THE DRIVERLESS TAXI REPORT

HOW AUTOMAKERS, SHARED MOBILITY SERVICES, AND TECH COMPANIES ARE USHERING IN A POST-DRIVER WORLD

August 2016

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BI INTELLIGENCE

KEY POINTS

- **Automakers, shared mobility services, and tech companies are investing in and partnering with each other to build driverless taxi services.** These services would pick up passengers much as Uber or other ride-sharing services do today — minus the driver.

- **The successful deployment of driverless taxi services would significantly benefit the companies and investors collaborating to create them — as well as the communities they serve.** These potential benefits include higher profits for automakers and tech companies, reduced traffic congestion, lowered pollution levels, and safer roads.

- **BI Intelligence expects the first mass driverless taxi service (350 or more driverless taxis operating) will be deployed by 2020.** While there have been many pilots for user-operated fully autonomous taxis — in which a driver is still monitoring the car from behind the wheel — the first truly driverless driverless deployment likely won't happen for a few years, due largely to regulatory hurdles.

- **Singapore is the best bet for the first driverless taxi deployment.** The country recently claimed the top spot in the Networked Readiness Index (NRI), and Singapore's citizens are highly willing to ride in and pay for driverless vehicles.

- **But it will take 20-plus years for a driverless taxi service to make a significant dent in the way global consumers travel.** For larger countries like the US — which spans 3.8 million square miles, compared with Singapore's 277 — it will be much more difficult to deploy a nationwide driverless taxi service that serves all consumers. Countries will need to revamp infrastructure to allow for driverless taxis, and that could take decades.

- **Driverless taxis will face three key challenges: regulation, improving autonomous technology, and consumer willingness to ride.** For now, automakers and tech companies will focus on improving driverless technology and pushing regulators to allow it. Eventually, though, they will need to launch consumer outreach and ad campaigns that show the benefits of fully autonomous cars to persuade consumers to ride in them.

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INTRODUCTION

The rise of shared mobility services, coupled with advancing autonomous technology, is creating a future in which consumers may order a driverless taxi to take them where they need to go. These services would mirror how an Uber works today, but there wouldn't be a driver.

The potential benefits of a driverless taxi system include higher profits for automakers and tech companies, reduced traffic congestion, lowered pollution levels, and safer roads. Major car manufacturers around the world are rapidly increasing their investment in autonomous-vehicle technology, and tech giants like Apple and Google have been working in the space for years. Ride-sharing services will provide the platform to manage and dispatch self-driving fleets; indeed, Uber and Lyft are already experimenting with driverless vehicles. The growth potential for players in each of these areas is substantial.

However, there would also be negative effects — not least of which is the potential loss of jobs for millions of drivers for legacy taxi and ride-sharing services. There's also a trillion-dollar economy that revolves around the way we drive now: Car dealerships, repair shops, insurers, banks making auto loans, and governments that count on traffic fines for a share of their revenue all face some degree of disruption from the implementation of driverless taxis.

These issues, together with unproven technology, is making the decision to allow driverless taxis a tough one for regulators. Meanwhile, consumer willingness to ride in driverless taxis is still uncertain.

In this report, BI Intelligence examines the potential for the combination of fully autonomous cars and shared mobility services to disrupt the car-ownership model. The report first looks at how automakers, shared mobility services, and tech companies are creating driverless taxi services, and what the benefits for each would be. It then examines the primary barriers driverless taxis face, including technology, regulation, and consumer willingness to ride. Finally, this report discusses expectations for the first mass driverless taxi deployment and lays out a timeline for global market penetration of driverless taxis.

