# THE FULLY AUTONOMOUS CAR

## HOW SELF-DRIVING CARS ARE POISED TO MOVE INTO THE MAINSTREAM AND UPEND THE AUTOMOTIVE INDUSTRY

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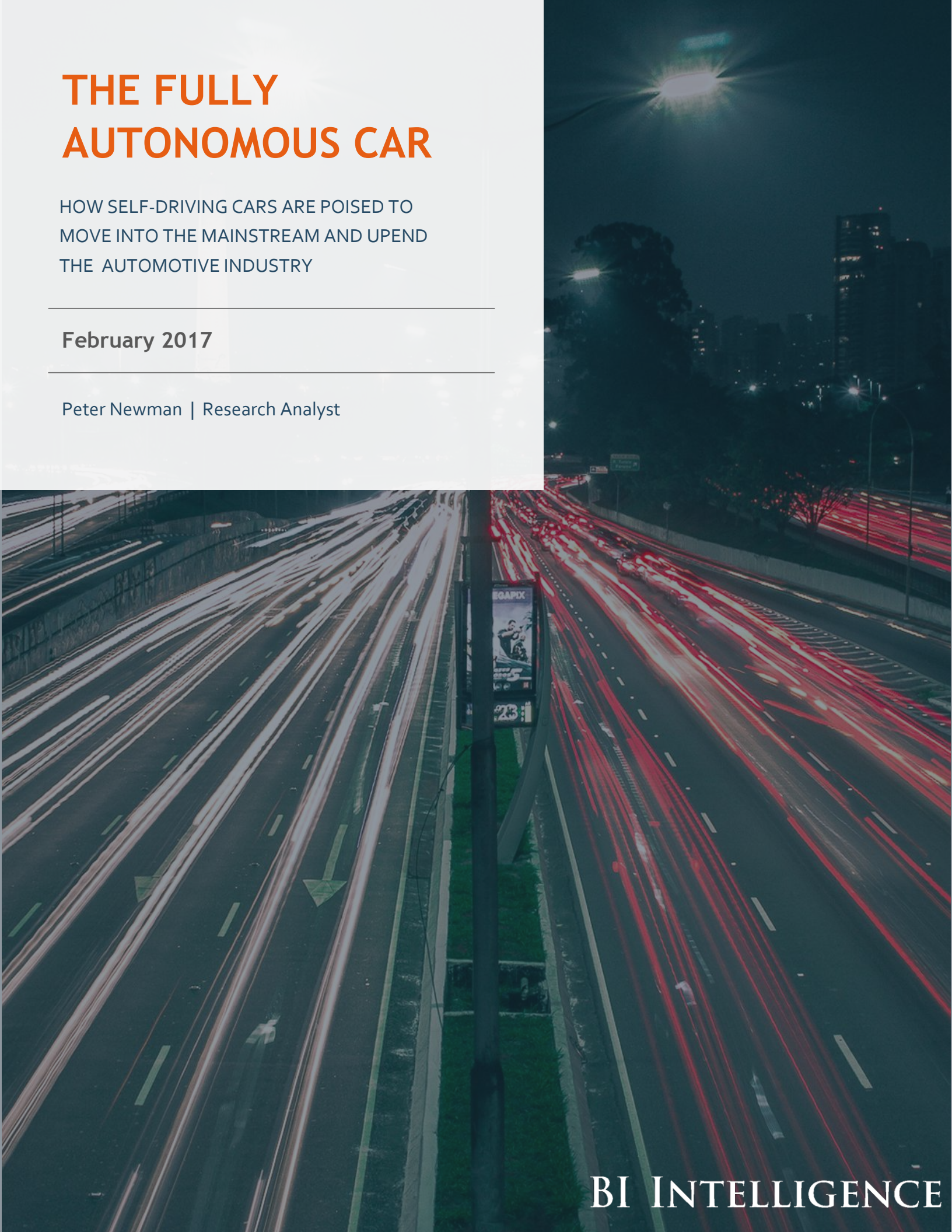

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# KEY POINTS

- **Fully autonomous vehicle technology continues to advance, and all signs point to self-driving vehicles becoming a reality in 2018.** In fact, consumers can can already buy vehicles that will get software updates over the next few years that will let them hit the road without a driver.

- **BI Intelligence estimates that nearly 2.4 million self-driving cars will be shipped in the US between 2018 and 2025.** By 2025, we project there will be nearly 2.1 million on US roads.

- **However, developers still need to address several challenges before autonomous vehicles can reach general consumer availability.**

    - **Technological developments.** Companies looking to create mass-market self-driving cars must augment vehicle sensor systems, continue to enhance autonomous driving artificial intelligence (AI) programs, and improve mapping and routing protocols, all while reducing the costs associated with these technologies.

    - **Regulatory barriers.** Autonomous car developers must navigate hazy regulatory frameworks, while balancing requirements and guidelines from different authorities and various levels of government. In addition, they must engage in testing only where permitted and only in specified manners.

    - **Consumer openness.** To achieve mass adoption, makers and sellers of autonomous cars will have to convince consumers that the vehicles will make their lives easier, and that the technology is safe and worth the increased cost.

- **As they approach the mainstream, autonomous vehicles will upend the traditional automotive sector and adjacent industries.** We anticipate massive disruption as a result of the introduction of self-driving cars, affecting not just the consumer automobile market, but both personal, municipal, and commercial transportation, shipping and logistics, and numerous other sectors.

Download the charts and associated data in Excel »

# INTRODUCTION

The self-driving car is no longer a futuristic fantasy. Consumers can already buy vehicles that, within a few years time, will get software updates enabling them to hit the road without the need for a driver. This autonomous revolution will upend the automotive sector and disrupt huge swaths of the economy, while radically improving energy efficiency and changing the way people approach transport around the world.

For most of the last century, automotive development focused on the car itself. Manufacturers tried to build more powerful engines, make more comfortable interiors, and streamline the car's body to reduce drag and increase fuel efficiency. Carmakers today must continue to invest in these areas, but they also face additional challenges related to the advent of autonomous technology, which is maturing fast and has already started to transform vast segments of the automotive sector. New companies are emerging in the space while legacy players rush to innovate or be left behind. The autonomous vehicle segment has been in near-constant flux, with major announcements and radical shifts occurring frequently.

As this technology takes hold, millions of jobs will transform radically or even disappear. In addition, personal car ownership could fade from practice, displaced by car sharing, ride-hailing services, and driverless taxis. The result of this may be that many of today's children will never drive a car at all.

This report will provide an update to BI Intelligence's earlier analysis of the self-driving car market. We size the US market and provide an updated forecast, as well as profile the players expected to take on a prominent role in the autonomous future. In addition, the report examines the barriers to autonomous car development and adoption, including necessary developments in technology, regulation, and consumer sentiment. And finally, we look at the impact the introduction of autonomy will have on various industries and transport trends.

# MARKET OVERVIEW

The US automotive market is a mature industry, populated by legacy companies with hundreds of billions of dollars in total assets. With cash on hand, these players are attempting to anticipate trends in car sales by investing in the nascent autonomous vehicle space, where a number of new entrants are also looking to cement a place.

## Addressable Market

Automotive sales have recovered from a major dip during the Great Recession, matching levels from the early 2000s, with sedan sales dropping as SUV, crossover, minivan, and pickup truck sales grow. Some industry observers have speculated that we are fast approaching or even have reached "peak car" and that the number of vehicles sold will begin falling in the coming years. While there are few indications that such a drop is imminent, increasing urbanization, the drop in multicar households, longer-lasting vehicles, and the growing functionality and reliability of ride-sharing services all point to a market that may be cresting a wave.

Carmakers are generating massive revenues; GM's automotive unit generated over $115 billion in the first three quarters of 2016, while Ford saw $105 billion for the same period. Automakers have prioritized more premium features, enabling them to command higher price points. For these firms, a move toward autonomy represents the ultimate premium add-on. This could act as a key differentiator in a market that may enter secular decline in the coming years and decades.

