

GLOBAL MOBILITY OUTLOOK



POPULATION 2016*
7 466 000 000



URBAN POPULATION %
54%



NUMBER OF PASSENGER CARS IN USE
947 100 000



**NUMBER OF VEHICLE PER HEAD
(DATA IN 2015) PER 1000 HABITANT**
127



95% OF ELECTRIC VEHICLES ARE SOLD IN ONLY 10 COUNTRIES
China, the United States, Japan, Canada, Norway, the United Kingdom, France, Germany, the Netherlands and Sweden



ESTIMATED SALES PARTIAL AUTONOMOUS VEHICLE SALES IN 2035
% of Autonomous vehicle 2035
21 Million



GLOBAL MOBILITY MARKET SIZE 2017
7 Trillion \$



DRIVERLESS MOBILITY AS A SERVICE CARS NEEDED IN 2035
45 Million



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Round-table Discussion: IHS Markit & Mazars

The Automotive Sector : Navigating the New Mobility Landscape

The automotive sector is undergoing seismic change as mobility requirements shift from one person one car ownership to a more sustainable car sharing and usage-based model. Capturing insights and intelligence needed to ensure OEMs and suppliers can navigate these new challenges is vital, particularly as the industry moves from an engineering to software-based system of vehicle production. As part of our global study on the topic of sustainable mobility, we invited consultants from market intelligence and analytical experts, IHS Markit, to a Q&A discussion on the key mobility trends and how change is likely to impact the automotive sector going forward.

The discussion is split into four micro trends:

- ownership;
- sales and investments;
- regulation;
- skills.

What was clear from discussions is that interpretation is key. How we apply in-depth research alongside day to day market intelligence, as well as formal and informal contact with players in the market can reveal different insights and ideas that, combined, help to paint a clearer picture of the issues driving change.

By sharing these ideas and thoughts, our aim is to support the automotive industry as it adapts and evolves. Our sincere thanks to IHS Markit's Jeremy Carlson, principal automotive analyst and Dr Egil Juliussen, director of Automotive research for their insights that have helped produce this report.

*Christian Back, Partner, Mazars Stuttgart &
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1. Vehicle ownership trends

“If you still own a car in 40 years from now, you’ll have to take it to a track to drive it.”

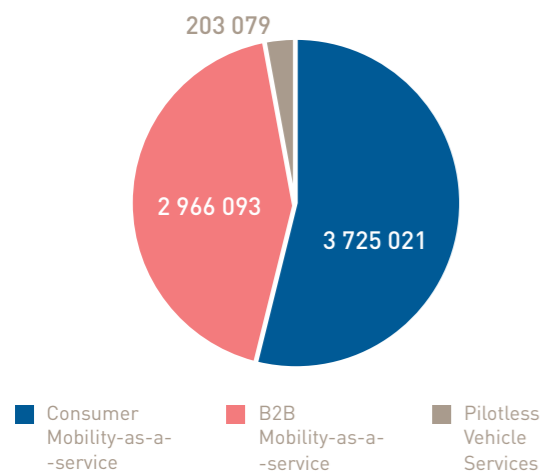
Dr Egil Juliussen, director of Automotive Research at IHS Markit.

There are a number of key trends currently impacting players in the automotive industry. From a car ownership model to an ownership-sharing or even a pure usage-based model, cost is an important factor in how this shift will eventually play out. But market innovation and disrupters from outside the industry are also playing their part in offering attractive mobility solutions as we move to a sharing economy. The signs are it is not a question of if this will happen, but when. Remaining agile to opportunities and adapting business models to take advantage of the new mobility landscape will be increasingly important.



How will a shift from car ownership to a sharing or usage-based model play out and what is driving it?

PASSENGER ECONOMY – FORECASTED GLOBAL REVENUE BY SERVICES 2050 (USD MN)



Source: Catapult - Market Forecast - For Connected and Autonomous Vehicles, IHS report, Intel - Autonomous Vehicle Service

Egil Juliussen: Ownership trends can vary a lot by region and country. As a general rule in countries where car ownership is high, a move to an ownership-sharing or usage-based model is going to take longer than places such as India or China where cars per capita are much lower. Affordability is key and in countries where mobility as a service is less costly than owning a car, the shift to share and usage models will be much faster.

Jeremy Carlson: I agree, a lot of sharing and usage models are being enabled by technology, such as an app on your smartphone and the use of cloud platforms to improve logistic efficiency. And while such innovation is heavily influenced by technology companies, there’s certainly a growing interest from automotive industry players to become more involved. There is also a pull from the demand side that is starting to drive some of that change because it’s all about giving consumers choice and cost options, whether its sole use of an Uber, a ride-share or taking public transport.