KEY PLAYERS
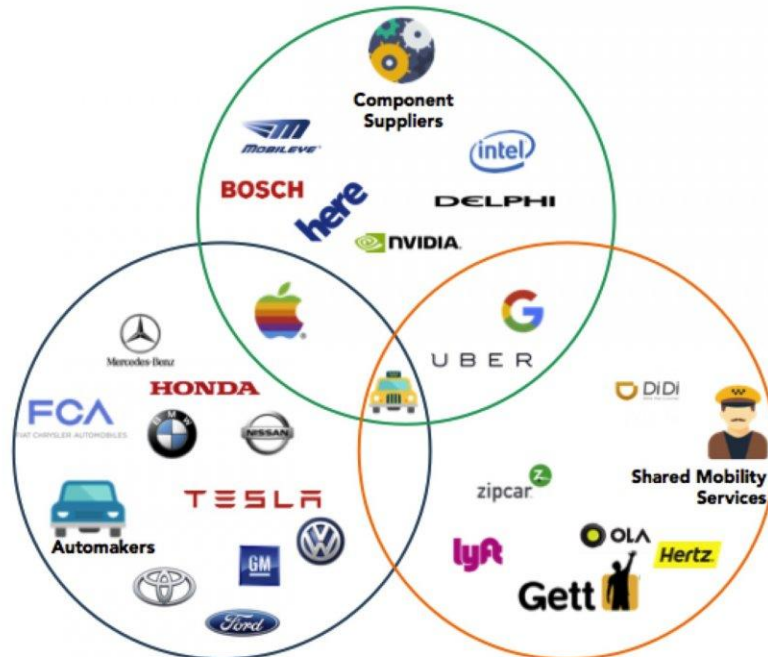

Driverless Taxi Ecosystem

Image sources: Wikimedia, Company Media Kits

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There are three key kinds of companies that will play a major role in autonomous shared mobility services: automakers, shared mobility services (which includes ride-hailing services like Uber, Lyft, and Gett, rental car companies like Hertz and ZipCar, and standard taxis), and tech component suppliers. In the driverless taxi model, BI Intelligence expects that automakers will provide the car, shared mobility services will provide the platform, and autonomous tech companies will supply the technology. The three groups are taking a hybrid approach by partnering with and investing in each other, as well as developing portions of the necessary components on their own.

Note that while this report highlights the developments over the past few years that are bringing driverless taxis closer to reality, the market is changing at lightning speed and new breakthroughs are happening every day. The information in this report is up to date through mid-August 2016. To stay abreast of developments in this space in real time, please monitor BI Intelligence's daily IoT Briefing.

Automakers

Automakers have invested over $2 billion in the past eight months in the driverless-taxi ecosystem. Significant transactions and partnerships include:

- **Volvo** has been working extensively with Uber to provide self-driving XC90 SUVs in what will undoubtedly be the most advanced deployment of driverless taxis to date. At the end of August, Volvo and Uber plan to launch a self-driving service in Pittsburgh and expect to have 100 vehicles operating by the end of the year. For now, the cars will be user-operated fully autonomous, which means that someone will be behind the wheel monitoring the car. Additionally, the trips will be free, which makes it seem more promotional and smaller-scale.

- **General Motors** invested $500 million in Lyft in January 2016 as part of the ride-sharing service's Series F funding round. The two companies are building a fleet of fully autonomous Chevrolet Bolt electric vehicles and plan to launch a self-driving car in cooperation as early as the end of the year. In August, it was reported that GM had unsuccessfully tried to fully acquire Lyft, but the companies did not comment. GM also bought Sidecar for $39 million in January. In March, GM bought Cruise, an autonomous-driving tech company, for over $1 billion.

- **BMW** partnered with Intel and Mobileye to help develop a fully autonomous car that it plans to produce in 2021. The company invested an undisclosed amount in the carpooling startup Scoop in late May.

- **Volkswagen** invested $300 million in Gett, and its head of digitalization believes driverless cars (vehicles without pedals or a steering wheel) will hit the road in 2025.

- **Daimler** purchased mapping service Here, a crucial component for fully autonomous cars, in conjunction with BMW and Audi at the end of 2015. The company also announced it will merge its ride-hailing MyTaxi business with Hailo, another ride-hailing service provider. Daimler will own 60% of the new company, and existing Hailo shareholders will own the other 40%.

- **Ford** recently announced it was aiming to provide driverless vehicle to a ride-hailing service by 2021. It also recently acquired SAIPS, a machine learning and computer vision company, to help it develop fully autonomous cars by 2021 and invested $253 million in software company Pivotal in May. In addition, Ford is working on a coalition with Uber and Google to push US lawmakers to speed up legislation for driverless vehicles. Separately, Fontinalis Partners, former CEO Bill Ford's investment firm, invested in Lyft.

- **Toyota** invested an undisclosed amount — reported to be less than $100 million — in Uber. The company also announced that it will invest $1 billion in artificial intelligence over the next five years. The goal will be to improve vehicle safety and help in the company's efforts to produce a car that can drive itself on highways by 2020.

- **Tesla** already offers a semi-autonomous system dubbed Tesla Autopilot. Tesla aims to have a driverless car on the road by 2018 — one of the most aggressive plans for a fully autonomous solution. After a fatal crash in May, the company announced that it would end its partnership with autonomous technology maker Mobileye. Signs now point to Tesla making the software itself.

In the short term, automaker investments in shared mobility services will create partnerships to sell vehicles to these services' drivers. For example, GM and Lyft launched the Express Drive service in March that allows Lyft drivers to rent GM cars. Strategic financing partnerships like these could prove lucrative for automakers. In the US, the Bureau of Labor Statistics expects the number of US taxi drivers and chauffeurs, including those working for ride-hailing services, to increase 13% between 2015 and 2024, which the agency notes is faster than average.

But the long-term potential shift to selling driverless taxis on a wholesale basis is much more appetizing for automakers.

- **First-mover advantage.** The first automaker to create a driverless car will be bombarded by shared mobility companies looking to purchase the cars on a wholesale basis. For example, under the Uber-Volvo deal, Uber will purchase user-operated fully autonomous cars from the automaker. Uber did note that it would not confine itself to buying vehicles from Volvo.

