FRANKLIN TEMPLETON INVESTMENTS

ALONG FOR THE RIDE

March 2018

FRANKLIN TEMPLETON THINKS™ DISRUPTION

Evaluating the Impacts of Self-Driving Cars

Key Takeaways

1. Autonomous features continue to be added to today's cars, but major improvements in radar and battery technology along with new policies for electric vehicles are making inroads toward greater adoption.

2. New technology approaches are transforming the way manufacturers achieve safety and improve efficiency—helping to save lives and jobs.

3. Implications for investors may range from shifts in the way insurance policies may be handled, to health care to impacts on real estate prices.

CATALYSTS DRIVING ADOPTION

Driverless car technology is no longer science fiction. The reality is that we are already exposed to aspects of autonomous-vehicle technology in our daily lives, and have been for several decades.

We've come to consider cruise-control and self-deploying airbags as standard automobile functions. These systems represent the beginnings of the exploration of self-driving vehicle technology. Automobile designers have now reached the stage of imagining a car that can autonomously handle many of the situations a driver might experience. Innovations available today include autonomous features such as accident-prevention software, traffic-jam assist programs, and radar- and video-assisted reverse driving and parallel parking systems.

Advances in technology—from mapping and navigation technology to innovative forms of radar to artificial intelligence programs that synthesize the information about the surrounding environment and instruct the vehicle to react accordingly—are now enabling the car of the future by contributing to vehicle autonomy. Twenty years ago, computers simply weren't powerful enough to crunch the amount of data that's flooding into modern vehicles.

So, the question today is not so much the invention of autonomous mobility, but rather the speed of mass adoption. And while there have been huge advances in autonomous technology, that doesn't mean the prospect of fully autonomous vehicles, capable of transporting passengers from points *a* to *b* with no human interference, is just around the corner.

First, it is important to understand that there are levels of autonomy within a vehicle related to the central functions of a car—including steering, monitoring the driving environment, and the control of the car. Based on the levels shown on the following page, some auto manufacturers believe we will achieve Level 4 autonomy by 2021.

What Does "Self-Driving" Mean?

Part of the challenge of this discussion topic stems from the fact that the term "autonomous vehicle" conjures up different images for different people.

The Society of Automotive Engineers (SAE) has outlined a classification system with six different levels of vehicle automation, from Level 0 as fully manual to Level 5 as fully automated. Today's newer vehicles offer a Level 1 experience. Current innovations being tested could offer consumers a Level 3 experience. Our analysts believe Level 5 autonomy is still a distant vision.

Robert Stevenson, portfolio manager, Franklin Equity Group, believes technological advances are opening up the competitive landscape in new ways that weren't possible 20 years ago. The playing field is now "wide open" in this race toward autonomous vehicles.

"I think the technological evolution and change that's happening with autonomy has brought down barriers to entry, and it's allowed new players to come in. As we look to the race to get to Level 4 autonomy in 2021, as Ford has said and as others have said, well, it's still pretty wide open. There doesn't really seem to be a clear lead in terms of who's going to get there first."

Robert Stevenson, Portfolio Manager, Franklin Equity Group

SAE Vehicle Autonomy Levels
October 2017

	Steering	Monitoring	Fallback	Modes
LEVEL 0 The status quo for traditional driving methods, with fully manual control of all functions including steering, brakes, throttle and power.				N/A
LEVEL 1 Limited automation where one function is handled automatically by the car—like adaptive cruise control in newer cars.				Some
LEVEL 2 Both steering and speed are automated using environmental information, but the driver must be ready to take control any time. Tesla AutoPilot is an example.				Some
LEVEL 3 All safety-critical functions are done by the car under certain road and traffic conditions. The driver can intervene, but constant monitoring is not required.				Some
LEVEL 4 The car monitors conditions and performs all safety-critical driving functions in certain driving scenarios such as highways, urban areas and parking garages.				Some
LEVEL 5 The autonomous vehicle's performance is expected to equal or better that which a human driver can demonstrate, for all driving conditions.				All

We view three key developments influencing the pace of adoption:

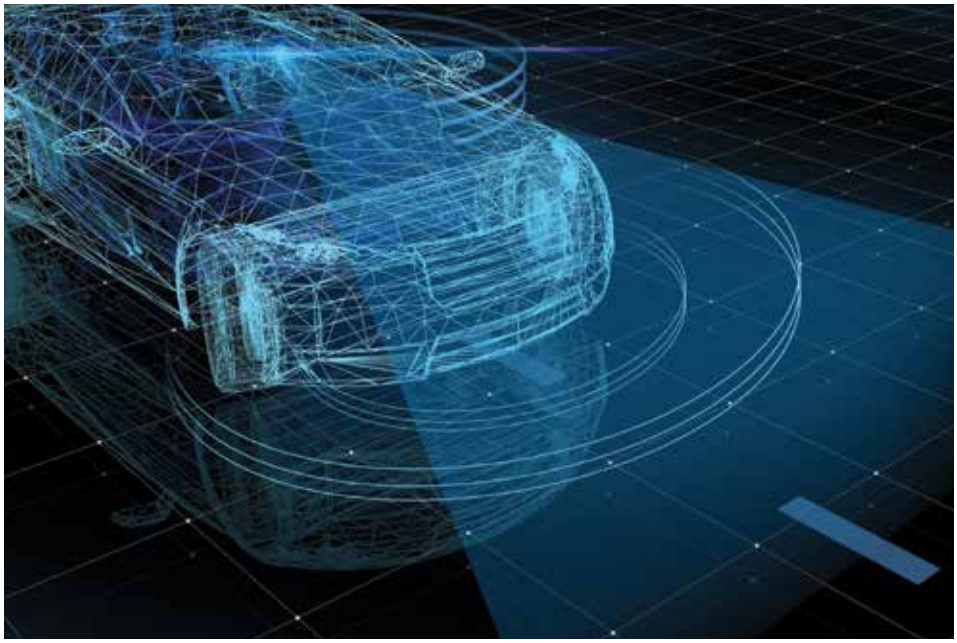
1. LiDAR (Light Radar)
2. Electric Vehicle Influence
3. Battery Technology Improvements

LiDAR: Creating a Perfect Set of Eyes for the Car

The development of LiDAR, a remote sensing method that uses light in the form of pulsed lasers to measure variable distances, is central to the self-driving revolution. LiDAR sensors are the "eyes" that allow autonomous vehicles to see what's around them. On test vehicles, they are multi-beam spinning units mounted to the roof, which rapidly build a 3D picture of a car's surroundings.

In the Grand Challenge races sponsored by the US Government's Defense Advanced Research Project Agency (DARPA), LiDAR forever changed the future for self-driving cars, allowing start-ups like Velodyne to remake transportation and robotics in general. Today, Velodyne is a top supplier of advanced automotive LiDAR and sells its sensors to virtually every auto and tech company that's building or testing autonomous vehicles. GM, Ford, Uber

and China's Baidu are big buyers, and even Caterpillar uses the technology for gargantuan robotic mining trucks. Google is both a major customer and a developer of its own sensors.



Electric Vehicle Influence: Shifting Policies Fuel Momentum

The evolution of self-driving vehicles is occurring in tandem with both the development of electric vehicle technology and the predicted demise of the internal combustion engine. In our view, the two are intrinsically linked: Autonomous vehicles will only become cost effective if they are heavily used. Electric vehicles tend to be cheaper to run than gasoline or diesel alternatives when heavily used.

In the current dynamic, the same inefficient low utilization of private cars that so invites market disruption also torpedoes any cost efficiencies an electric car could deliver. When a car is driven only an hour a day, the savings on gasoline from electrification aren't sufficient to justify the upfront added cost of the vehicle. But in a future of shared, autonomous vehicles with much higher utilization, electric cars make far more economic sense than their gasoline counterparts.

Meanwhile, many governments are pushing hard to replace the internal combustion engine (ICE) with cleaner electric vehicles—in 2017 both the United Kingdom and France said that by 2040, new cars completely reliant on gasoline or diesel will be illegal.

Currently, electric vehicles make up less than 1% of cars on the road. Based on these new policies, original equipment manufacturer expectations and our own calculations, we're in broad agreement with projections from the International Energy Agency suggesting the number of electric cars on the roads globally should reach between 9 million and 20 million by 2020, rising to between 40 million and 70 million by 2025.[1]

Significantly, China was the largest electric car market in 2016—the most recent year for which figures are available—accounting for more than double the number of electric vehicle sales as the United States.

China is witnessing the emergence of a new dynamic which we think could push it to the front of the pack in the autonomous-vehicle race: the central government is collaborating with large, established companies and small, venture-backed, emerging-technology companies.

Japan, by contrast, has proven to be a bit of a laggard. The World Economic Forum survey suggests enthusiasm for self-driving vehicles in Japan is well-below international peers.[2] This may be surprising to some observers because of Japan's legacy as a leading-edge technology developer.

However, there are signs that Japanese companies are looking to catch up. Japanese technology and financial companies have been looking for co-investment opportunities with overseas partners to explore areas such as electrification or autonomous mobility.

We think emerging markets could eventually be at the forefront of designing and building the components that underpin the roll-out of self-driving vehicles, but for the foreseeable future we see the addressable market as North America, Western Europe and potentially some of the larger cities in China.

Despite the apparent enthusiasm for driverless cars in some lower income countries like India, we think there would have to be a significant drop in the cost of these vehicles for them to take off in these countries.

Battery Technology Improvements: Mining and Materials Offer a Core Opportunity

Advances in battery chemistry have been phenomenal in recent years. A decade ago, battery costs were prohibitive. But over the last 10 years, costs have dropped dramatically as the industry started to scale. We expect that trend to continue.