Egil Juliussen: The high tech industry has been the main driver behind the shifting landscape, but as the automotive industry gains a better understanding of the market potential we are beginning to see the likes of GM and Toyota getting involved. It’s going to be a huge market and with profit margins potentially higher than core business earnings, they simply can’t afford not to be part of it.

Jeremy Carlson: Of course, the service business model represents a change for no other reason than you’re able to evolve and push change into that business model much more quickly when its service based. If we take GM’s mobility and car sharing service, Maven, as an example they can make changes within a week. That speed of change is just not possible in vehicle production.



What is the likely impact of ownership models on OEMs and suppliers going forward?

Grégory Derouet: It’s a shift that heralds structural change. As the mobility landscape shifts to a more technology-focused proposition, there’s work to be done on analysing how traditional roles are likely to alter. This is particularly important from a supplier perspective in helping to define what their role will be in the future and how business models need to be adapted, particularly if car ownership becomes less important and sales fall. We need to explore how a traditional supplier can adapt and survive in a changing market that is underpinned by technology.

Christian Back: Certainly, suppliers focusing on car components will face changes as we see the percentage of technology in the component cluster increase. With autonomous driving and electric vehicles we can see that new technology will certainly impact traditional suppliers. Particularly when we see that many of the typical component cluster of a vehicle will decrease due to these technologies by up to 30% or 40%. Suppliers currently focusing on traditional cockpits face the real big changes when the number of alternative drive vehicles increase.

Jeremy Carlson: I think that’s a very good point. But we are seeing signs that suppliers, particularly those that focus on cockpit electronics, are not sitting back as we move from a control to a user-based experience. They’re creating flexible cockpits so that during this transition they can support the consumer demand in either situation.

Egil Juliussen: There’s certainly evidence already that OEMs are looking at vehicle component elements they want to own themselves, so suppliers will face a squeeze in what they will be required to provide. OEMs are increasingly looking to own their own software platforms through acquisition like GM. It means going forward there’s less opportunity for Tier 1 suppliers to become the major software providers to OEMs.

2. Impact on vehicle sales and investment plans

“In terms of allocating investments, we are entering unknown territory - one where already we have seen huge investments sunk into failed collaborations.”

Grégory Derouet, Partner, Mazars.

While we are seeing contradictory trends emerging such as strong global vehicle sales forecasts up until 2030, a decrease in overall car sales is expected as the vehicle share and usage-based market grows. The emergence of new opportunities, particularly in the aftermarket sector, could increase to help counteract the drop in sales. At the same time, the higher importance being placed on technological development is set to increase R&D investment budgets. The lack of reliable KPIs as we step into new mobility territory could hinder the investment decision process and make it increasingly difficult to strategize.



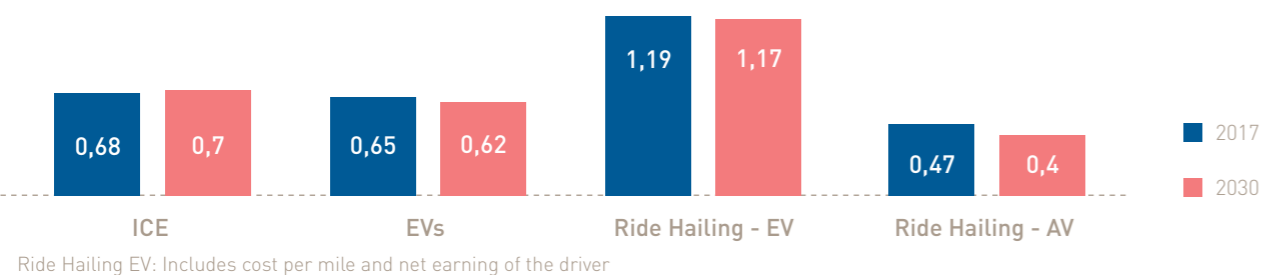
Are there any firm signs to suggest that mobility models will impact car sales?

Jeremy Carlson: In terms of the impact on the market overall, over the next few decades we would probably expect to see a reduction in vehicles sales, and potentially a reduction in vehicle fleets on a slightly larger scale as we combine mobility services with autonomous technology. Obviously this can change dramatically depending on each specific market, but I think in the interim the picture is less clear as the industry is such a state of flux right now.



