White paper

The five conditions essential to successfully operate autonomous carsharing fleets in the future

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The subject of autonomous driving is currently everywhere. Many automobile manufacturers, suppliers and mobility newcomers are working feverishly on the development of autonomous vehicles. Both the business community and government agencies are investigating ways in which autonomous vehicles can be used, and pilot trials are being carried out all over the world. The future of the car will be autonomous – there's almost no doubt about it.

For cities, the vision of the future with autonomous driving is good news. Self-driving, fully electric cars will make private transport in city centers cleaner, cheaper and safer. A key factor will be the highly efficient use of autonomous fleets, which enable significantly better utilization than is possible with current carsharing and other private mobility models.

Today, privately owned vehicles sit unused on average for more than 23 hours per day. A carsharing vehicle in the free-floating system has a five to six times higher utilization rate. An autonomous carsharing vehicle in the future will be on the move more or less around the clock. However, to achieve this, optimal management of autonomous carsharing fleets will be critical. Thankfully, preparations are already being made for this.

The use of autonomous vehicles will be a quantum leap for carsharing – comparable with the change from station-based carsharing to the free-floating approach. car2go is already making extensive preparations for the jump to autonomous carsharing, and is ready and waiting for the autonomous future.

According to car2go, there are five conditions essential for the optimal management of an autonomous carsharing fleet:

1. professional fleet management
2. demand prediction
3. fleet intelligence
4. intelligent charging
5. the best customer experience

car2go is already working at full speed on all five conditions and is able to benefit from the comprehensive experience, data and results obtained from almost ten years of operational experience

1st condition: Successful fleet management

Whoever wants to optimally manage fleets must manage both the software, i.e. algorithms, big data and apps, as well as the hardware, i.e. the cars. There are many players in the fiercely competitive mobility market, but there are hardly any mobility providers outside the carsharing branch who actively operate larger vehicle fleets. This will change when the age of autonomous fleets arrives.

Knowledge and experience are necessary to be able to successfully operate fleets containing thousands of cars. This knowledge offers a huge strategic advantage in the mobility market of the future. Breakdowns of a larger number of vehicles simultaneously would greatly affect an autonomous mobility service. Cars which are permanently in operation need to be serviced and repaired, and tire and oil changes must be made.

car22go currently manages a combined fleet of over 13,000 vehicles in 26 cities. And consequently, has been able to gain almost ten years of valuable fleet management experience. The efficient servicing and maintenance of the vehicles is already part of the operative business of car2go and is an important prerequisite for high availability of any shared vehicle fleet. Each day a car spends in the workshop is an operational day lost.

car2go already uses management software to efficiently and effectively manage vehicle downtime. Ensuring the availability of the maximum number of vehicles is a considerable challenge for free-floating carsharing. New technologies are currently in the pipeline to make the planned cleaning and maintenance of the vehicles even more efficient. car2go is actively involved in the development of such technology.
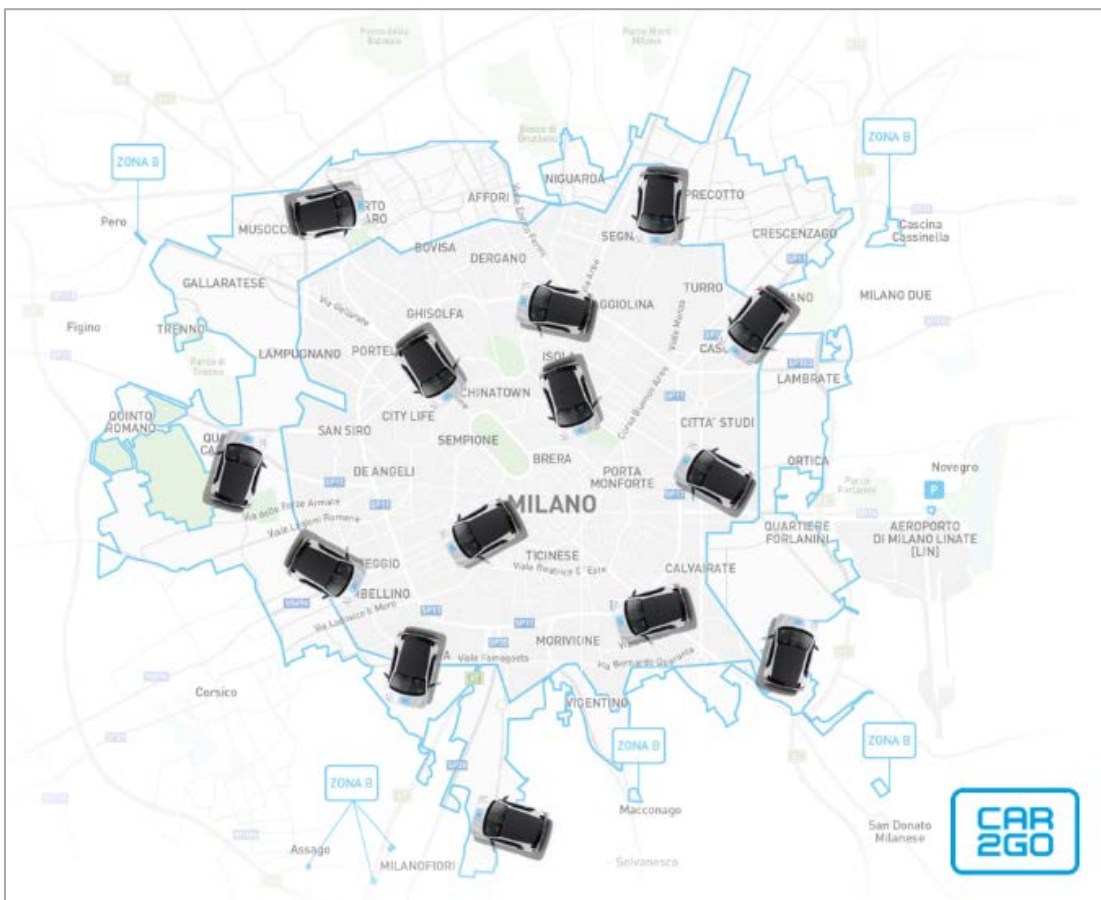