1. Source: International Energy Agency, Global EV Outlook 2017. There is no assurance that any projection will be realized.
2. Source: World Economic Forum, "Self-Driving Vehicles in an Urban Context," 11/24/15.

Finding investment opportunities among companies that are actually manufacturing components can prove challenging. But as we look at wider electrification of vehicles, we expect to see some attractive opportunities among chemical companies in particular.

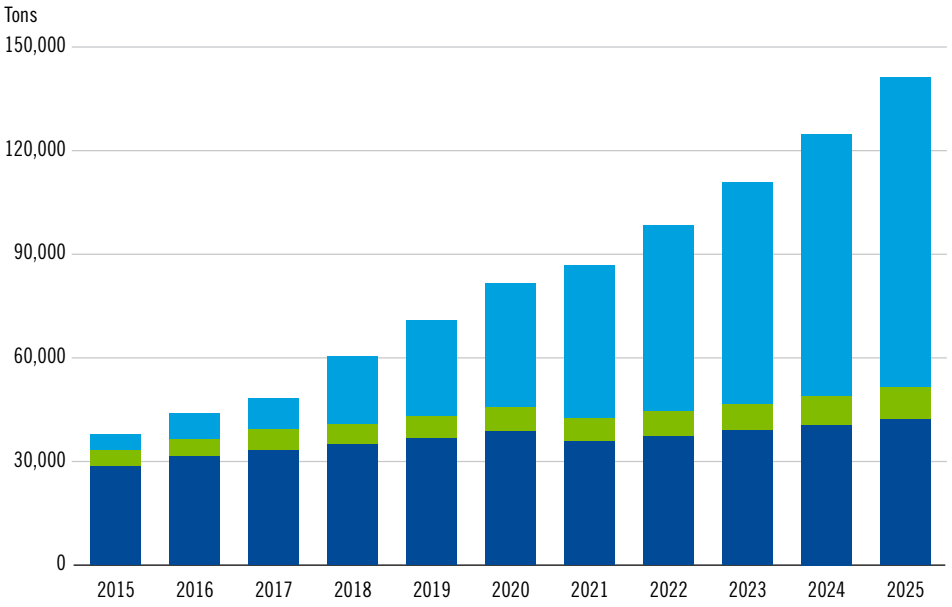
Our estimates suggest the number of electric cars on the road could potentially multiply by a factor of 10 in the next decade, potentially crimping the supply chain of materials required to manufacture batteries, like lithium and cobalt. That is an issue we are monitoring carefully and we're already seeing some impact in market developments.

In one particular instance, the market disruption's cause was fears of a lithium shortage, prompted by concerns that electric vehicles were suddenly competing with laptops, drones and smartphones for lithium-ion batteries, and saw prices for the ductile metal triple in just 10 months, to more than US$20,000 per metric ton.[3]

Many observers believe there should be enough lithium in the ground to meet the needs of an electric-car future. However, battery makers are going to need development of more mines to support their production, and they may need them more quickly than previously thought.

Demand for Cobalt in Battery Applications

2015–2025 (Forecast)



Source: CRU Group, Avicenne, as of 3/1/18. There is no assurance that any forecast will be realized.

Analysts at business intelligence firm CRU Group forecast the battery sector will need more than 140,000 tons of cobalt a year by 2025, up from around 48,000 tons in 2017.

As a result we expect battery and auto manufacturers to sign multi-year deals to secure supplies of raw materials, including cobalt and lithium.

"For commodity products, it's kind of mind boggling to think that companies are asking for 10-year volume commitments long-term supply for something like lithium, which is, at the end of the day, a commodity. That's an area where we think there are investment opportunities."

Robert Stevenson, Portfolio Manager, Franklin Equity Group

3. Source: Bloomberg, "We're Going to Need More Lithium," 9/7/17.

INDUSTRY DISRUPTION: NEW AVENUES FROM SILICON VALLEY

On October 26, 2017, Franklin Templeton Investments facilitated a discussion with senior leaders of notable autonomous technology start-up ventures. They discussed some of the ways new technology enables changes to existing markets in four areas: safety, car ownership, municipal buses and heavy-duty freight trucks.

Safety First: New Forms of Virtual Test Environments Complement Road Tests

Before any public rollout can happen, autonomous vehicle manufacturers will need to perfect multiple technologies, involving sophisticated software testing over billions of miles of road conditions in virtual settings, in addition to performing even more of the actual highway and road testing that began several years ago. When it comes to virtual testing, Silicon Valley and the state of California are setting the trend.

In September 2017, California's Department of Motor Vehicles formally proposed rules that, starting in 2018, will govern how everyday people can get self-driving cars into their lives. This development was a big step forward for regulations that were first drafted in December 2015 and then redrafted to accommodate companies' concerns. In California alone, 50 companies have received testing permits and they have logged hundreds of thousands of miles on nearly 300 prototypes.[4] Other states including Arizona, Nevada, Utah, Michigan and Texas have also hosted testing.

