University of Tartu
School of Economics and Business Administration

Oleg Monastyrskyy

THE FUTURE TENDENCIES IN CAR OWNERSHIP: IMPLICATIONS FOR THE AUTOMOTIVE INDUSTRY

Master Thesis

Supervisors: professor Maaja Vadi, Kristjan Pulk

Tartu 2021

Name and signature of supervisor: .....

Name and signature of supervisor: .....

Allowed for defense on .....
(date)

I have written this master's thesis independently. All viewpoints of other authors, literary sources, and data from elsewhere used for writing this paper have been referenced.

.....
Author Oleg Monastyrskyy

Abstract

This paper examines the factors that affect car sharing development and its impact on the automotive industry. Car sharing can be considered as a new alternative way of mobility, that contributes to efficient transportation through the city. To examine the factors, 8 independent interviews with various experts and stakeholders were conducted to find key factors that affect the development of car sharing. The most common factors were: regulations, policies, autonomous driving, infrastructure, and parking. To find how car sharing may affect the automotive industry, a scenario planning method was used. For this endeavor, 2 most uncertain key factor was chosen: regulations and policies were combined into legislative support, as both of those factors are dependent on local/state authorities, and autonomous driving. The scenarios shed light on what four different types of future car sharing companies and automotive industries may face. This paper contributes to the literature by further examining the factors that affect the development of carsharing and elaborating on the possible future outcomes for people, car sharing, and the automotive industry. The future variations of shared autonomous vehicles are also considered.

Keywords: car sharing, autonomous driving, legislative support, municipality

1. Introduction

The automotive industry is one of the largest industries in the world and holds nearly 11 percent of North America's, Europe's, and Japan's GDP individually (Maxton G., 2004). The number of cars on the road nearly doubles every 20 years: in 1976 there were 342 million vehicles, while in 1996 this number increased to 670 million (Chesterton A., 2018). While it is hard to calculate all of the vehicles around the world, research made by Navigant estimated 1.2 billion vehicles in 2014 and forecasted 2 billion in 2035 (Gao P., Hensley R., 2014). At the same time, the automotive industry has not faced any major disruptive modifications in its sales channel for almost 100 years (Knoedler D., 2020). The business model remains the same: design a car, start mass production, sell the cars to the customers, and finally provide car maintenance services for the customer. Most car manufacturers have been employing this business model since Ford Model T was built back in 1908.

Throughout its history, the automotive industry had undergone three revolutions that had a positive effect on the value of the end product: first at Ford with shifting to mass production, second with introducing customizations to the cars, and third on Toyota with the shift towards lean production (Maxton G., 2004). The aforementioned revolutions only touched the internal processes in the industry and the final product but didn't change or modify the sales channel. As for now, automotive companies are testing different ways to acquire new customers like giving them a car on a subscription-based plan and developing their car sharing platforms. The automotive industry has been based on the principle of delivering a product to the end-user, but soon it may shift to providing Mobility as a Service instead.

The best example of Mobility as a Service is ride-sharing. The rise of online ride-sharing platforms like Uber, Bolt, and BlahBlahCar has changed the way people treat cars. The services of such platforms brought convenience to the end-user of the car (a person who wants to ride from point A to point B rather than own the car) and made it possible for car owners to have additional benefits. The ride-sharing platforms simplify the life for the end-user in comparison with owning a personal car: there is no need to drive around the streets

looking for a parking spot or pay for parking or think about filling up the car at a petrol station, or have a driving license.

From the municipality's point of view, the concept behind these platforms was to increase the utilization of cars on the roads. A driver who is willing to share his vehicle with other people can pick up fellow travelers. It means that potentially there may be fewer cars on the road driving in the same direction. In theory, this new way of transportation could change people's perception of traveling around the city and influence both the municipal infrastructure and municipal transportation. In reality, people are perceiving these new ways of transportation as a substitute for a traditional taxi.

An alternative to a ride-sharing platform, which has recently started developing, is car sharing. The car sharing platforms like GetManCar or AutoLevi are designed to give a better value to the end-user of the car at a lower price: a person enjoys all the advantages as the car owner but does not pay the full price for the car and does not bear maintenance costs (Shaheen et al., 1998). From the municipality perspective, car sharing should increase the utilization of the cars thus resulting, at least in theory, in a decrease in the number of cars especially in the center of the municipality during business hours. The car sharing also allows the user to pick up the car that fits his needs at the specific moment: a van if more than 5 people are traveling together, or a small coupe for easier parking in the city center, or an SUV if one wants to make a countryside trip.

The other important factor that should be taken into account is generation preferences. For example, millennials tend to use Uber over purchasing a personal car. Recent research shows that people aged 16-35 buy half as many cars when compared to 35-49 and 50-55 age groups. Moreover, millennials are not that interested in getting their driving license. According to a study of the University of Michigan, today in the United States only 60% of 18-year-olds have a driver's license, compared with 80% in the 1980s (ETEHAD M., 2016). Another research shows that millennials aged 18-34 are more open to sharing cars than owning a personal one (Gao P., Hensley R., 2014). According to William H. Frey's 50.7% of the population in the United States are millennials (22%), Gen Z (20.3%), and younger (8.4%)

(2020). Also, 10.1% of Gen Z are older than 18 years old, so they have entered the car buying and driving age. Another 18.6% of the population soon will also get the same right. We are already observing a change in people's behavior towards car ownership. If new generations will support this trend, we might observe a drastic change in the car industry.

It is believed that the urban population will show steady growth in the next 25 years (Graph 1). Local authorities should come with a transportation solution, that will be able to handle an additional amount of people and cars. Those solutions can be categorized into 2 types: efficient city planning (main KPI: time spent for traveling), and new regulations inside the city. Efficient planning includes building new car interchanges, widening the streets, launching new routes for public transport. This solution is time and resource-consuming. On the other hand, the introduction of new regulations is a fast reaction to the ongoing problem. Some municipalities create restrictions for private cars in the city center. Another approach is to raise the parking fee. Given these 2 limitations, driving a personal car becomes expensive and uncomfortable. Thus, fewer cars will be driven on the roads, because people would choose alternative ways of transportation (Mounce, 2019). To provide comfortable living, municipalities should allow citizens to move quickly and conveniently through the city. In this case, shared mobility can be a favorable transportation option, that will accompany the available transport system. As a person, who is passionate about cars, and who lived the entire life in the capital, which enters the top 10 cities with the most intensive traffic (TomTom, 2020), I would like to investigate what the future holds for cars enthusiasts.

In the current situation when the sharing economy and internet of things are rising, it is vital for car manufactures to understand the future stand of car use. Therefore the main goal of my thesis is to make a forecast of how car sharing affects people’s perception of cars, which can give a better understanding of how to face new challenges.

This paper has the following structure: the introduction part is followed by a literature review, providing the information about sharing mobility background, describing the principles of shared economy, and comparing the related work. Methods are being described in the third

section. Data, results, and results from the discussion are presented in the fourth section. Limitations and conclusions are given in the last part of the paper.

2. Literature review

2.1 Shared mobility background

Shared mobility consists of vehicles, motorcycles, and other types of transport that can be shared among people for a limited time or distance of usage (Shaheen & Chan, 2016). In this thesis, we are not going to take into account bikes, scooters, motorbikes, or buses and will concentrate only on cars. Two-wheeled vehicles can be considered as micro-mobility (for 1 or 2 users), while cars are much more versatile and flexible. Shared mobility can be divided into two parts by the principle of operation: sharing a vehicle and sharing a ride.

When sharing a vehicle, the individual can rent a car that will meet his needs. He can get all the benefits of owning a car but without spending on its purchase, maintenance, insurance, etc. The low rent price is achieved because the costs are divided between individuals who use the car continuously, henceforward increasing the utilization of the car (Shaheen and Barth, 2006). Here one can distinguish between (1) roundtrip sharing, (2) one-way sharing, and (3) personal vehicle sharing. An example of roundtrip sharing is a regular car rental where an individual should return the car to the place where he took it (Shaheen and Cohen, 2013a). One-way sharing means that an individual can pick up the car at one place and finish his ride at a different place (Firnkorn, 2012). This option can work within the city, within the country, or across multiple countries. Personal (peer-to-peer) sharing is the sharing of the vehicle between the physical owner of the car who can allow temporary usage to individuals who are interested in car sharing (Ballús-Armet, Shaheen, Clonts, & Weinzimmer, 2014). In this case, there should be a company that will connect car owners who are willing to share their cars and individuals who are interested in renting a car.

When sharing a ride, the individual rents a car with a driver. He does not gain full access to the car, but rather becomes a passenger. Ride-sharing is becoming a popular way of traveling It is believed that by 2025 ride-sharing will reach a market size of USD 218 billion (Markets and Markets, 2018). It's not only making travel more convenient for passengers and car owners by reducing the cost of the ride for both (Agatz, 2012) but also can positively affect

the municipality by utilizing the car capacity and so reducing the number of cars on the roads used for personal trips (Agatz, 2012; Teubner and Flath, 2015).

The first recorded car sharing company called Procotip was launched in 1971 in Montpellier, France. The company had 35 cars and 19 stations. It closed 2 years later due to technological and financial issues (Biau, 1991). Nowadays, technology is not a bottleneck, but rather the enabler of shared mobility. Emerging innovative technologies like high-speed wireless internet connection, smartphones, GPS were the key factors that made shared mobility become a growing sector of the sharing economy (Shaheen, S., & Chan, N., 2016). The problem that ride-sharing and car sharing companies can face is customer adaptation. The survey that was conducted in 8 countries and covered 11,566 respondents showed rural and urban customers' interest and readiness for shared mobility. As a result, one can see that urban customers are more interested in e-hailing (48% over 32%), ride-sharing (45% vs 25%), and P2P car sharing (39% vs 18%) than rural customers (Knoedler D., Wollschlaeger D., Stanley B, 2020).

2.2 Sharing economy

At this stage of global development, the modern world witnesses an extremely rapid transformation of the sharing economy into a new global trend. It is an economic model, that is based on the collaborative consumption of shared goods and services, rather than on actual ownership of goods and services. Sharing access to goods is often performed through the online-based platform (Bardhi, 2012). It allows one to act as both a consumer and a producer, and enjoy the possible financial gain from the produced consumer value. As an alternative to expensive traditional services, it is cheaper to cooperate and seek help from a neighbor, and maybe even a stranger - for a small fee, or even just "thank you".

The spread of such practical ideas prompted the creation of online sharing Internet platforms that allowed people to quickly and securely share anything, regardless of content: things, services, knowledge, etc. At the same time, they promoted the idea of sharing when a person in need of something would turn to another person rather than to a shop. The list of such

sharing Internet platforms, subjects of the sharing economy, already includes hundreds of projects around the world. Today, the development of the sharing economy is of interest to many (Botsman, 2010).

The modern concept of sharing economy was formed by Rachel Botsman and Roo Rogers in 2010, co-authors of "What's Mine Is Yours: Rise Of Collaborative Consumption". The authors created a hypothesis that will drive the sharing economy and encourage people to become devoted supporters. Those hypotheses are still substantial in modern times. Furthermore, they match very well with the concept of car sharing, in particular: saving time and resources, reducing costs, rational consumption, trust in society, and usage of communication technologies. Mobile communications and technologies, as well as the Internet, are the key drivers and contributors to the growth of the sharing economy. According to the International Union of Communications (ITU, 2016), the Internet is available to almost 50% of the world's population. As of 2017, the number of Internet users is over 3.5 billion, and there is a natural increase in the number of supporters of the use of mobile applications.

Human needs can be limitless but the resources are limited. This global economic problem has been pursuing society for centuries. The sharing economy can give a response to this problem as it reduces costs in using the resources (Martin, 2016). In theory, the list of what can be rented is unlimited: from clothes to real estate. However, the sharing economy includes services in addition to goods.

2008 remarks the beginning of intensive development of the sharing economy despite that this year is usually associated with the global economic crisis. Around that period there appeared such giants as BlaBlaCar in 2006, Airbnb in 2008, and Uber in 2009. These giants are often called the underlying examples of the sharing economy model. In 2010, TIME magazine ranked the concept of the sharing economy as one of ten global ideas that will change the world (Walsh, 2011). PwC forecast stipulates that while in 2015 15% of the world's population used the sharing services at least once, by 2025, the total profit of the general consumption in the sharing service market will reach $ 335 billion (PwC, 2015). In

terms of revenue, it will catch up with companies employing a traditional approach in the same industries.