Figure 1: Management of a fleet spread over the entire urban area of a city is a huge challenge

2nd condition: Demand prediction

The second important condition for autonomous carsharing is accurate demand prediction. The question as to when and where a customer will need a car has to be answered even before the customer actively searches for a vehicle.

Why is this? In a competitive mobility market, the customer is most likely to select the provider who offers the best, most reliable service in the shortest time and at a good price – and has cars available at exactly the right time and place that the customer needs. For the provider this means: the car should ideally already be on its way to the customer even before it has been ordered.

This can be explained more clearly by taking a look into the autonomous future using a practical example. Suppose that a soccer match has ended in a stadium in a large city. There are now two scenarios.

Scenario one: there is no demand prediction. Mobility providers therefore do not know before the end of the game that many fans will be looking for a car after the match. The fans will walk out of the stadium and order a car with their smartphones. A large number of cars then have to be driven to the stadium, which takes some time and thus results in long wait times – wait times which are inacceptable from the customers' point of view.

Scenario two: There is demand prediction, which recognizes that cars will be required at the stadium at the end of the match. The mobility providers are then able to send cars to the stadium in advance so that they are ready and waiting for the fans as they leave the stadium.

Predicting when and where customers will need cars is already part of the daily business at car2go. With the data which car2go has collected over the years, the company is able to predict demand extremely accurately using complex, proprietary algorithms.

External data, such as the weather or dates of events, is also included in our calculations. It may sound trivial, but when it rains, the demand is higher than it is when the sun shines. And, after a large concert or during a carnival, demand is higher in certain areas of the city than is normally the case.

Data protection is also an important factor. Demand prediction only forecasts that customers will need cars at a certain time. It does not determine which customer will be needing the car. Hence, no personal data is collected or stored in this respect.

car2go continually predicts demand in all car2go cities, and thus knows when and where customers will need a car. car2go can also estimate how high the demand for vehicles will be on a certain day, for example, in Berlin city center, or even on individual streets in New York City. This helps in the management of the fleet so that the maximum possible availability can be achieved for car2go customers. Our learning algorithms consistently improve through the use of "Advanced Machine Learning Technologies."