Safety is a paramount concern, both as a selling point and a potential liability. Traditional automakers and Silicon Valley upstarts may be taking divergent approaches to teaching cars to drive autonomously, but everyone agrees that cars that don't text, fall asleep, drink, or drive erratically may eventually save thousands of lives that would otherwise be lost to human-caused car crashes. Most technology and industrial companies say a launch or slow rollout of life-saving autonomous technology is still at least a few years away.

"You can no longer drive your way to safety. You need billions of miles of testing to be able to adequately verify that safety"

Chad Partridge, CEO, Metamoto

Millions of additional "miles" have been test-run in scalable simulations for autonomous systems. Companies such as Metamoto, Inc., a startup offering scalable testing simulations for autonomous systems, have emerged to fill a gap that didn't even exist a few years ago. Virtual test systems have been designed to build knowledge for the computer systems that will be managing the driving functions.

According to Chad Partridge, CEO, Metamoto, "If you change your training sets, and you make an update to your 'black box,' you need to exhaustively go through it. That's exactly why you have to have millions of tests a night." This level of testing can only come with technological support.

Now, in addition to using conventional crash test dummies and all of the traditional road tests, these vehicles are also subjected to thousands of virtual test case scenarios and parameters that are designed to identify and correct potential problems with the software. The virtual test case scenarios are driven by enterprise software that contributes to mission-critical video, geospatial data and computer vision and other forms of "sensing" within the unmanned systems markets. These complex autonomous system projects require the fine-tuning of sophisticated engineering, machine learning, control, automation, robotics, sensing and hardware design.

4. Source: California Department of Motor Vehicles, 1/11/18.

Ownership Dynamics and the Impact of Ride Sharing: What's Your New Car Smell?

Arguably the biggest disruption to the automobile industry in the last 10 years has been the evolution of mobile phones and, in particular, the ability to use mobile phone technology to match people wanting a ride with people offering a ride. Today, most privately owned cars are used just a few hours per day for commuting to and from work, or shopping at brick-and-mortar stores. Owned-vehicle utilization is only about 10% of usable time.[5] Anticipating continued development of self-driving technology, some observers predict that traditional car ownership could drop significantly with a corresponding rise in car rental, car-sharing and ride-hailing.

There's increasing evidence that millennials, who are moving in increasing numbers to cities, often do not see car ownership as a status symbol, and instead opt for car-sharing models. The number of even younger post-millennial adults getting drivers' licenses has been declining as car-sharing alternatives are sufficient for their mobility needs and are much cheaper.[6] If the thrill and independence of car ownership is outweighed for these young people by the convenience of ride sharing, that leaves a dilemma for auto manufacturers seeking to sell cars.

"Nowadays when you get picked up in an Uber, you don't really care what brand that vehicle is. You don't care what color it is. There isn't that emotional attachment any more that you have with a car that you own," said Dragos Maciuca, technical director, Palo Alto Research and Innovation Center at Ford Motor Company.

"The interior then becomes extremely important. We think the interior is something that needs to surround you and has to cocoon you—you know that it's yours. So the more we know about you, the more we can customize that vehicle for you for your use," said Maciuca.

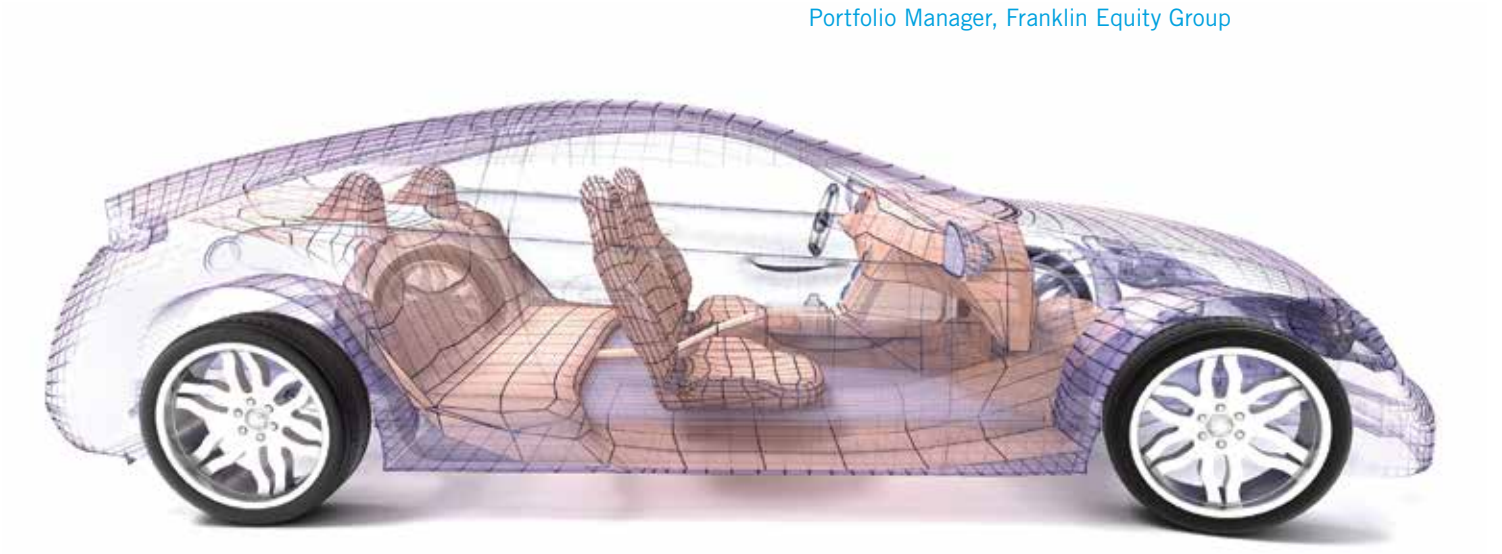
Maciuca added that pleasing the manufacturers' range of customers poses additional challenges. "What makes the job more interesting is that now we also have this intermediate customer, which is the fleet operator. And we need to make our vehicles, our fleets, more interesting for them. So that means easier to maintain, easier to manage. At Ford, we provide this 'transportation operating system,' we call it, on which you can add apps, other vehicles, or different modes of transportation. The easier we make it for that intermediary customer, the more they'll want our vehicle. At the same time, we may go back to the old adage, 'you can have it in any color you want as long as it's black.' So it reduces the number of choices that we need to offer.

