

How the auto industry is preparing for the car of the future

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Autonomous and electric cars, connectivity, and ridesharing are changing the way auto industry players think about value chains, data analytics, and manufacturing.

Behind all the talk of robo-cars, electric vehicles, and increased car connectivity is a focus by major car companies on serving customers' more intricate technological needs. In this episode of the *McKinsey Podcast*, senior partners Asutosh Padhi and Andrea Tschiesner speak with McKinsey's Simon London about how four trends—autonomous driving, connectivity, electrification, and ridesharing—are paving the way for entirely new forms of mobility.

Podcast transcript

Simon London: Welcome to the *McKinsey Podcast*. I'm Simon London with McKinsey Publishing. Let's start with a question. What's the smartest device you own? Is it your phone, your laptop, maybe you're wearing a smartwatch? Well, if you drive a car that's less than a few years old, it's probably smarter than any of these. And your next car will be even smarter: more sensors, more connectivity, more processing power. Perhaps even the ability to drive autonomously.

This is all very exciting for us consumers, and for carmakers and suppliers it means there's a lot of change coming down the road. For a quick spin through the issues, I'm joined today by Asutosh Padhi, a senior McKinsey partner based in Chicago, and Andreas Tschiesner, a senior partner based in Munich. Asutosh and Andreas, thanks so much for taking the time today.

Asutosh Padhi: Thank you, Simon.

Andreas Tschiesner: Happy to be here.

Simon London: I've heard you talk about the four ACES, which is a useful framework and almost a mnemonic device for thinking about the trends. Why don't you just give us a quick tour of the four ACES.

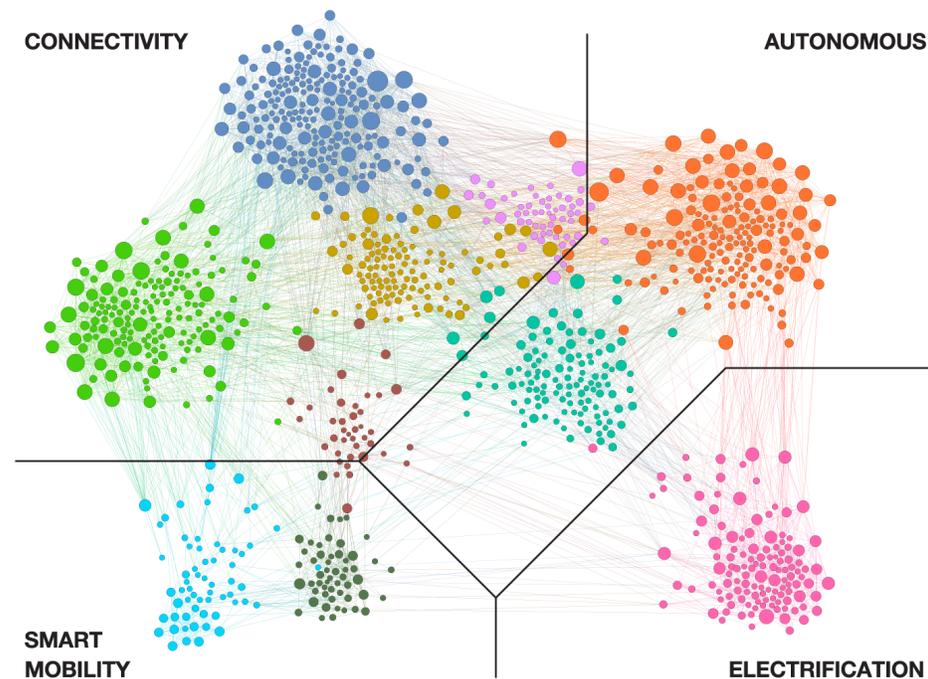
Asutosh Padhi: Our view is that the automotive industry will see more disruption in the next ten years than it has seen in the last 50 years. This disruption will be driven by four factors that we call the ACES. It stands for autonomous, connectivity, electrification, and ridesharing. Autonomous really is, along a full range, what we call from level one to level five, with level five being a driverless car that can operate in any part of the world.

Connectivity is, you start to think of the car as a computer on wheels, and a computer generates massive amounts of data. A car is going to have 200 million lines of software code in the future. All of Facebook in comparison today is roughly about 50 million lines of code. So it's a massive change.

Electrification is the shift away from the bedrock of the industry, which has been the internal-combustion engine to a whole range of battery applications. It has been driven by the environmental factors.

Analysis of the new mobility start-up and investment landscape shows activities across ten clusters.