One of the principles of the sharing economy is to maximize the utilization of resources (Martin, 2016). Logistics is an illustrative example of this principle. By introducing shared consumption, logistics companies can reduce the cost of warehousing infrastructure, transportation, and personnel. Rational use of assets will have a positive effect on the final cost of services or goods, as it initially includes the cost of logistics. The report "Sharing economy logistics. Rethinking logistics with access over ownership", published in 2017 by DHL, examines several trends that are already affecting the entire industry, like sharing unused space (DHL, 2017). A startup called Flexe has developed a platform to lease excess storage space that already unites more than 1,000 warehouses, opening access to free space for the accommodation of small retailers and enterprises that produce seasonal products, when the warehouse is used for only a few weeks or months. Flexe uses customers to monetize unused storage space and payment is based on a flexible pay per use system - for the actual use of space; the startup earnings is 20% of each transaction.

Another aspect of logistics that lacks utilization, but would benefit from the sharing economy, is the transportation of goods. According to Frost and Sullivan (2018), 1 in 4 trucks on the roads of the United States and Europe is empty or not filled, in China, this figure reaches 40%. Such inefficient use of transport capacity and its downtime affects the speed and cost of delivery, as well as the cost of security of goods, and tracking of parcels. This problem is solved by sharing services by renting a space in the trucks. Joint consumption during transportation changes approaches towards logistics, sets new standards for openness and accessibility of logistics services. Startups like Saloodo, Freightos, Convoy, Loadsmart, and Huochebang are being created all over the world to increase vehicle capacity utilization. These platforms operate under a classic sharing economy scheme - they charge a certain percentage for each transaction. At the same time, users get access to transportation of their goods and the technical infrastructure of the company like real-time tracking and secure payments.

2.3 Car sharing

This chapter contains papers and studies that were made on car sharing. Articles were added to the literature review if they contained the following information: how car sharing changes people's perception of cars and how car sharing affects the transportation system in the city.

Let's distinguish ownership, sharing, and access in the paradigm of the sharing economy. Ownership of an item means possession of personal property (Snare, 1972). The owners of the item may identify themselves with this specific item, the item becomes an extended part of the owner (Belk, 1988). The owner has the right to access and use the object for his purposes without any restrictions. At the same time, sharing or accessing the item can be classified as a temporary possession of the item, without receiving the ownership rights (Chen, 2009). Belk (2007) describes sharing as the process of sharing an object that belongs to us with other people, and the ability to use objects that do not belong to us. However, there is one significant difference between sharing and access. Belk (2010) gives an example of family use of an object, where there is no clear division between owner and user. In this case, all users are interested in the proper use of the object and caretaking. Upon access, the user does not feel a social obligation to the object of use (Belk, 2010). In terms of car sharing, it can be the careless attitude to the car interior, reckless driving, lack of desire to wash or refuel the car. To increase the social responsibility of users, GetManCar blocks UAH 3,000 (around USD 100) on the user's card before using the sharing car. This deposit will be refunded overnight if the user did not damage the car during the use. This company also transfers the obligation to refuel the car to the user. With less than 20% of fuel, the user must refuel the car. Refueling spending will be refunded to the user + UAH 50 (around USD 2) to the bonus account, which can be used during the next trip.

In numerous studies, the quantitative measure was chosen as the main approach to describe how car sharing may change people's perception of cars. Cervero's and Tsai's (2004) study showed that one-third of car sharing members in San Francisco got rid of one or more previously owned cars, and more than a half of the members are not planning on buying a personal vehicle after they tried car sharing. Another study conducted in Europe and North

America by Shaheen and Cohen (2007) showed that between 11% and 34% of car sharing participants sold their cars in favor of car sharing. A survey in London among DriveNow members showed different results: members with higher income and higher levels of education were unwilling to implement changes in their car ownership, while members who were using buses and car sharing as their main mobility option are likely to change their car ownership after becoming a member of car sharing. However, this survey encompassed 298 members only and the data collection period was 3 months, so the outcome of the analysis cannot be generalized or applied to other cities/countries.

Cervero, Nee, and Golub (2007) tried to determine key factors that affect people's car ownership behavior. The researchers possessed data that showed results of a 4-year survey among members of CarShare (station-based car sharing aka round-trip). They have identified that age, availability of car sharing stations, and the presence of child/children in the family were the key factors to affect people's willingness to abandon owned cars and switch to car sharing. Although the statistical model was larger encompassing 530 respondents, the results of this survey may not be suitable for today. Modern car sharing is no longer station-based, cars are distributed in the city and members do not depend anymore on car station location but the location of the closest available car.

Another study takes a different approach in the analysis of how car sharing may affect car ownership. When preparing a questionary, authors categorize two types of car sharing: one-way and round-trip. Based on the results from the interviews they create 3 classes of users: 1) First Class that shows extremely low interest in car sharing, 2) Second Class described as "car sharing learning" includes respondents, who intend to replace a larger share of their trips by car sharing and 3) Third Class described as "car sharing enthusiasts", who intend to use carsharing the most. The result shows that 40% of respondents are willing to replace some of their trips on a private car with car sharing and 20% may postpone a planned purchase of a car or abandon a private car in favor of car sharing. The survey was conducted among 1003 respondents. The questionary was divided into two parts, and only the respondents who meet the requirements were asked the second part of the questionary. The paper considered to have

a more in-depth analysis of the collected data and a meticulous approach to select the respondents. (Liao, Molin, Timmermans, 2020)

In Beijing, the researchers analyzed how electric vehicles may affect car sharing. The authors state that car sharing leads to cost savings, increases transportation efficiency, and positively affects the environment. Additionally, the authors found factors that affect customer's choice when selecting between one-way and round-trip car sharing. For one-way car sharing the authors indicate that age, car ownership, shelter mode, the original cost for taxi users, perceived parking availability, cold weather, and relative cost differences are significant for the customers. For round-trip car sharing they indicate car ownership, income, gender, environmental concern, and relative cost differences. They also indicate that cost of car sharing is a significant factor for both one-way and round-trip car sharing. At the same time, car ownership positively affects one-way car sharing and negatively affects round-trip car sharing. (Yoon, 2017)

Another study, that took place in Boston, analyzed the actual ownership of the car with the "access to the car". Through the interviews, the authors found out that ownership of the car continues to be more valuable for the users than access to a shared vehicle. Sign value and brand community also come to place when we talk about car sharing, as some of the customers are proud to be associated with car sharing brand, while the others don't want to be seen in a shared vehicle, despite the brand of the vehicle itself. (Bardhi, 2012) We can see that there are people who prefer owning a car over a shared car, despite all of the benefits, like cost savings, that car sharing companies provide. The other problem is that some people don’t want to “look cheap” while using shared cars or don’t want to be associated with a specific brand.

The table below compares the results of related works more descriptively.

Table 1. Comparing the related work

Authors	№ of respondents	Quality of respondents	The essence of usage	Key findings
Cervero and Tsai (2004)	More than 1,800	Individuals who joined City CarShare	Round-trip	1/3 got rid of one or more previously owned cars, and more than a half are not planning on buying a personal vehicle
Shaheen and Cohen (2007)	298	DriveNow members	Round-trip	Between 11% and 34% sold their cars in favor of car sharing
Cervero, Nee and Golub (2007)	530	Car sharing members	Round-trip	Key factors to affect people's willingness to abandon owned cars: age, availability of car sharing stations, and the presence of child/children in the family
Liao, Molin, Timmermans (2020)	1,003	Panelclix was used to recruit respondents, 2 part questionary to filter respondents who meet requirements	Round-trip and one-way	40% willing to replace some of their trips on a private car with car sharing, 20% may postpone a planned purchase of a car or abandon the private car in favor of car sharing
Yoon, Cherry, and Jones (2017)	1010	Car sharing users	Round-trip and one-way	Investigated the factors influencing the consumer decision to use carsharing, the type of fuel of shared vehicle is indifferent to customers; cost of the service positively affects customer's choice
Bardhi, Eckhardt (2012)	40	ZipCar users in Boston	One-way	Some respondents prefer owning a car rather than having an access to the car; branding of the car can repel some of the customers

Based on the above studies one can conclude that car sharing encourages car owners to switch to car sharing platforms. In theory, this should positively affect traffic conditions during peak traffic hours and decrease the number of cars parked in the city center. An investigation by Stasko, Buck, and Gao (2013) demonstrates that every shared car on the road may lead to 15.3 less privately owned cars. Carplus (2015) surveyed car sharing members encompassing

more than 2,000 respondents in London. The analysis of the survey demonstrated a slightly different, but still positive impact on traffic: 8.6 less privately owned cars for 1 shared car, 19.8 determined purchases of the private car for 1 shared car. Another paper that was made in London by Le Vine et al. (2014) also shows a 3.5% reduction in the number of privately owned cars if the city implements round-trip car sharing services and an additional 0.5% reduction if point-to-point car sharing will be introduced. Yet another paper on how car sharing affects traffic was made in Ulm by Firnkorn and Muller (2012) and shows that there will be 19.2 fewer privately owned cars for 1 car from Car2Go company.

Emerging and fast-growing car sharing and ride-sharing platforms may affect the automotive industry in the nearest future. By 2030, there will be a drop in the annual growth rate in global car sales from 3.6% over previous years to almost 2%. The change in growth rate is affected by new car sharing services and other macroeconomics factors. Also, there might be a decline in private car sales for increased sales of shared cars. It is also expected that in 2030, 1 of 10 sold cars will be shared (Gao P., Kaas H-W., Mohr D., Wee D., 2016).

Right now if we compare the ride-sharing business model, shared mobility business model, and business model of traditional automakers, we can see that traditional automakers are focused on delivering the product to the end customer because that is their main income. A theoretic framework was created (Lasmar, Gandia, Sugano, Souza, Rodriguez, 2016) to simplify the findings from this comparison. As a result, one can see an unbundled business model for carmakers that separates the production business model from the car mobility business model and takes into account customer relationship management, product/service innovation, and infrastructure management. Some of the automaker companies already took the first steps to implement their carsharing platforms (Maven from GM, Drive Now from BMW, Car2Go from Daimler, and Tesla Network from Tesla), which means that we are witnessing a change in the tendency of car ownership.

The aforementioned articles gave a better understanding of how car sharing changes people's perception of cars and how car sharing may contribute to the city infrastructure.

3. Research methods

Literature review revealed that a lot of studies were quantitative: researchers were either conducting their surveys or were analyzing already collected data. Also, the researchers were assigned to a specific municipality. The solution, that works for one municipality is not guaranteed to be applicable for the other. Thus, my research is not based on a specific municipality or country, it is rather universal and versatile. For this endeavor, the qualitative research method was taken, as it can provide a rich description of complex phenomena, interprets events by actors from different roles, and helps to develop theories around the phenomena (Sofaer, 1999).

This paper displays the future of car ownership and the future of the automotive industry. When we are talking about cars and peoples' perception of cars in the future, we should take into consideration that the generation, which is going to face that future is too young to be precisely analyzed or was not born yet. As I am planning to discover detailed information on the aforementioned topics, in-depth interviews with experts were chosen as a primary method for data collection. I am seeking a more complete picture of the topic, so interviews with experts can fulfill my demands. (Boyce, Carolyn, and Palena Neale, 2006).

The results of this study come from open-ended interviews. 8 relevant transportation experts and stakeholders were asked 10 open-ended questions to understand their thoughts, attitudes, and motivations behind car sharing. The interviews were conducted through telephone conversations and live meetings lasting between 20 and 45 minutes. The goal of the interviews was to gather the key factors and trends that affect car sharing in both positive and negative ways and the questions were worded accordingly. The questions were open-ended so that the interviewee had the freedom to say whatever came to mind on the subject matter. The interviewees were allowed to tell about their own experience of car sharing after they were asked certain questions on how car sharing affects citizens, municipality, and the automotive industry. The interviews should be considered as the primary data, while researches, articles, and various papers as secondary data. In Table 2 below all the questions are listed with explanations as to why the specific question was asked.

