as the variation in optional in-car extras already evident today from country to country. The significantly higher average relevance of the service groups among Japanese users compared with German users can be explained to an extent by their tendency to be more open to new technologies. The correlation between the relevance of the service group and the associated willingness to pay shows that the willingness to pay for the respective service increases as the relevance increases. Where the relevance is the same, the willingness to pay among German respondents is on average higher than that of the Japanese users surveyed.

Customer preferences in the national markets for in-car service offers differ greatly.

The data on relevance and willingness to pay at the service group level and the ranking of value-added services that this enables allows the future market opportunities from the selected applications to be rated effectively as well as strategic test markets to be identified. The country comparison performed allows conclusions to be drawn as to the meaningful prioritization of test markets for the use of value-added services in the framework of automated driving. The results indicate that suitable prerequisites for a test market exist in Japan. Fast market penetration can therefore be assumed. The high level of acceptance also of in-car activities that are not possible at present allows new applications to be tried out as well as the opportunity to progressively develop the services for other markets. Moreover, the infrastructure in Japan fulfills the requirements for early introduction of autonomous vehicles on public roads compared with other markets.

Japan fulfills the requirements for a test market for in-car service offers from the customer's perspective.

Users from California (U.S.) exhibit the greatest willingness to pay for services.

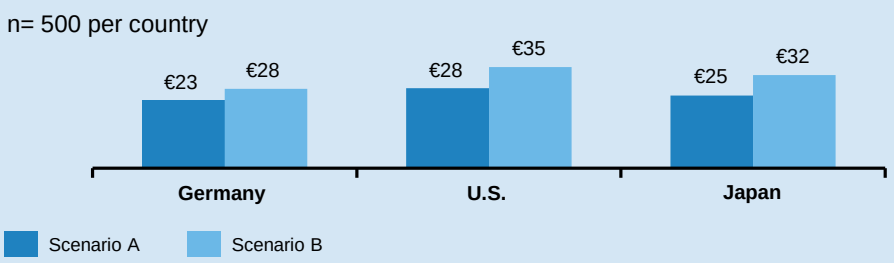
FINDINGS OF SURVEY

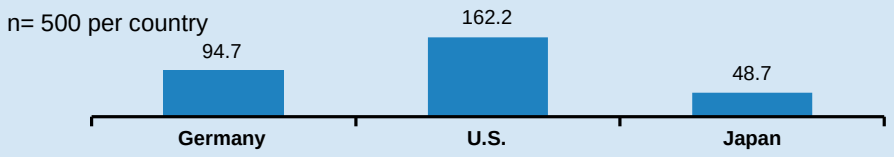
Based on the survey of monthly willingness to pay per need in the countries under review, it is clear that this is highest on average among users from the U.S. (California) for both scenarios A and B.

If the average monthly willingness to pay per need and country is considered, the amounts are highest in the U.S. at €28 for Scenario A and €35 for Scenario B. The lowest average willingness to pay on the other hand is in Germany at €23 for Scenario A and €28 for Scenario B. If the willingness to pay is considered relative to the average travel time per weekday, however, Japanese users surveyed show the highest willingness to pay relative to daily usage time.

Japanese users show the highest willingness to pay per need in relation to daily usage time.

Average monthly willingness to pay per service group





Data source: Fraunhofer IAO / Horváth & Partners | November 2015

The diagram shows a comparison between the willingness to pay and the average travel time per weekday.

Particularly worthy of emphasis are the service groups "Eating & Drinking" as well as "Training" with a cross-country variation in the willingness to pay of at least 20 percent in each case compared with the country average in both scenarios. The service groups "Wellness", "Fitness", and "Social Networks & Interest Groups", which can be classed as especially relevant for the automobile industry, likewise have an above-average rating. On the other hand, mandatory and value-adding activities, such as the service groups "Work" or "Shopping for daily requirements" for example, play a lesser role in the willingness of the U.S. users surveyed to pay.

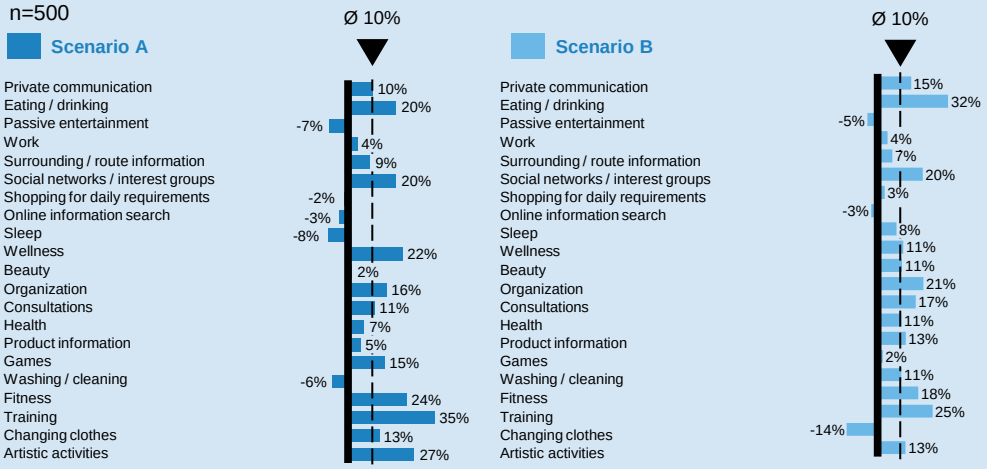
The willingness to pay for the service groups "Eating & Drinking" and "Training" is disproportionately high among U.S. users surveyed.

Users from California (U.S.) exhibit the greatest willingness to pay for services.

FINDINGS OF SURVEY

The willingness to pay on the part of U.S. users in comparison with the country average

Variation in average willingness to pay per service group



Data source: Fraunhofer IAO / Horváth & Partners | November 2015

The diagram shows the relative variation in the willingness to pay among respondents in California per service group compared with the country average.

Taking account of the average passenger car travel times per weekday, the high willingness to pay on the part of the U.S. users surveyed is hardly surprising. Compared with their German counterparts, U.S. users spend around 72 percent more time in the car, while compared with Japanese motorists this figure even rises to 230 percent. This higher percentage of time spent in the car results in a much stronger perception of the car as a living space. Furthermore, U.S. drivers already have a higher affinity traditionally with performing non-car activities in the car than is the case in other countries. Examples of this include the widespread use of business models on the basis of drive-thru or drive-in customer interfaces. This also partly explains the tendency toward higher willingness to pay for in-car value-added services.

The willingness to pay for service offers correlates with the daily travel time.