## The Autonomous Segment

The car market of the future will allow consumers to choose between traditional vehicles, semi-autonomous vehicles, and fully autonomous vehicles. These will offer different features and be available at multiple price points. **This report will focus exclusively on fully autonomous, self-driving vehicles, and the technology, regulation, and perceptions that surround them.**

Autonomous cars will likely be first available for widespread consumer purchase starting in 2018, with increasing availability in the following years. As they are introduced to the broader market, they will make up a small but steadily increasing portion of automotive sales.

The rollout of direct-to-consumer self-driving cars will likely occur in stages:

- **Stage 1:** At first, autonomous features will be available as optional add-ons for luxury and cutting edge, fully electric vehicles. These will be meant to appeal to high-income, tech-savvy buyers who will be the first adopters of the new technology.

- **Stage 2:** Some vehicle lines will be modified or introduced to include autonomous features as part of the base vehicle. This will also likely be limited to luxury and fully electric vehicles.

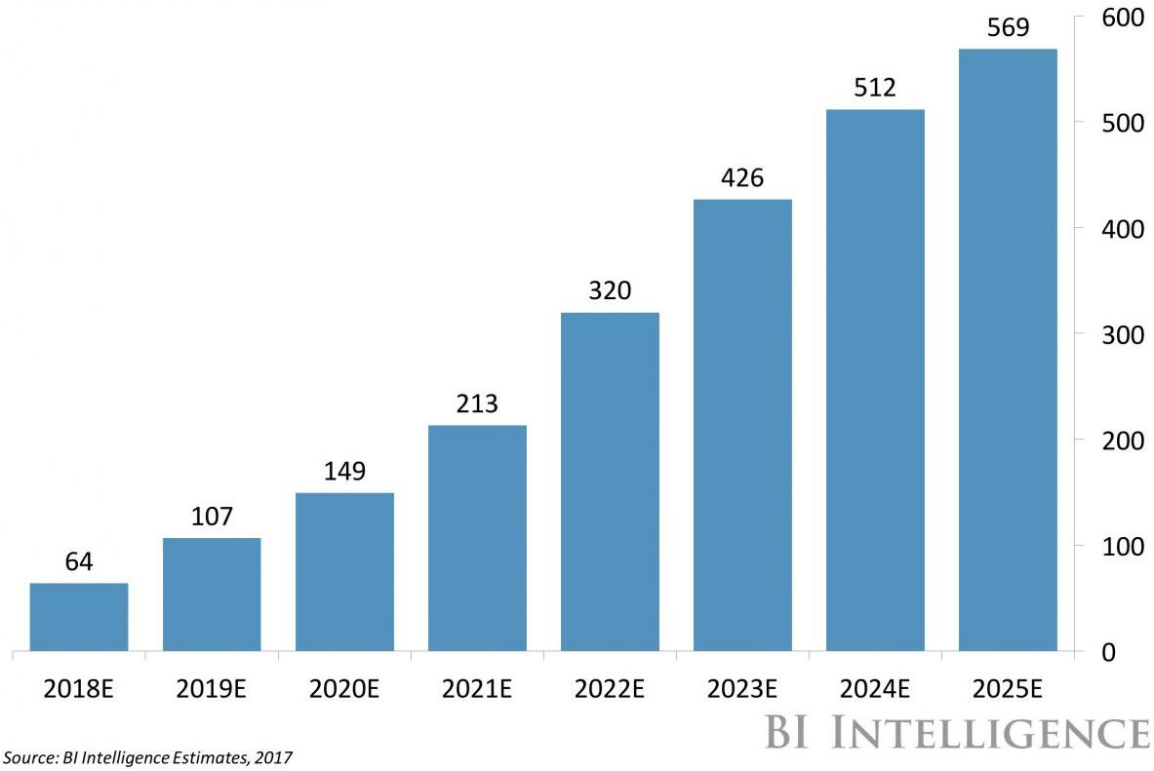
- **Stage 3:** As the technology matures (beyond the timeline of our forecast), costs drop, and consumers gain greater exposure to autonomous vehicles, the features will filter down to mid-level vehicles.

- **Stage 4:** At a later point, autonomous cars will be ubiquitous and trusted, and regulations will allow automakers to remove the steering wheel, pedals, and other such components from the vehicles.

- **Stage 5:** Finally, self-driving cars will reach a critical mass, and authorities will move to limit the place of traditional vehicles on the roads due to the safety advantages that come from autonomous vehicles.