MOBILITY-AS-A-SERVICE:

Autonomous Vehicles (AV) are set to revolutionize light weight vehicle costs per mile by 2030 /USD/mile)



Source: World Economic Forum, Catapult - Market Forecast - For Connected and Autonomous Vehicles

Christian Back: Indeed we have some contradictory factors such as higher number of people using cars, higher number of miles by the user and on the other side we have a higher level of car sharing leading to a less cars required and a lower level of production. But this may be an indication that the after sales market could increase which could offer new opportunities

Jeremy Carlson: Well if we expect that some people are going to give up owning a vehicle in exchange for service based mobility and, in turn, that to impact top line industry sales, then we also have to offset the fact that vehicles are going to run at a higher rate and therefore a reduced life cycle. This could certainly impact the after sales market in terms of utilization, wear and tear whether it's components on the vehicles side, controls, tyres, brake pads or internal electronics.

Christian Back: It's an interesting point, as in some areas of the after sales market there are better margins for the OEM and supplier, particularly in the area of maintenance. As the market progresses it will be interesting to see whether this area is one that some automobile players will begin to focus and specialize on.

Egil Juliussen: At some point there will be a decrease in car sales. If you take the United States, there are currently 2.7/2.8 cars per household which is forecast to drop to 2 per household. This is mainly based on the fact that an autonomous vehicle can handle more than one person's driving activity. The forecasted drop in car sales will depend on how aggressive the take up is as well as the time frame.

Jeremy Carlson: We know the impact is going to be pretty significant on a lot of different areas within the automotive industry. But there is also the question of the ripple effect on peripheral industries beyond automotive. While it's not yet clear, the bottom line is that significant change over a long period of time will certainly impact other industries as well.



Looking at the different mobility models, how will companies focus their investments moving forward?

Grégory Derouet: From an investment perspective, I think it's going to be increasingly difficult to strategize. On a traditional model you had the security of reasonably reliable forecasts on consumer preference and car sales that could formulate investment plans in terms of development going forward. In terms of allocating investments, we are entering unknown territory - one where already we have seen huge investments sunk into failed collaborations.

As business models evolve, the ability to add value will be dictated by how much to allocate to R&D and in identifying the right technology. There therefore needs to be a degree of speed and flexibility in processes to achieve this. There's also the question of which key performance indicators (KPIs) should investors take into account when allocating investments. For me, there will be a lot more valuable and non-collectable data to take into account in the investment decision-making process for mobility services. To use an analogy, the cockpit for the CEO and CFO going forward will be much more difficult to pilot.

Egil Juliussen: I estimate that the cost of investment in autonomous driving has up to now been around US\$30bn with future yearly investments across high tech and automotive likely to be US\$7-10bn per year going forward and it's probably going to increase fairly rapidly as deployment gets going in a few years. That's a pretty significant level of investment.

Christian Back: I think we can identify how traditional players are handling this in three steps and they are all linked. The first one is R&D; OEM's and traditional suppliers are investing significant amounts in R&D on an increasing annual basis. Then there's investment in solutions. Within the next 5 years, Volkswagen has announced to invest \$35bn in mobility technology solutions that is around 70% of their total R&D expenditure; Hyundai for example will also invest \$17bn. Third, there is collaboration. Recent examples have seen Toyota, Audi and BMW all announcing collaborations with partners that progress the new mobility landscape.

3. Regulatory influences

“Markets have been pretty aggressive in trying to control different independent drivers engaging in these services and we do expect that to have an impact on how different mobility services progress.”

Jeremy Carlson, principal automotive analyst at IHS Markit

Some countries have taken a more liberal position than others on regulating the sharing economy, particularly in the deployment of self-drive solutions. From a regulatory point of view, there's a balance to strike in terms of encouraging sustainable and sharing economy solutions and regulating safe use. While the automotive sector is already used to being heavily regulated, how countries deal with new mobility challenges is likely to change the regulatory environment which in turn is likely to shape how business models evolve.



What impact is regulation having on players in the mobility sector?

Egil Juliussen: In terms of regulation, states in the US such as California have been much more lenient on autonomous driving rules. This basically means everybody is testing in these cities. In California alone, 50 companies have a permit to test in California. Out of this 50, 10 are Chinese and just under 10 are European. It means that all of the testing knowledge is getting accumulated in the US because regulations in Europe have been much slower to adapt. However, we are seeing regulations in China beginning to change, which should begin to attract companies looking to test autonomous vehicles in China later this year or early next year.