The findings show that the willingness to pay a surcharge in the U.S. (California) in particular is very pronounced, among other reasons because of the above-average amount of travel time per day. Based on the correlation between willingness to pay and daily travel time in the car, it can be concluded with respect to use in the automobile market that the services offered have to be adapted to the usage time in the respective market. The evaluations in relation to the variation in willingness to pay from the cross-country average value at service group level additionally indicate that there are major differences in the monetary weighting of the service groups between the countries. Taking the preferences of the U.S. respondents as an example, future providers of service offers, such as in California, could focus on the service areas of "Eating & Drinking", "Fitness", as well as "Training".

Service offers have to be selected specifically for the respective user group and national market.

Even in case of a short travel time per day, end customers are prepared to pay for value-added services.

FINDINGS OF SURVEY

The use of in-car services relates directly to the time the end customer spends in the vehicle. The demand for activities that take a longer time, such as watching a movie, therefore depends more heavily on the journey time than the demand for activities that only require a short time, such as answering an e-mail. It can therefore be assumed that users who typically only make short journeys will demand different services than drivers who regularly spend longer periods in the car. Moreover, it can be assumed that the willingness to pay for service offers is dependent among other things on the potential monthly overall usage time. This means that frequent drivers are more likely to have an opportunity to use a service than those drivers who only spend time in the car occasionally or for short periods. In addition to the monthly journey time, in other words the time reserve that could potentially be used for services, the type and character of the journeys being made is a critical factor with respect to the demand for (secondary) activities. Drivers who usually spend long, unbroken periods of time in the car or who make monotonous legs of journeys, such as commuting on the freeway, are more likely to feel the need for diversion and activity than those drivers who tend more to travel short or varied routes. A dependency on the level of vehicle automation must in turn be assumed in this regard. Highly automated vehicles (Scenario A), which return the task of driving to the driver in complex driving situations, as occur more often for example in the morning rush hour, will not allow convenient use of services in such situations, whereas fully automated vehicles (Scenario B) can guarantee fundamental use of the service offers.

The nature of the daily driving route influences the choice of (secondary) activity.

Full automation guarantees convenient use of services.

The survey conducted shows that the basic willingness to pay increases as the journey time increases. It is noticeable, however, that there is a relatively high willingness to pay even with short daily journey times of less than 30 minutes. Averaged across the need groups, the users indicated a willingness to pay approx. €21 per month in Scenario A and €27 per month in Scenario B per need. The further increase in willingness to pay with longer daily journey times only increases at a disproportionately lower rate. Users with a daily journey time of more than 90 minutes are on average only prepared to pay around 50 percent more for activities than those who spend less than 30 minutes in the vehicle. It was shown across all journey time clusters that there is a much higher monthly willingness to pay for using services in Scenario B than in Scenario A. It should be noted that the additional willingness to pay remains constant at around €6 to €7 per month across all groups. This means that the willingness to pay for service offers in a fully automated vehicle with a daily usage time of 30 minutes is at the same level at €27 as the willingness to pay for services on a highly automated journey with twice to three times the usage time of 50 to 90 minutes.

The willingness to pay is high even with a short journey time.

Even in case of a short travel time per day, end customers are prepared to pay for value-added services.

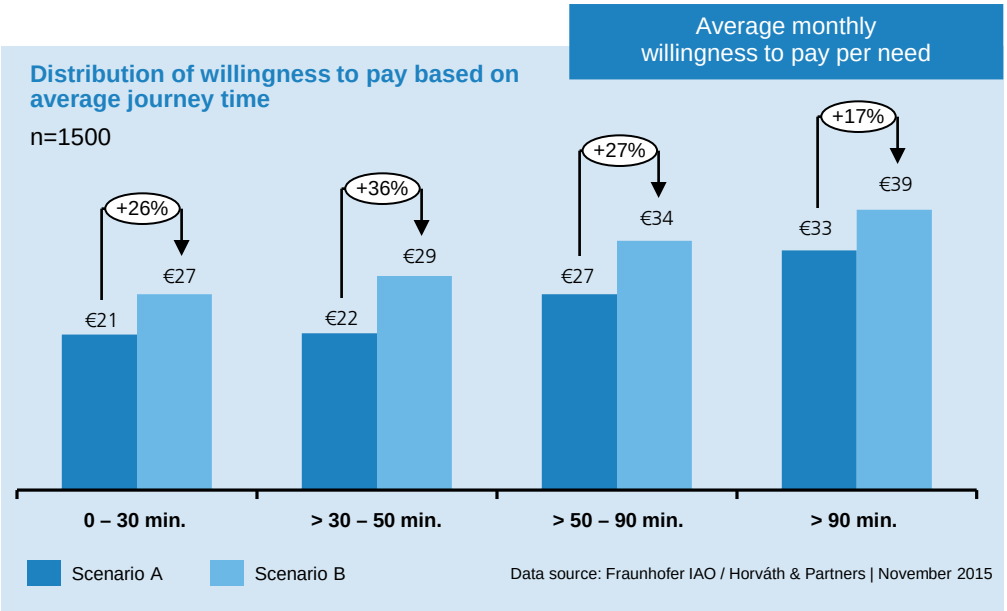
FINDINGS OF SURVEY

Looking at the findings in greater detail shows that in all countries and in both scenarios the activity "Sleep" or "Rest" is rated highly relevant with a daily journey time of less than 30 minutes (rating of 7 in Scenario A and 5 in Scenario B) but other activities are preferred with a longer journey time of more than 90 minutes. The test subjects in the countries under review essentially behave very similarly in rating services depending on the journey time, though with varying tendencies. A significant increase in the attractiveness of the activity "Work" can be identified among U.S. users on longer journey times than among other respondents. An especially striking value however is the rating of the activity "Fitness", which contrary to the opinion of the respondents from the other countries is rated as especially relevant in the U.S. for short journey times in highly and fully automated vehicles. As the journey time increases, however, the U.S. test subjects likewise give precedence to other activities.

"Sleep" is a popular activity on short journeys.

The high willingness to pay established even with low usage time shows that a broad range of potential users can be addressed with the services offered. However, services have to be found for shorter journeys, which can compete with those activities that can already be performed without special chargeable service offers, such as resting or writing e-mails. The likewise sufficiently high willingness to pay for services in the highly automated scenario, however, can be regarded as a primary indicator of the market relevance and opportunities of an early offer of initial (secondary) activities.

It will be possible to offer initial services soon.



The willingness to pay increases at a disproportionately lower rate in relation to the duration of the vehicle usage.

Younger users are prepared to pay more than their older counterparts.