## FORECAST: Fully Autonomous Car Shipments

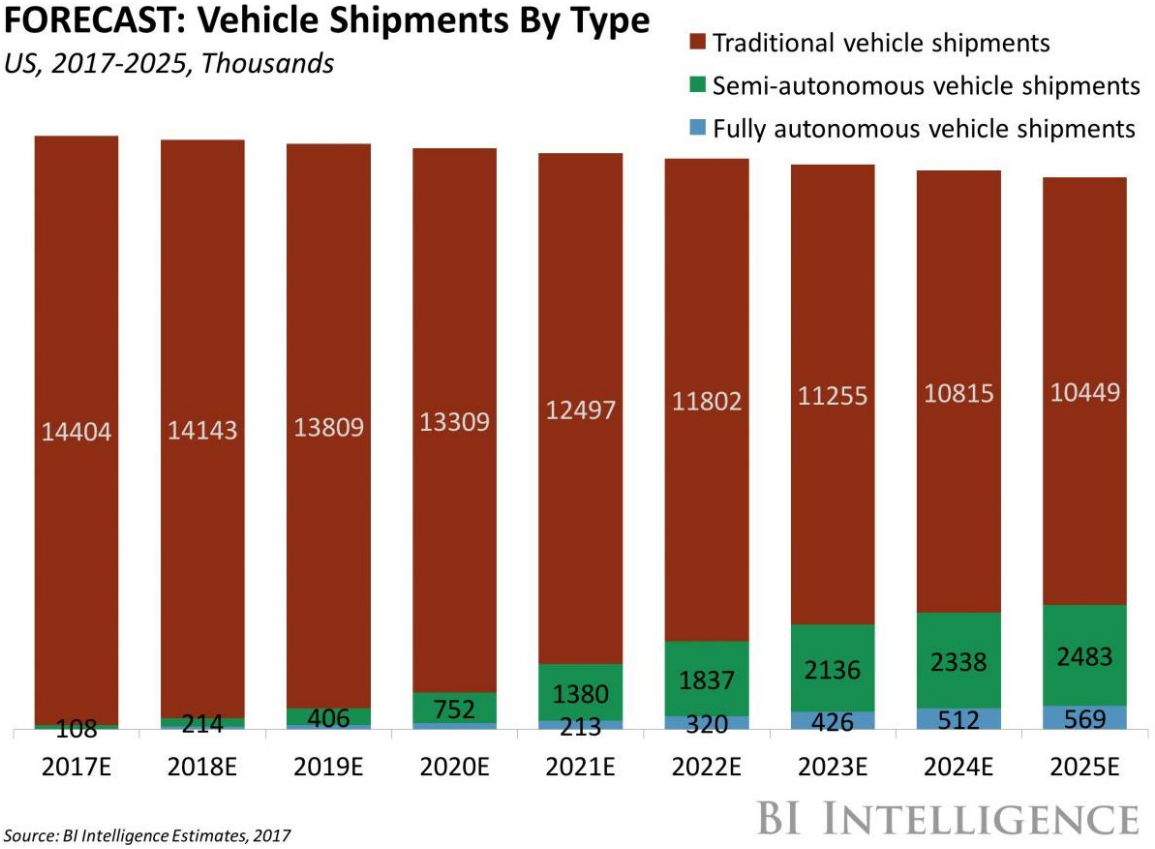
*US, 2018-2025, Thousands*




*Source: BI Intelligence Estimates, 2017*

## FORECAST: Vehicle Shipments By Type

*US, 2017-2025, Thousands*

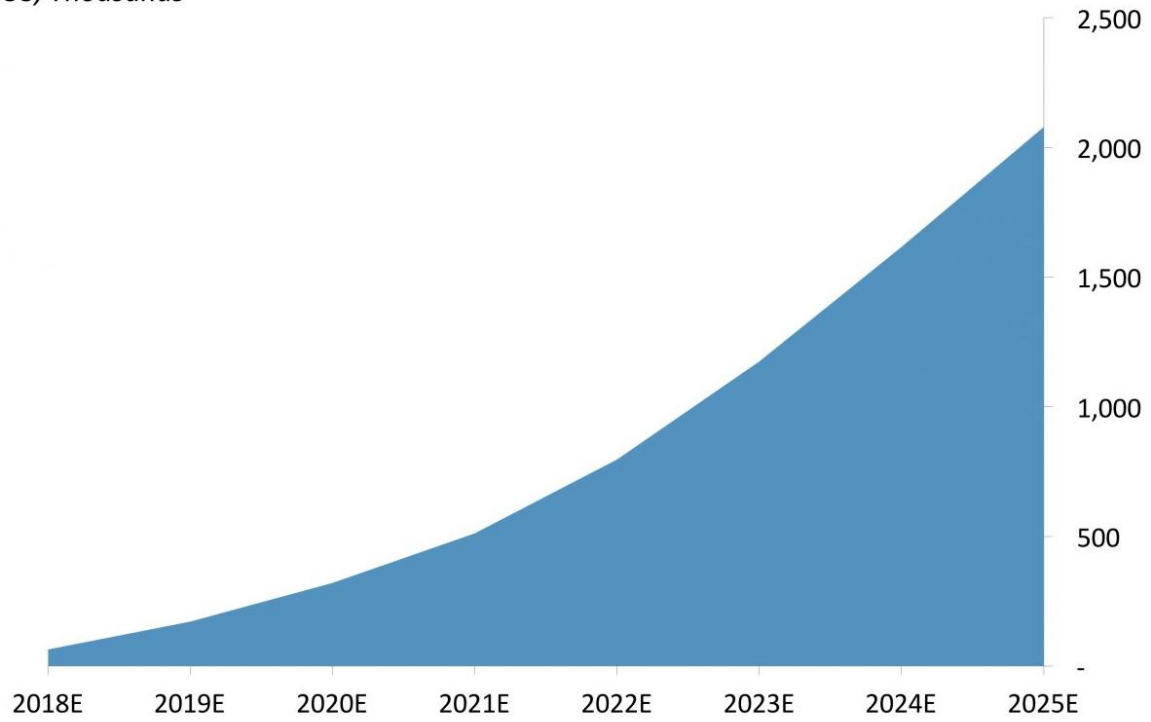



*Source: BI Intelligence Estimates, 2017*

Fully autonomous car shipments are poised to begin and steadily grow in the coming years — BI Intelligence estimates that nearly 2.4 million self-driving cars will be shipped in the US between 2018 and 2025. We developed this forecast based on recent public vehicle sales data, as well as announced and speculative plans for autonomous car deployments. During stage 1 of the rollout, there will be steady growth in both the number of vehicles offering self-driving capability and the number of buyers who choose to pay for the autonomous add-on. By 2025, we estimate there will be nearly 2.1 million self-driving cars on US roads.

**FORECAST: Total Autonomous Cars**

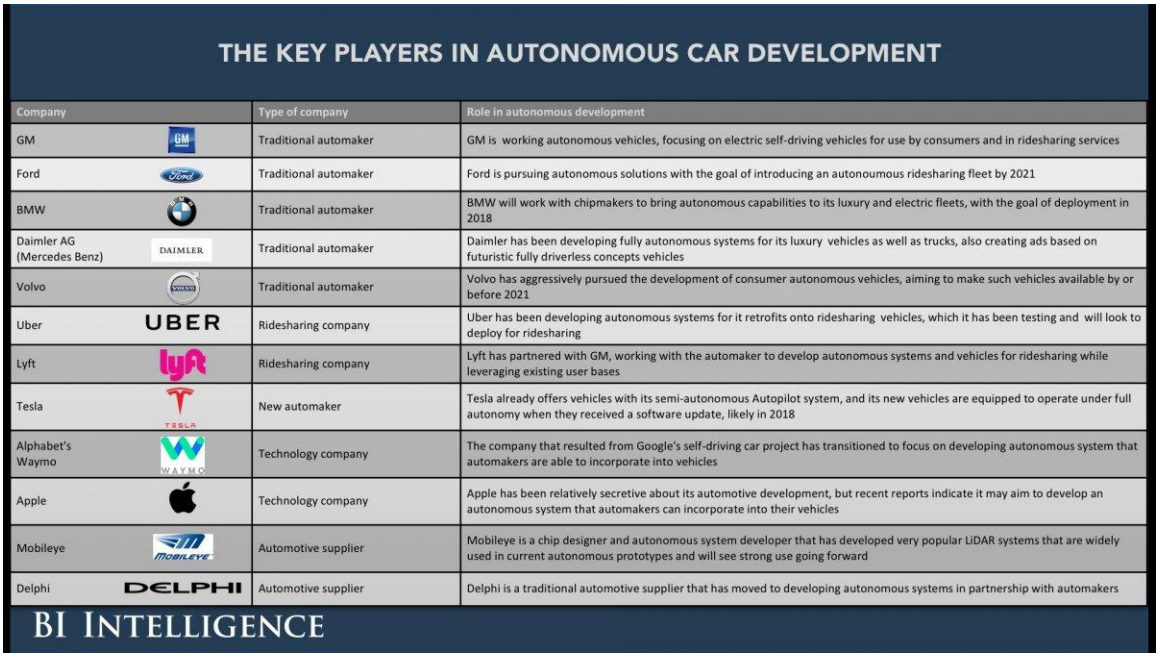
*US, Thousands*




*Source: BI Intelligence Estimates, 2017*

## Key Players

The companies vying for roles in the autonomous market are many and varied. Those making the most news are legacy carmakers, but ride-sharing companies, newer automakers, auto suppliers, and even tech companies are also making significant contributions to the development of the self-driving economy.



THE KEY PLAYERS IN AUTONOMOUS CAR DEVELOPMENT

| Company | Type of company | Role in autonomous development |
|---|---|---|
| GM | Traditional automaker | GM is working autonomous vehicles, focusing on electric self-driving vehicles for use by consumers and in ridesharing services |
| Ford | Traditional automaker | Ford is pursuing autonomous solutions with the goal of introducing an autonoumous ridesharing fleet by 2021 |
| BMW | Traditional automaker | BMW will work with chipmakers to bring autonomous capabilities to its luxury and electric fleets, with the goal of deployment in 2018 |
| Daimler AG (Mercedes Benz) | Traditional automaker | Daimler has been developing fully autonomous systems for its luxury vehicles as well as trucks, also creating ads based on futuristic fully driverless concepts vehicles |
| Volvo | Traditional automaker | Volvo has aggressively pursued the development of consumer autonomous vehicles, aiming to make such vehicles available by or before 2021 |
| Uber | Ridesharing company | Uber has been developing autonomous systems for it retrofits onto ridesharing vehicles, which it has been testing and will look to deploy for ridesharing |
| Lyft | Ridesharing company | Lyft has partnered with GM, working with the automaker to develop autonomous systems and vehicles for ridesharing while leveraging existing user bases |
| Tesla | New automaker | Tesla already offers vehicles with its semi-autonomous Autopilot system, and its new vehicles are equipped to operate under full autonomy when they received a software update, likely in 2018 |
| Alphabet's Waymo | Technology company | The company that resulted from Google's self-driving car project has transitioned to focus on developing autonomous system that automakers are able to incorporate into vehicles |
| Apple | Technology company | Apple has been relatively secretive about its automotive development, but recent reports indicate it may aim to develop an autonomous system that automakers can incorporate into their vehicles |
| Mobileye | Automotive supplier | Mobileye is a chip designer and autonomous system developer that has developed very popular LiDAR systems that are widely used in current autonomous prototypes and will see strong use going forward |
| Delphi | Automotive supplier | Delphi is a traditional automotive supplier that has moved to developing autonomous systems in partnership with automakers |