- **High churn of cars.** Driverless shared mobility would turn into a public transportation system requiring routine replacement of vehicles on the road. The average New York City taxi lifespan is 3.6 years, compared with the normal 11.6-year lifespan of cars. Higher usage would create higher churn, and thus greater potential for new car sales.

- **Control over maintenance.** Autonomous cars will have sensitive software on them. Many automakers might require that their autonomous vehicles be fixed at the dealership as opposed to an independent repair shop, thereby increasing their service revenue.

Shared Mobility

For shared mobility companies, the benefit is a much more lucrative business model. For example, Uber currently charges a commission of 20%. By cutting out the driver, it could earn 100% of the fare.

Ride-Hailing Cumulative Global App Downloads
Between September 1, 2014 - May 25, 2016
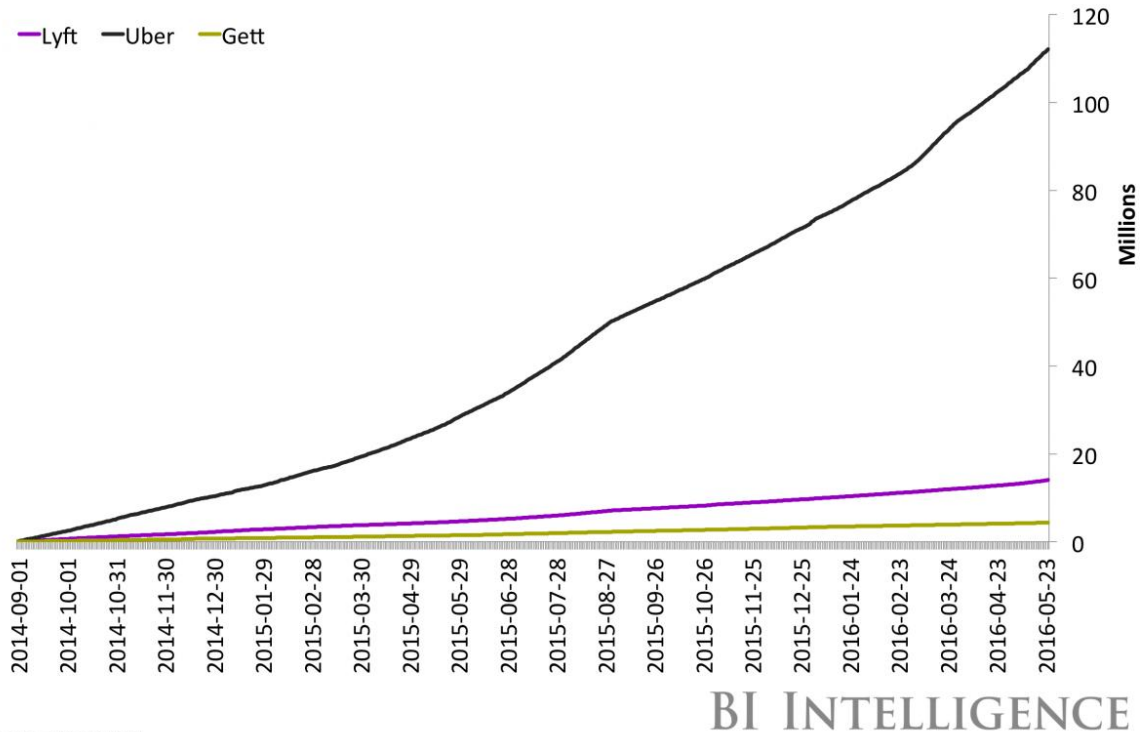
Source: Priori, 2016

More beneficial than even driverless single-rider taxis would be driverless carpool taxis, like uberPOOL and Lyft Line. In the carpool taxi model, separate riders in the same vicinity and with similar destinations are picked up and dropped off by a single driver. Costs for these services vary by city but are guaranteed to be less expensive than base services. In New York, for example, uberPOOL costs $5 during commute times. The services are growing rapidly in popularity because they're cheaper and sometimes compete with public transport — a New York subway or bus ride is $3 for a single ticket.

Uber [released](#) details on uberPOOL growth in June. Highlights include 100 million trips made since November 2014, 30 million trips per month in China, 100,000 trips per week globally, and 20% of all trips now on uberPOOL. That percentage rises to 40% of all trips in San Francisco.

In the driverless taxi ecosystem, shared mobility services are expected to provide the platform, handle customer service, and manage the taxis.

- **Uber, which is valued at $68 billion, is the most dominant of the shared mobility services and furthest along in driverless taxis.** As mentioned above, Uber plans to launch a public test of self-driving Ubers in Pittsburgh in August using modified Volvo XC90s. **Again, these cars will be user-operated, meaning there will be someone behind the wheel to monitor it.** This is important because, from a regulatory perspective, the person behind the wheel is viewed as the driver of the vehicle. The much more appealing situation for Uber would be a fully driverless vehicle, as then it would not need to share the fare with a driver. But to reach that point, Uber would have to meet regulators' demands.