FINDINGS OF SURVEY

The increasing use of service offers as well as hybrid service offers has become established as a continuous trend primarily over the last 10 to 20 years. While physical products and services were formerly primarily separate product offerings, the boundaries between the product types offered are blurred these days. Younger users who have grown up with this new product understanding are used to paying for additional services on a situation-dependent or flat-rate basis after purchasing the actual physical product – typical examples here include on-demand and streaming services. The services that can be purchased retrospectively often play a major role in delivering added value as well as customer satisfaction. It can be assumed that younger people are therefore more likely to be interested in additional in-car service offers than the older generation, who tend to view an automobile as a high-priced product with complete value proposition ex works.

The willingness to use service offers is a question of generation.

The survey confirmed that there are significant generation differences in terms of willingness to pay for in-car service offers, with younger people in particular demonstrating a 50 percent higher willingness to pay. Three groups can essentially be differentiated: users under 35 are prepared to pay around €38 per month and need for Scenario A, with the values for respondents under and over 25 not differing greatly. The second group is made up of respondents aged between 36 and 65 years of age, whose corresponding willingness to pay is around €25. The over 65s make up the final group, in which there is a noticeable decline in the willingness to pay. At the same time, a basic willingness to pay for service offers is still evident with this group at a value of €14. A clear willingness to pay a surcharge for service offers in the fully automated scenario also exists across all groups. The values mentioned increase again in this case by around 20 to 30 percent, with the largest expenditure again in this case expected among customers under 35 years of age.

Users under 35 years of age would pay 50 percent more for services than older users.

When broken down further, the survey findings show that around 60 percent of respondents in the over 40s age group are not prepared to spend more than €50 per month for services. There is absolutely no evidence of a willingness to spend money on services in around one third of over 60s and even one quarter of over 40s. The picture is somewhat different among the under 40s. Around two thirds of respondents indicated that they would be prepared to spend €50 per month on services. Some 25 percent of respondents even indicated that they would be prepared to pay between €100 and €250 per month. No willingness to pay still exists among some 15 percent of respondents under 40 years of age.

25 percent of under 40s would spend between €100 and €250 monthly.

Apart from the dominant desire for "Communication", the respondents in the under 40 age group attribute high relevance primarily to the service groups "Work" and "Shopping for daily requirements". Around two thirds of respondents

Younger users are prepared to pay more than their older counterparts.

indicated that they would be happy to receive appropriate service offers. While the relevance of the service group "Work" is rated similarly for Scenario A and B, "Shopping for daily requirements" falls from second (71 percent) to fourth (64 percent) place in comparison to Scenario A. The exact opposite is the case in terms of the relevance of the service group "Sleep". While only around every second user under 40 would like to sleep in the highly automated vehicle, the figure in the case of the fully automated vehicle is around two thirds. "Sleep" is therefore regarded as the second most relevant service group after "Private Communication" in Scenario B among younger respondents. Particularly noteworthy among respondents over 60 years of age was the desire in both scenarios for service offers from the area of "Environment & Route Information", which is rated as the second most important service in Scenario A and even the most important in Scenario B.

Work and private communication are the most important activities for the under 40s.

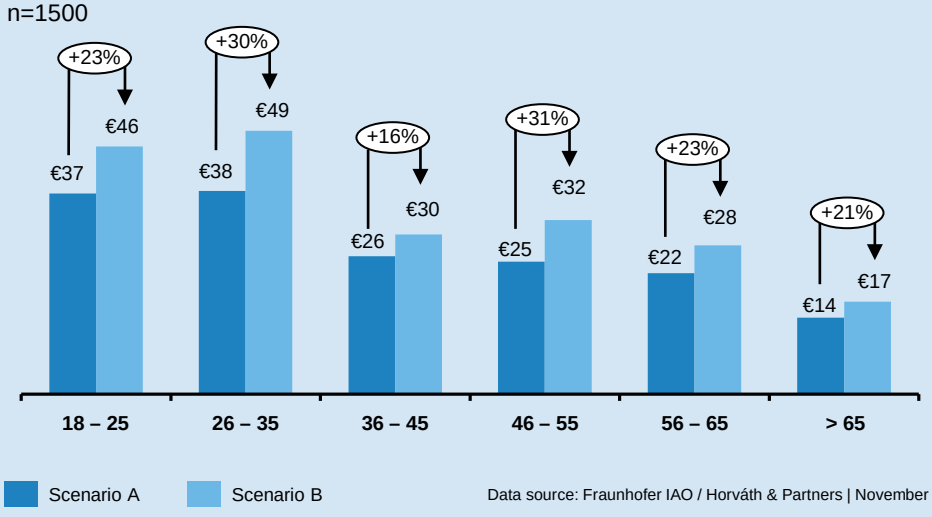
The results show that the younger respondents are significantly more open to service offers than their older counterparts, though this age group also indicates a basic willingness to pay. It can be assumed that the differences are not so much a factor of age rather the respective generation of the respondents. A greater interest in services can therefore be expected in the future than current surveys can illustrate. It will be some years yet until fully automated vehicles from Scenario B are introduced, which means that the younger generation of today who are more willing to pay will then already be in the higher-income middle generation.

The willingness to pay depends more on the generation than on the age.

Average monthly willingness to pay per need

Distribution of willingness to pay based on age

n=1500



Data source: Fraunhofer IAO / Horváth & Partners | November 2015

There are distinct generation differences in the willingness to pay.

The willingness to pay is largely independent of the vehicle segment.

FINDINGS OF SURVEY

The willingness to pay for optional extras on the part of automobile customers is dependent in general on the chosen vehicle segment. Higher surcharges are paid for optional extras in the case of high-priced vehicles in the high-end class or sports car and SUV segment than for vehicles in the smaller vehicle segments. This is primarily due to the average income of the vehicle buyers in the respective vehicle class. There has been an increasing trend in recent years however to also offer a range of optional extras in the small car segment in particular so that a new car can be configured to suit individual requirements. Examples here include the MINI, Opel Adam, or Fiat 500, all of which have a particularly wide range of optional extras. Furthermore, customers in the high-priced vehicle segments essentially expect many extras as standard equipment, for which a surcharge can be demanded in turn with smaller vehicles. Any special extras packages offered as well as the associated prices therefore usually have to be designed to suit the specific vehicle.

The willingness to pay for optional extras is dependent in general on the vehicle segment.