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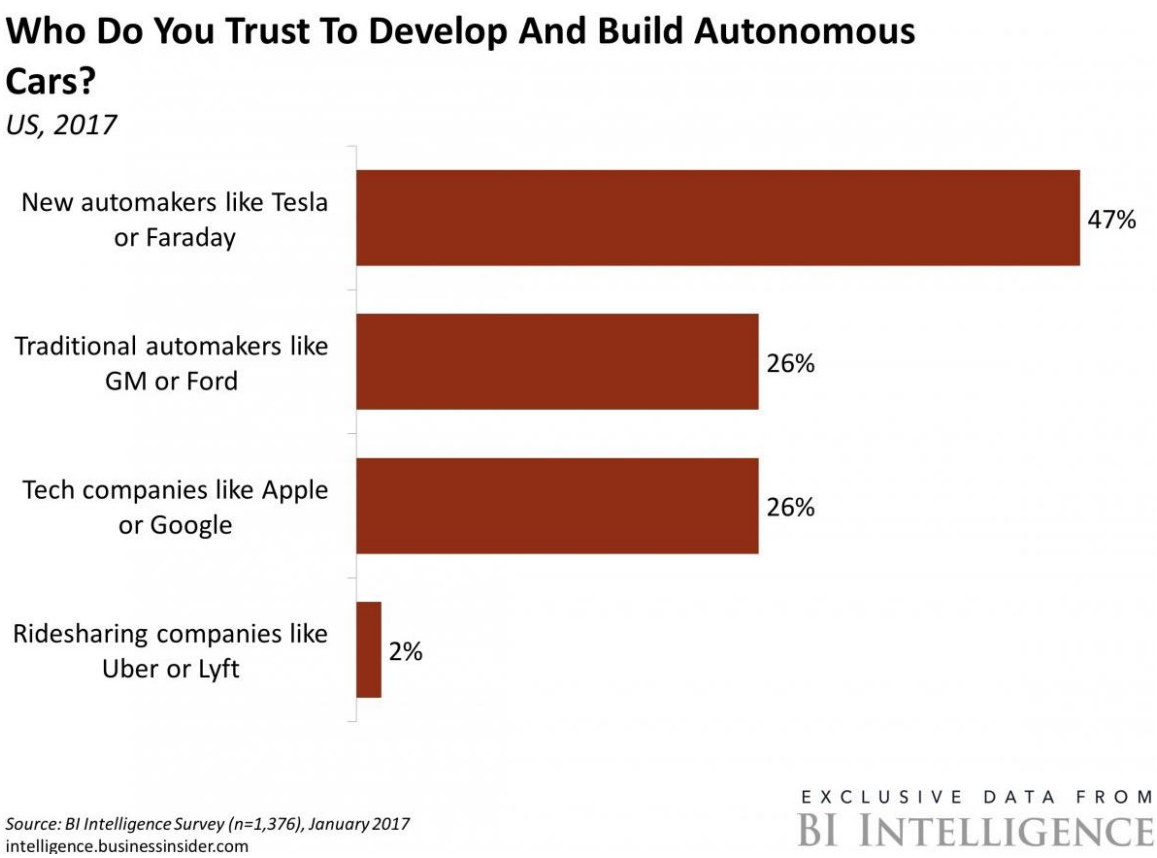
**Forty-seven percent of respondents in an exclusive BI Intelligence survey said they would trust new automakers like Tesla to build self-driving cars, while just 2% would most trust ride-sharing companies like Uber and Lyft.** This has potentially significant implications as these diverse players vie for position in the market. And hailing from different sectors, each provides their own value proposition with which they hope to win over the market.




It's worth noting that the self-driving car market is still in the early stages, and consumers don't have a huge amount of knowledge about such vehicles yet. New automakers like Tesla may have a lead in perception, but traditional automakers like Ford, BMW, and others have existing driver bases and loyal customers. Overall, the first few companies to bring self-driving cars to market will likely be the ones to establish leading positions in the initial wave of autonomous vehicles. But there's still a way to go in getting these cars onto the roads and into the hands of consumers.

# THE CHALLENGES AUTONOMOUS CARS FACE

Although self-driving cars have moved closer to reality in recent years, developers still need to address a number of key challenges before they can reach general consumer availability:

- **Technological developments.** The technology to power and direct self-driving cars has taken massive leaps forward in recent years, but there are still areas that need to be perfected before the technology is ready for widespread consumer deployment. Companies looking to create mass-market self-driving cars must augment vehicle sensor systems, continue to enhance autonomous driving AI programs, and improve mapping and routing protocols, while reducing the costs associated with these technologies. These firms also need to complete extensive road-testing, both on proving grounds and public roadways.

- **Regulatory barriers.** Self-driving cars won't reach consumers until regulations allow them to be used, and at this time, regulatory standards for autonomous technology are still not fully worked out. Companies developing these vehicles must navigate hazy regulatory frameworks, while balancing requirements and guidelines from different authorities and various levels of government. In addition, they must engage in testing only where permitted and only in specified manners, which limits their ability to clear regulatory hurdles quickly and efficiently.

- **Consumer openness.** To achieve mass adoption, manufacturers and sellers of autonomous cars will have to convince consumers that self-driving cars will make their lives easier, and that the technology is safe and worth the increased cost. The reliance on consumers to choose whether to add autonomy to their new vehicles is what introduces the most uncertainty to as when autonomous vehicles will hit the mainstream. That said, enough will likely be open to early adoption to start the ball rolling and demonstrate to friends, family, and others that autonomous cars are viable.

# TECHNOLOGICAL DEVELOPMENTS

The primary driver of autonomous car development has been the maturation of the technologies that can enable them. Traditional automakers, new competitors, and automotive supplies are building all sorts of systems that will be necessary for the development of self-driving vehicles. Here are some of the central technologies that will power self-driving cars as they come to fruition.

## Radar and LiDAR

A central challenge for autonomous car designers is creating a vehicle that can gather data in real time to provide the car with as much information as a driver would glean from his or her eyes and other senses. Cars are able to use visual sensors, but unlike a human brain, which is highly skilled at contextualizing sequential visual information and using it to make inferences about behavior, a car uses an AI that is bound by probabilities and observations. To gather the information this AI needs, automakers are developing sensor technology. There are two main types of imaging that automakers are pursuing: LiDAR solutions and radar solutions.

**LiDAR is an imaging technology that uses lasers and infrared cameras to generate a digital map of the area surrounding a vehicle.** These systems boast wide viewing areas to capture detailed information about an object in the camera's field of view, meaning a LiDAR solution can provide the tools for an AI to differentiate between a car, a pothole, and a pedestrian. One of the leading developers of LiDAR solutions for autonomous vehicles is Mobileye, the Israeli chipmaker and automotive supplier.

One common drawback to LiDAR solutions is cost — each sensor tens of thousands of dollars, and autonomous vehicles often require more than one. As a result, building a self-driving car with even a relatively inexpensive sensor like Velodyne's Puck would still be an extremely costly venture. A car like a Tesla Model S, which is already equipped with hardware to allow it to operate autonomously, includes three forward-facing camera arrays. Were Tesla to use Puck, that would be almost $24,000 in additional costs (excluding any discounts from contractual partnerships or bulk orders), just so the car could "look" forward.

Recently, however, Alphabet's Waymo reportedly succeeded in building a much cheaper LiDAR array for use in its own fleet of autonomous cars, developed in partnership with traditional automakers. This array would cost under $10,000, slashing the cost by 90%. It's likely that competitors like Mobileye and Delphi are also attempting to create less expensive LiDAR arrays to limit the cost disparity between traditional and autonomous vehicles.