Table 2. Explanation to list of questions

Question	Explanation
Have you ever tried using car sharing? From your own experience, what are the advantages of car sharing? From your own experience, what are the disadvantages of car sharing?	These questions will show if the respondent used car sharing and will tell personal experience with car sharing.
What are the key advantages and disadvantages of car sharing for the users, for the city, for the car industry?	Car sharing is considered a new way of city mobility. This question will uncover how car sharing will affect the user, the city, and the car industry.
What hinders the development of car sharing today? What barriers would you point out? What can be a driving force for the development of car sharing?	These questions will indicate key barriers that hinder car sharing development and key driving forces. As the aim of the paper to find how car sharing will affect the car industry, it is crucial to understand the factors that can positively and negatively affect car sharing.
In your opinion, will car sharing affect the further development of the automotive industry? How? In your opinion, do you think that car sharing can grow into a separate line of business for the automotive industry?	Direct questions to see interviewees' thoughts on car sharing and its effect on the automotive industry.
What can state and/or local authorities do to develop car sharing?	Direct question to pick up information about policy, regulations, and local authorities. The questions about "what hinders" and "driving forces" are too broad. I need to have a specific answer to this question, as policies and regulations may have a crucial role in car sharing development.
In your opinion, how will car sharing look in 15-20 years?	Open-ended direct questions to pick up interviewees' thoughts about the future of car sharing.

When searching for interviewees, I was considering 2 aspects: 1) the interviewee should be accessible for the interview, and 2) the interviewee should be professionally connected with the automotive industry, sharing economy, the infrastructure of the city, or be an independent car enthusiast. Table 3 shows the list of the respondents, their occupations, and additional information about interviews.

The qualitative nature of the study implies its limitations in scope, scale, and replicability. However, it helps shed the light on the emerging field of the sharing economy. Despite the

relative maturity of the car sharing industry in some cities, the collected data is still relevant as it gives key factors that affect the development of car sharing. As previously mentioned, the paper should describe the future of car sharing and the automotive industry. For this endeavor, the scenario planning method was selected. It is a technique, used for strategic planning and foresight (Ratcliffe, 2003). Hence, it fits very well with the main aim of the paper and provides an approach to have a better understanding of the future. Each of the scenarios describes the future of car sharing, the automotive industry, and the tendencies in car ownership.

The scenario planning method is a part of a strategic planning process. Fundamentally, a scenario planning method is used to develop alternative scenarios to shed light on the selected topic. This method helps to create multiple environments, that will occur in the future. Thus, we can mitigate risks and create plans at different points to guide ourselves through the decision-making process. The analysis begins at identifying and mapping key uncertainties – things, that we are not sure about. The uncertainties must exist within a topic that is being analyzed. The next step is to elaborate on how these uncertainties may affect the topic in the future. The third step is to pick the two most uncertain key factors and assign them to two axes to create a 2x2 matrix. The matrix creates 4 different fields – 4 potential scenarios. Thus, the following step is to narratively describe how the future is going to look like in each four of the presented alternative environments. As a result, we have developed 4 possible outcomes. Now we are looking at what might be happening in the future, where we are now, and what decisions should be made to steer us to the most favorable future. The reason for the scenario planning method is to win some time to mobilize the recourses to make an effective and in-time decision both in the near and long terms. (Mariton, 2016)

4.1 Results

After the interviews were gathered and translated into English, the codes were assigned to the corresponding quotes. You can find an example of the coding outcome in the table below.

Table 4. Example of quotes and corresponding codes

Provide basic infrastructure, this applies to a system of paid parking, which has guaranteed that the car will be in that place. This system should be evenly distributed throughout the city. (B)	Parking for car sharing
Explore the potential of use, at least in large cities, because it is the most favorable base for the development of car sharing. This has not been done systematically anywhere, this method of mobility is new and no one has studied its potential [talking about Ukraine]. This, of course, must be done. (B)	Analyze the potential of car sharing
Establish a stable dialogue with businesses that are interested in car sharing. These companies are communicating with city authorities, but it seems to me that the dialogue should be broader, to include at least the main players in this field. (B)	Dialogue with city authorities

Interestingly, that 5 out of 8 respondents mentioned autonomous driving in their answers, while the questions didn't ask directly about this type of mobility. When analyzing related work, autonomous driving was not considered as a future type of shared mobility, so I deliberately did not add this question. The prepared questions and the selected method of data gathering proved that a more complete picture of the selected topic can be collected.

All quotes that have been used during the analysis can be found in Appendices in Table 6. The most frequent codes are listed in the table below, respondents are marked with alphabetical letters.

Table 5. Codes

Codes/Interviews	A	B	C	D	E	F	G	Total	% of total	Cumulative %
Regulations		3	3		4	1	3	14	22,2%	22.2%
Policy		4	3	3	2	1	1	14	22,2%	44,4%
Autonomous driving	1		3	1		5	3	13	20,6%	65%
Infrastructure	2	2		2	2	1	2	11	17,5%	82,5%
Parking	2	2	2	1			3	10+1	17.5%	100%
Total	5	11	11	7	8	8	12	63	100%	

From the interviews, we can observe that regulations, policy, autonomous driving, infrastructure, and parking are the most frequent key factors that will affect the development of car sharing. Since this business is quite young and has not yet gained mass support from the citizens, the most relevant answers from interviewees were on regulation and policy. State and city authorities have not yet reacted to new market players. The regulations and rules that exist now in some cases hinder the development of car sharing. Because laws and regulations were adopted and agreed upon before car sharing was implemented, many aspects of this type of business were not taken into account. Now development is constrained by a vicious circle of business and government representatives.

Local authorities have not yet convinced themselves that car sharing is a new progressive type of mobility that can have a positive impact on urban mobility. To see the benefits of car sharing, authorities need to analyze the city, transport infrastructure, road infrastructure, and citizens' attitudes. It takes time and resources. Authorities are better off spending this money on solving existing problems that lay on the surface. On the other hand, businesses don’t want to enter a new market, where car sharing capabilities were not analyzed or discovered.

Cars, their insurance, customs clearance, and maintenance are very big investments. The company must understand that over time, their money must pay off and begin to generate income. To enter the market - they need to realize that the investment will pay off. For this endeavor, companies will need to conduct their market analysis. And even if the result satisfies them, there is still a problem with the regulations and rules. And this leads to negotiation between business representatives and local authorities. Someone alone has to break this vicious circle, and then we can confirm that the process has started.

Many respondents indicated that autonomous cars are the future of mobility. There is currently no clear date or year when autonomous vehicles will be available, legalized, and certified for use. One thing that should accelerate the development of autonomous cars is the regulation that was implemented recently in the UK. In 2030 all petrol and diesel-powered cars cannot be sold (Gov.uk). If more countries will consider implying this regulation, it will have an even more significant impact on electric vehicles. From a mechanical point of view, an electric car is much simpler than our usual car with an internal combustion engine. In an electric car, the electric motor is directly connected to the wheels of the car, the gearbox is missing. This simplifies the operation of the computer that will drive the car, as there is no need to choose the right gear. It also has a positive effect on the maintenance of electric vehicles: the absence of an internal combustion engine and gearbox means that there is no large number of parts that are prone to gradual wear and need regular maintenance and replacement of parts by maintenance guidelines.

The prevalence, common usability, and wide line-up of autonomous vehicles also directly depend on the regulations and rules in a given country. As soon as car manufacturers manage to reach, for example, 100% safety, countries will begin to adopt changes in legislation to allow the use of fully autonomous cars on public roads. At the moment, we cannot predict exactly how quickly the automotive industry will be able to release such a car and make it available to users. From a hardware perspective, we do not yet have a computer that is at the same time powerful enough to drive a car autonomously, compact, and energy-efficient enough to fit in a car, and cheap enough to manufacture. From a software perspective, the computer must make its own decisions. In cases where the car accident is unavoidable, we

cannot be sure what decision the car will make: in favor of its passengers or favor of other road users.

The current legislation makes it impossible to use a car without a driver, as there is no clear process of steps that should be taken in case of an accident. For example, who will be guilty in case of an accident: the owner who did not respond to the danger and did not prevent the accident, the software manufacturer who did not calculate all the possible actions of the car in critical cases, the municipality utilities that did not monitor the quality of road markings and signs. There is also an unresolved issue of insuring such a car and under what conditions and to whom the insurance company should pay compensation. The very concept of using an autonomous car is very interesting because in this way transport and logistics companies will be able to maximize the utilization of such cars, which means a quick return on investment and subsequently higher profits due to lack of human drivers.

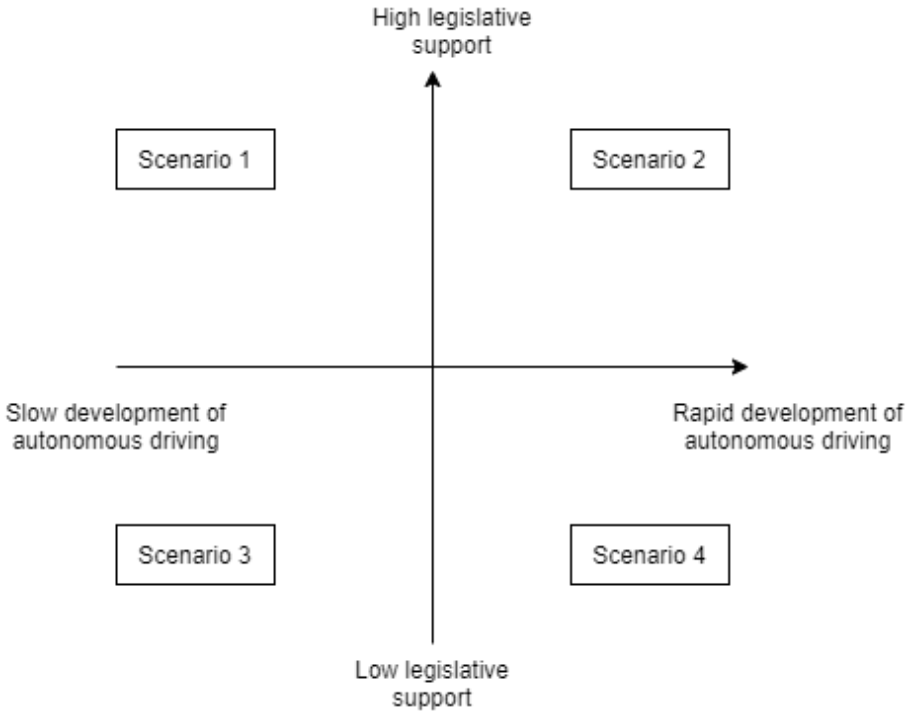
Next on the list are infrastructure and parking. These 2 aspects also should be considered as factors that influence car sharing. Since car sharing is the mobility solution in the city, it is very important to understand how car sharing fits into the existing transport system of the city and its infrastructure. These 2 aspects were separated into 2 different codes as respondents directly emphasized parking lots (parking spaces), and infrastructure (charging stations for electric vehicles, transport, and road infrastructure). 5 respondents noted that car sharing can have a positive impact on the city: reducing the load on road traffic, reducing the load on parking lots. 2 other respondents do not fully agree with this statement. Shared cars have less utilization than ride-sharing cars and taxis: they hardly standstill in the city, are always on the move, and thus do not take up parking spaces. While shared cars will stay in the parking lots while waiting for their next users. 4 respondents noted that the allocated parking lots and parking privileges for shared cars can have a positive impact on the development of car sharing. Citizens will be convinced that in the city center there will always be a free place for a shared car and they will not have to pay for parking. This will be a competitive advantage of car sharing over a private car. As for the infrastructure for electric vehicles and the transport system, the city and state authorities are already actively involved in the regulation of such vehicles. Thus, in some countries, consumers do not pay tax to

import electric vehicles, some banks may provide loans at a significantly lower interest rate for electric vehicles, parking owners are obliged to allocate separate spaces for electric vehicles with chargers. As for charging stations, one of the solutions for the city is to find investors or negotiate with companies that import electric vehicles.

4.2 Scenarios

For the scenario planning method, the 2 most uncertain key factors should be chosen. The first uncertain factor is autonomous driving because it has an impact on the development of car sharing. The second factor includes both policy and regulations and is titled "legislative support" because the policy and regulations depend heavily on local and state authorities. The key factors were chosen because interviewees mentioned these topics the most. Figure 1 below shows how different scenarios are displaced on a 2x2 matrix.

Figure 1. 2x2 matrix



Below we discuss four different scenarios in terms of how 2 selected key factors affect car sharing and the automotive industry.