The findings of the user survey in relation to the usual vehicle segment of the respondents are interesting for this reason. What emerged was that there are no major differences across the vehicle segments in the willingness to pay for service offers with automated driving. Drivers of small cars indicated a willingness to pay €24 per month per need for highly automated driving, which is two euros less that drivers of mid-sized or high-end vehicles. The figures for drivers of sports cars and vans are somewhat lower with a willingness to pay €22 in each case per month and need. Only drivers of SUVs can be regarded as "outliers" here, indicating a value of €32 for Scenario A. However, these drivers are also more aligned again with high-end and mid-sized classes in Scenario B with a monthly willingness to pay of €35. It can therefore be shown that there is no special correlation between the vehicle segment and the willingness to pay for offered services.

SUV drivers are prepared to spend more on services than drivers in other segments.

In terms of the stated relevance of the different service groups also, the findings of the different vehicle segments are quite similar. For example, high relevance was attributed to the service groups "Private Communication", "Eating & Drinking", as well as "Environment & Route Information" in most segments both in Scenario A and Scenario B. The sports car drivers deviate from the rest however in this case, rating "Eating & Drinking" as less important than the others (7th place at 51 percent in Scenario A and 9th place at 46 percent in Scenario B). Sports car drivers would prefer instead to perform "Shopping for daily requirements" on the road, which they indicate as the third most important service category in both scenarios.

Sports car drivers would prefer to do their shopping than eat while on the road.

The willingness to pay is largely independent of the vehicle segment.

FINDINGS OF SURVEY

Consideration of high-end class drivers, who are particularly open owing to their higher available income, offers another interesting finding. A significant drop in the relevance of the service group "Work" can be seen here with the change from the highly automated to the fully automated scenario. Just 38 percent of high-end class drivers view "Work" in the fully automated vehicle as a relevant activity, which corresponds to a ranking of 14 out of 21 service groups evaluated. On the other hand, the relevance of the service groups "Sleep" and "Fitness" increases significantly among high-end class drivers from Scenario A to Scenario B. This trend can also be confirmed for the other segments in the case of the service group "Sleep". However, only a relatively slight increase in relevance can be identified among sports car drivers (from 49 percent to 51 percent) and drivers of small cars (from 51 percent to 55 percent).

High-end class drivers would prefer to sleep than work in the fully automated vehicle.

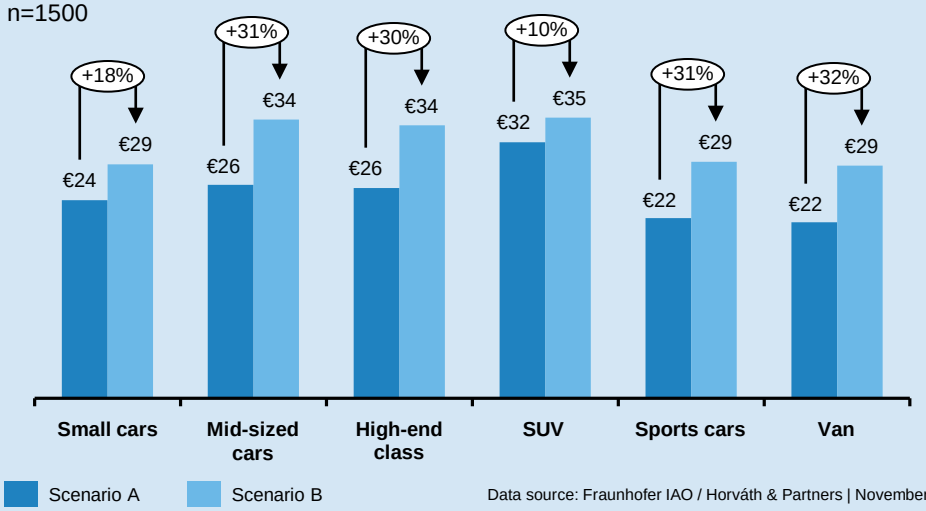
As a basic principle, services and their prices in the case of automated driving should be relatively independent of the vehicle segment. Service offerings can be made to all customers equally across the broad range of offers under the same terms and conditions. This means that possible services can be developed "across the board" and a large number of potential users can already be reached at an early stage. This makes it especially attractive to develop service offers and launch them on the market.

Service offers can be developed "across the board" for all segments.

Average monthly willingness to pay per need

Distribution of willingness to pay based on the most commonly used vehicle segment

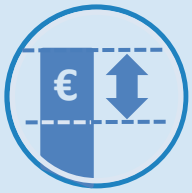
n=1500



Data source: Fraunhofer IAO / Horváth & Partners | November 2015

The willingness to pay on average per need varies little according to vehicle segment.

The willingness to pay a surcharge for an automated vehicle is significant across all vehicle segments.



FINDINGS OF SURVEY

The willingness to pay a surcharge for an automated vehicle indicates how much a customer is prepared to pay for the scenario-specific "automated" driving function on a one-off basis in the sense of a special extra in addition to the basic price of the standard vehicle. In Scenario A, the function represents highly automated driving, where the driver has to be prepared to intervene spontaneously at all times in certain situations and take back control of the vehicle. In Scenario B, the function allows unrestricted fully automatic driving. The willingness of the customer to pay a surcharge contrasts with the manufacturer's costs for integrating the function and in this regard especially the costs of the components for the sensors, actuators, and software.

The willingness to pay a surcharge for automation functions contrasts with the system costs.

The survey showed that there is a willingness to pay a surcharge for the automated driving function across all vehicle segments. In Scenario A, the figure was between €980 and €735 among all respondents who assigned their vehicle to a segment. In Scenario B, the willingness to pay a surcharge even amounts to between €1,461 and €980 and is thus just under 50 percent higher than in Scenario A. The highest willingness to pay a surcharge in Scenario A is among drivers of mid-sized vehicles, followed by the small car segment, high-end class, SUVs, vans, and sports cars. In Scenario B, drivers in the small car segment demonstrate the greatest willingness to pay a surcharge, followed by the mid-sized class, high-end class, SUVs, sports cars, and vans.

A willingness to pay a surcharge for automated vehicles basically exists.

A considerable willingness to pay a surcharge exists across all vehicle segments. The comparatively limited willingness of drivers of sports cars to pay a surcharge on average for the "autonomous driving" function does not sound surprising at first as they allegedly place less emphasis on comfort and a high value on a self-determined, dynamic driving experience. In reality however, this only applies for the U.S. and Germany. The willingness of sports car drivers in Japan to pay a surcharge at €3,041 in Scenario A and €4,542 in Scenario B is the highest across all vehicle segments and countries. Striking also is the average willingness to pay a surcharge in the small car segment and mid-sized class, which in absolute terms is the highest and therefore also higher than in the high-end class. In terms of the basic vehicle price, the willingness to pay a surcharge in the small car segment and in the mid-sized class is even more pronounced. This may be due to the fact that a higher basic functionality is expected in high-end class vehicles owing to the comparatively high purchase price than in other vehicle classes and consequently there is a more limited willingness to pay a surcharge over and above the purchase price in comparison with the volume segments. Again in this case, this finding only applies for the U.S. and Germany. The willingness to pay a surcharge in Japan in the high-end class at €2,677 in Scenario A and €3,180 in Scenario B is more than twice as high as in the small car segment and mid-sized class.