- **Lyft is primarily focused on the US but has a growing foothold in Southeast Asia.** The company is primarily tied to GM and has launched many self-driving initiatives. By the end of the year, Lyft reportedly plans to launch a test with GM that is similar to the Uber deployment.

- **Didi Chuxing recently overtook the Chinese market.** China is a massive potential marketplace for ride-sharing companies with its dense urban areas, increasing incomes, and growing smartphone ownership. Didi Chuxing recently won a battle with Uber over the Chinese market by acquiring the latter's operations in the country. Kalanick noted in a blogpost that the acquisition will let the two companies focus on providing fully autonomous services.

Ride-hailing services often dominate the conversation around driverless taxis because they're seen as innovative companies with the infrastructure necessary to make these services a reality. But in the long term, other forms of shared mobility, including traditional taxi fleets and rental car services like Enterprise and ZipCar, could play a significant role, as these companies also have the infrastructure required. Over time, it's very possible that we'll see the three groups of shared mobility services (ride-hailing, taxis, and rental) mold into one solution.

That said, it's a brutal competition, and there's a possibility that shared mobility services could be cut out entirely. Although they've invested considerably in ride-hailing services, automakers and tech companies might attempt to bypass shared mobility services in the long run, instead choosing to work with cities directly to build a driverless taxi system. Shared mobility services like Uber bring the most value via their platforms and brand recognition. But in the ride-hailing industry, regional players often perform better because of how well they know the landscape. This helps them edge out the heavy-hitters, as Didi managed to do with Uber in China. Automakers are likely to work primarily with tech companies to develop and deploy autonomous technology in pockets throughout the world. After that, they may try to build and market their own platforms, or acquire regional players.

Tech Component Suppliers

Many companies outside of automakers and shared mobility services are in the driverless-taxi race. **For them, benefits include increased revenue from the purchase of driverless taxis, as well as new revenue streams.**

- **Google is arguably the most well-known company in driverless-car development.** The company releases monthly reports detailing the advancements of its self-driving car initiative, as well as any crashes. Google is currently testing 58 fully autonomous vehicles in four locations in the US. The company also owns Waze, which recently launched a carpooling service that could be Google's answer to Uber. In the future, the tech giant may couple its driverless technology with the Waze carpool platform.

- **Delphi was one of the first companies to launch a pilot program for autonomous taxis.** The auto parts manufacturer began [piloting](#) a user-operated, fully autonomous taxi in Singapore in July 2016 and aims to transition its pilot program to a fully operational service by 2019. The vehicles (Audi SQ5s) will require a driver during the testing phase, but the company plans to make the cars driverless eventually. Delphi [successfully](#) drove a fully autonomous SQ5 across the US in April 2015.

- **nuTonomy is an MIT startup that is also piloting in Singapore.** The company entered into an agreement with Singapore's Land Transport Authority to test a fleet of autonomous taxis. Singapore reportedly wants to have a driverless taxi service built by 2018.

- **Apple is the most secretive of the companies developing an autonomous car.** There have been numerous reports in the last year that the company's Project Titan is developing a fully autonomous car, but there has been no confirmation from Apple. Some speculate that the company recently gave up trying to build a car and has transitioned the project to focus on autonomous driving software. Apple [invested](#) $1 billion in Didi Chuxing in May.

- **Baidu wants to bring fully autonomous cars to market by 2021.** Like most tech companies, Baidu is solely focused on making autonomous software. The company invested in Uber in 2015 to support its now-abandoned effort in China.

- **Alibaba recently released a connected car made with SAIC Motor Corp.** The company [revealed](#) that the car has technology that will make it self-driving in the future.

BARRIERS TO DRIVERLESS TAXI ADOPTION

When it comes to the implementation of a driverless taxi system, there are three barriers: **Regulators have to allow driverless taxis on the road, the technology has to be improved, and consumers have to be willing to ride in them.**

Regulators

Eighty-eight percent of regulators believe fully autonomous cars will come within the next decade, according to a World Economic Forum and Boston Consulting Group study. Of these, 48% believe fully autonomous cars will hit the roads by 2020, while 40% believe they will come sometime between 2021 and 2025. The study notes that the results were not statistically significant due to a small regulator sample size.

From a regulatory perspective, there are many benefits of driverless taxis:

- **Urbanization.** The world population has been shifting toward cities over the past 50-plus years. Right now, approximately 55% of the world's population lives in cities, and that's expected to grow to 66% by 2050, according to the UN. As more people move into cities, driverless shared mobility services may become more accessible to a larger portion of the population because taxis will need to travel shorter distances to pick up and take passengers to their destinations.