**Radar is the other technology used to allow autonomous cars to create virtual representations of the environment.** The technology dates back to the 1940s, and uses sound waves reflecting off an object to determine location. An advantage to a radar system is that it is not necessarily bound by line of sight in the same way that LiDAR systems (or human drivers for that matter) are. For example, a Tesla Model X using the automaker's Autopilot and radar systems was caught on video avoiding an accident that the driver could not even see yet. However, radar doesn't possess the ability to distinguish between the different textures of objects, so it's less able to provide useful information for an AI to tell whether a bike or a pedestrian is next to a car.

Radar and LiDAR systems have advanced steadily in the past few years, and they're already in use in a number of autonomous vehicle tests, such as Uber's in Pittsburgh. It's likely that some combination of radar, LiDAR, and camera-based systems will fulfill the sensor needs of self-driving cars as they approach the mainstream. The technology is ready for larger deployment, and while costs will still need to come down, the key to the widespread release of autonomous vehicles is not gathering the data, but rather making sense of it.

## AI And Visual Processing

Adding sensors to cars is an extension of the traditional automotive design process, just applied to a somewhat new category of part. Instead of using sensors to enable anti-lock braking or to automatically turn on headlights, they now gather information about the road and relay it to the car's internal computer. Where the use of autonomous technology greatly diverges from that traditional process is in the routing of the data gathered from those sensors to an AI that is able to use it to control the vehicle.

Traditional automakers are generally not equipped to handle the transition to the high level of processing that the AI for autonomous cars requires. To cope with this disadvantage, some have sought to acquire companies with experience in AI and other software development — Ford purchased SAIPS, while GM bought Cruise, for example. Others, meanwhile, have looked to create partnerships with companies that offer expertise in AI. This approach is exemplified by GM's investment and collaboration with Lyft, and Fiat Chrysler's partnership with Alphabet's Waymo. In addition, the need for powerful processors and AI expertise has brought new companies into the automotive space — microprocessor designers like Intel, Nvidia, AMD, and Qualcomm have all made moves into the sector and are now working with automakers to design stand-alone systems for autonomous vehicles.

**AI is critical to self-driving cars because it's what takes the place of the human driver and controls a vehicle.** When taking a trip in an autonomous car, a passenger will select a destination, and the car will use routing software to determine the best way to get there based on current conditions. The computer controlling the car will have maps that tell it the basic contours of a route, but there will be other vehicles on the road, as well as numerous additional obstacles. The job of the AI is to get the car from point A to point B safely, avoiding pedestrians, bicycles, cars, and other objects that might be in its path using the built-in sensors. It must interpret the sensor data to determine the nature of the objects around it, and constantly account for those objects' whereabouts in order to avoid the possibility of a collision.

Developers are able to improve the AI for these vehicles through exposure and practice, largely by utilizing machine learning techniques that expose an AI to a situation and let it use trial and error to formulate the best solution. To work out all of the issues an AI might face, it must be exposed to extensive testing, on closed courses as well as public roads.

**Overall, vehicle AI has taken major steps forward — fully autonomous cars can navigate city streets and suburban and rural roads without major issue,** and can identify other vehicles as well as markings and signage. Executives in the industry point out that the technology is ready for public testing and close to prepared for nontest deployment. With continued testing to expose and eliminate remaining issues in the different systems, the AI powering self-driving vehicles will steadily advance, and by 2018, we expect multiple systems to be ready for consumer use.

## Mapping

For a self-driving car to get from point A to point B, it needs a detailed map of the route, including information about the final destination. Integration with mapping and routing is what will differentiate an autonomous car from a highway control system like Tesla's Autopilot, which is able to monitor surroundings and control the vehicle safely, but cannot navigate from one destination to another.

Maps are a major issue for autonomous car developers. That's because, while services like Google Maps may seem exhaustive to a consumer, they have limitations — for example, autonomous cars need to know what lane to travel in at all times, and GPS signals used by such offerings can be unreliable. In addition, autonomous cars need to know where to go when they are finishing a ride. When a passenger enters an address, the car doesn't just need to drive to the GPS coordinates associated with that location, but to a specific place such as a door or a parking lot, which doesn't necessarily appear on a map.

While mapping is a bit behind other areas of autonomous development, it's getting better. Companies are building out 3D maps of roadways, using them at testing sites, and gathering data from them along routes around the world. The reason for the lag? Many thought maps would be phased out. Ford CEO Mark Fields discussed the changing perception of the role of maps in the self-driving car space in an interview with Business Insider recently, saying that maps were initially expected to be replaced by sensors and AI, but that experience with such vehicles has led to a re-emphasis on mapping.

Carmakers and other players in the market are already pursuing solutions to this issue. But developing the sorts of maps that autonomous cars will need is a costly endeavor, both in upfront costs as well as ongoing expenses for storage and data transmission. Uber will spend $500 million to create better maps, while a group of automakers purchased the Here mapping company from Nokia for over $3 billion. Creating the digital maps cars need for autonomous driving will take time, but autonomous car tests and the introduction of semi-autonomous vehicles that collect and transmit data about roads will help to speed up this process.

# THE REGULATORY ENVIRONMENT

No matter the capabilities of autonomous technology, self-driving cars will not reach consumers until they pass regulatory scrutiny. Autonomous cars need the approval of governments to drive on public roads, whether in trials or in commercial capacities, and meeting the disparate standards between varying levels of government across jurisdictions will be critical to the deployment of these vehicles.

## Testing Sites

Autonomous cars need testing to prove their viability. As mentioned, automakers and others developing autonomous vehicles must engage in extensive trials, both on closed roads at proving grounds, and critically, on public roadways. BI Intelligence has covered several of these tests in various editions of our daily IoT BRIEFING.

**These trials, rare so far, are becoming more common as authorities grow more open to allowing companies to test autonomous cars on public roadways,** so long as the test is registered and there is a driver behind the wheel ready to assume control of the vehicle should any issues arise. Uber's expulsion from San Francisco, a high-profile rebuke, stemmed from a failure and unwillingness to register, rather than any regulatory doubts about the technology.

The openness of authorities around the world has resulted in a wide variety of testing sites available to autonomous car developers, providing a boon to the advancement of the technology. Automakers are able to expose their cars and systems to the sunny, dry conditions of Arizona, the snowy roads of Ontario and the foggy, windy old streets of London, among others. The varied climates, conditions, and road profiles allow autonomous car designers to gather increased data to use in their AI development.

In the US, Michigan, the traditional center of auto manufacturing, has established itself as a leader in regulation and autonomous vehicle testing. In December 2016, the state passed regulations allowing the testing of autonomous vehicles on all public roads in the state, including tests of vehicles that do not have a backup driver at the wheel, as well as those without pedals or a steering wheel. The law also provided a framework for the certification of fully autonomous vehicles for consumer sale. In response, automakers have begun tests in Michigan and announced plans to design and build vehicles there.

**Still, some places, including parts of the US, have been less willing to allow autonomous tests to take place on public roads.** As many of the prominent companies developing fully autonomous cars are based in the US and produce vehicles in the country, its openness to autonomous testing is critical. According to the National Conference of State Legislatures, only 11 US states have taken actions that affirmatively permit autonomous vehicles to operate. In the rest of the country, autonomous cars exist in a legal gray area, where they're often not explicitly prohibited, but also not affirmatively permitted.

## Cross-Border Regulations

The varying treatment of fully autonomous cars across state and national borders is the primary regulatory hurdle to adoption of the technology. For example, a vehicle could be purchased and registered in Michigan and driven in any one of the 39 states that have not addressed the technology yet. But this could prompt action by local governments wary of the introduction of autonomous vehicles to their states' roads, regardless of evidence or safety certification.

Groups in New York and Chicago, for instance, have proposed banning autonomous vehicles due to unspecified safety and economic concerns. National legislation or regulations from the US Department of Transportation would remove this potential roadblock, possibly forcing states to accept autonomous cars on public roads, though it likely wouldn't force states to register such vehicles. A similar issue could come up in the EU, where individual countries may look to place stricter limitations on autonomous cars, requiring the EU to issue regulations on the question.