"Instead of having the potential for hundreds of thousands of combinations between options and letting every consumer pick what they want, maybe we'll just have 10 options of the same vehicle and let the fleet operator pick which one they want. So, that reduces our costs in terms of manufacturing those vehicles."

Managing the production costs across the fleet and individual car options will be an important objective for car companies. With a focus on higher-end individual car sales, Tesla has struggled

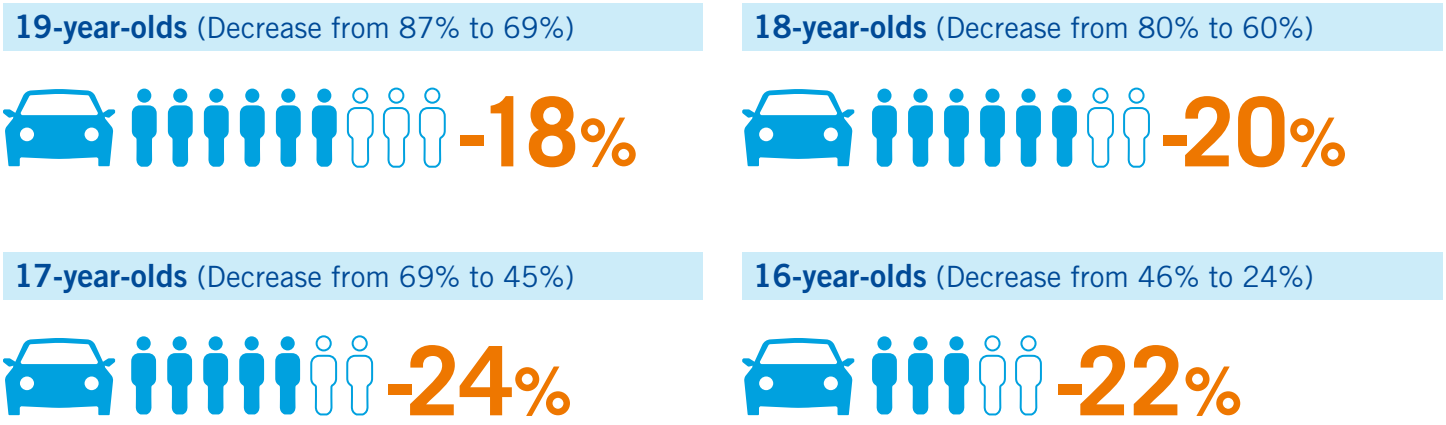
"The auto industry is slowly changing, but I don't know how much it would be changing if smartphones hadn't been invented."

Robert Stevenson,
Portfolio Manager, Franklin Equity Group



5. Source: Silicon Valley Innovation Center (SVIC) estimate, as of 10/23/17: 1.5 hours per day, out of 15 hours useable time. There is no assurance that any estimate will be realized.
6. Source: University of Michigan Transportation Research Institute, "More Americans of All Ages Spurning Driver's Licenses," 1/20/16.

Decrease in the Number of Licensed Young Adult Drivers
1983–2014



Source: University of Michigan Transportation Research Institute, "More Americans of All Ages Spurning Driver's Licenses," 1/20/16.

to produce net income for shareholders over the past few years.[7] Our Franklin Templeton auto sector analysts estimate the ownership mix will shift somewhat more toward fleet, but the change will be smaller and more gradual than some people may currently believe.