The investment rules are changing

The calculus of where to invest is changing. It's no longer a question of one person's mobility equals one car. I think that fundamentally changes how auto makers and the rest of the industry allocate investment budgets, particularly when these auto makers and suppliers are already developing many of the technologies that underpin mobility as a service, autonomous driving and vehicle electrification. While such development has perhaps been used for a slightly different application, it's not necessarily representing a completely different area of investment for them.

There's certainly some nuance to that when you think about how you apply those technologies to different business models. For example, there has been a lot of technology investment based on the status quo of one to one owned vehicles which can also be applied to shared vehicles in the future.

But the sheer pace of change within the industry is accelerating and the agility that companies need to be able to stay on top of it and not fall behind highlights how complex the challenge is from an investment perspective. There are so many different elements of technology, vehicle control, computing, connectivity that have to go into a vehicle, it's an incredibly complex and costly machine.

Of course, companies have been partnering to produce these vehicles for a number of years and that's not going to change, but I think that as vehicles become increasingly intricate it's leading many companies to realize that no matter how much money they invest, it's never going to be possible to do it on their own. So partnerships, investing in disruptive technology at an early stage, investing in suppliers and developing closer partnerships within the supply chain to develop those solutions will become a more important focus of any investment program.

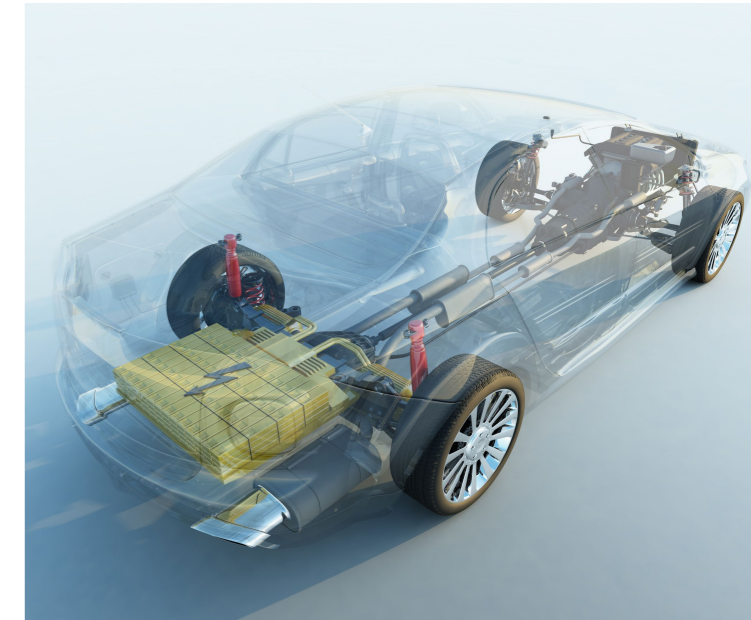
Jeremy Carlson, principal automotive analyst at IHS Markit

Jeremy Carlson: Yes, the autonomous vehicle is a pretty big game changer for mobility services, which is why we see the likes of the US and now China at the vanguard. However, the European autonomous mobility market is unique in that we are seeing a lot of exploration between automotive providers, the supply chain and municipalities and they're having deliberate discussions about where and how they can deploy these services within existing infrastructure. Whereas if you look at regulatory environments in the US and China, there's a different and more company-led operating environment when talking about deployment that is impacting players.



Is regulation helping to shape how mobility service models evolve?

Jeremy Carlson: If we look at mobility as a service, regulation can certainly shape how the different business models evolve, particularly in terms of ride hailing with individual drivers. Certainly, we can see most markets have been pretty aggressive in trying to control different independent drivers engaging in these services and we do expect that to have an impact on how different mobility services progress.



Grégory Derouet: Players are both reacting and anticipating their responsibilities, particularly in the area of autonomous driving. But the automotive industry is already very heavily regulated, especially in terms of passenger safety and security. So even if the regulatory focus changes, I'm sure the industry would find it easy to adapt to any new regulatory environment. So while regulatory requirements will need to be managed, I don't see it as being a major risk for players.

4. Bridging the skills gap

“... These specialists range from robotics experts, cloud architects and even developers in the gaming industry, which shows the diversity of skills now required in the automotive sector.”