Scenario 1: Mid-way

High legislative support, slow development of autonomous driving

The number of autonomous vehicles on the roads currently is low. Autonomous cars have not been widely spread thus far because, until now, car manufacturers have not been able to ensure necessary safety standards. Nevertheless, car manufacturers continue investing in R&D. Independent investors and car manufacturers, who are actively investing in autonomous driving, are willing to receive a financial gain. So, to ensure safety standards and get financial gain, car manufacturers are adapting autonomous cars to a specific city. In doing so, they incorporate into the cars a detailed map of the city, which includes all road signs, rules on how to pass car interchanges, zones for parking, problematic areas, and steps to be taken to drive through these areas. Using machine learning and big data, the car knows the driving habits of inhabitants, can predict their behavior on the streets, and avoid accidents. KPMG's executive automotive survey claims that there will be isolated "islands of autonomy" where autonomous vehicles operate under a certain set of rules (Global Automotive Executive Survey 2020). These precautions permitted to increase the safety of autonomous vehicles, which resulted in the certification of cars by the relevant government agencies, thus making the cars legally useable on the roads. However, R&D, adaptation, and certification of autonomous cars adversely affected the price of an autonomous car by its increasing to the price range of an executive car. Based on the price, autonomous cars are competing in the premium segment but lack luxurious interior elements. At the same time, car manufacturers are providing autonomous cars to ride-sharing companies and taxis under customer affordable terms and conditions. The car manufacturers continue providing a product rather than a mobility solution, so they were not able to develop a separate distribution channel with a big customer base. In this regard, a win-win opportunity for the car manufacturers lays in symbiosis with ride-sharing companies and taxis. Taxis and ride-sharing companies now offer a customer the option of a switch from a regular car with a driver to an autonomous car. The price of the ride by an autonomous car will be cheaper for the customer as there is no need to pay for the driver. Further, high utilization of autonomous vehicles would allow returning investments faster. Interestingly, car sharing companies will

unlikely benefit much from autonomous driving as they will be providing a different mobility solution: the customer becomes an owner of a car for a certain period, while autonomous cars are mimicking/replacing taxi and ride-sharing.

The car manufacturers will not experience a drastic change in their business model; rather autonomous vehicles will become a separate segment in the manufacturer's line-up among SUVs, sedans, coupes, and electric vehicles. Some car manufacturers that were experimenting with car sharing and subscription-based business models may implement their experience on autonomous driving and add mobility solutions to their existing customers. Nissan with its Nissan Switch subscription-based program is a great example in this case. The customer can choose a plan that fits well with his demands because Nissan provides a wide range of cars that can be exchanged merely daily and, for additional payment, one can get their exotic GT-R model. Nissan claims that "This program provides more choice, convenience, and flexibility. For those who want a sedan during the week and an SUV or sports car, like the GTR, on the weekends, Nissan Switch provides the solution." (Nissan Motors Corporation, 2020).

Scenario 2: Positive

High legislative support, the rapid development of autonomous driving

The number of autonomous cars on the roads is larger than the number of cars with manual control. We can see ~15% of fully autonomous vehicles by 2030 and as much as almost 90% by 2040 (McKinsey & Company, 2016). The first fully autonomous cars are used on highways because the traffic intensity there is less than in the city and it is easier to adapt the car for use on highways. The introduction of autonomous cars into the market is gradually organized: first, countries improve legislation, then the countries make changes to traffic rules, and finally, the high safety level of autonomous cars began to gain the trust of the users. KPMG's survey denotes that 83% of execs agree that regulators and industry policies are driving technological agendas (Global Automotive Executive Survey 2020). Autonomous cars are perceived as a safe and convenient way of mobility. New high-performance and energy-efficient computers, as paired with software already tested on highways, allow

manufacturers to conquer almost 100% safety. Once such cars are properly certified, they are used legally on roads without any restrictions. From KPMG's research, we can see that legislation and policy are a substantial key factor that shows the country's readiness to adopt autonomous vehicles. Singapore, New Zealand, and the Netherlands are the top 3 countries in terms of adaptation of their legislation and policy (Autonomous Vehicles Readiness Index, 2018). In the US, 33 states accommodated autonomous vehicles on public roads (Medium, 2018). Car sharing and ride-sharing companies are very interested in such cars. For example, the car sharing companies will not bear the cost of cosmetic repairs of cars after the careless attitude of users. Ride-sharing companies and taxi companies will be able to increase their profits by higher utilization rate of autonomous vehicles as cars do not need anything except gas and maintenance while drivers need to be paid and their workload is subject to limitations. The return on investment of autonomous cars is higher and faster than that of a regular car. KPMG's executive survey shows that 82% of executives are confident that measuring vehicle usage or miles driven will become the new focus (Global Automotive Executive Survey 2020). It supports the assumption that car utilization will play the most important role in the future, let alone that the high safety of autonomous cars will decrease the number of accidents on the road almost to 0. Car sharing and ride-sharing companies are blending as they are offering the same mobility solution. Once the customers see for themselves the advantages of an autonomous car over a private one they may gradually abandon 'the ownership of a car' attitude in favor of autonomous car sharing.

The business that already had their car sharing and car companies, which provided cars to customers by subscription, becomes an active player in the car sharing market. A large base of own customers has given the business a confident entry into the market. The car manufacturers will change their current business model to operate 2 separate business models at once: the first one will continue selling cars to the customers with maintenance, and the second one will be Mobility being a service business where the main product is providing mobility solutions for the customer. The most important criteria for customers when choosing a shared car is the price of the trip, and the one who provides the best price gets the customer. Autonomous cars give customers a lot of free time while riding to the destination, and

customers have to fill in such time somehow. Therefore, another criterion like “filling in the time” will be added to the price: what exactly the car sharing company can offer to program participants during the trip to best meet their needs. Since as yet there is no such market, it is hard to predict what kind of combinations there will be.

Scenario 3: Relatively realistic

Low legislative support, slow development of autonomous driving

Low legislative support and slow development of autonomous driving resulted in a miserable number of autonomous cars on the roads. KPMG’s executive survey shows that more than 1 in 5 execs do not believe in the adoption of autonomous vehicles before 2040 (Global Automotive Executive Survey 2020). Automakers couldn’t meet the safety standards, so the vehicles could not be operated without the actual driver behind the steering wheel. The cars are being equipped with various driving assistants, that still can control the car automatically, but due to restrictions and regulations, these cars can only help to control the car, but not make the decisions instead of the driver. While driving in automatic mode, the software inside these cars is analyzing drivers' attention to the road. If the driver is getting distracted from the road too frequently, the car would not allow the driver to use automatic mode until the end of the trip. On the other hand, software and driving assistants made the cars safer and easier to drive. Thus, young drivers would feel more comfortable riding these types of cars. Car sharing didn’t face a drastic development as well. Since local authorities don’t see car sharing as an option that can solve rush hours traffic jams and problems with parking in the city center, car sharing didn’t receive any benefits from the government in form of dedicated parking spots or import tax exemption. As the cars became safer and easier to drive, car sharing companies lowered the minimum driving experience and the amount of collateral during the rental, which attracted new customers. Likewise, car sharing companies could cut the losses on cosmetic repairs, because cars can park themselves more accurately and monitor the surrounding traffic while in motion. Car sharing has its niche on the market, but it’s hard competing with ride-sharing companies, which deliver mobility at a lower price.

Car companies are offering vehicles with driving assistance as an option. Due to restrictions and lack of regulations, they cannot offer fully autonomous cars to the customers. Besides, they are still experimenting with the subscription-based business model, but, due to high import taxes, it's only mimicking auto leases, with hardly any substantial advantages for the regular customer. Meanwhile, luxurious car vendors like Land Rover and Jaguar can combine the subscription-based business model with a personalized customer experience. Pivotal is a great example: they take care of insurance, tax, and services, the car is being replaced every 6 months, they have a 'home delivery' option and roadside assistance. (Pivotal, 2021) In the end, the customer is not only receiving a car, but also strong customer support from the company.

Scenario 4: Negative

Low legislative support, the rapid development of autonomous driving

The rapid development of technology allowed car manufacturers to produce autonomous cars at affordable prices. The level of safety in these cars is reaching almost 100%, however, local and state authorities have not reacted to the emerging phenomenon of autonomous cars. It means that these cars cannot be legally operated on the roads without drivers. Furthermore, the traffic flow, where both autonomous cars and manually driven cars meet together, was not tested. According to KPMG's executive survey, 77% of execs believe that this kind of mixed traffic may lead to severe safety issues (Global Automotive Executive Survey 2020). On the one hand, this affected the interior of the new cars: they still have a driver's seat with a steering wheel and all other controls that autonomous cars do not need anymore. On the other hand, the authorities did not impose any new restrictions on autonomous cars, which means that end-users can use the autonomous option from time to time but only at their own risk. Some private parking lots, like those in front of the supermarkets, allowed users' cars to park themselves automatically – there is no more need for drivers to ride circles around a parking lot in search of available space because the car can find a space independently from the driver. And when it's time to leave, the car can drive right to the main entrance minimizing the walking time to the car for the driver and passengers. Car sharing companies may benefit

from such types of cars, if local authorities would allow autonomous cars to park themselves on the streets, as well. This would create an added value to the customer because the nearest free parking spot can be a long away from the point of the customer's destination. ParkNow from BWM is a solution that helps drivers find parking spaces on the streets (ITS International, 2018). Combined with autonomous driving, this could become a game-changer. In this case, car sharing could compete with ride-sharing, but due to low legislative support, the car sharing companies are not allowed to implement an 'automatic parking' feature in their cars. In its turn, a car sharing company is not interested in purchasing autonomous cars as their price is higher than that of a regular car while the return on investment is almost the same and there is no added value for the customer in the autonomous car.

The car manufacturers are not motivated in the production of autonomous vehicles because it is more expensive and the end-user cannot fully benefit from the options an autonomous car can offer. Although one can see autonomous cars in the line-up of the car manufacturers, this option is available only to mid to top-end models. In addition, as car manufacturers are still experimenting with subscription-based business models their new autonomous vehicles cannot become a driving force for the dramatic change in their business model. Previous BMW's experience in Nashville showed that paying for the subscription is more expensive for the customer than lease a car. (Hawkins, 2021) Importantly, when a leasing contract expires the car becomes the property of the customer, while the customer who is paying the subscription will never become the owner of the car.

The table below clearly compares the 4 aforementioned scenarios.

Table 6. Scenario comparison

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Number of autonomous cars	Cars are not widely spread	By 2030 – 15% of cars are autonomous By 2040 – around 90% of cars are autonomous	Cars cannot be driven autonomously	Miserable amount of autonomous cars
How cars operate	Cars operated in a specific area or location (e.g. in a separate city)	Cars are operated countrywide /world wide	Cars do have various driving assistants, but cannot be operated without a driver	Cars can park themselves, but only in allowed areas
Price	High price	The price is higher than a manually driven car but the difference is not significant	Price is higher if the car is equipped with driving assistants	The price is higher than a manually driven car, but not significantly
Car sharing/ride-sharing	Car sharing will not benefit Ride-sharing may have an option of the autonomous vehicle at customer's choice	Car sharing and ride sharing merge because they provide similar solutions	Car sharing – less damage to the cars attracts new customers. Ride-sharing – higher safety rides	Car sharing and ride-sharing will not benefit as autonomous cars do not provide added value for the customer
Car manufacturers	The autonomous car is a self-standing model in a company's line-up	Operate 2 business models: selling cars and providing mobility solution (Mobility as a Service)	Experimenting with OEM car sharing	Experimenting with a subscription-based business model

I have identified 4 possible scenarios, which describe different future alternatives. 1. Mid-way scenario benefits from high legislative support, but slow development of autonomous driving prevents the widespread of autonomous cars. 2. Positive scenario is more on a utopian side, with high legislative support and rapid development of autonomous driving. 3. Relatively realistic scenario doesn't require any steps or decisions to be taken to achieve the described future alternative. It can not be described as the worst, but not favorable. 4. Negative scenario shows how low legislative support hinders the development of autonomous vehicles, and, thus, negatively affects car sharing.

Using the scenario planning method I have discovered that legislative support and development of autonomous vehicles are the 2 most uncertain key factors that affect car sharing. It is important to denote that those factors are external and should be addressed accordingly. The legislative support will highly depend on the municipality or country, so that is one more point that should be taken into consideration.