Shift toward Electric Municipal Buses: A Green Initiative with Added Benefits

The trend away from car ownership by millennials should also increase demand for mass transportation. It's an expensive proposition for cities to purchase and manage a fleet of municipal buses to service a major metropolitan area. In addition to labor costs for drivers and staff and the cost of gas, there is the added maintenance cost of repairing the buses when they breakdown. Saddled by large, aging fleets of diesel buses, maintenance costs are a common problem for municipalities.

Ryan Popple, CEO of Proterra, a leading innovator in heavy-duty electric transportation, shared some of his experience managing the transition to electric buses in cities across the United States. "Believe it or not, city buses are actually less fuel efficient than many heavy-duty trucks because combustion engines do not like to start and stop, and heat up and cool down. With electric buses, they're saving 40 to 50 cents per mile on fuel. Importantly, we have about a six-year operating history we estimate, based on early usage, that the maintenance savings—both the spare parts and labor cost savings—is equal to the energy savings."

In addition to improving the air quality in urban environments by reducing diesel emissions, the transition to electric buses also offers cities cost savings beyond just saving significant sums of money on fuel.

Popple added, "New York City has approximately 5,500 heavy duty transit buses. It's the connective tissue of their rail infrastructure. On any given day, roughly 10 percent of those buses are parked. To cut to the chase for our customers, they're going to save anywhere between $25,000 and $50,000 per year in fuel and maintenance costs. Park City, Utah, is a great example. They have six electric vehicles on a bus rapid transit system as of last April. When they came into the fleet, they were running each vehicle about 50,000 miles a year. Today, they're running them 18 hours a day, and some of the vehicles will exceed 140,000 miles in a year. Municipal city managers have realized the more they use the electrics, the more they pull in the payback, and they're leaving the diesels parked. By our estimates, it's an industrial payback of probably two to six years on a 12 year asset."

Freight Movement: "Platooning" Improves Long-Haul Trucking Operations and Maintains Jobs

Heavy-duty vehicles designed to transport freight by ground are a significant testing ground for innovative autonomous technology. Freight owners have to contend with rising fuel costs, increasing liability costs for accident coverage, and labor shortages that are reducing the number of professional freight drivers.

One of the start-ups leading the way to solve these challenges is Peloton Technology, a developer of connected and automated vehicle systems for US and global freight carriers. Peloton is pioneering a drafting technology called "platooning" in which two or more trucks are paired together electronically. Platooning combines vehicle-to-vehicle communication with vehicle to cloud communication to basically form a virtual coupling between those two trucks.

7. Source: Tesla, Fourth Quarter and Full Year 2017 Update.

Josh Switkes, founder and CEO of Peloton Technology, describes the experience. "If you're in that rear truck, there's still a driver. That driver's steering, but their feet are off the pedals. They are controlling the gas and the brake similar to cruise control, but we are able to basically synchronize the actions of those two trucks. That means when the front truck applies the brakes, we're immediately applying the brakes on that rear truck. When you're riding in the truck, it feels like it's simultaneous braking in the two trucks. This enables us to prevent a lot of accidents.

"And very importantly, it lets us bring the trucks closer together than what's typically safe, and then they're basically drafting one another, similar to race cars or cyclists. They're getting aerodynamic improvements that reduce wind resistance and save a lot of fuel," commented Switkes.

Switkes pointed out that freight operators in the United States typically spend $80,000 to $100,000 on diesel fuel per truck per year. The value-add for freight operators, in addition to improving their safety records, is their ability to save five to 10 percent of their fuel costs. This can significantly transform these companies' profits.

This focus on improving the bottom line may lead some to conclude the goal of autonomous vehicles is to displace actual drivers. Switkes says that's not the case for his business. "In Washington, we've seen resistance from the truck driver unions, resistance against including trucks in the autonomous vehicle bill that's trying to go through Congress right now. What we've found is for platooning, because we're not replacing the driver, we've gotten very little, if any resistance."

Partly due to the increased demand for freight transportation created by online retail businesses such as Amazon, there's currently a huge shortage of drivers in the trucking world.

Switkes estimated that the current shortage of roughly a hundred thousand drivers today will likely grow to a shortage of hundreds of thousands of drivers over the coming years. "Almost every fleet we talked to says if they could hire more drivers, they would haul more freight. So the current drivers are not going to be put out of work. There will just be fewer new drivers coming into the workforce over time."

How We Get There

Dual Use: Government Backing Is Crucial

In the industrial technology field generally, government involvement is often crucial at the early stages of development. GPS, satellite communication, fiber optics—and even the internet—began as government-backed projects.

Self-driving vehicles are no exception. Most observers point to the US Government's DARPA Grand Challenge in 2004 as sparking the current era of autonomous mobility. The goal of that DARPA challenge was to create an autonomous vehicle that could drive 50 miles through a desert.