While this problem has the potential to stymie the spread of autonomous vehicles, we don't expect this to be a major issue moving forward. Authorities in both the US and EU have spoken openly of the technology, and have sought to foster development. It would be a radical and unexpected shift from indicated policies for either the US or EU to move in a way that would retard the spread and growth of this sector. It's more likely that this hurdle will be cleared as authorities develop comprehensive regulatory plans that address the use of autonomous technology.

## Other Complicating Factors

Although testing and legislation are the main hurdles autonomous vehicles will need to clear to reach mass adoption, there are a few other regulatory areas that could limit the spread of self-driving cars:

- **Vehicle communication networks.** Autonomous cars are intended to operate as members of fleets that can communicate with one another and with cities' infrastructure to maximize the efficiency with which passengers get to their destination. To communicate in this manner, however, requires the creation of Vehicle-To-Vehicle (V2V) and Vehicle-To-Infrastructure (V2I) networks. V2V networks will allow vehicles to communicate accidents, obstacles, or even mundane traffic information to one another, while V2I networks will pass the same information through a built-out infrastructure. To develop such networks, automakers must agree to some shared standard for communication. In addition, V2I networks will require investment from local governments.

- **Auto Insurance.** The development of autonomous cars could fundamentally transform the auto insurance industry, drastically reducing its scope and revenue. Self-driving cars promise improved safety, which is expected to reduce the frequency of insurance claims and the pool need to cover the cost of those claims. The other question insurers, automakers, and governments will have to grapple with is who will be legally responsible for an autonomous car's actions.

# CONSUMER OPENNESS

The third, and perhaps most important challenge that autonomous car developers will have to overcome lies in consumers' willingness to climb aboard. If people don't want to buy, ride in, or share the roads with autonomous cars, then adoption will be much slower or could falter altogether. To better understand consumer sentiment around autonomous vehicles, BI Intelligence surveyed our panel of Business Insider readers and executive decision-makers. Click here find out more about that panel.

**Sixty-eight percent of our respondents say they would be willing to ride in a self-driving car if presented with the opportunity,** while just 14% would not ride in such a vehicle. This highlights a couple of important factors:

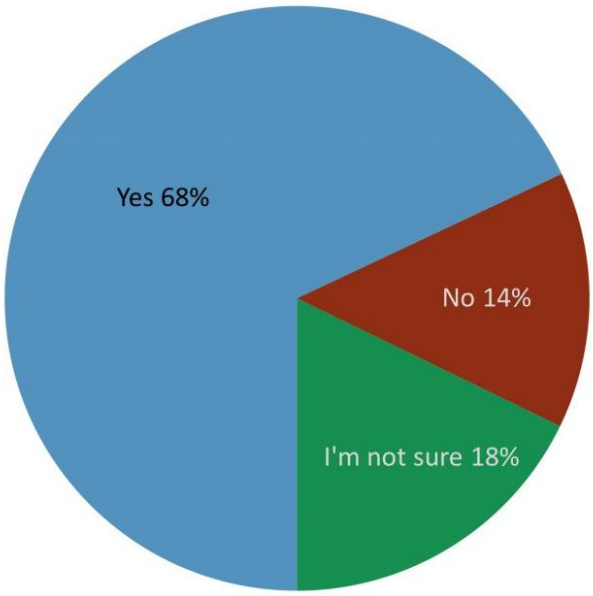
- **People are open to autonomous cars.** The high level of willingness to ride in autonomous vehicles shows that the technology, especially when presented in an approachable, grounded manner, engenders widespread popular interest. For example, driverless taxi trials are ongoing in Pittsburgh, PA and Singapore, providing real-world examples that allow respondents to imagine riding in this sort of vehicle on public roads.

- **Respondents perceive self-driving cars as safe.** People would not be willing to ride in a vehicle that they believe is unsafe. Public tests have likely helped to create this impression of safety, and further trials that draw media attention could serve to reinforce this idea.

However, while a large portion of our survey respondents would be willing to ride in a self-driving car, there's much more hesitation when there's children involved.

## Would You Ride In A Self-Driving Car?

*US, 2017*




*Source: BI Intelligence Survey (n=1,376), January 2017*
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EXCLUSIVE DATA FROM
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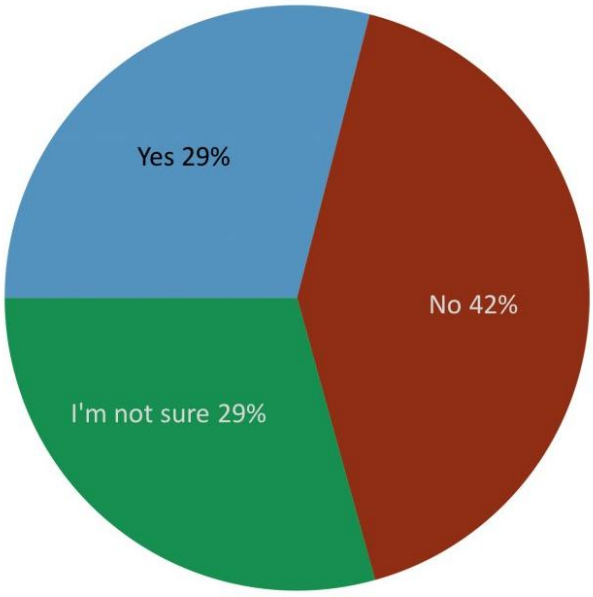
## Would You Let Your Child Ride In A Self-Driving Car?

*US, 2017*




*Source: BI Intelligence Survey (n=1,376), January 2017*
intelligence.businessinsider.com