Accurate demand prediction will continue to be crucially important for the transition to autonomous carsharing.
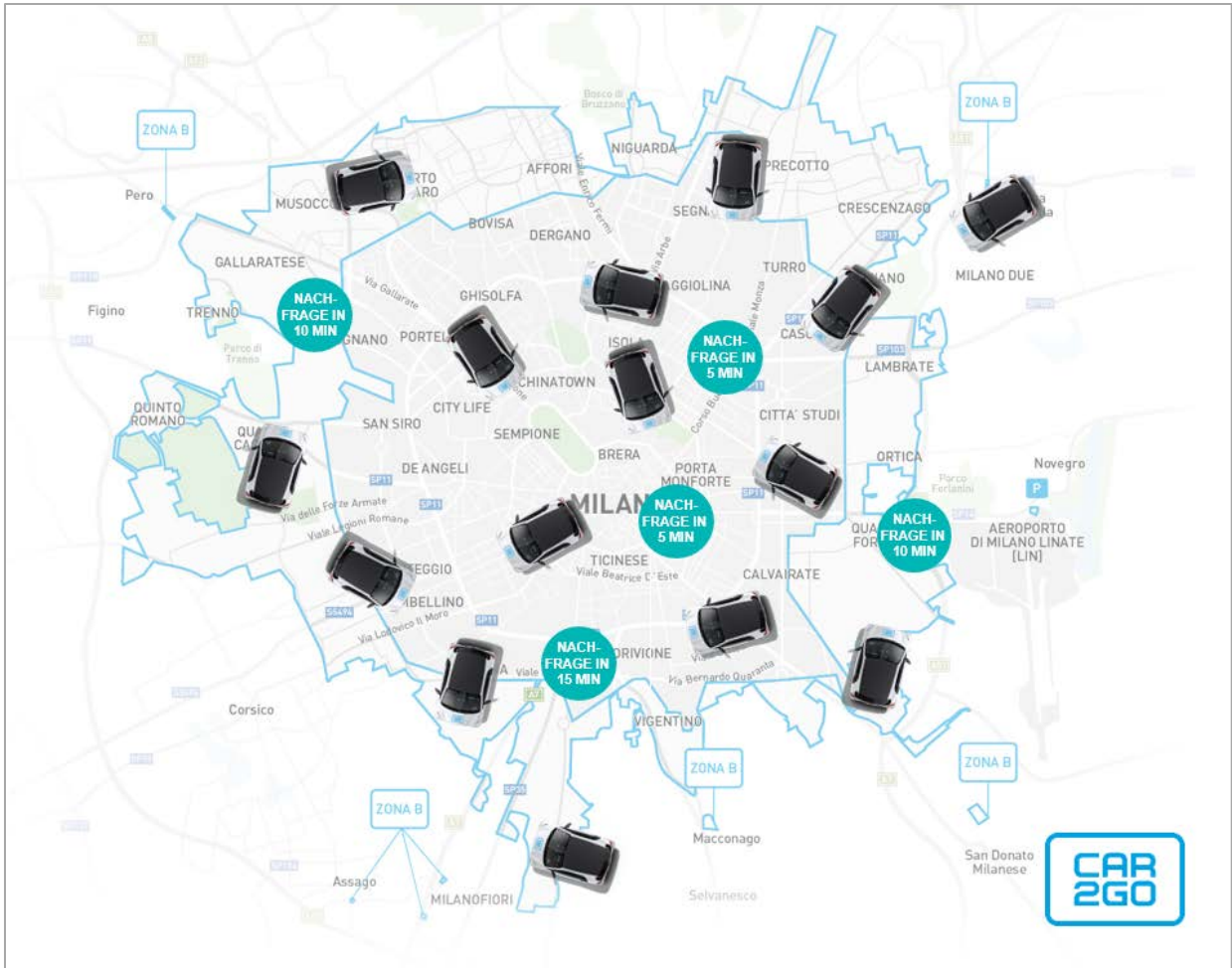
Figure 2: With demand prediction, fleets can be managed more efficiently

3rd condition: Fleet intelligence

The key component required for functional autonomous carsharing is sophisticated and intelligent fleet management. What does fleet intelligence mean? As soon as it is known where a customer needs a car, the decision has to be made as to which car should be driven to the customer and which route it should take. This may sound easy at first, but it is not. There are various reasons why the closest car may or may not be the one that should drive to the customer.

A simple example explains why this is not always the best solution: Take another look at the soccer stadium scenario. In this scenario, the stadium is close to the city center. If all the cars closest to the stadium, i.e. those in the city center, are driven to the stadium, it would cause a huge absence of cars in the city center. This will, in turn, lead to long waiting times there.

Cars from the suburbs should therefore be sent to the stadium so that sufficient cars remain in the city center to cover demand there. However, this should ideally be done so that as few journeys without passengers are made on the longer route to avoid causing unnecessary traffic. The route must therefore be intelligently managed so that customers are transported for short sections of the journey, or the cars can be used as couriers and be loaded with packages. "Efficiency" is the magic word here to minimize empty journeys – to thus reduce the amount of traffic and also protect the environment.