- Back end and cybersecurity
- User-interface technologies
- Telematics
- Gesture/voice recognition
- Parking and mobility optimization
- Sensors/semiconductors
- Autonomous solutions
- Electrification/energy storage
- Vehicle leasing/fleet mgmt.
- Sharing solutions



The only reason electrification currently exists is because of regulations. But regulations are going to drive initial adoption that then provides the scale that the industry needs for electrification to become a viable economic option. So our view is that we are likely to get to a tipping point by which battery costs drop from \$200 to \$225 a kilowatt-hour today to the neighborhood of roughly \$100 a kilowatt-hour, which is going to be the breaking point when fleets, for example, will start to prefer electric vehicles over the internal-combustion engine.

On ridesharing, all of us have been users of Uber and Lyft. And we've all experienced the benefits and convenience of ridesharing. This is what we call ridesharing 1.0, where consumers are taking existing cars that are typically standing in the garages or in the parking lots for about 97 percent of the time and thinking about how they can monetize an asset in which they put in the money.

There are real limitations with the current ridesharing model; for example, you can only travel point to point. It typically works in an urban environment. It does not work with kids. As we think about ridesharing 2.0, there is going to be an unlock on each one of these as car companies start to reimagine how a car for ridesharing is going to look and feel different.

One great example would be around the usage of fleets. When you start to look at fleets, the fleet owners are going to make decisions on car buying based on the total cost of ownership. And this is where electrification and ridesharing start to go hand in hand together. In fact, we expect that a lot of the vehicles that'll be used from a ridesharing standpoint might actually be electric vehicles.

Andreas Tschiesner: Now building on this, while the individual trends are already shaping up the industry, it's the conversions of those four trends that make completely new forms of mobility happen in the future.

We did analysis on how in certain cities, high-income, highly densely populated cities, we will see a future with fully connected robo-cars—robo-cars that are connected to vehicle control centers in the city and are fully integrated into the mobility infrastructure of cities and are really providing completely new forms of mobility.

“Many carmakers have completely rethought the customer experience and the customer interface.”

So the customer experience will change. The offering of the automotive industry and adjacent industries will completely change. And while today those disruptive business models that Asutosh just talked about make up about 1 percent of the revenues, our model shows that by 2030, which is just two to three generations of cars out, we will have 25 percent of revenues coming from those new disruptive business models. So the change is happening very, very fast.

Simon London: One of the things that's quite difficult from a consumer perspective is just to understand—or even just somebody who's interested in cars, like me—how fast is this actually going to happen? How does this look five years out, ten years out? When does the fleet of robo-cars arrive? Twenty years out by the sound of it. Talk us through when this is all going to happen.

Andreas Tschiesner: Many of the changes will take time. We've just been talking about the different levels of autonomy. But we will see the first signs of change relatively quickly. There are lots of companies now working very heavily to bring out the first set and the first small fleet of robo-cars within the next couple of years. Yes, they will be geofenced. They will just be working under certain conditions like no snowfall, like we often have in Austria.

But in certain type of cities and in certain restricted times of the day, we will be able to have an autonomous driving experience. For example, the first autonomous bus in Germany has just been [made operational] in a small town for the distance of a quarter of a mile. But we will see the change happening in certain instances relatively quickly. And as I said, by the next ten years, those changes will have a fundamental impact on the profit pool as well as on the revenue pool of the industry.

Asutosh Padhi: I expect that electrification is going to play out in the next five years or so, starting with China and then starting with fleets back in the United States.

If you look at connectivity, it's already here. I think most consumers are paying a lot of attention to the kind of software enablement that cars provide. Many of the carmakers have come back and completely rethought the customer experience and the customer interface.

Ridesharing 1.0 has accelerated significantly. The market has been growing in high double digits for the last several years. I think ridesharing 2.0 is likely to happen in the next three to five years. From an autonomous standpoint, our view is that the level-four applications we expect to see will start to happen in the next possibly three to five years.

Andreas Tschiesner: We have seen that investments in those ACES technologies have increased by the factor of 12 in the last couple of years.

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Simon London: So if I'm a carmaker, all this is probably both very exciting but also a little bit alarming. As you said, Asutosh, when there are big technology changes like this, control points change, profit pools change, the major players often change quite quickly, like in the case of the smartphone industry. How do we see big car companies reacting here?

Asutosh Padhi: The first thing that I think car companies need to get a handle on is a viewpoint that the revenue pools from the traditional technologies and the traditional business models—which is where we are primarily selling a car to a consumer—has essentially flattened out.

All the growth in the future is going to come from the combination of the ACES. It's new technologies, it's new business models. If you recognize that, then we would say there's a few things that they need to consider, which are very different than how the industry has historically operated.

The first is what are the control points within the ecosystem? Control points meaning the elements that matter most to the customer. The elements of the customer value proposition that matter. How do you get a handle on what's really going to matter, and how do you think of the car less as an OEM tier one, tier two, which has been the traditional structure, but how do you think of the technology stack? And which elements of the technology stack do you need to play a critical role in?