The willingness to pay a surcharge is highest in Germany and the U.S. in the small car segment and mid-sized class.

The willingness to pay a surcharge for an automated vehicle is significant across all vehicle segments.

FINDINGS OF SURVEY

Also worthy of note is the willingness of SUV drivers to pay a surcharge in the U.S., which is highest in Scenario B across all vehicle classes, while it is only limited in Germany and does not exist at all in Japan. The willingness to pay a surcharge is therefore heavily determined by cultural factors.

The willingness to pay a surcharge is strongly influenced by cultural factors.

The average willingness to pay a surcharge overall in both scenarios is significantly less than the manufacturing costs for the components required for automated driving. According to a study by Frost & Sullivan in 2014 these costs will amount to at least USD 2,500 per vehicle by 2020 (Frost & Sullivan, 2014). While a greater willingness to pay surcharges for the "automated driving" function was identified in some cases in other studies, this it mainly due to the fact that the question concerning the willingness to pay a surcharge for the specified function in the study to hand was only posed without prior notice after querying the willingness to pay to perform the services that are the focus of investigation.

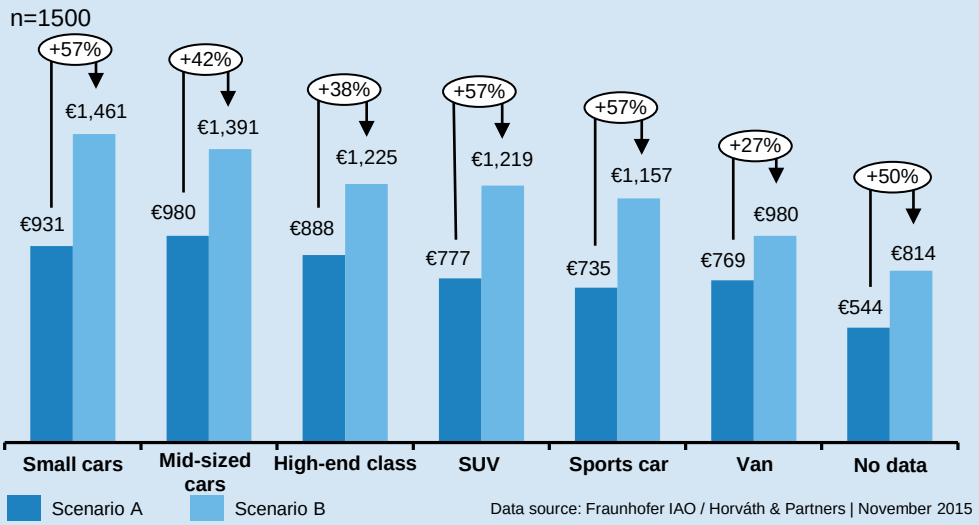
The willingness to pay a surcharge is lower than the integration costs.

Innovations in automobile construction are typically first introduced exclusively by traditional technology leaders in the luxury and high-end class and only then integrated after a delay in the remaining vehicle classes. The spread in the willingness to pay a surcharge for the "automated driving" function suggests, however, that the manufacturers should integrate the new technology directly in the high-volume small car segment and mid-sized class in the U.S. and Germany. Scale effects can thus be generated quickly and competitive advantages gained. However, owing to the limited willingness to pay a surcharge in comparison with the manufacturer costs at market launch, a low-price strategy is recommended initially in order to eliminate any resistance to buy on the part of the customer and to ultimately increase earnings through scale effects as well as the offer of services.

Manufacturers should not only introduce automated driving functions from the top down.

Average willingness to pay a surcharge across all countries

Willingness to pay a surcharge for automation-related optional extras per vehicle segment



The average willingness to pay a surcharge for automated vehicles varies greatly depending on the vehicle segment.

The "Value of Time" varies according to country, age, income, and vehicle segment.

FINDINGS OF SURVEY

The "Value of Time" indicator shows how much an extra hour of free time in a day is worth in monetary terms to an individual. This additional hour of free time can arise on one hand because certain leisure time activities can be transferred to the car and utilized when active control of the vehicle is relinquished. On the other hand and, if the opportunity presents itself, the principal professional occupation can be carried out during the journey, with the result that the remaining working time to be performed is shortened and additional free time is created outside of the vehicle.

The "Value of Time" indicator expresses the value of an additional hour of free time.

The survey revealed that an additional hour of free time is worth €16 on average to an individual across all countries. This value is only slightly above or below the highest average monthly willingness to pay per service group respectively in Scenario A and B. The "Value of Time" is highest among German respondents at €18 on average, followed by Japanese respondents at €15, and U.S. respondents at €14, whereby young people under 25 years of age consider an additional hour of free time as particularly valuable with a willingness to pay of €29. This high regard tends to decrease steadily with increasing age to a value of €10 among the over 65s. The willingness to pay increases steadily at the same time as salaries increase. While people with an annual gross income of below €20,000 are prepared to pay €14 for an additional hour of free time, those with an income of between €75,000 and €99,999 constitute the group with the highest willingness to pay with a "Value of Time" figure of €23. An additional hour of free time is only worth €19 however to people with an even higher income. In terms of the vehicle segment, drivers of sports cars are most willing to pay for an additional hour of free time at €22 on average, while drivers of SUVs and vans are least prepared to pay at €12 each. Drivers of cars in the compact, mid-sized, and high-end classes rate mid-way with a "Value of Time" of €16 to €18 on average.

Germans, young people, high earners, and drivers of sports cars account for the highest "Value of Time".

An additional hour of free time is an intangible commodity for which most people are prepared to pay. Young people, high earners, drivers of sports cars, and Germans place the most value on an additional hour of free time. The result is especially surprising with the latter, since according to an OECD study from 2014, there is scarcely any other industrial nation where people work as few hours as in Germany owing to the large number of vacation days and public holidays – 21 percent fewer than in Japan and 23 percent fewer than in the U.S (OECD, 2015). There are numerous possible socio-demographic, cultural, and legal explanations for these findings.

The "Value of Time is an intangible commodity with a price.

The "Value of Time" varies according to country, age, income, and vehicle segment.