5 out of 8 respondents were talking autonomous driving during the interviews. They had quite positive feedback on this topic. Their thoughts on car sharing and car industry development jibe well with the second scenario. I, as a car enthusiast, can say that people who are interested in this topic would see development in scenario 2 direction as preferable.

4.3 Discussion

The results of this thesis indicate the external factors influencing the development of car sharing. For potential owners of car sharing systems, the results show that car sharing services depend on 2 factors: legislative support and autonomous driving. I have found 4 possible outcomes of car sharing future and interpreted each into the narratively described scenario. To develop in the direction of the second scenario, car manufacturers need to partner with suppliers and developers of software and hardware. Car manufacturers also need to negotiate with local and state authorities so that new laws allow autonomous cars to be driven in the cities. At the same time, car sharing companies also should negotiate with local authorities about parking spaces for shared cars, etc. Thus, automakers will be able to eliminate the 2 most uncertain factors affecting the development of autonomous cars. Interviewees also stated that a properly designed car sharing approach can provide certain benefits. A good example would be less strain on urban infrastructure. But these changes will only be felt if the share of shared cars is significant to meet the needs of users and encourage them to leave private cars.

From a perspective of strategic planning, the next step after the description of scenarios is the decision-making part. As mentioned earlier, there is no single solution that can satisfy the needs of different cities and countries. Thus, a final decision shall be made by the local authorities or entrepreneurs.

5. Limitations

The limitations come directly from the nature of the qualitative analysis. The findings and scenarios cannot be applied to all car sharing companies, automotive industries, and countries. The interviewees were all from Ukraine, so the key findings may be inherent in Ukraine at its current state. Respondents from other countries may give different answers. The other limitation is the number of interviewees. A greater number of interviewees would have given a better conformation on the key findings and probably would give a much broader view on the car sharing development and its effect on the automotive industry. Therefore, the area for future research will be a more sophisticated question and a larger sample of respondents. For example, interview representatives from car sharing companies. A questionnaire for respondents can be designed for a specific country or a specific city. Most likely, additional information gathering will provide extra insight into the factors that affect car sharing and highlight the steps that will be needed to be taken to enhance the development of car sharing.

6. Conclusion

The future of car industry is uncertain, therefore I wanted to bring some light on this issue by writing the given paper. There are following concerns like what kind of fuel will be used and what will be “the new role of the car”. My paper was focused on the latter topic. I was inspired by the current traffic intricacies in big cities. Moreover, reorganization of this type of transportation will involve almost everyone. Thus, it is necessary to enhance understanding of changes in the future of mobility.

This research paper aimed to gather the necessary data that describe the current situation on the market and unfolds how the future of car ownership looks like. Based on the qualitative analysis of the interviews, 2 key factors, that affect the development of car sharing were found. Using the scenario planning method, 4 different scenarios that shed light on the future of car sharing were narratively described. The results show how these 2 key factors affect how the cars are being operated.

For the next analysis I can propose following directions. First one will be addressing of the issues which I described in the limitations part, namely larger and diverse sample of the people for the interview. Second one can be narrow case study. For instance, we can take one city and estimate how car sharing or autonomous driving cars may influence traffic situations. Third one is on the firm level, for example, making a structural forecast of the development or how challenging it will be to adapt for the future circumstances.

7. Appendices

Graph 1.

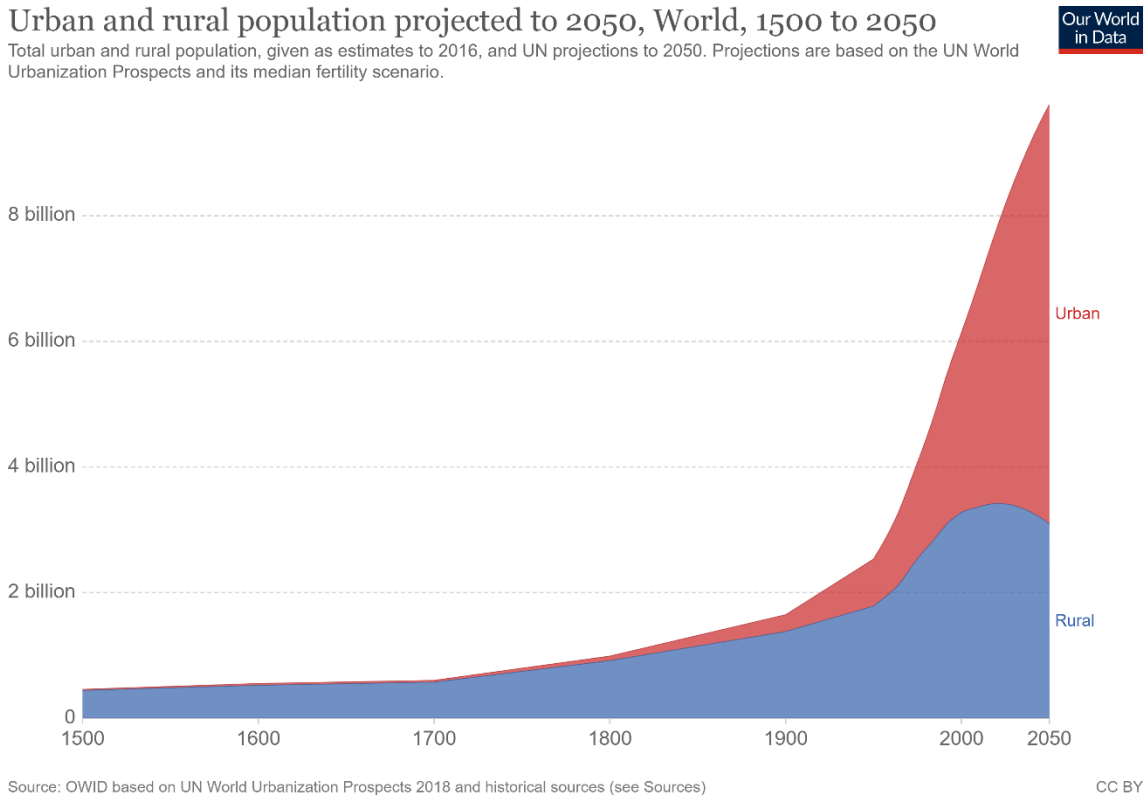


Table 3. List of respondents and information about interviews

Name	Position	Classification	Interview date	Interview duration	Location	Sex
Arkadiy Vershebenyuk	Former GM Uber in Eastern Europe	Market Expert	18.03.2021	41:28	Kyiv	M
Hyundai representative	Official Hyundai importer	Stakeholder	26.03.2021	N/A, sent written answers	Kyiv	N/A
Nataliya Nesterchuk	CEO Sixt Ukraine	Market player	15.04.2021	34:42	Kyiv	F
Oleksandr Anisimov	Researcher at Buro-n-Line	Urban planner	26.03.2021	45:33	Kyiv	M
Petro Rondiak	Head of the Management Board in Winner Group (official importer of Ford,	Stakeholder	23.03.2021	23:40	Kyiv	M

	Land Rover, Bentley, Volvo, Porsche, and Jaguar)					
Roman Kazanko	Managing partner at ARMA (official importer of Renault)	Stakeholder	6.04.2021	14:31	Kyiv	M
Serhiy Vovk	CEO of Centre of Transportation strategies	Market Expert	22.03.2021	14:19	Kyiv	M
Viktor Stelmah	Auto reviewer, a journalist at Autoconsulting and mobility expert	Media expert of automotive market	29.032021	27:06	Kyiv	M

Table 7. Interviewees answers and coding

Advantages for the city	
"*The advantage for the city is that, in theory, one person will require fewer cars. Accordingly, it is affecting parking, it is affecting traffic jams, it is less road wear. In theory, this is less movement of cars.*" (A)	Less load on city infrastructure
"The first is that car sharing will reduce the load on urban infrastructure. We have researched this issue a bit and we see that one car in car sharing replaces, for example in the city, about 10-15 cars that are used privately by citizens. Obviously, this is new mobility, and it has great potential." (B)	Less load on city infrastructure
There are fewer cars in the city, the air is cleaner, there are less traffic jams. This is where car sharing began: the use of one car by people from the same yard. This is a good thing for the city. (F)	Less load on city infrastructure
Helps reduce pollution if car sharing models are electric cars. Also, choosing a model can solve the problem of parking. Smarts are half the size of a regular car, they take up less space. (G)	Solve parking problem (+ less pollution)

This would solve the problem of parking because conditionally 400 cars would not move 400 people, but let's say 7 times more. The same cars, but the cars are less parked, they are in demand. It's not that someone came to the center and stood until the evening to then go home. The cars stand for a maximum of 40 minutes, and then go on. Therefore, it could solve the problem of parking. (G)	Solve parking problem
If people started using car sharing frequently, there would be much less strain on parking lots. Cars would be in motion, not parked as often as they are now. (C)	Solve parking problem
If car sharing is adopted by a certain number of people as the predominant solution over owning a car, it can really improve the traffic situation on the road to some extent. The car then becomes part of public transport, car sharing increases the utilization of the car. (E)	Another way of mobility
To some extent, this is a more flexible way of owning a car at a time when it is needed. Ride sharing is the solution to the spot problem: now I need one trip, and I have the choice of either driving my own car or an Uber. Uber can be more convenient in many cases: I do not need to look for a place to park, it is if we are talking about residents of large cities, it is more flexible. Car sharing can be an interesting solution in terms of not only a spot problem (one trip), but if you need to go to several places, or need a car for a day to go out of town. (E)	Another way of mobility
People who buy a personal car do not think that they do not need the car itself, but need a solution at a certain time. Here, car sharing can deliver benefits for the user. (E)	Another way of mobility
For each city, it would be prestigious, interesting and would show a higher level of development by providing this service. The transport system would be very extensive. This gives more opportunities, more choice. It is possible to choose not from 1-2, but from more options. (G)	Another way of mobility

If we know that there are parking lots where there are cars in free access, then it also gives some freedom to choose a car, take it and drive it. (G)	Convenience for the citizens
Advantages for the user	
"In addition, it saves your own costs, this is especially important for young families in the first place. In addition, it saves you as much time as possible due to the fact that you save on traffic jams." (B)	Save money
Lower costs for long trips, in the presence of developed vehicle parks - access to car exclusives (such as electric cars or premium cars) (D)	Save money
It is necessary to compare the total cost of owning a car for a certain period of time and the use of a car sharing car. It seems to me that mathematics will gradually really work in favor of car sharing. The car, as an asset, constantly loses in price on the one hand, on the other hand, it requires additional spending: gasoline, insurance, maintenance. And it doesn't matter how much you use it. The utilization of a personal car is very low. (E)	Save money
I do not need to look for a taxi, call a taxi, I saw the car on the map near my house, and took it into use. This is an advantage. If the company has a large coverage area, then you always have a car at hand, you always have access to it. (F)	Convenience
Car sharing is a personal capsule without a driver. You are on your own, you go where you want, completely your own space for yourself, for your family, for your loved ones. There is some freedom and comfort. (G)	Convenience
It is cheaper than owning your own car: insurance, maintenance, parking. It [car sharing] is more affordable. (G)	Save money

Disadvantages for users	
The structure of insurance payments and control over the condition of cars is not always transparent. The complexity of operating applications and billing for the older generation. (D)	Too complex to use
Before the trip, I have to inspect the car and record all the damage, so that then the existing damage is not recorded on me. When you take a car sharing car, you are always in a hurry, you need a car already. You do not have time for a detailed inspection of the car: damaged wheels, scratches, damaged interior. (F)	Too complex to use, time-consuming
Taxis are easier. There is a category of people who have the inertia of thinking. They no longer want to learn new software, learn how to book a car there, how to rent it, how to take pictures. It is much easier to call a taxi driver. Car sharing is too complicated. (G)	Too complex to use
It would be convenient for me to drive from home to the airport and not pay for parking this car. But going to the car with things is inconvenient, there is no guarantee that the car will be waiting for me in a convenient place for me at the right time for me. (F)	Certain risks
Now the big problem is covid. There is no guarantee that someone will process this car after each customer, there is no guarantee that I will get in the car and not get infected.	Certain risks
Underdeveloped segment and low availability. Not as affordable as we would like. There are no free cars, say, within a radius of 100 meters. (G)	Less convenience
Only you drive your own car. Everything is adjusted to you: mirrors, seats, steering wheel. You also know where everything in your car lies. And yet, this is the car of your dreams. Car sharing can be the most economic option [the closest car to you can be from the cheapest class]. (G)	Less convenience
Disadvantages for the city	