The second thing that I think car companies will need to do, which is, again, different than how it has worked historically for the automotive industry but is something that other industries have learned really well, is the monetization of data. Recognizing that there are big investments that'll need to happen in software. Players need to start to think about how do you monetize the data. For example, usage-based insurance. But that really is the tip of the iceberg. And there'll be a whole new world of opportunity there.

The third thing we'd say is around agile and two-speed R&D. Traditionally, the automotive industry has used a waterfall-based approach to software development. Now, as the car becomes a computer on wheels, the amount of software content in the car is going to triple in the next 15 years. To be able to get that software developed is going to require a massive increase in the number of software engineers.

And currently the industry is just not positioned to be able to meet that incoming demand. Therefore the model, which is more productive, which is used by the rest of the world, is a model called agile. Now agile is typically about two and a half times more productive and about two times faster than the waterfall-based approach.

In the automotive industry, however, the challenge is how to take a linear, sequential product-development approach the industry has developed for the last 100 years and combine that with a model like agile, which is much more rapid, much more iterative. Being able to get to this new model is what we call a two-speed R&D.

Andreas Tschiesner: And what's interesting, in spite of all this request for a much, much higher productivity in software development, our model predicts that we still need about 100,000 additional software engineers for the automotive industry in the US alone. So a huge number. That is a big challenge, not only for the industry but for society as such and for the industry in general to build up, and to build those talents for the software engineers. While

software is hugely important, that's just one out of 25 new competences that we analyze the auto industry has to pick up.

The good news is that at this point in time we are at record years in terms of profitability. So there is a financial cushion for the industry to take on those challenges. We still believe that the integration that has to happen on an automotive level is actually a good asset that the industry has today. So we are all positive that they will be able, if they act quickly enough and decisively enough, that they will be in a good position to master these challenges.

Simon London: Potentially, this is really good news, isn't it, for car companies, because actually you're in more constant touch and more intimate touch with your consumers, and you know more about the consumers and their habits than if you were just making a metal box, selling it through a dealer, and unless there's a recall, you might not have very much contact again.

Asutosh Padhi: Our view is that this disruption is both good news and bad news for the industry. The bad news is that the traditional business models and the traditional technologies have peaked.

The good news is that for players who are able to move successfully into this new world, there is a whole new world of revenues and profit pools that could come from the ACES opportunity. The size of that is going to be very significant.

Simon London: Let's just talk a little bit more about what you call the control points. Why consumers really buy vehicles, and what matters to them most. I know we've done quite a lot of consumer research on this. What do we know about what consumers want?

Andreas Tschiesner: In addition to what Asutosh just mentioned on the willingness of consumers to switch brands for better connectivity offerings, we also found out that 86 percent of the consumers are looking for driver-assistance systems, which bring up safety, which eventually also, if you have level-three and level-four autonomy in the cars, also are completely new use cases. Being able to use smartphones in the car, which for many of the consumers, as we found, is the most important aspect of using the driving time more productively.

For the auto industry there's a good analogy. If you look at the gaming industry, how the gaming industry has a 24/7 view on their consumers, especially the most important consumers—those heavy players who are accounting for 90 percent of the profit pool—they are watched continuously and server load is watched continuously. That is something the auto industry will also have to copy—that you have a clear eye on how your consumer is using the product and what you have to do in order to make the customer experience as superior as possible.

Asutosh Padhi: So let me build on what Andreas just said around ADAS [advanced driver-assistance systems], which when we look at consumer research, as Andreas said, about 86 percent of the consumers are willing to potentially switch vehicles because of ADAS.

Now if you look at ADAS, inside of ADAS if you're an automotive OEM, you'd go back and say that there are probably two or three things that really matter. The first is what does the cloud content look like? Because that's part of what we call this high-definition mapping which drives a user experience. The second is the quality of the algorithms that you're using to be able to write the software. The last part of this are the sensors, which are essential for accurate perception and improved driving experience. If you think about it, consumer backed, you'd say those are the three critical control points in ADAS.

Then you'd take a step back and say, "Which of those can you own? Which of those do you need to buy? And which of those do you need to facilitate?" Facilitate is a new skill. Automotive players are used to either owning or buying. Facilitation is a certain level of technology integration with other players in the ecosystem that have critical capabilities, but with an ability to still positively impact the customer experience.

Simon London: It's interesting that you mention ecosystems. We recorded a podcast a little while ago talking about the ecosystem view of strategy that was having to come to a lot of different industries because of the technology enablement and the integration that's required. It sounds like the automotive industry is almost exhibit A for a whole new view and a whole new strategic competency. Is that right?