FINDINGS OF SURVEY

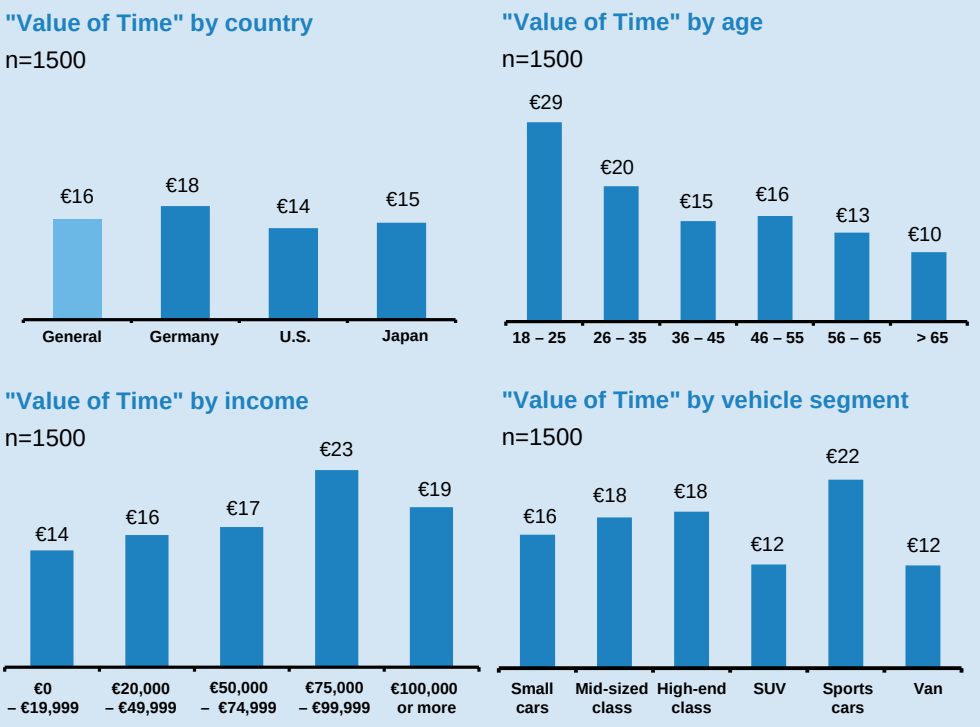
Career is possibly more important to Japanese and American respondents than German respondents owing to labor regulations. Moreover, a higher salary may also go hand in hand with greater responsibility and a higher workload, which makes an additional hour of free time seem more desirable. The reason for this cannot be explained definitively, however, as the value of an additional hour of free time ultimately correlates in principle to the amount of free time available in any case and is thus highly subjective. Furthermore, the indicator is very much situation-dependent. An additional hour of free time may be more valuable to some people if they have to prepare an urgent and important management presentation at short notice than if they want to play chess.

The "Value of Time" indicator is individual and situation-dependent.

The finding that people are prepared to spend a not inconsiderable amount for more free time illustrates the importance of technologies that will create free time for people. The "automated driving" function therefore has a high strategic relevance for vehicle manufacturers in terms of competing for the customer's favor. The "Value of Time" added up throughout the vehicle's lifecycle generally counterbalances the costs of vehicle integration. Provision of associated services ultimately allows a high earnings potential to be tapped.

Functions that create free time have a high strategic relevance.

Average willingness to pay for an hour of free time



Data source: Fraunhofer IAO / Horváth & Partners | November 2015

The average willingness to pay for an additional hour of free time varies according to country, age group, income, and vehicle segment.

The user group with the maximum and minimum willingness to pay is almost identical in both scenarios.

FINDINGS OF SURVEY

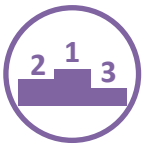
The following user groups demonstrate the highest or lowest willingness to pay per feature. While the willingness to pay and relevance of service groups in Scenario B is mostly higher than in Scenario A, the user groups scarcely differ between the scenarios when it comes to the maximum or minimum willingness to pay.

Maximum willingness to pay		Minimum willingness to pay	
Scenario A	Scenario B	Scenario A	Scenario B
California		Germany	
Male		Female	
25 – 35 years of age		Over 65 years of age	
Executive employee		Job seeker	
≥ €100,000	€75,000 – €99,999	€0 – €19,999	
SUV	Mid-sized cars	Van	
≥ 19,000 km per year		4,000 – 8,000 km per year	
1 – 3 hours per day		Less than 20 minutes per day	20 – 35 minutes per day

Data source: Fraunhofer IAO / Horváth & Partners | November 2015

How should potential service offers be designed?

SERVICE POTENTIAL

Findings	Meaning	
75 percent of users are prepared to pay for value-added services.	Services that allow secondary activities to be performed during automated driving can be offered as a chargeable service.	
Highest willingness to pay in the areas of "Communication", "Productivity", and "Basic Requirements."	Service offers that allow efficient use of travel time are especially relevant.	
The countries differ greatly in terms of relevance/ranking of service groups.	Services should be developed and offered on a region-specific basis.	
Users from California (U.S.) exhibit the greatest willingness to pay for services.	The services offered should be priced on a region-specific basis.	
Even in case of a short travel time per day, end customers are prepared to pay for value-added services.	Services can essentially be offered for drivers with very different driving profiles.	
Younger users are prepared to pay more than their older counterparts.	When developing services, providers should take account primarily of younger customer groups.	
The willingness to pay is largely independent of the vehicle segment.	Services and prices must not be designed on a segment-specific basis, rather can be offered uniformly across the entire vehicle range.	
The willingness to pay a surcharge for an automated vehicle is significant across all vehicle segments.	Services should also be designed primarily to take account of customers in the high-volume small and mid-sized classes.	
The "Value of Time" varies according to country, age, income, and vehicle segment.	Those services that create additional free time offer special potential by enabling activities that would otherwise be performed outside of the vehicle.	

Expert opinion on future service potential does not always concur.

SERVICE POTENTIAL

Selected quotes from industry experts:

"The legal constraints are limiting automation."

"Services in autonomous vehicles are a basic prerequisite for the success of automation."

"Services are important for balancing the new time gains offered by autonomous driving."

"The surcharge for autonomous vehicles will remain within reasonable limits."

"Services legitimize a surcharge in terms of purchasing a car."

"The willingness to pay for services and the "Value of Time" are highly individual and dependent on personal preferences, purpose of journey, number of vehicle occupants, and the respective situation."

Comparison between industry experts:

Unity

Services increase the attractiveness of automated vehicles for end customers.

The "Value of Time" is highly individual and situation-dependent.