The problem of optimal fleet management is so complex that a decision cannot be made individually for each car. Instead, an automated, central management system for the entire fleet is required. After all, an autonomous carsharing fleet is not just a collection of independent vehicles, it is a complex,

collective body in which the behavior of one car has direct effects on all the other cars. And this collective body has to be optimally managed with the aid of algorithms. More precisely: an autonomous carsharing fleet is more than just the sum of its cars.

Admittedly, this sounds extremely futuristic. Are we talking about things here which are still a long way away from reality?

Not at all! car2go already operates using a sophisticated logic system which optimally distributes the fleets across the services' home areas. It is important here to understand that the overall management of our global fleet is managed centrally. A server operates the central intelligence for the global fleet and manages service teams in 26 cities worldwide. There is subsequently no human involvement in the decision as to where the cars should be driven.

Thanks to this high level of intelligence, it is now possible to optimize availability so that up to 16 rentals/day/car are achieved in the car2go cities. This means that each car is located in close proximity to demand, and thus able to satisfy demand up to 16 times each day!

How exactly does fleet intelligence work at car2go? Thanks to demand prediction, car2go knows exactly where cars are going to be needed – as well as where a surplus of cars currently exists and where not enough cars are available. car2go then addresses this discrepancy by sending service teams to move cars from overstocked areas to areas in which cars will soon be needed. car2go is therefore able to make a car available to a customer where there would otherwise not have been one, and thus increases customer satisfaction.

Once cars reach level 5 autonomy, the cars will be able to distribute themselves throughout the city based on the same logic.
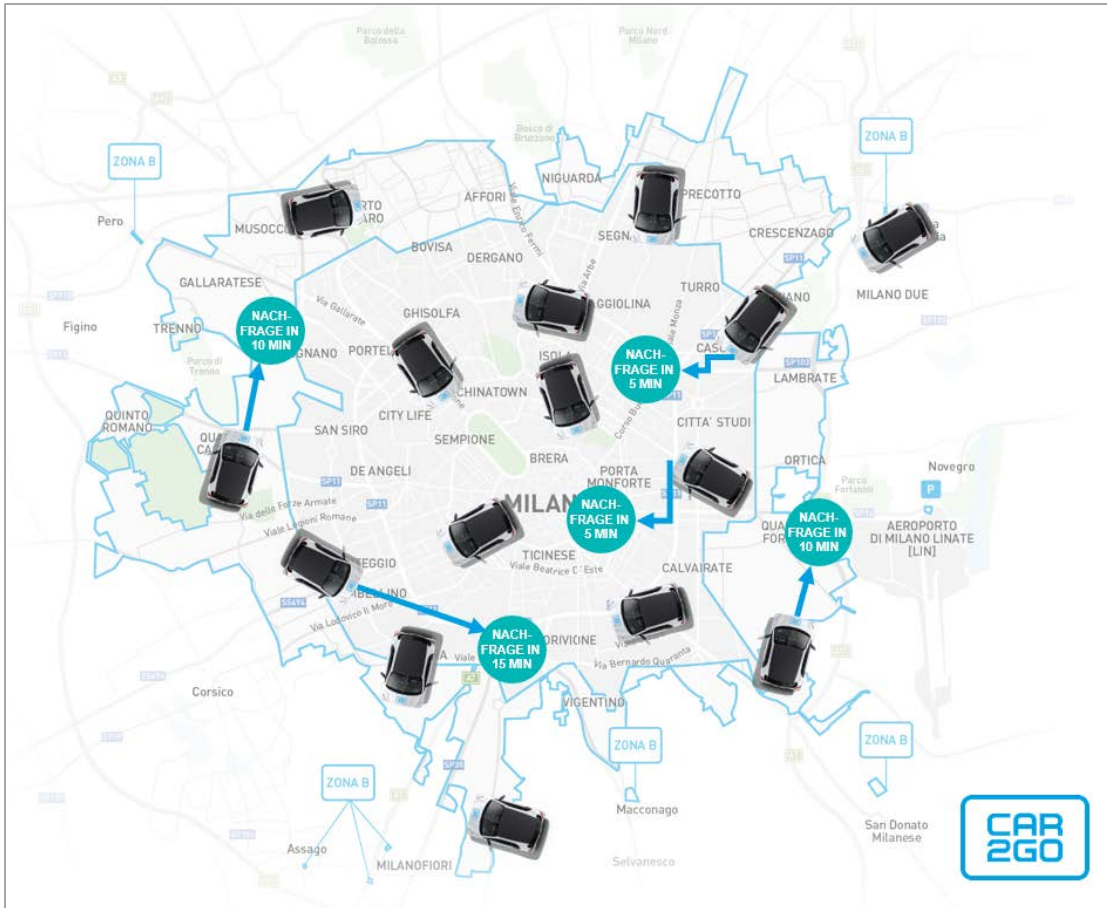
Figure 3: Vehicles will be distributed optimally according to demand with the aid of fleet intelligence