One of the disadvantages for the city is that a certain amount of the parking lots is always occupied while the car (carsharing car) is waiting for its customer. These cars are all parked and waiting for someone to pick them up. For other car users, this is a bit inconvenient if it gains a lot of volumes. (A)	The utilization of the shared vehicle is not high enough
It's hard for me to name the disadvantages, if it worked - it could be analyzed [talking about Ukraine]. But it is obvious that if this procedure works, the formalization of car sharing will comply with the law, the disadvantages of car sharing can be reduced to zero. I mean the risks that the car may be taken over by a person who does not have the right to use it and so on. (B)	No procedures, formalization or policy
Depends on the situation, but I don't really feel the difference between car sharing and a taxi in terms of traffic efficiency. For me, a taxi is a car that runs up 70-80% of its time. Accordingly, it does not create problems with parking, does not take up space in the city. They drive around the city and do not take up space. (H)	Parking
Disadvantages for the car industry	
If carsharing will become a common story, it will result in a decrease in sales. In most cases, those people who take cars for car sharing, in order to reduce the cost of an hour of use, take used cars (60 - 70 thousand kilometers run) In fact, they don't buy cars for car sharing in car dealerships. (A)	Decrease in sales
If we are talking about pros for car dealerships, I do not know, there are no positive effects. If car sharing will continue to grow. (A)	No positive effect on dealerships
Car sharing reduces the number of cars per capita. When you say that you don't need 2 cars in the family, or you don't need a car in the family at all. You need the car three times a week. So you went and picked up a car for 2 hours, used it for your own purposes and gave it away. That is, in fact, you reduce production for the automotive industry,	Decrease in sales, decrease in production

reduce sales. Mass production lives just on volume, only you reduce the volume, then your cost grows. Because of so-called overhead costs, which must be divided by the volume of production. You need to either rebuild or record losses in this direction. (A) *This is not a good thing, because fewer people will buy cars. Before everyone bought their own car, now there will be no such need. The car industry is ready for this because there is already a trend in European cities, where young people do not want to have their own car because it has a lot of problems: maintenance, parking, and it is expensive. 5-7 years ago, young people began to prefer taxis. The car industry followed suit, so they paid a lot of attention to autonomous cars, which were then going to be used in car sharing. Covid greatly prevented this. Uber even sold its autonomous division, which they had been working on for several years. Because users do not know who used the car before them and whether they will be infected during the trip. This will change over time, and autonomous cars will be used in car sharing. There are no financial problems for the industry, an autonomous car is more expensive than usual, so the car industry will get its money. (F)*	Decrease in sales, people's perception is changing, autonomous driving
Effect on car industry	
There are examples when a car company (dealer) sells an option to use different cars from its model line. You sign the agreement, and you pay not for the car, but for the use of the cars that the company has. You can ride an SUV for one week/month, another month drive a sports car, and so on. For me it is a very interesting service, I'm waiting for it to appear in Ukraine because I'm quite a petrol head, I really like cars, I enjoy driving different types of cars and so I would be interested to try this service. I think that such technologies, aimed not at the direct sale of cars, but at their use by customers, they will become one of the defining sales channels in the future, and on a par with classic sales, when the car becomes your property. In this way, there are benefits for the consumer because he has the opportunity to get acquainted with several models without the need to buy them. And for the automakers, it is also a plus because they receive	New sales channels - subscription to a car

another channel to sell their products. I think that companies that are the first to master this tool and be able to adapt it to the realities of local markets, will gain an economic advantage by increasing their market share. It seems to me that this would be very interesting for companies, especially the premium segment because these cars are not available to everyone. But there will be an option to take a car for yourself to use [extended subscription-based use, not a test drive], and then make a more augmented decision to purchase the car or not. (B)	
There may be some adaptation, if the car sharing model spreads, then for them [automotive industry] it may mean some unification of models, possibly narrowing the model range. If car sharing develops, you can create a universal type of car, the most common, and focus on it. This is advantageous in terms of cost. This can be beneficial in terms of marketing efforts. A big cost part for the industry is marketing and selling these cars. If they have large users, such as car sharing companies, or if they can become car sharing companies themselves, this can significantly reduce their marketing and sales costs. (E)	Unification of model line, reduce expenses on marketing, have their own car sharing
In the event of a change in consumer patterns, the automotive industry will be able to generate a more optimized product for these proposals. At the same time, there may be a significant impact in the field of product classes: mass product - rational and available in all areas of use or ownership. Premium - an individual that meets personal needs. (D)	Unification of model line

What hinders the development of car sharing today? What barriers would you point out?

Most people think that a car is like your home. We spend a lot of time with them. People want to know where and what they have in their cars, who is sitting inside if the car is clean. In a car sharing car, you do not know what happened to the car yesterday. And this is the perception of the car as a home that has not changed, the "not pragmatic use"	Attitude: My car - my property, the old way of thinking

of the car to just transport yourself from point A to point B. (A)	
The psychological factor of owning your own car. There is a postulate of owning your own property, as well as owning a car. (E)	Attitude: My car - my property, the old way of thinking
People's awareness, politeness, tact, accuracy, culture. Fear of investing: vandalism, theft, careless and untidy attitude, attitude "not mine - not taking care of it".(G)	People's attitude
Consumer way of usage in Ukraine involves in most cases the ownership of the product and not "the usage of it", especially if we are talking about "use when needed". (D)	Attitude: My car - my property
And the final point puts consumer behavior - "own" and not to "use".	Attitude: My car - my property
The second thing is ease of use. Still, car owners are more accustomed to the fact that the car is at your house at any moment, near work, and when you need it - you take your car and drive. In car sharing you have to look at the map to find a place, where an available car is parked, somehow get to that car, take it and go. In fact, car sharing is needed for people who rarely use a car. (A)	Too complex
In Ukraine, in fact, car sharing is almost at the price of a taxi. I think that in some cases it is even more affordable to call a taxi. Taxi will come to the house, will pick you up, and will deliver you to the place that you need. You don't think about parking or anything. This is a deterrent, because in fact the price of use matters. And car sharing is used when you need a car for your personal purposes: to take something, to bring something. Not only take yourself from point A to point B, but when you need other advantages of owning a car. (A)	Price to value ratio
What hinders car sharing: Expensive car insurance. Very expensive compared to Western Europe and the United States [talking about Ukraine]. A cheap alternative to	Price

car sharing is also a barrier (if compared with taxi companies or Uber). (C)	
On the one hand, all the principles of maintaining the vehicles, on the other hand, high credit and insurance rates that reduce the profitability of services. (D)	Price
The high price of autonomous cars also hinders development and raises the threshold for entering this segment. (F)	Price
Undeveloped parking infrastructure, because you have to park the car in the permitted places, officially in the parking lots. In Ukraine, there is a big problem with finding a place where you can leave the car. (A)	Undeveloped infrastructure - parking
It seems to me that this is such a passive position of local authorities, which does not yet fully understand the benefits of this type of transport, including for the city. Here, it is very important that this industry works as one of the elements of urban mobility. It depends not only on business operators, but also on the city authorities being active in the discussion. This applies to such issues as the allocation of paid parking lots + some specific legislative issues that need to be addressed. There were problems when law enforcement arrested the car, because drugs were found in a woman who used a shared car. The car was confiscated, and while the investigation was going on, while the relevant criminal proceedings were underway, the car was under arrest and was returned a few months later. Of course, this makes it very difficult for companies to do business. Some points concerning the legal status and the moments of taking into account the losses that may occur, they need some settlement. The problems always exist, there are no ideal markets, but if the local government took a more active position, it is the desire of business, and all these issues related to regulation could be solved. (B)	Parking, policy and regulations
Last but not least, the unsuitability of urban infrastructure for such products (allocated parking spaces, the availability of high-speed charging systems for electric vehicles,	Undeveloped infrastructure -

clear and transparent regulatory policy on insurance and technical supervision of such parks). (D)	parking, charging stations, policy
We have considered this model more than once in the expectation that it (car sharing) will be a cheaper transportation mechanism than others available, such as uber. Uber is very cheap. If the car was officially brought, officially certified, the taxes were paid, then our prices were too high to be interesting for the customer. (C)	Policy and regulations
People expect that they can walk to the nearest car. We thought that in order to be efficient in terms of customer expectations, we would have to have a large number of cars to have a good distribution in the city. (C) *This is a scale effect. If you have 10 cars for the whole city, it will not work, it will not be interesting to users. It is important for the user to understand that when he needs it, he will always find a car nearby. (E)*	Large number of cars needed to satisfy customers Large number of cars needed to satisfy customers
Lack of regulatory policy in the taxi service series. [talking about Ukraine] (D) *We rely on security and finances. World car sharing is focused on autonomous cars. They are expensive, but they do not meet all the safety standards required by the state. If there is an accident on an autonomous car, who will be responsible? The manufacturer, the person who is in the car and did not stop the accident, to whom the insurance company must pay the money, these are serious issues that are not yet resolved. (F)*	Policy Policy - autonomous driving
Restrains the existing model of automakers. At this stage, one of the restraining factors is car manufacturers who are interested in selling as many cars as possible. If the car will increase utilization by 5-7 times, it will mean that they will sell fewer cars. Until their business model is not changed, they are not interested. (E)	Car industry is not interested, unchanged business model

What can be a driving force for the development of car sharing?

Price is always a good indicator, when you give more value for less money, in fact it is a good incentive for development. If something can be done at the state level like introducing some kind of benefits that will make car sharing cheaper, and people will find it more convenient, it will definitely stimulate the industry. Manufacturers will not be stimulated, because for them it is mostly a negative rather than a positive thing to do. This can be done through dumping the prices of players who understand that they will now train the customers to use car sharing more often, and then will benefit from the gained volume of customers. (A)	Competitive price, benefits from state side
Development of urban mobility, I will call it. The largest Ukrainian cities understand that the solutions that need to be implemented in order to reduce the burden on urban infrastructure are very expensive. This applies to the expansion of roads, reorganization of municipal transport. These are very expensive solutions that cost tens of millions of dollars, but for example to solve the same similar problems could be through car sharing. (B)	State authorities, regulations and policy
Give us an opportunity to import new cars for car sharing without VAT. If it benefits the city, the state, then give us that opportunity. In Western Europe, commercial vehicles do not have VAT, in Ukraine they still have. It's like the idea of supporting entrepreneurs who do business. That's one thing. Car sharing should be brought closer to other alternative modes of transport. (C)	State authorities, regulations and policy
Regulatory work with specific city authorities with a long-term strategy to optimize traffic in the city, optimize the quality of life in the city. In large cities, the transportation element is a key. This is an improvement in the way citizens move around the city. One of the issues is traffic jams, lack of parking spaces, air pollution. If the strategy will gradually encourage people to change the habit of having their own car in a big city and provide alternatives to it, then people will gradually give up private cars. It will not be an emotional story, it will be a more practical story. You can't just raise the price of entry	Regulations and policy

to the center for people if there is no alternative solution. Until the issue of public transport is resolved, people will not abandon the alternative solution in the form of a private car. In this case car sharing can be an alternative to a private car. (E)	
Joint dialogue with local authorities to allocate parking lots, charging stations for electric vehicles, so they can cover the demand. (G)	Dialogue with authorities
Cheap free money. While there are high credit rates, it is difficult to predict the payback of the project for 42 months or more. (G)	Regulations
Much will depend on the activity of business operators, I know a couple of companies operating in Ukraine in this segment. But it seems to me that they needed to work more aggressively with the information component in order to really explain to the consumers (potential and real) the benefits of using such a type of mobility. Thus, they could also be a driving force for the development of this business. (B)	Convince customer to switch
Organic proactive growth of the car sharing platforms; gradually teach users that there is another solution and question them why they need to have their own car: work with math, give comparative figures. (E)	Convince customer to switch
The incentive for automakers is financial gain. As soon as autonomous cars will be at a high level of safety, autonomous taxis will work without a stop, they will fully work off their high cost: without stops for rest, without unions, which shorten the working day for drivers. (F)	Financial gain, autonomous driving

In your opinion, will car sharing affect the further development of the automotive industry? How?