Disunity

Only a few industry experts see the development of services as independent of the development of automation.

There is lack of agreement between industry experts as to whether services should be offered on a country-specific basis.

Comparison between industry experts and end customers:

Unity

Services from the areas of "Information", "Communication", and "Productivity" have the highest relevance.

The maximum market potential lies in the areas of "Communication" and "Productivity".

Disunity

Industry experts attribute a higher relevance to services from the area of "Productivity" and a much lower relevance to services from the area of "Information" than is the case with end users.

While industry experts see a relatively high market potential in the areas of "Information" and "Entertainment", users are more likely to be willing to pay more for services from the area of "Basic Requirements".

A significant market potential will develop even in the coming decade.

SERVICE POTENTIAL

The willingness to pay established in the user survey at needs level allows an initial conclusion to be drawn regarding the possible market potential of in-car value-added services. The following analysis represents a market appraisal created on the basis of the findings of the study as well as taking account of additional external sources and assumptions. As already described in the preceding sections, the monetary rating of activities that users cannot yet perform in the car is very abstract and therefore difficult for users to assess. The calculated market volume should therefore primarily represent a scale, which will be possible in the future for value-added services in highly automated vehicles. The following analysis therefore shows the market potential of in-car value-added services in Germany for highly automated driving by way of example.

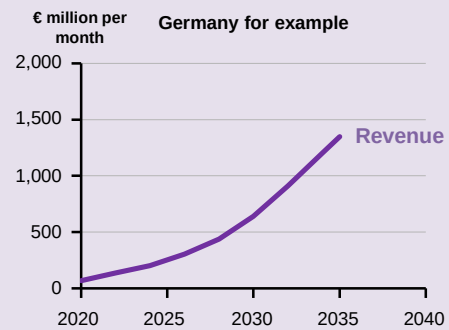
The market volume can be estimated based on the rate of penetration of highly automated and fully automated vehicles on the German automobile market in the period up to 2035 as well as on the average monthly willingness to pay. It is assumed for calculation purposes that the rate of penetration of these vehicles in Germany (approx. 44 million passenger cars) will increase from approx. 1 percent in 2020 (Cacilo et al., 2015) to approx. 25 percent in 2035. An upper limit can be derived on this basis with respect to the monthly turnover from value-added services of approx. €67 million (€800 million per year) in 2020 and approx. €1.35 billion (€16.2 billion per year) in 2035. The greatest market potential can be achieved in this context with the need "Productivity" with a monthly turnover of €255 million in 2035. The calculations additionally include a correction factor from the year 2030, which should take account of a declining willingness to pay on the part of users over time, for example owing to increased competition on the market for services.

The market potential for services depends on the rate of penetration of highly automated vehicles on the automobile market.

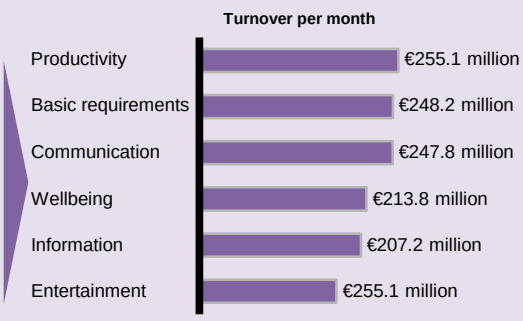
This sample assessment for the German automobile market shows the high market potential that the different provider groups (e.g. OEMs, subcontractors, IT companies, etc.) can exploit in the future from in-car value-added services. Value-added services will therefore represent an additional and not inconsiderable source of income.

In-car service offers will represent another important source of income in the future.

Market volume per month for value-added services across all needs – approximation based on findings of study –



Distribution of market volume at needs level in 2035 – approximation based on findings of study –



Conclusion and Outlook

The automobile sector is set to face profound changes in the coming years. Innovations in the area of autonomous driving will allow new in-car services and business models to be offered to users in the future. When cars can drive themselves, the occupants will want to use the time gained to perform other activities in the car.

What is still not really clear, however, is how the new "automobile" service world will look and what market potential can be exploited for different sectors. It was shown as part of the study that a significant majority of motorists are prepared to pay to organize their time freely in the car through the use of value-added services. The service groups that are most relevant for users were established as well as the amount users are willing to pay to use the services. Findings were also made in relation to the extent to which the relevance and willingness to pay depends on other factors, such as personal mileage, the user's vehicle segment, or the age of the driver. This information is extremely important for targeted development of new business models in the framework of autonomous driving.

Based on the data collected for the study as well as the applied methodology, additional questions can be answered in a targeted way, which go beyond the existing study findings. Additional detailed analyses are therefore possible for example in relation to the user's willingness to pay depending on the car brand or model. Furthermore, investigations of the correlations between groups of individuals and relevant services are conceivable in order to be able to offer targeted service bundles in the future. The survey's findings also allow further evaluations to be performed regarding the user's preferred means of payment.

The findings of the study have interesting potential for the future development of the automobile and the associated business models. The Fraunhofer IAO and Horváth & Partners will continue to work in research and practice to identify and assess this potential and to monitor the development of successful business models.

List of References

Abraham, B., & Runge, W. (2016): in ATZ elektronik 01/2016: Autonomes Fahren Nur ein trojanisches Pferd der digitalen Unternehmen?

Automobil Club Verkehr (2015): ACV Akzeptanzstudie – Autonomes Fahren, Cologne.

Becker, D., et al. (2016): Global Automotive Executive Survey 2016.

Brauck, M., Hawranek D. und Schulz T. (2016): Spiegel. Steuer frei – Das selbst-fahrende Auto wird nicht nur unsere Art der Fortbewegung verändern – sondern die gesamte Gesellschaft. Etablierte Hersteller wie Daimler und digitale Konzerne wie Google liefern sich ein Wettrennen. (p. 12–20).

Focus Online (2013): Ohne Parkplatz kein Auto: Mega-Metropole Tokio. From focus.de: http://www.focus.de/auto/ratgeber/unterwegs/strassenverkehr-in-tokio-ohne-parkplatz-kein-auto-mega-metropole-tokio_aid_1158819 .html, Date accessed: 2/19/2016.

Cacilo, A. et al. (2015): Hochautomatisiertes Fahren auf Autobahnen – Industrie-politische Schlussfolgerungen. Studie im Auftrag des Bundesministeriums für Wirtschaft und Energie (BMWi).

Frost & Sullivan (2014): Strategic Analysis of the European and North American Market for Automated Driving, p. 35–36.

Geyer, S. (2013): Entwicklung und Evaluierung eines kooperativen Interaktionskonzepts an Entscheidungspunkten für die teilautomatisierte, manöverbasierte Fahrzeugführung, Darmstadt: Technical University of Darmstadt.