4th condition: Intelligent charging

The rise of Electric carsharing fleets in cities around the world is definitely very good news for the cities and their inhabitants. With electric carsharing fleets, emissions become cleaner and the vehicles themselves are much quieter. All of this contributes to greater quality of life.

But this scenario brings various challenges with it. Regardless of how powerful the batteries of future electric vehicles will be and how quickly they can be recharged, the time always comes when a car's battery is empty and must be recharged.

Consider this using another practical example: imagine that an electric car has to be recharged after a rental because its battery is very low. What if, however, there is no charging station available where the car is parked at the end of the rental? The car then has to drive a long way to the next charging station. This means that the car is not available for rental during this period and thus customer demand cannot be fulfilled. The extra journey required to the distant charging station also causes additional traffic.

It is therefore essential that charging stations are optimally located throughout a city so that the described situation does not occur – only in this way can short distances and optimal efficiency be achieved, to the benefit of all those involved.

Complex simulations can be used to accurately predict charging scenarios. The results provide – depending on all possible patterns of demand behavior, driving behavior, number of vehicles and many other factors – the ideal scenario of an optimal charging infrastructure in a city. Even calculated to the accuracy of just one meter.

In order to achieve maximum efficiency, car2go is already working with cities to optimally prepare for the electric and autonomous future. Thanks to its knowledge of the mobility sector, car2go knows where additional charging stations should ideally be located. car2go shares this knowledge with the cities, helping to ensure that electric avoid adding to unnecessary traffic in the city centers.

Cities are already benefiting from this knowledge. An optimal charging infrastructure is also the prerequisite to help convince more and more people to buy an electric car and subsequently improve the air quality in the cities.
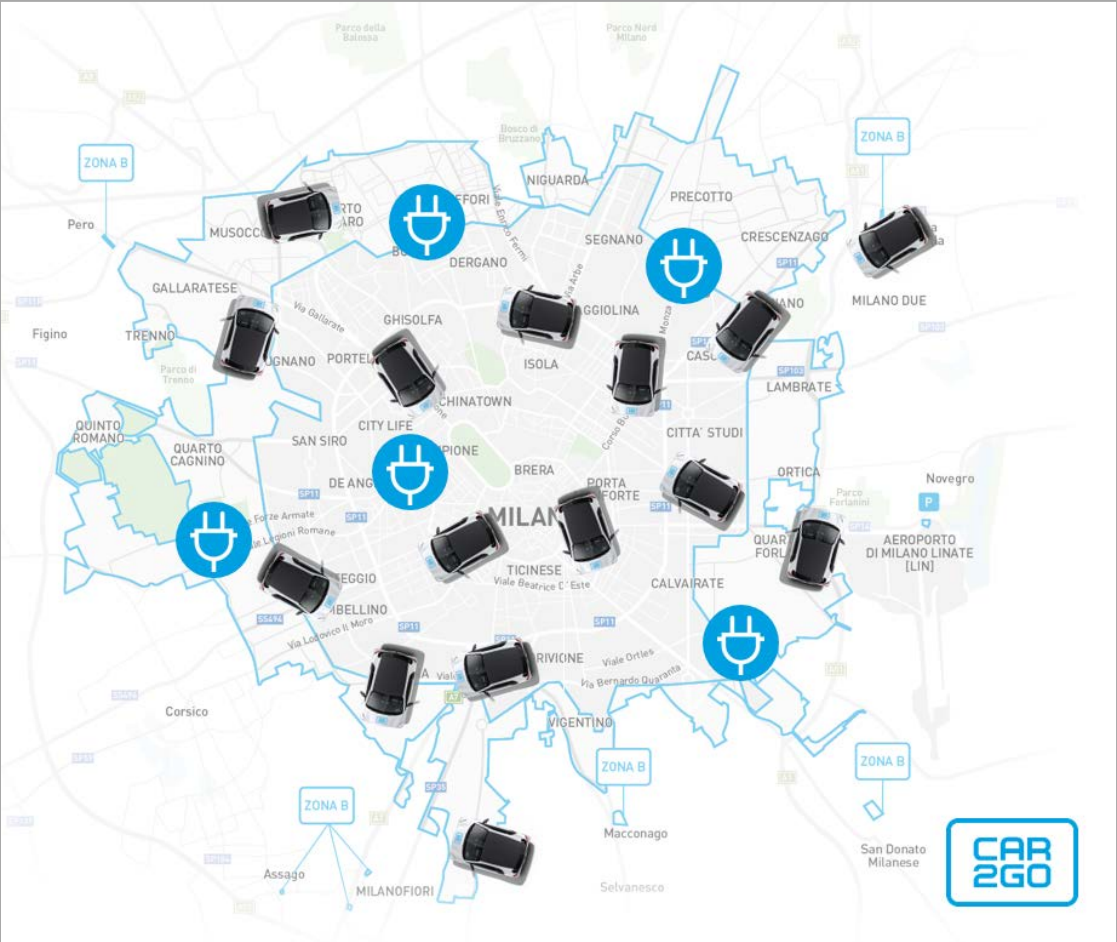