EXCLUSIVE DATA FROM
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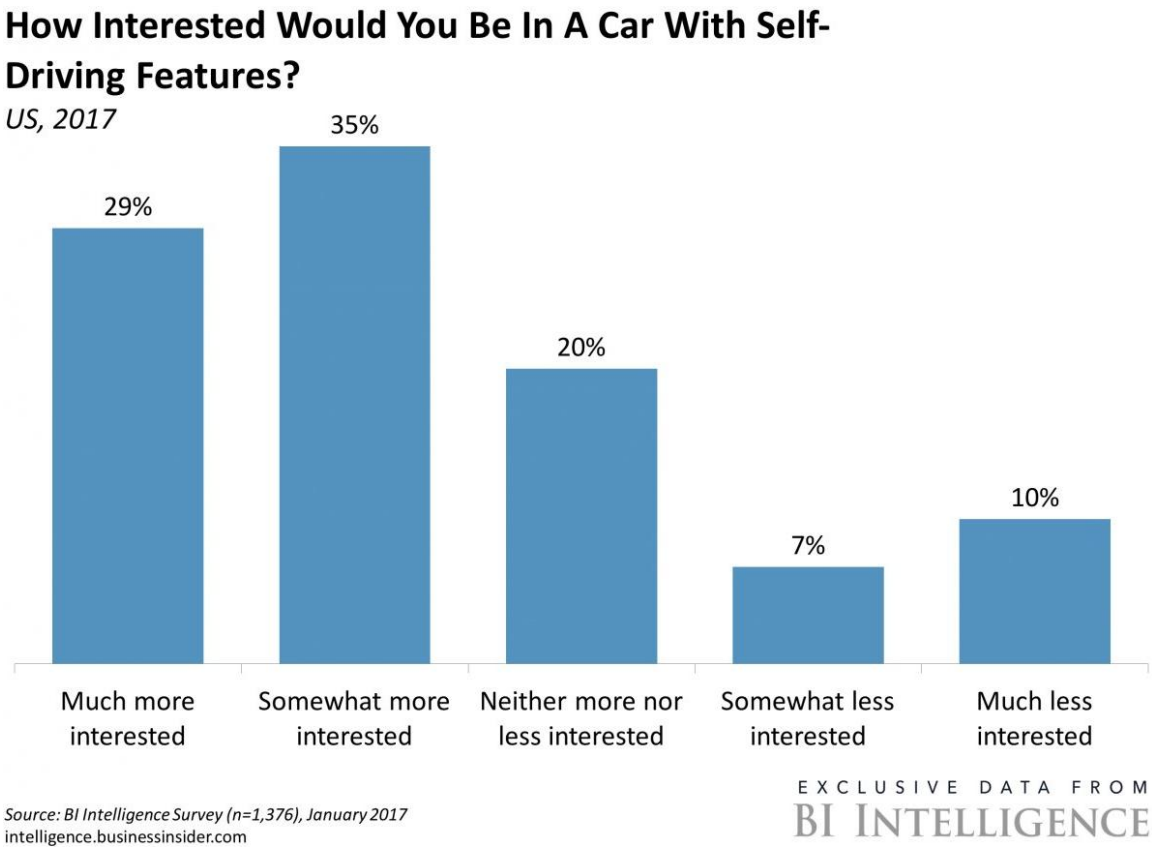
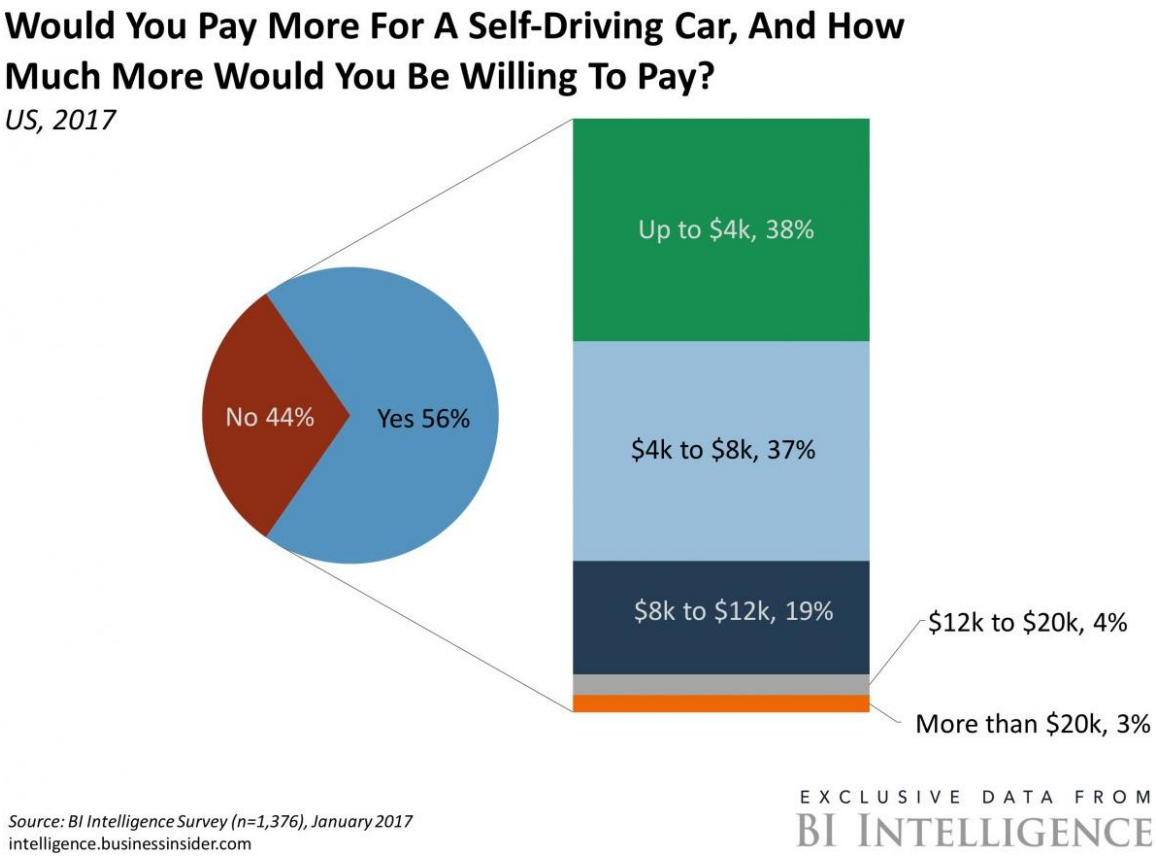
**Just 29% of respondents would be willing to let their child ride alone in a self-driving car,** while 42% say they would not. The reluctance here may be attributed to the newness of the technology and its relatively untried nature. Perhaps individuals are willing to experiment with it alone, but not with their children. This could be problematic, as one potential advantage of autonomous cars is their ability to provide mobility to those who cannot drive, including the young, the elderly, and disabled individuals. If parents don't trust autonomous cars to shepherd their children around, that advantage may not be realized. Further, worried parents might not consider such vehicles for the family car, which could hamper adoption. It's worth noting, though, that some respondents may simply be uncomfortable letting their children ride without an adult.

## Autonomy Interests, But Only If Price Is Right

The idea of purchasing an autonomous car seems to appeal to respondents to our survey. In fact, 64% of respondents say the availability of self-driving features would make them somewhat or much more interested in a car while shopping around.



And they're willing to pay more for these vehicles, which may bode well for the adoption of autonomous cars in the short term, even before costs come down.




**Overall, more than half of respondents would be willing to pay more for an autonomous vehicle.** And of those, most would be willing to pay over $4,000 more for such capability, while 38% would be willing to spend up to that amount. This indicates that a large portion of respondents accept that autonomous cars will cost more, at least initially, than comparable traditional vehicles. Where there could be a problem, however, is in the high base price of the vehicles we anticipate will be the first to offer autonomous features.

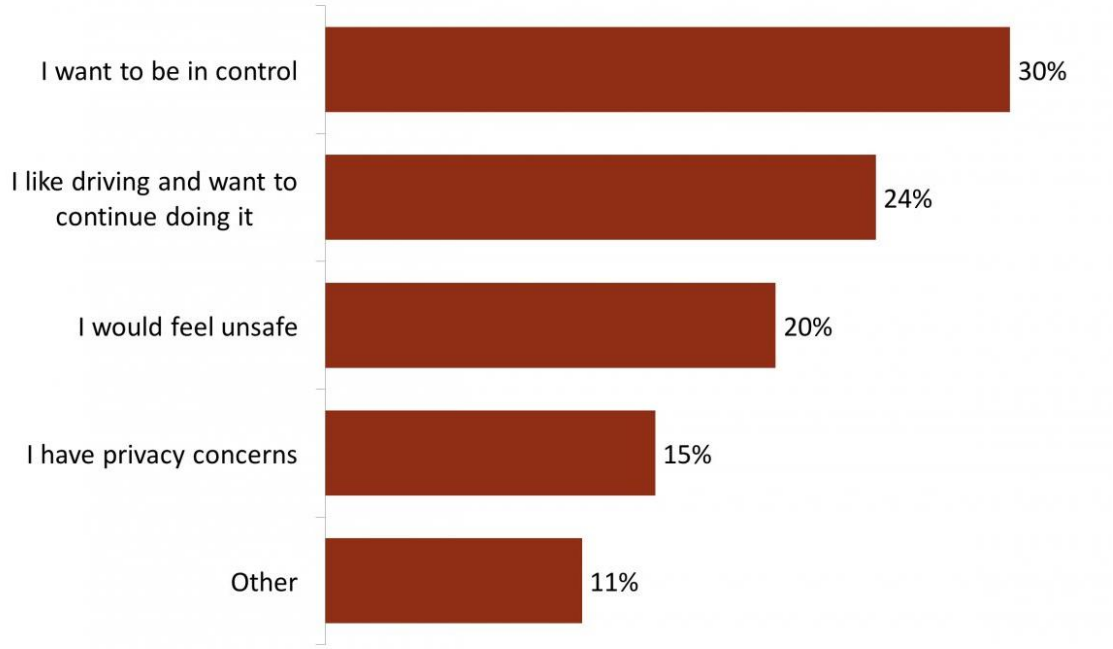
The first autonomous cars available for purchase will likely be luxury and electric vehicles, which cost more than the most popular cars consumers buy. Adding $5,000 more to the cost of a $25,000 mid-level sedan is one thing, but adding that cost to a luxury vehicle with double the sticker price could cause potential buyers to balk. As a result, the earliest adopters will likely be those for whom cost is a nonissue, and these drivers will serve as ambassadors of the technology for family and friends likely to adopt later on.