Hofacker, A. (2013): Nissan testet autonomes Fahren auf öffentlichen Straßen. https://www.springerprofessional.de/automobil-motoren/nissan-testet-autonomes-fahren-auf-oeffentlichen-strassen/6562002?searchBackButton=true, Date accessed: 2/10/2016.

Lutz, Tang, & Lienkamp (2012): Analyse der rechtlichen Situation teleoperierter (und autonomer) Fahrzeuge, Munich.

Meck, G. (2015): Daimler schickt selbstfahrende Trucks auf die Autobahn. From FAZ.net: http://www.faz.net/aktuell/wirtschaft/daimler-schickt-selbst-fahr ende-trucks-auf-deutschlands-autobahnen-13720135.html, Date accessed: 2/8/2016.

Meyer, G. (2015): Cyber Security – Achillesferse hochautomatisierten Fahrens. From Intellicar.de: http://intellicar.de/spezial/cyber-security-die-achillesferse-des-hochautomatisierten-fahrens/, Date accessed: 2/16/2016.

NHTSA (2013): U.S. Department of Transportation Releases Policy on Automated Vehicle Development. From NHTSA.gov: http://www.nhtsa.gov/About+NHTSA/Press+Releases/U.S.+Department+of+Transportation+Releases+Policy+on+Automated+Vehicle+Development Date accessed: 2/17/2016.

List of References

OECD (2016): Average annual hours actually worked per worker. 2016, URL: https://stats.oecd.org/Index.aspx?DataSetCode=ANHRS, Date accessed: 2/19/2016.

Prädel, J. & Emenako, D., et al. (2016): Studie IT-Trends 2016: Digitalisierung ohne Innovation?

Pander, J. (2012): Spiegel Online. From Mobilitätswandel: Wie Kalifornien der Autowelt die Trends diktiert: http://www.spiegel.de/auto/aktuell/strenge-abgasvorschriften-kalifornien-setzt-in-der-autoindustrie-die-trends-a-868966.html, Date accessed: 2/17/2016.

RAND (2014): Autonomous Vehicle Technology - A Guide for Policymakers.

Reschka, A. (2015): Sicherheitskonzepte für autonome Fahrzeuge. In M. Maurer et al., Autonomes Fahren (p. 489-513).

Schroers, M. A. & Steuwer, S. (2015): Autonomous Driving - Political, Legal, Social, and Sustainability Dimensions. In M. Maurer et al., Autonomes Fahren (p. 151-173).

Statista (2015): Größte Automärkte weltweit nach Pkw-Neuzulassungen von Januar bis Juni 2015 (in Millionen). From Statista: http://de.statista.com/statistik/daten/studie/164769/umfrage/groesste-automaerkte-weltweit-nach-pkw-neuzulassungen/, Date accessed: 2/10/2016.

Thrun, S. (2008): Simultaneous Localization and Mapping. In M.E. Jefferies et al., Robotics and Cognitive Approaches to Spatial Mapping (p. 13–41). Berlin, Heidelberg.

Verband deutscher Automobilindustrie (2015): Automatisiertes Fahren. From VDA.de: https://www.vda.de/de/themen/innovation-und-technik/automatisiertes-fahren.html, Date accessed: 2/16/2016.

Wehinger, S., & Cords, S., (2015): Transformation von Geschäftsmodellen in der Automobilindustrie am Beispiel von "Automatischem Fahren". In Proff, H. Entscheidungen beim Übergang in die Elektromobilität, DOI 10.1007/978-3-658-09577-2_10, © Springer Fachmedien Wiesbaden 2015.

Wachenfeld, W. & Winner, H. (2015): Die Freigabe des autonomen Fahrens. In M. Maurer et al., Autonomes Fahren (p. 439–464).

World Economic Forum (July 29, 2015): The Global Competitiveness Index 2014–2015. From the World Economic Forum: http://www.weforum.org/reports/ global-competitiveness-report-2014-2015, Date accessed: 2/23/2016.

Authors and Contact

Fraunhofer IAO

Dr. Jennifer Dungs
Head of Division Mobility and Urban Systems Engineering
jennifer.dungs@iao.fraunhofer.de

Daniel Duwe
Research Associate
daniel.duwe@iao.fraunhofer.de

Dr. Florian Herrmann
Head of Competence Center Mobility Innovation
florian.herrmann@iao.fraunhofer.de

Alexander Schmidt
Research Associate
alexander.schmidt@iao.fraunhofer.de

Sebastian Stegmüller
Research Associate
sebastian.stegmueller@iao.fraunhofer.de

HORVÁTH & PARTNERS
MANAGEMENT CONSULTANTS

Ralf Gaydoul
Partner
Competence Center Automotive
rgaydoul@horvath-partners.com

Peter Lukas Peters
Consultant
Competence Center Automotive
ppeters@horvath-partners.com

Maik Sohl
Consultant
Competence Center Automotive
msohl@horvath-partners.com

About the Partners

Fraunhofer IAO

The **Fraunhofer Institute for Industrial Engineering IAO** helps companies and institutions introduce new business models and efficient processes to make their businesses more successful. With our in-depth knowledge of organizational structures and technologies, we have the skills you need to put applied research into practice. We participate in international networks, investigating and shaping the frontline themes that are most relevant to the future of Germany as a business location. Around 40 employees from the fields of Engineering, City Planning, Computer Science, Economic Science, and Sociology pool their expert knowledge to create inspiring systems solutions for mobility and future cities. With electrification, automation and networking in transportation on the rise, our focus is on developing and implementing sustainable mobility concepts on an industrial scale.

HORVÁTH & PARTNERS
MANAGEMENT CONSULTANTS

Horváth & Partners are independent, international management consultants with over 600 highly qualified employees. Founded in 1981 and headquartered in Stuttgart, Germany, we have offices at locations in Germany, Austria, Hungary, Romania, Switzerland, Saudi Arabia and the United Arab Emirates. Moreover, Horváth & Partners are a proud member of the Cordence Worldwide global management consulting partnership, which strengthens our ability to undertake consulting projects in important economic regions of the world with the highest professional expertise and precise knowledge of local circumstances.

Our core competences lie in the fields of Corporate Performance Management and Performance Optimization – both for the entire company and for the business and functional areas of Strategy, Innovation, Organization, Sales, Operations, Purchasing, Controlling, Finance and IT. Horváth & Partners stand for project results which create sustainable benefit, which is why we accompany our clients through the entire process from developing the business concept through to anchoring via integration into processes and systems.