- **Safety.** If fully autonomous technology is perfected, driverless cars could become safer than driver-required cars. That's foreshadowed by the fact that cars with semi-autonomous technology tend to be safer than cars without it. In the US, there are 1.12 deaths for every 100 million miles driven. But Tesla's recently scrutinized Autopilot averages 0.78 death for every 100 million miles driven. In a best-case scenario of full driverless-taxi adoption, deaths on the road could approach zero.

- **Pollution.** The majority of driverless taxis would be hybrid or electric, according to BI Intelligence's analysis. These are the most fuel-efficient vehicles, and are therefore optimal for driverless taxis. Examining new car purchases in top taxi markets, it's clear that taxi drivers are switching to hybrid and electric vehicles for this very reason. Aside from fuel efficiency, hybrid and electric driverless taxis would also lead to decreased pollution levels. One study predicts that efficiencies created by electric driverless taxis, including reduced congestion, could reduce emissions by 94%.

- **Productivity.** Consumers' cars spend a lot of time parked. In fact, they're used only approximately 45 minutes per day. In addition, Morgan Stanley notes that the time spent in cars goes largely wasted as people are unable to work while driving. The investment firm estimates that "trillions of dollars" in productivity time are wasted in cars. By having access to driverless taxis, consumers would arguably have more time to work during commutes, adding more economic value.

But there are also significant concerns:

- **Decrease in government revenue.** In the US, the National Highway Traffic Safety Administration (NHTSA) estimates that over $6 billion per year in state revenue is generated from driving citations. Driverless taxis, which in theory would be programmed not to break traffic laws, would reduce or eliminate this stream of revenue. In addition, the US collected $42 billion in revenue from motor fuel taxes in 2013. More fuel-efficient cars would reduce the amount of fuel used, and potentially reduce the tax collected. Lawmakers would then have to find new tax revenue streams to compensate.

- **Massive economic effects.** If successfully implemented, driverless taxis would have the potential to eliminate thousands of jobs in the US alone. The BLS estimates that more than 233,000 people worked as taxi drivers or chauffeurs in 2014. Not only would these jobs be displaced, but many other businesses that rely on the auto industry and drivers could be harmed. For example, auto insurance is a $205 billion-per-year industry that might be significantly impacted, as driverless taxis wouldn't need the same insurance that driver-required cars do.

- **The technology is unproven.** The recent fatal Tesla Autopilot crash has many people worried that autonomous technology isn't ready for mass adoption. It will likely take multiple proofs of concept to convince global regulators that the technology works.

Regulators face a tough decision in allowing driverless taxis to operate in their countries. Undoubtedly, some will choose to allow driverless taxis because doing so benefits their countries' needs more than barring them does. For example, countries with high pollution levels, too many cars on the road, and high car-crash fatalities are more likely to allow the technology to be implemented. But others that don't suffer from such problems may determine that too many are employed by the taxi industry, and the economic repercussions would be too great.

Technology

Fully autonomous technology is advancing faster than many originally thought and could prove viable in the next five years. As of 2016, fully autonomous cars, or cars that can drive themselves between two points with limited to no human interaction, are in the early stages of testing. There have been many pilots of driverless cars (with a driver still behind the wheel) and taxis throughout the world. Uber's Pittsburgh pilot is the most notable test because of the scale of Uber and because it will operate in a US city. However, the company will need to improve the technology greatly to be able to cut out the driver and meet regulators' expectations.