Figure 4: A comprehensive charging infrastructure is the key to preventing unnecessary journeys

5th condition: The best customer experience

The provider of autonomous carsharing services that offer the best customer experience is the provider that will stay ahead of the competition in the market. Customer experience includes, of course, the fast availability of the car and previously mentioned points regarding efficient fleet management, demand prediction, fleet intelligence and intelligent charging. But the positive customer experience involves much more.

Most cities do not yet have any autonomous vehicles on the streets and therefore, have not yet obtained user experience feedback. It is therefore even more crucial to obtain information about the wishes and needs of the future customers with respect to trips by autonomous vehicles.

The range of questions to be answered is wide – from the design of a corresponding app, to the communication between customer and vehicle, right through to additional offers, experiences and services in the vehicle during the trip itself.

A small selection of detailed questions should make the diversity of the customer experience clear: Where exactly should the vehicles drive – especially on busy roads? How does the customer find a vehicle in locations that are difficult to access? Does the customer open the door or does the vehicle open the door for them? Does the vehicle simply drive off or does the customer say "start now"? How does the customer communicate with the vehicle during the journey? Voice control, operating device, or other? Does the customer benefit from in-car offers and information, such as the display of schedule information for connecting with local public transit options?

car2go is already working together with its parent company Daimler Mobility Services on providing the best possible customer experience in the autonomous carshare future. Over eight years of experience in the development and optimization of an intuitive app helps to ensure this. Experience from other Daimler Mobility Services business units, such as moovel and mytaxi, is also of assistance.

But perhaps the most detail-rich input is obtained from specific application studies, which are commissioned in cooperation with universities. For this, an autonomous carsharing service is simulated in tangible everyday situations in order to provide knowledge for future business models. The result is that car2go receives specific knowledge about the user behavior of a young and progressive target group.

For example: the application studies show that customers want seamless connectivity between their smartphones and tech in the vehicle. This means that the option should continue to be available for carshare customers to be able to use their own smartphones within the vehicle in addition to the tech built into the vehicle.

Summary

The automobile industry is changing rapidly. Travel by car in urban areas will be significantly influenced by the rise of autonomous fleets of vehicles which can be easily booked at any time via a smartphone. The result is an on-demand offer providing inexpensive and personal mobility.

The biggest challenge will be to make the best product available right at the very beginning in a highly competitive market. The market for personal mobility in today's world is fragmented and shared between taxi services, ride-hailing providers, carshare services and other market players. These business models will draw closer together in the future, and competition between them will become even more direct.

The color of the car will then no longer be a decisive factor. There will be much more important matters, such as: who can get a vehicle to the customer in the shortest time? How much will it cost? How reliable is the service, and is the offer the most targeted to the customers' requirements?

Whoever wants to be successful in this market has to start making preparations today. car2go – as the world's largest free-floating carsharing provider – is already actively doing so. With the smart Vision EQ, the smart brand has presented its vision of the carsharing vehicle of the future. With car2go, the operation of this vehicle in an intelligent fleet will also be possible.