## Perceived Drawbacks To Self-Driving Cars

The advent of autonomous cars will fundamentally change the way people use their vehicles. And while many welcome efficiencies will be introduced, some changes will likely be perceived as drawbacks that could lead consumers to hesitate to adopt self-driving cars.

**Drawbacks Of Autonomous Cars**

*US, 2017*




*Source: BI Intelligence Survey (n=1,376), January 2017*
intelligence.businessinsider.com

EXCLUSIVE DATA FROM
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To better understand the hesitations consumers may have, we asked our panel about the drawbacks they associate with autonomous technology:

- **The most cited drawback is the loss of control,** with 30% of respondents selecting this option. Allowing an AI to completely control a vehicle likely gives consumers pause because it means relinquishing the responsibility that comes with sitting in the driver's seat.

- **Another 24% enjoy driving and don't want to give it up.** Although this will not be a major issue with the first autonomous cars, which will also include the ability to drive manually, it will develop moreso in the future as cars begin to eliminate the steering wheel and pedals. By that time, however, future generations may not view driving as it is seen today, allowing this drawback to fade away.

# THE SELF-DRIVING WORLD

As autonomous cars make their way to the market, the pressing question will be: How they will impact the world? We anticipate massive disruption as a result of the introduction of self-driving cars, affecting not just the consumer automobile market, but both personal, municipal, and commercial transportation, shipping and logistics, and numerous other sectors. This technology is poised redefine car ownership and mobility broadly, transforming entirely how people and goods get from one place to another.

## Impacted Industries

Here are some of the industries beyond automotive manufacturing that could be affected by the development and introduction of autonomous vehicles:

- **Shipping and logistics.** Autonomous delivery vehicles will radically redefine trucking, shipping, and logistics — sectors that employ 1.8 million heavy drivers and 1.3 million delivery drivers in the US alone. These jobs will drastically be reduced as autonomous vehicles develop the ability to transport goods with limited human supervision, reducing the need for workers at the last mile.

- **Municipal transportation.** Cities will be presented with new options to improve mobility for residents. Local governments may choose to upgrade existing bus services to incorporate autonomous vehicles, maintaining today's public transport model. Or, they could break from that model and utilize public shared mobility fleets, in partnership with automakers or other providers. This would result in pooled transportation options using a limited number of roving vehicles. Either option would greatly reduce costs, but also eliminate a large number of current jobs.

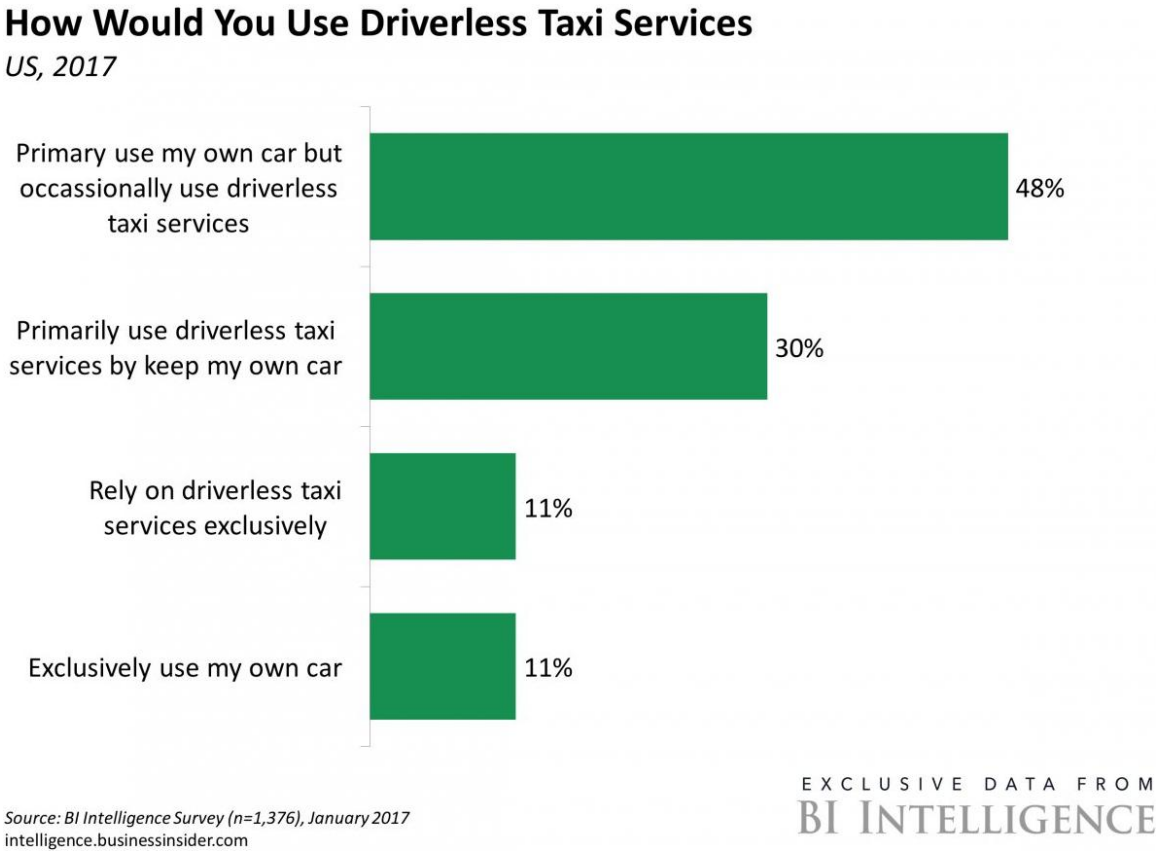
- **Media and entertainment.** The transformation of the driver into another passenger will free that individual from monitoring the road, and turn hours formerly spent behind the wheel into time open for media consumption. Media companies and social media platforms will need to tailor their offerings to appeal to car passengers given the space and interfaces available. In addition, the autonomous car represents a new advertising platform that companies will need to adapt to.

## Individual Ownership

Autonomous cars may have the capacity to upend the current car ownership model. In fact, some automakers, such as Ford, are planning to introduce autonomous vehicles through shared mobility fleets, rather than in a direct-to-consumer model.

These cars could operate more effectively as part of a shared fleet due to a number of distinguishing factors, such as higher upfront cost. In addition, traditional cars are parked when not in use because they cannot be operated without a driver, but autonomous cars are not limited by that problem. Shared mobility fleets would allow a smaller number of cars to service a community, as they could move from one user to another as requested, with little to no down time.

However, it's worth noting that consumers are attached to their cars, and to the institution of car ownership. As such, changing the model of car ownership in developed markets would require clear benefits, as well as a transformation of mindset among consumers.



Millennials are more open to the idea of primarily or exclusively using driverless taxi services or shared mobility fleets, with 50% of millennial survey respondents saying they would do so, compared with 39% of Gen Xers and 32% of Baby Boomers. As millennials and subsequent generations make up a larger share of the overall consumer market, this acceptance of shared mobility will likely help such fleets grow established as viable alternatives to car ownership.

# THE BOTTOM LINE

- Fully autonomous vehicle technology continues to advance, and all signs point to self-driving vehicles reaching fruition in 2018.
- BI Intelligence estimates that nearly 2.4 million self-driving cars will be shipped in the US between 2018 and 2025. By 2025, we estimate there will be nearly 2.1 million on US roads.
- However, developers still need to address several challenges before autonomous vehicles can reach general consumer availability. These include improvements in technology, clearing regulatory hurdles, and most importantly, convincing consumers to ride in them.
- As they approach the mainstream, autonomous vehicles will upend the traditional automotive sector and adjacent industries.

# BI INTELLIGENCE

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