We see the development of this technology as classic "dual use," potentially benefiting both government and private enterprise, in particular when it comes to data collection. For example, autonomous vehicles measuring ride comfort could also be gathering real-time data on potholes for local or state government.

IMPACTS AND IMPLICATIONS

Disruption, by definition, is about creating new markets that significantly change the status quo. Cars, trucks and buses with more autonomous capabilities may bring business implications and potential considerations for investors.

Driving Careers: Not Lost and Forgotten, but Reinvented

One might assume that the evolution of transformative technology would put jobs at risk. But that's not necessarily the case.

Research conducted by Deloitte in 2015 suggests that technology had contributed to the loss of around 800,000 jobs in the United Kingdom since the beginning of the century.[8] However, it found technology had also helped to create 3.5 million new jobs in their place.

While technology might eliminate low-skilled, manual or clerical jobs, it creates demand for higher skilled, better remunerated creative roles—particularly those requiring human social interaction—in professional and business settings.

In some situations, automation can lower prices which can lead to higher demand for goods and services. Amazon is a great example of this in the retail sector. Its fulfillment centers use highly advanced technology, but it is also a significant employer—with more than 500,000 employees as reported in Q4 2017 company earnings statements.

But "driver" is currently the most common occupation across the United States and the arrival of truly driverless vehicles presents potentially difficult societal challenges.

According to 2014 US Census data, more than 4.4 million Americans aged 16 and above work as drivers. The vast majority of those are men, who are categorized as "driver/sales workers and truck drivers."

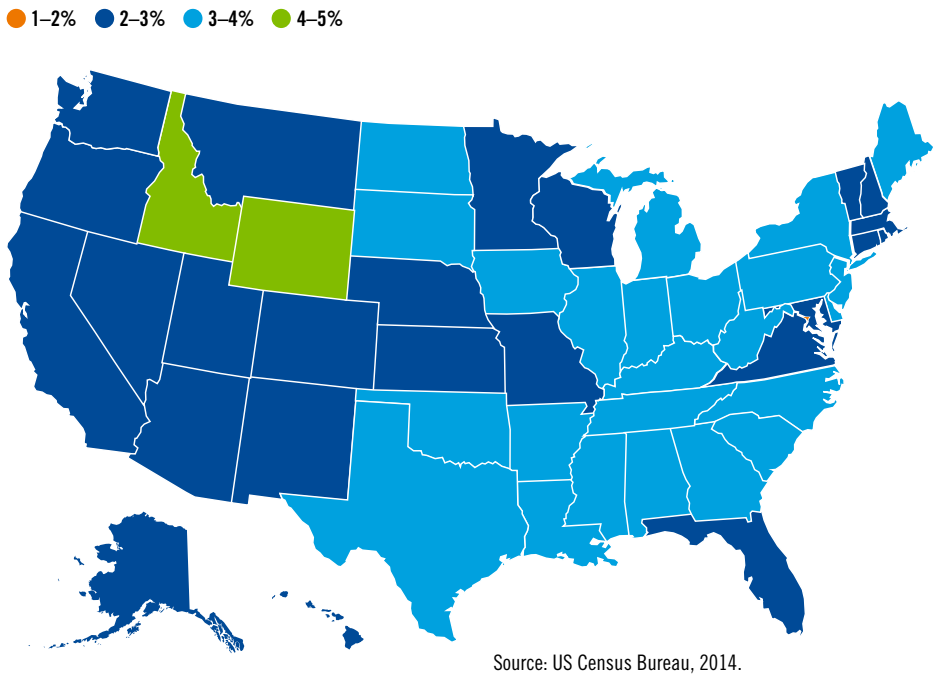
In Wyoming and Idaho, more than 4% of the labor force work in so-called driving jobs, while the rate in the District of Columbia (the lowest by far) is only 1.6%.[9]

But the challenge of shifting vast numbers of workers out of driving jobs is not just an issue for the United States. In November 2017, UK Chancellor of the Exchequer Philip Hammond predicted that over the next 20 years, 1 million people who drive for a living in the United Kingdom would have to retrain as driverless cars come to market. Driverless cars would "revolutionize" the workplace, he said.

Hammond was more bullish than many commentators: "It is happening already. Cars are driving around our roads at the moment with a safety attendant on board with the car driving itself … We have said by 2021 we want to see on Britain's roads genuine driverless vehicles," he said.

But Hammond is cognizant of the implications. He added, "The challenge for us is making sure that the million-odd people in the UK who drive for a living, over the next 10, 20 years or so, as driverless vehicles come in, are able to retrain and reskill so they can take up the many, many new jobs that this economy will be throwing up."

Percent Employment from Driving Jobs



Source: US Census Bureau, 2014.

8. Source: Deloitte, "From Brawn to Brains: The Impact of Technology on Jobs in the UK," 2015.
9. Source: US Census Bureau, 2014.