No, it will not affect it in any way. (A)	No effect
It will definitely have an impact, it will be another new sales channel, so the car business	New sales channels,

can stimulate its own production and spread awareness about its own product. This is another channel for active marketing, so I think they will be actively involved. Especially in a situation where fewer people in the world are interested in buying a car, believing that it is quite a waste of money. (B)	new marketing approach
In the short and medium term, I think not. I think that while it is developing, autonomous vehicles will appear. My personal opinion is that the 5th level of autonomy will come in about 10 years. Tesla says that they already have such technology, but realistically about 10-15 years. And when autonomous vehicles appear, these cars will be used for car sharing, or not for car sharing, there is simply no such thing at the moment, so there is no name for this type of mobility yet [autonomous vehicles will replace both car and ride sharing]. (C)	Autonomous driving
At conferences, car manufacturers show us videos of how the whole parking lot disappears, the concept of parking disappears. You take the shopping center, which has a huge parking lot in front of them, and they [parking lot owners] form beautiful green areas. Because autonomous cars come, drop off some people, pick up others and so on, there is no stopping. It's interesting, I think car sharing has a lot of opportunities. (C)	Autonomous driving, parking lots transformation, new opportunities
All automotive giants are currently transforming the business from a final product format to a mobility offer format. Car sharing is part of the data segment. With the growing demand for "mobility on demand", such a scenario is likely. But at the same time the development of automated personal cars can be significantly transformed (where the taxi industry will look more like a car sharing system). (D)	Autonomous driving
Of course it will affect. From the very beginning, from electric cars, everything was sharpened for autonomy and car sharing. In the electric car it is much easier to control all car systems compared to classic cars with internal combustion engines or manual transmissions. Accordingly, the sight in this direction has been around for a long time.	Autonomous driving, electric cars

It will evolve. I may be wrong, but it seems to me that your generation [talking to me, I'm 22] will be the last to drive on their own. When in 2030, with the European green consent, all manufacturers will switch to electric cars, then in 2040 - 2050, all will move to autonomous cars. Perhaps premium brands will be retained as a manual control option for aesthetes who like to drive a car on their own. But everything is moving towards autonomy. (F) *Most likely, novelties, such as a taxi that arrives without drivers, passengers can choose this option. (G)* *I think these are autonomous cars. Everything is moving towards automation and electrification of processes. (G)*	Autonomous driving Autonomous driving
I think there is a generation that doesn't want to own a car, there is a growing percentage of demographics in America that don't even want to get a driver's license. For me, it was a status, as my own way to independence from my parents. It's a big deal to have a driver's license in America. But the generation behind them, the youngest that goes after the millennials, they are very significant in what will happen after the millennials. (C)	People's attitude
In the medium to long term, this will move towards a "car as a solution". I think car companies are gradually beginning to understand this, certain car companies are already gradually developing their car sharing. I think it will gradually move there. On the one hand, there will be more and more unification of cars for car sharing. If car manufacturers will understand their consumer, they will target them to use their own car sharing. In this way the companies won't lose customers to other companies; or they will simply gradually absorb, possibly buying car sharing players to integrate them into their system. There will simply be several segments: cars for personal use (the car becomes the property of the user, premium cars), for middle and economy class cars, manufacturers will pay much more attention to unification. In the long run, there is potential for some growth in the car market, there are many countries that are just	Unification of models, new way of mobility, own car sharing

beginning to develop, their economies are growing, usually when the economy grows, people have more money, and one of the key things is the car. This has happened in other countries as well. But in the long run, car sharing can bring the stagnation of car sales in the market just for end users. And reformatting the car manufacturers themselves to a hybrid production and service model. (E)	

In your opinion, do you think that car sharing can grow into a separate line of business for the automotive industry?

It may be so. If you can't fight the revolution, you have to lead it. Car-sharing is about big resources. It is necessary to freeze a lot of money at once and then to take out them for a long time. In fact, factories have such a resource, they can issue hundreds of thousands of cars to car sharing, arrange and occupy cities one after another. Manufacturers can lead this car sharing movement when they realize that there is no going back and car sharing has taken a good place in consumption. (A)	Changing business model
This can be a separate type of transport business, at least to ensure urban mobility. That is, it is primarily for domestic consumers of cities. It will be at the level of rent or the same taxi. (B)	Changing business model
From what I see, even Ford has started saying that they are not a car company, they are a mobility company. How this will develop in reality, I do not know yet. But they are definitely changing, they want to be a mobility provider. They know it won't just be a car. They process their own strategies. (C)	Changing business model
This can and will happen gradually, there are many models that are now being tested by car manufacturers. This is the purchase of a car by subscription. You pay a certain subscription fee per month and can change your car several times a year, ride in different cars. For automakers, there is an understanding that the economic model will	Changing business model - subscription, car sharing

change, and this is still due to the change of generations. Studies show that Generation Z is less attached to all aspects of ownership of any objects. It's about real estate, it's about the car. The car for the new generation is no longer as important as it was for older people. Automakers are good at seeing this trend, of course they are thinking about what to do with it, and car sharing is one of the key stories where they will move to stay in business but replacing their business model. (E)	
Now they are investing a lot of money in this direction. BMW Mercedes has car sharing divisions, they have been counting on it for a long time. Mercedes has long been producing cars purely for taxis, so the production of cars purely for car sharing is not a big problem for them. (F)	Changing business - new branch of business

What can state and/or local authorities do to develop car sharing?

There may be some parking privileges, some special parking spaces for car sharing, so you can always park. And then you realize that you have no problem in the center where to put the car. There may be some benefits to use. More families do not buy a car, but use one. Accordingly, the number of cars on the road decreases, the load on the infrastructure decreases. Some price benefits like cashbacks to stimulate development. (I speak intuitively). (A)	Parking, price benefits
Provide basic infrastructure, this applies to a system of paid parking, which has guarantees that the car will be in that place. This system should be evenly distributed throughout the city. (B)	Parking for car sharing
They can allocate parking, I think it would be cool. I noticed in LaGuardia in New York that a multi-story car park had been built, and the whole floor just for ride sharing. You order an Uber at the airport and they say go to the 3rd floor, spot 27. Very organized,	Parking for car sharing

no mess in front of the airport. This is not difficult to organize. I think for car sharing it was also possible to make zones as for bicycles. (C)	
Explore the potential of use, at least in large cities, because it is the most favorable base for the development of car sharing. This has not been done systematically anywhere, this method of mobility is new and no one has studied its potential [talking about Ukraine]. This, of course, must be done. (B)	Analyze the potential of car sharing
Establish a stable dialogue with businesses that are interested in car sharing. These companies are communicating with city authorities, but it seems to me that the dialogue should be broader, to include at least the main players in this field. (B)	Dialogue with city authorities
Look at the legislative field. Now we are actively working on the law on taxis, it seems to me that new types of mobility also require regulation at the level of legislation. (B)	New policy, new regulations
Take away VAT for car-sharing cars, this 20% is a significant amount. (C)	New policy, new regulations
As from the city authorities, there should be more restrictions and tougher penalties, more regulation of traffic quality: fines for improper parking, evacuation of the car. This is a half-hearted solution, because there are no alternatives. (E)	New policy, new regulations
The strategy should be on the one hand to encourage people to use their own car less. (E)	Regulations
Not all telematics in our country have a license, not all models of car manufacturers have a license for use in Ukraine. (G)	Regulations
Disposal (recycling) of batteries for electric vehicles. How to do recycling, what to do with waste and so on. (G)	Regulations

When you have expensive paid parking in the city center, and you can't get around it, you will be evacuated, you will be fined, everything is in electronic form. When it works, car sharing becomes a very attractive alternative. (E)	Regulations
The city administration should regulate the use of car sharing and agree with companies on payment for the use of parking spaces. There are no problems for the city. It's all an agreement. Taxi services must also agree with the city on specially designated places for cars. (F)	Regulations
Development of clear and transparent rules in the field of transport services (including taxis), creation of appropriate infrastructure facilities in large cities (D)	Infrastructure and policy
One of the great world trends is the ecology. It has been and is one of the main drivers at the global level, at the level of governments to encourage change in the automotive industry. Namely, these are stricter standards for cars, emissions, push towards electric cars. Electricity needs a completely different infrastructure. People may be interested in cars, but they will not take them if they do not understand that the electric car is as easy to use [convenient] as a traditional car. First of all in terms of range and the ability to quickly charge. (E)	Infrastructure around electric cars
Electric cars are a very interesting solution for car sharing, but this requires a comprehensive approach to creating a network of electric chargers and general charging infrastructure in the city. For car sharing, this is a great story. The car will not need to be refueled, it will be charged while waiting for the customer. There will be no refueling element that someone has to refuel this car at a certain time. (E)	Infrastructure and electric cars
Support for business: if it is a tax system, then benefits for electric vehicles. For large car parks of electric vehicles, it is necessary to have stations with charges so that the	Infrastructure and policy

cars can be charged quickly: a third of the tank is 20 minutes. Electricity can be drawn from natural resources: solar energy, wind energy. (G)	
Roads, signs, matching roads to maps. (G)	Infrastructure

In your opinion, how will car sharing (the car ownership) look in 15-20 years?

I am convinced that more efforts will be made in autonomous cars than in car sharing. We will observe a concept that the taxi will be replaced by a driverless taxi. It will immediately be significantly cheaper, and this option will be more from the car manufacturers side. But industrially we are not ready in terms of routes, markings on the roads and everything else. I think it will start with more developed countries: European, American, where it's a little easier. They have already started the process of introducing autonomous cars as taxi cabs there. I know cases where there are 15-20 cars carrying students and teachers. Volvo together with Uber launched about 40 thousand XC90, which are operated without a driver. But only for a certain city, which the company adapted the cars for. I think it [driverless taxis/autonomous driving] will develop very much; a lot of money will be invested in this sphere. (A)	Autonomous driving
5 level of autonomy, I think that car sharing will be transformed completely. Because it will all be autonomous, we can not only order cars, it will be a unique vehicle for your needs. If you want a manicure, you order a manicure salon. And during your trip you can get a manicure. There will be various strange combinations. Time will be precious to people. The founders of Uber, the genius was not in transport, but in convenience. This convenience is transformed in free time. I don't have to order a taxi over the phone, describe where I am, bargain or pay in cash. (C)	Autonomous driving, more convenience
Autonomous taxis, 100% in China, possibly in Europe. Now everything is going to this, full digitalization. Now autonomous planes, autonomous boats, autonomous loaders in	Autonomous driving

ports are being tested. The question here is when the generation that wants to drive a car on its own will die out. Autonomous car codes will communicate with each other, will communicate with the road infrastructure - the level of safety will rise immediately. There will be no people who violate traffic rules, because they will be replaced by robots, and robots can't violate rules. And everything will be fine. (F) *100% of this will happen on highways for long-distance transportation of both buses and trucks. Because there is no such intensive traffic as in the cities. It is much easier to organize and make a profit due to the absence of a driver. (F)* *I think that car sharing is the future. Car sharing is a step towards fully autonomous cars: when the computer in a car, a robot, controls the car instead of a human. (G)*	Autonomous driving Autonomous driving
I think 90% of it will be other companies, not car manufacturers. These will be small investors who will buy 10-15 cars (as is happening now with Logans) [talking about Ukraine]. They buy cars, put them on the streets under some brand and connect to some platform to tie up all of the cars together. Putting cars to use and actually making money on them, as is now the case with most taxis. (A)	Future of car sharing - small investors
In 15-20 years it will be one of the most common types of urban mobility. Similarly, today there are taxis and long-term car rentals. I am quite optimistic about the development of car sharing as a type of business. You will choose between A: buy a car and bear the costs or buy, for example, a season ticket from a car sharing company, respectively, do not own a car, but calmly use it to solve your own problems and needs, without incurring parking costs, car operation and a number of other additional spending. Everyone will choose what suits him best. (B)	New way of mobility
Availability of cars in remote places, and you can choose which car you want to have. More choice, more availability, sustainability. (G)	Convenience

List of references:

Agatz, Niels & Erera, Alan & Savelsbergh, Martin & Wang, Xing, 2012. "Optimization for dynamic ride-sharing: A review," European Journal of Operational Research, Elsevier, vol. 223(2), pages 295-303. Ballús-Armet, I., Shaheen, S. A., Clonts, K., & Weinzimmer, D. Peer-to-Peer Carsharing, 2014, Citations: 107

Bardhi F., Eckhardt, G.M., Access-Based Consumption: The Case of Car Sharing, Journal of Consumer Research, J Consum Res, 2012

Barth M., Shaheen S., Fukuda T., Fukuda A., Carsharing and station cars in Asia: overview of Japan and Singapore, Volume: 1986 issue: 1, page(s): 106-115, Issue published: January 1, 2006

Bardhi F., Eckhardt G.M., Access-based consumption: the case of car sharing, J. Consum. Res., 39, 2012, pp. 881-898

Belk R., Possessions and the Extended Self, Journal of Consumer Research, September 1988, 139–68

Belk R., Why Not Share Rather than Own? Annals of the American Academy of Political and Social Science, 611, 2007, 126–40

Belk R., Sharing, Journal of Consumer Research, 36 (February), 2010, 715–34.