Mapping technology, internet availability, and advanced analytic capabilities are just some of the components that need to be perfected to enable a driverless car. Mapping includes ensuring that the car is following the most precise route. The mapping technology has to be consistently updated to reflect routes that are changing due to construction, accidents, etc. In addition, GPS technology and internet connections need to be precise and widely available. A driverless taxi that thinks it's a few feet to the left of its actual location could be disastrous because it might lead the car into the wrong lane. Advanced driver assistance systems can help prevent this by making sure the car remains in its lane and senses the environment around it, but it's still a major consideration. There are many ethical questions that need to be addressed when it comes to the car's analytics capabilities, as well. For example, if faced with colliding with a pedestrian or crashing and endangering its own passenger, what should the driverless taxi choose to do?
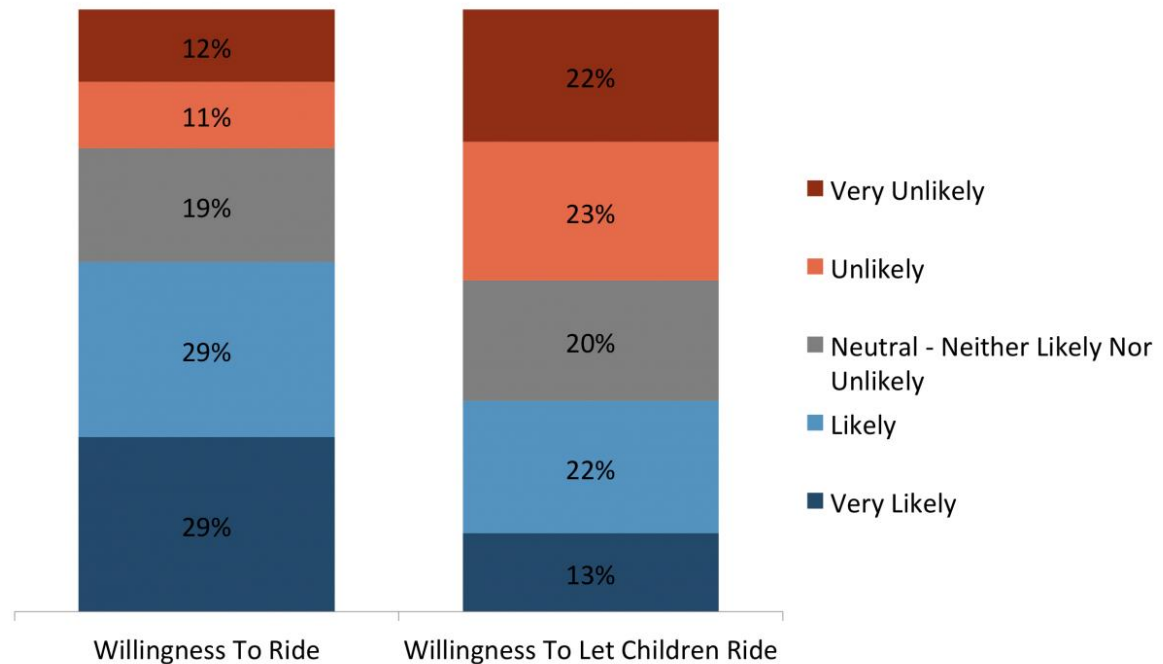
Executives in the space believe that fully autonomous technology faces the most challenges in cities — the primary location expected for driverless taxis — due to the huge number of variables in city environments. Pedestrians crossing the road, street closures, and so on, make these environments far more difficult to navigate. A critical component needed for cities to combat this problem is a vehicle-to-infrastructure (V2I) solution, which would connect driverless cars to an IoT platform that monitors and manages street closures, crime, congestion, mapping data and traffic-light patterns. By taking into account all of the environmental components, the driverless taxis would drive optimally. Audi recently [announced](#) a V2I service that would start this fall in select cities.

Consumer Willingness

With driverless taxi services headed toward reality, the biggest question is: Will consumers be willing to ride in them? There are three factors that will come into play: Trust in the driverless taxi, cost of ride versus cost of driving, and willingness to give up driving.

Global Consumer Trust In Self-Driving Cars

Q: How likely would you be to consider taking a ride in a self-driving car? How likely would you be to let your children ride alone in a fully self-driving car?

Willingness To Ride:
- 12% Very Unlikely
- 11% Unlikely
- 19% Neutral
- 29% Likely
- 29% Very Likely

Willingness To Let Children Ride:
- 22% Very Unlikely
- 23% Unlikely
- 20% Neutral
- 22% Likely
- 13% Very Likely

Legend:
- Very Unlikely
- Unlikely
- Neutral - Neither Likely Nor Unlikely
- Likely
- Very Likely

N= 5,635, 2,480
Source: World Economic Forum, BCG Analysis, 2015

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Trust

Fifty-eight percent of global consumers said they would be willing to ride in a fully self-driving car, according to a World Economic Forum and Boston Consulting Group (BCG) survey. But **only 35% would let their children ride alone in one.** Of the countries broken out, people in India were the most willing to ride in a fully autonomous car and to let their children do so. Consumers who wouldn't ride in a fully autonomous car were mostly likely to cite safety as their reason, followed by a desire to be in control at all times.

For now, automakers and tech companies will continue to focus on improving driverless technology and pushing regulators to allow it. Eventually, though, they will need to launch consumer outreach and ad campaigns that show the benefits of fully autonomous cars to make consumers not only willing, but comfortable riding in them. For example, in Uber's pilot, each fully autonomous car will have a tablet in the backseat to explain to the passenger they are in fully autonomous vehicle.