Christian Back, Partner, Mazars

IT and software skills are a vital part of mobility services with demand for such skills increasing as the market evolves. How quickly and efficiently the automotive sector copes with incorporating the required IT skills into a predominantly engineering and production-led sector will be key. As well as demand and supply, investment in education, the ability to transfer existing skills, as well as recruiting from the non-automotive sector will all ensure that the industry meets the sheer numbers and level of skills required? However, pressure on employment costs and the push for further collaboration and partnerships to up-skill the existing and new workforce will prove challenging.



Will we see new skill sets emerging and how will the industry plug any gaps in the short to medium term?

Christian Back: Of course OEMs are currently looking for an enormous number of IT specialists. We have an example of Volkswagen looking for a thousand specialists in Wolfsburg, Germany alone. These specialists range from robotics experts, cloud architects and even developers in the gaming industry, which shows the diversity of skills now required in the automotive sector. Other examples include GM seeking 2,500 data scientists and also people who have experience in 3D printing and Ford last year hired 400 programming experts from Blackberry's mobile communication centre to develop in-car connectivity. So we cannot only see how IT skills are vital, but we also see how IT skills needed are changing. We can also see this on the non-tech side where skills on evaluating and creating new business models for the automotive industry is increasingly important, whereas in the past the focus was much more on continuously improving margins and processes. So we are seeing how skills across the board are changing due to new mobility models.

Grégory Derouet: We see a large part of R&D focused on the security of the car today. But as Christian says, looking forward there will be more and more focus on software rather than the engineering side. We already have a lot of movement with new players coming into the industry, as well as working with technology that is constantly evolving to cope with the new mobility market needs. Finding people with the right skills will become increasingly challenging when taking into account the sheer numbers of IT experts required. Looking forward, employment costs could be an issue.

Egil Juliussen: Yes. The biggest requirement will be for software skills and there is already a shortage, particularly in the field of cybersecurity. If you look at all start-up companies in the autonomous driving and mobility service sector they are nearly all based in the US with China a strong second. There are a few in the UK and a couple in France. After that it's pretty scarce in terms of industry participation. If we are to ensure that mobility service expertise isn't clustered in one or a few countries, there needs to be wider global participation.

Jeremy Carlson: I agree and it kind of reiterates that this isn't all a brand new challenge as the industry has been hiring software engineers to develop a lot of the new automotive electronics for some time. But I think the challenge will become much more acute due to how much of the vehicle will be software defined in the future.



Does this herald a higher concentration of players in the mobility sector in future?

Christian Back: In Europe we see a lot of providers in the ride hailing and car sharing segment, which I think is very typical for a young and new market. But my expectation is that we will see market concentration within these segments further down the line.

Egil Juliussen: I think it will depend on how mobility evolves, as well as how much influence there is from regulators. We are likely to see between three to five major players as well as a number of niche players focusing on specialized areas. But much will depend on whether cities start to exert control as they do in the mass transit sector. In Europe particularly, there's more likelihood of controlling who gets to run driverless vehicles and mobility services in cities. In which case there may well be a higher concentration of providers.

Jeremy Carlson: There's also the question of whether municipalities deploy their own mobility fleets as a public transport function rather than outsourcing to a private company and regulating an industry that supports their citizens. We don't know how that will all play out yet, as it's still quite a fragmented market. While competition is going to be important, I certainly would expect some consolidation in future. There may well be a higher concentration of providers.

● ACQUISITION ● OWNERSHIP ● INVESTMENT ● PARTNERSHIP

	BMW	Daimler	Ford	GM	PSA	Renault	Toyota	VW
AD Maps (HERE, Civil Maps, Tom Tom, etc.)	●	●	●					
Autonomous technology (Nauto, SAIPS, Autonomic, etc.)	●	●	●	●	●		●	
BEV-bus (Protera)	●							
Business unit (Maven, InMotion)				●				
Car-sharing (TravelCar, Rent a Car, Zipcar, etc.)	●	●	●	●	●	●	●	●
Driver data (Zendrive)	●							
Driverless mobility (MOIA)								●
Hailing (Uber, Grab, Lyft, etc.)	●	●	●	●	●		●	●
Intra-city bus services (Flixbus)								
Mass transit information (Embarq)	●							
Mobility app (Maas Global)							●	
Parking app (JustPark, Park Mobile)	●							
Platform (MyTaxi, Moovel, Moovit, etc.)	●	●	●					
Ride-sharing (Via, BlaBlaCar, Chariot, etc.)	●	●	●					
Transit app (GlobeSherpa)		●						
Travel app (RideScout)		●						

Source: < Mobility as a Service > by Dr. Egil Juliussen and Jeremy Carlson, updated on 26 Sept 2017