Botsman R., Rogers R., “What's Mine Is Yours: A Rise Of Collaborative Consumption”, 2010

Boyce, Carolyn, and Palena Neale. "Conducting in-depth interviews: A guide for designing and conducting in-depth interviews for evaluation input.", 2006, Citations: 2374

Carplus, 2015. Carplus Annual Survey of Car Clubs 2014/2015. Accessed March 2, 2016. http://www.carplus.org.uk/wp-content/uploads/2015/03/CarplusAnnual-Survey-of-Car-Clubs-2014_London_Final1.pdfccessed

Cervero, R., Y. Tsai, “City CarShare in San Francisco, California: Second-year Travel Demand and Car Ownership Impacts.”, 2004, Transportation Research Record: Journal of the Transportation Research Board 1887: 117– 127, Citations: 253

Cervero, R., A. Golub, and B. Nee, “City CarShare: Longer-term Travel Demand and Car Ownership Impacts.”, 2007, Transportation Research Record: Journal of the Transportation Research Board 1992: 70–80, Citations: 319

Chen Y., Possession and Access: Consumer Desires and Value Perceptions Regarding Contemporary Art Collection and Exhibit Visits, Journal of Consumer Research, 35 April 2009, 925–40

Chesterton A., How many cars are there in the world, 2018, Link: [https://www.carsguide.com.au/car-advice/how-many-cars-are-there-in-the-world-70629]

DHL, Sharing economy logistics, 2017, Link: [https://www.dhl.com/content/dam/downloads/g0/about_us/logistics_insights/DHLTrend_Report_Sharing_Economy.pdf]

Eduardo Lúcio Lasmar Júnior & Rodrigo Marçal Gandia & Joel Yutaka Sugano & Thais Assis De Souza & Demóstenes Zegarra Rodriguez, 2019. "New business models and the sharing economy: impacts and challenges for the traditional automotive industry," International Journal of Automotive Technology and Management, Inderscience Enterprises Ltd, vol. 19(3/4), pages 301-320.

Etehad M., Nikolewski R., Millennials and car ownership? It’s complicated, 2016, Link: [https://www.latimes.com/business/autos/la-fi-hy-millennials-cars-20161223-story.html]

Fernkorn, J., 2012. "Triangulation of two methods measuring the impacts of a free-floating carsharing system in Germany," Transportation Research Part A: Policy and Practice, Elsevier, vol. 46(10), pages 1654-1672, Citations: 83

Fernkorn, J., and M. Muller, “Selling Mobility Instead of Cars: New Business Strategies of Automakers and the Impact on Private Vehicle Holding.”, 2012, Business Strategy and the Environment 21: 264–280, Citations: 244

Frey W. H., Analysis of Census Bureau Population Estimation, June 2020, Brookings Institution Press.

Frost and Sullivan, Global Digital Freight Brokerage Market Opportunities, Forecast to 2025, 2018, Link:[https://store.frost.com/global-digital-freight-brokerage-market-opportunities-forecast-to-2025.html]

Gao P., Kaas H-W., Mohr D., Wee D., Disruptive trends that will transform the auto industry, 2016, Citations: 244

Gao P., Hensley R., Zielke A, A Road Map to the Future of the Auto Industry, McKinsey Quarterly, October 2014

Gov.uk, official website, "Government takes historic step towards net-zero with end of sale of new petrol and diesel cars by 2030", published 18 November 2020, Link [https://www.gov.uk/government/news/government-takes-historic-step-towards-net-zero-with-end-of-sale-of-new-petrol-and-diesel-cars-by-2030]

Hawkins A., BMW becomes the latest automaker to shut down its subscription service, The Verge, 14 January 2021. Link: [https://www.theverge.com/2021/1/14/22231451/bmw-access-subscription-shut-down-nashville-cancel]

ITS International, ParkNow and BMW solution takes Intertraffic 2018 Innovation Award, 22 March 2018. Link: [https://www.itsinternational.com/news/parknow-and-bmw-solution-takes-intertraffic-2018-innovation-award]

ITU releases ICT figures, 2016, Link:[http://www.itu.int/en/mediacentre/Pages/2016-PR30.aspx]

Knoedler D., Wollschlaeger D., Stanley B., Automotive 2030: Racing toward a digital future, 2020

KPMG, Autonomous Vehicles Readiness Index, January 2018. Link: [https://assets.kpmg/content/dam/kpmg/tw/pdf/2018/03/KPMG-Autonomous-Vehicle-Readiness-Index.pdf]

KPMG, Global Automotive Executive Survey 2020, 2020. Link: [https://assets.kpmg/content/dam/kpmg/pl/pdf/2020/07/pl-raport-kpmg-international-pt-global-automotive-executive-survey-2020.pdf]

Le Vine, S., M. Lee-Gosselin, A. Sivakumar, and J. Polak, "A New Approach to Predict the Market and Impacts of round-Trip and Point-to-Point Carsharing Systems: Case Study of London.", 2014, Transportation Research Part D: Transport and Environment 32: 218–229.

Liao, F., Molin, E., Timmermans, H. et al. Carsharing: the impact of system characteristics on its potential to replace private car trips and reduce car ownership. Transportation 47, 935–970 (2020), Citations: 28, Link: [https://doi.org/10.1007/s11116-018-9929-9]

Markets and Markets, Ride Sharing Market, 2018, Link: [https://www.marketsandmarkets.com/Market-Reports/mobility-on-demand-market-198699113.html]
Mariton J., What is scenario planning and how to use it, Strategy Management Consulting, 2016
Martin C.J., Upham P., Grassroots social innovation and the mobilization of values in collaborative consumption: a conceptual model, J. Clean. Prod., 134, 2016, pp. 204-213
Maxton G., Wormald J., Time For a Model Change: Re-engineering the Global Automotive Industry, Cambridge University Press, November 2004
McKinsey & Company, Automotive revolution – perspective towards 2030, 1 January 2016. Link: [https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/disruptive-trends-that-will-transform-the-auto-industry/de-de]
Medium, Global Survey of Autonomous Vehicle Regulations, 15 March 2018. Link: [https://medium.com/syncedreview/global-survey-of-autonomous-vehicle-regulations-6b8608f205f9]
Mounce R., Nelson J. D., On the potential for one-way electric vehicle car-sharing in future mobility systems, Transportation Research Part A: Policy and Practice, Volume 120, 2019, Pages 17-30
Nissan Motors Corporation, Drivers can switch their ride every day with Nissan's first subscription service, 19 February 2020. Link: [https://usa.nissannews.com/en-US/releases/drivers-can-switch-their-ride-every-day-with-nissans-first-subscription-service#]
Pivotal Subscription by Jaguar and Land Rover, 2021. Link: [https://www.drivepivotal.com/]
PwC, Sharing or paring. Growth of the sharing economy, 2015. Link: [https://www.pwc.com/hu/en/kiadvanyok/assets/pdf/sharing-economy-en.pdf]
PwC, The sharing economy, 2014, Link:[https://www.pwc.com/us/en/industry/entertainment-media/publications/consumer-intelligence-series/assets/pwc-cis-sharing-economy.pdf]
Ratcliffe J., Scenario Planning: an Evaluation of Practice, Futures Research Quarterly, 2003

Shaheen S., Chan N., Mobility and the Sharing Economy: Potential to Facilitate the First- and Last-Mile Public Transit Connections, 2016, Citations: 208

Shaheen, S., Cohen A., “Growth in Worldwide Carsharing: An International Comparison.”, 2007, Transportation Research Record: Journal of the Transportation Research Board 1992: 81–89.

Shaheen, S., Cohen, A., Carsharing market overview, analysis and trends, 2013a, Citations: 51

Shaheen S., Sperling D., Wagner C., Carsharing in Europe and North America past, present, and future, Transport. Quart., 52 (3) (1998), pp. 35-52

Sofaer S., Qualitative methods: what are they and why use them?, Health Serv Res., 1999

Snare F., The Concept of Property, American Philosophical Quarterly, 9, 1972, 200–206.

Stasko, T., A. Buck, and H. Gao, “Carsharing in a University Setting: Impacts on Vehicle Ownership, Parking Demand, and Mobility in Ithaca, NY.”, 2013, Transport Policy 30: 262–268.

TomTom, Traffic Index Results 2020, Link: [https://www.tomtom.com/en_gb/traffic-index/ranking]

Teubner, T., Flath, C.M., The economics of multi-hop ride sharing, 2015

Yoon T., Cherry C., Jones L., One-way and round-trip carsharing: A stated preference experiment in Beijing, Transportation Research Part D: Transport and Environment, Volume 53, 2017, Pages 102-114

Walsh B., Today’s smart choice: Don’t own, share, 10 Ideas that will change the world, 2011. Link: [http://content.time.com/time/specials/packages/article/0,28804,2059521_2059717_2059710,00.html]

Resümee

AUTOOMANDUSE TULEVIKUTRENDID:
IMPLIKATSIOONID AUTOTÖÖSTUSELE

Oleg Monastyrskyy

Selles artiklis uuritakse tegureid, mis mõjutavad autode jagamise arengut ja selle mõju autotööstusele. Autode jagamist võib pidada uueks alternatiivseks mobiilsuse viisiks, mis aitab kaasa tõhusale transpordile läbi linna. Oluliste faktorite uurimiseks viidi läbi 8 sõltumatut intervjuud erinevate ekspertidega, et leida autojagamise arengut mõjutavad võtmetegurid. Kõige olulisemad tegurid olid: regulatsioon, poliitika, autonoomsed sõidukid, infrastruktuur ja parkimine. Et leida, kuidas autode jagamine võib autotööstust mõjutada, kasutati stsenaariumi meetodit. Analüüsi jaoks valiti 2 kõige riskantsemat võtmetegurit: regulatsioon ja poliitika ühendati seadusandlikuks faktoriks, kuna mõlemad need tegurid sõltuvad kohalikest / osariiklikest omavalitsustest ja autonoomsete autoed kasutuselevõtust. Stsenaariumite abil kaardistati neli erinevat tüüpi tulevasi autojagamisettevõtteid ja autotööstusi. Antud artikli panus seisneb täiendavalt autode jagamise arengut mõjutavate tegurite uurimises ning töötades välja inimeste, autode jagamise ja autotööstuse võimalikke tulevasi tulemusi. Samuti võetakse arvesse ühiste autonoomsete sõidukite tulevasi võimalusi.

Märksõnad: autode ühiskasutus, autonoomsed sõidukid, seadusandlik tugi autonduses, omavalitsus

Non-exclusive licence to reproduce thesis and make thesis public

Oleg Monastyrskyy,
(*author's name*)

herewith grant the University of Tartu a free permit (non-exclusive licence) to

reproduce, for the purpose of preservation, including for adding to the DSpace digital archives until the expiry of the term of copyright,

The Future Tendencies in Car Ownership: Implication for the Automotive industry,
(*title of thesis*)

supervised by

Maaja Vadi and Kristjan Pulk
(*supervisor's name*)

2. I grant the University of Tartu a permit to make the work specified in p. 1 available to the public via the web environment of the University of Tartu, including via the DSpace digital archives, under the Creative Commons licence CC BY NC ND 3.0, which allows, by giving appropriate credit to the author, to reproduce, distribute the work and communicate it to the public, and prohibits the creation of derivative works and any commercial use of the work until the expiry of the term of copyright.

3. I am aware of the fact that the author retains the rights specified in p. 1 and 2.

4. I certify that granting the non-exclusive licence does not infringe other persons' intellectual property rights or rights arising from the personal data protection legislation.

Oleg Monastyrskyy
author's name

01/06/2021