Estimated Cost Per Mile Of Vehicle Services For Consumers

$2.50	$2.15	$1.05	$0.57	$0.25	$0.17
New York City Taxi	UberX	Shared Ride-Hailing	Personal Vehicle	Single Rider Autonomous	Shared Autonomous
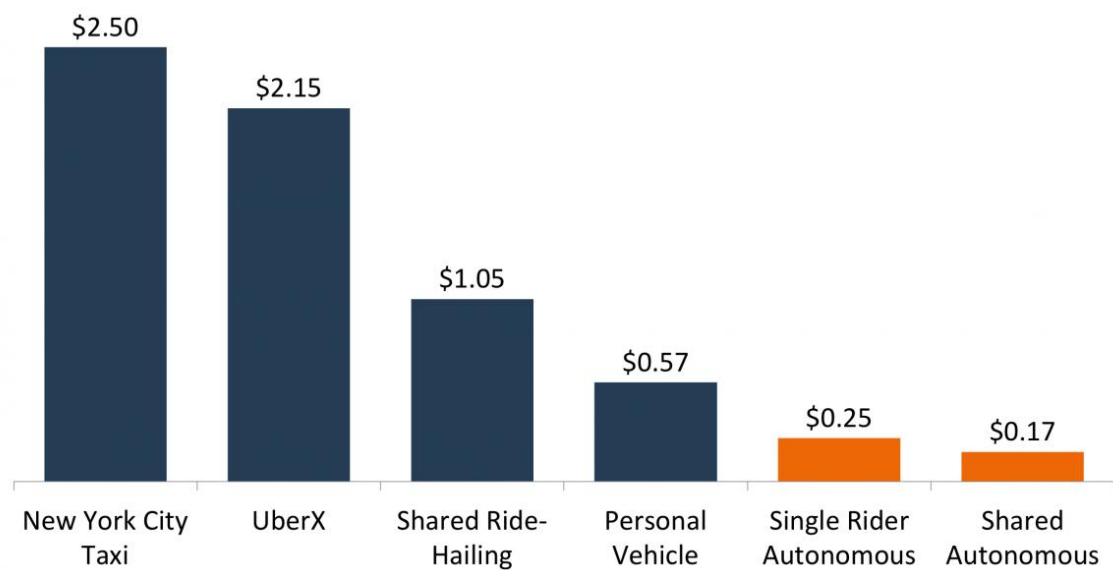
*Fully optimized autonomous solutions
Source: Taxi Fare Finder, Uber, Lyft, Via, Gett, AAA, Goldman Sachs, Morgan Stanley, BI Intelligence estimates

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Cost

Cost will likely be the determining factor in whether consumers are willing to ride in a driverless taxi. The WEF and BCG study found that as the price of a carpool driverless taxi declined, more people were willing to ride in one. This makes sense — carpool ride-hailing services are increasing in popularity right now largely because they're less expensive.

- **Cost of owning and driving a car: 57 cents per mile driven.** In the US, AAA estimates that the 2016 average cost of owning a mid-size sedan driven 15,000 miles per year is $8,558, or 57 cents per mile driven. AAA's estimate includes the cost of fuel (8 cents), insurance (8 cents), depreciation (23 cents), maintenance (5 cents), license/registration/taxes (5 cents), finance charges (5 cents), and tire costs (1 cent). Depreciation is the largest cost, but that's primarily driven by new cars shipped — the more cars that are installed, the less valuable existing cars become. In the US, 77% of commuters use their car to get to work, according to Citibank.

- **Cost of ride-hailing service in the US: $2.15 per mile.** Based on BI Intelligence's analysis, the average cost of an UberX ride that lasts five minutes and travels three miles in 15 of the largest cities in the US is $6.46, or $2.15 per mile driven. Uber-driver pay stubs posted online show that Uber takes approximately 20% (43 cents per mile driven) of the fare. This does not account for surge pricing during peak times.

- **Cost of a carpool ride-hailing service in the US: $1.05 per mile.** Depending on the time of day, city, company operating, and demand, a carpool service costs, on average, $1.05 per mile, based on our analysis of a pricing comparison. That's 55% less expensive than the cost of a single rider ride-hailing service.

- **Cost of a subway fare: $2.51 per ride.** We examined metro fares in 20 cities and found that the average cost is approximately $2.51. Unsurprisingly, the cost of a subway ride changes dramatically by city. In the US, 9% of commuters take the subway, so it makes up only a small portion.

- **Cost of a driverless taxi: 25 cents per mile.** BI Intelligence estimates that the cost of a driverless ride-hailing service could be as low as 25 cents per mile. The elimination of the driver would save approximately 55% of the fare. In addition, the operating costs associated with maintenance, fuel, and tires could also be cut dramatically. Goldman Sachs estimates that driverless cars would likely improve traffic flows and could improve overall fuel efficiency in the US by 30%. And in a perfectly optimized driverless car scenario, auto insurance might no longer be necessary at all. However, the cars would still depreciate faster than consumer vehicles because they'd likely be running continuously and need to be replaced. For context, NYC taxis travel an average of 70,000 miles in their 3.6-year life span.

- **Cost of a carpool driverless taxi: 17 cents per mile.** A carpool driverless taxi would deliver the same benefits as a single-rider driverless taxi but at an approximately 55% lower cost. (That's based on applying the same cost ratio for carpool ride-hailing as for single-rider trips.)

Willingness To Give Up Driving

**Consumers' reluctance to give up the wheel may hinder adoption of driverless taxis.**
Around the world, being able to drive and own a car is seen as a milestone in a person's life, and many may not want to give it up. This is part of the reason that user-operated fully autonomous cars have been the first to come to market. Having the ability to switch to driving mode adds a layer of comfort for drivers to take control if they don't trust the technology.