Andreas Tschiesner: I think that's totally right. The automotive industry is a good example of past successful cooperation between suppliers and OEMs in the value chain. But at this point in time, it is very linear. So the OEMs did the specifications, they did the systems. Then the suppliers were delivering certain systems, certain components, and the whole value chain was very, very structured.

I think we are looking at a future where we will see ecosystems where we have "coopetition." You will cooperate with certain players while you compete in other areas. It will be much more open. It will be a real open platform for different companies bringing their competencies and obviously then the automotive players integrating them into a product and someone making sure that the customer experience is there. But the way of cooperating will be completely different. That's also one of the big challenges for the companies—to open up for a more dynamic and more open platform-based cooperation.

Simon London: So they need to learn to play nice with others.

Andreas Tschiesner: It will be interesting to see those new forms of cooperation with all trades of the auto industry, like a big view on operational excellence and on the zero-defect strategy, how that will play out—and how we will see the combination of those two things, of a more dynamic platform-based cooperation with old-fashioned and very, very important elements of the auto industry in combination.

“When disruption happens, our experience is first and foremost that consumers benefit a lot.”

Simon London: It's almost lean production and agile having to be kind of melded together, two of the great management trends of the last 30 years or so, one that's been around for a long time, one that's only just emerging. They're going to have to be ambidextrous and do both.

Asutosh Padhi: I would agree with that. But I think in addition to lean and agile there is also another frontier that's going to open up called Industry 4.0. The first industrial revolution involved mechanization, water, and steam power. The second one saw the assembly line, which the automotive industry led. And in the third industrial revolution, value was created by computers and automation. When we look at Industry 4.0, it's a new world in which the physical world is going to coexist with unprecedented amounts of data, computing power, and other advances.

Every single era has seen a massive shift from a productivity standpoint, has seen a massive implication around the kinds of skill sets that are relevant—massive, and profound implications in society. Industry 4.0 is actually different than lean.

Lean was about how to take existing processes and make them more efficient. Industry 4.0 is about reimagining the work itself. The question here is, how does the automotive industry, on top of all this disruption, take advantage of the capabilities that are coming from Industry 4.0—which are essentially high amounts of data with great amounts of analytics that are going to provide an opportunity for productivity—and take advantage of that to drive some of the productivity that's needed—to be able to fund all the investments that are going to be needed.

Andreas Tschiesner: And if you just think about the billions and billions that the industry now has to invest into ensuring the maturity and the quality levels of a product through prototyping, through durability testing for power-train solutions as well as the car in the future with condition monitoring, constant views on the car, I think a lot of that will be done through simulations. A lot of it will be done through digitizing and by having constant overview on the condition of the car out in the road. That whole system of making sure that the quality is right for the consumer will be able to done at much lower cost levels.

Simon London: I happen to live in Palo Alto in California and this is why over the last ten years I see all these automotive OEMs and a lot of automotive suppliers opening research facilities and quite big campuses in Silicon Valley.

To play devil's advocate here, go back to the mobile-phone industry. Whenever you get disruptive changes like this, the incumbents really struggle. There are probably a few examples of tectonic changes like this in the technology, the control points, and the industry structure where the incumbents, the dominant players, do manage to navigate the transition. Can the big car companies really do this?

Asutosh Padhi: When disruption happens, our experience is first and foremost that consumers benefit a lot. But also the profit pool shifts with the shift in the control points. Interestingly enough, what we are finding is that in the automotive industry, when we did research around what brand of autonomous vehicles are you likely to buy, consumers still

have a high degree of confidence behind the current brands that OEMs have, and they believe that there's going to be a certain degree of trust and safety that's associated with buying an autonomous car from a brand-name OEM.

However, the incumbents still have advantages as far as consumers are concerned. The consumers are going to be pretty brutal and very finicky around whether or not they're able to meet their increasingly high levels of expectations.

Andreas Tschiesner: Understanding the customer; I think that's the single biggest item to make this change positive. Obviously there are few other assets that the auto industry has. It's a highly regulated industry. It's an industry where the car has to be kept safe and in some condition over a period of five to ten years, in many markets even longer.

So the entry barriers for others are obviously pretty high. But by all means that's not a cushion for the industry to rest upon. How do we acquire those new resources? How do we acquire new competencies? How do we cooperate together? And I think we see many, many positive examples of companies taking on that challenge. But given the totality of the change I think the complexity for management is really, really high to master all of those.

Simon London: So sadly that's all we have time for today. Thanks again to Asutosh and Andreas for speaking with us today. And thanks, as always, to you, our listeners, for joining. To read more about cars, technology, and to learn a little about the McKinsey Center for Future Mobility, please visit McKinsey.com. 

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