Current usage of ride-hailing services is an interesting indicator that shows consumers might not be willing to give up their cars for new services.

- **Only 15% of Americans have tried a ride-hailing app,** like Uber or Lyft, according to a 2016 Pew Research survey. And of the 15% who have used these apps, only 17% use them daily or weekly. Americans are still far from replacing their vehicles with ride-hailing services.

- **Unsurprisingly, millennials (28%) and people living in urban environments (21%) were more likely to have tried a ride-hailing service, but their usage is still low.**

American Usage of Ride-Hailing Apps

■ Have used   ■ Have heard of but not used   ■ Have not heard of

15%

51%

33%
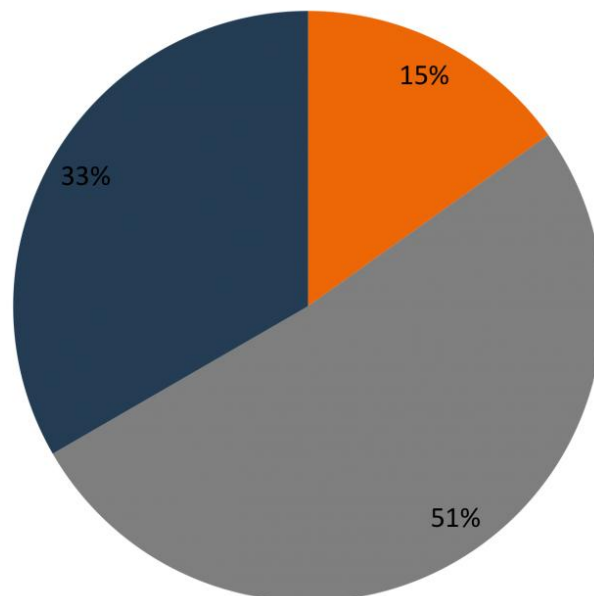
N = 4,787
Source: PEW Research, 2016

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MARKET OUTLOOK

BI Intelligence's analysis shows that, if fully optimized, driverless taxis could significantly change the way consumers travel — especially in urban environments. Increasing urbanization means that more consumers would likely stop commuting in their own cars and opt for driverless taxi systems. For automakers, this means that their primary customers could switch from consumers to shared mobility service providers. BI Intelligence expects that this will further motivate automakers to cut shared mobility services out of the equation.

Driverless taxi services are available today but in very limited settings. The services cover small geographical areas and tend to be on private property — like college campuses or airports. In comparison, since pilots of user-operated fully autonomous cars still have a driver behind the wheel, the liability of a crash shifts onto the driver. These proof-of-concept tests are critical in preparing for a mass deployment of driverless taxis, as they collect data about the taxis' use, as well as information about the cities they're operating in. While limited, in certain countries regulators are pushing for the fast deployment of driverless taxis, primarily to help reduce traffic congestion.

BI Intelligence expects the first mass driverless taxi service (350-plus operating driverless taxis) will be available by 2020. Although certain countries have much more aggressive plans for deployment, we believe that these areas will face many challenges that will slow them down. These issues particularly relate to building out the infrastructure necessary to optimize driverless taxis.

Singapore is the best bet for the first deployment. The country recently [claimed](#) the top spot in the Networked Readiness Index (NRI), a system that ranks nations based on how well they utilize information technology to drive social and economic transformation. In addition, Singapore's citizens are highly willing to ride in and pay for driverless vehicles. For self-driving carmakers, this means that Singapore is one of the best countries to test and deploy their vehicles.

Broad adoption likely won't happen until 2045. Singapore is a very small country — it covers just 277 square miles. For larger countries, like the US — which spans 3.8 million square miles — it will be much more difficult to deploy a nationwide driverless taxi service that serves all consumers. Large countries will need massive changes to infrastructure to meet the technological needs of driverless taxis. **As a result, it will likely take 20 years or more for driverless taxis to achieve wide-scale adoption and have significant economic effects.**

THE BOTTOM LINE

- Automakers, shared mobility services, and tech companies are investing in and partnering with each other to build driverless taxi services.

- The potential benefits of a driverless taxi system include higher profits for automakers and tech companies, reduced traffic congestion, lowered pollution levels, and safer roads.

- By 2020, we expect the first mass driverless taxi service (350+ driverless taxis operating) will be released. Singapore is our top bet for the first deployment.

- But it will take 20-plus years for a driverless taxi service to make a significant dent in the way global consumers travel. This is because larger countries will need to revamp infrastructure to allow for driverless taxis.

- Driverless taxis will face three key barriers: regulation, improving autonomous technology, and consumer willingness to ride. For now, automakers and tech companies are primarily focused on improving driverless technology and pushing regulators to allow it.

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