Insurance: Liability Shifts Prompt New Policy Approaches

The global insurance sector is facing a dramatic overhaul in the face of advances in self-driving car technology and is taking a long, hard look at the implications.

In particular, many countries require auto insurance policies to indemnify drivers in the event of an accident, so underwriters are considering the policies required for self-driving vehicles, including a shift toward liability insurance for manufacturers.

Insurers in the United Kingdom already offer a personal lines policy for autonomy in vehicles. It covers hacking and damage caused by satellite failures or outage, as well as failure to use manual override to avoid an accident if software fails.

The UK government released a bill in February 2017 requiring insurance coverage for the two states of vehicle operation: when the driver is in control and when the vehicle is in self-driving mode. The Vehicle Technology and Aviation Bill is designed to make it easier for an accident victim to recover no matter who is in control.

In our view, self-driving cars are unlikely to become ubiquitous even in the most welcoming countries, so there will continue to be demand for traditional auto insurance personal lines coverage.

But as the number of insureds drops—switching to self-driving vehicle coverage—the cost of regular auto insurance will likely rise because of the smaller population over which risk is spread.

Equally, while the expected drop in accidents because of increased safety standards might reduce insurers' claims bills initially, a decreased risk profile over the longer term (and consequently lower insurance premium income) should likely bring down insurance revenue, too.

Health Care: Declines in ER Visits Could Alter Hospital Revenue Streams

One of the key predictions for self-driving vehicles is that they will drastically improve road safety. McKinsey now predicts that autonomous vehicles could reduce US auto accidents by 90%.[10]

Nearly 1.3 million people in the world die in road crashes and 20–50 million are injured or disabled each year.[11] According to World Health Organization research, road traffic deaths and injuries in low- and middle-income countries are estimated to cause economic losses of up to 5% of gross domestic product.[12]

In 2016, more than 35,000 lives were lost on US roads; more than 94% of these fatalities were related to human error with drunk driving, with speeding-related and distraction-related accidents accounting for over 25,000 deaths alone.[13]

A lower number of accidents and resulting injuries would likely lead to a substantial reduction in both revenue and costs for the health care industry as well as a drop in the proportion of emergency room cases from car accidents.

Auto Retailers: Changing the Car Buying Experience

Away from urban environments, in areas where the adoption of self-driving vehicles among consumers is likely to be lower, many observers expect auto retailers to continue to sell cars in a similar way to today.

10. Source: McKinsey & Company, "10 Ways Autonomous Driving Could Redefine the Automotive World," June 2015.
11. Source: World Health Organization, Global Status Report on Road Safety 2015.
12. Ibid.
13. Source: Association for Safe International Road Travel, US Department of Transportation's National Highway Traffic Safety Administration.

But urban environments may require fewer car dealerships as ownership of private cars declines.

However, it's important to remember that the fleets of these—likely electric vehicles—will still need somewhere to charge and get serviced.

For most car dealerships, selling new cars is already their least profitable activity. We consider a potential shift of focus for existing dealerships to charging and servicing fleets of vehicles could be attractive and lead to potential upturns in the profitability of dealerships.

Even the big public companies that are buying up auto dealerships around the country still own only a single- to low-single-digit percentage of the total. So we feel there could be potential opportunities to further consolidate the industry and for it to develop into a much more profitable business than it is today.

Infrastructure: New Possibilities for the Way We Live and Work

Today's city infrastructure is designed primarily for the needs of cars and cargo vehicles. If fewer humans are driving, city planning could significantly change. As one example, there will most likely be fewer cars parked along the sides of city streets.

There's a strong argument that this de-cluttering could help make urban centers more attractive places to live. Wider adoption of driverless cars is also expected to result in faster and easier commutes that could, in turn, impact the real estate industry.

Currently people pay a premium to reside outside crowded, congested city centers but still close enough to commute to work or to enjoy city nightlife, entertainment, restaurants, etc.

We might expect property even further outside urban centers to become more valuable if people become willing to jump in an autonomous car and ride somewhere for 45 minutes or an hour to go out at night for dinner or to get to the office.

Residential property values could shift from properties in urban centers to suburban areas. In commercial real estate, a similar trend may emerge because the need to locate corporate offices in city centers will likely diminish.

Autonomous vehicles could increase the effective carrying capacity of currently built roads, even during periods of peak congestion (rush hour). Traffic signals can be redesigned and possibly eliminated, as autonomous cars are able to take turns at higher speeds and move around each other more smoothly. Some city areas may be restricted from personal vehicle use and will be accessible only for public transport and ride-hailing services.

Cities could also see their revenues from traffic tickets and other infractions reduced, particularly as the need for paid parking could drop. Fewer traffic enforcement officers may be needed. Connected to a city network, every vehicle could potentially be informed of accidents and obstructions, and police/fire/rescue activities and change routes accordingly. This type of on-the-fly route changing could also help improve response times for emergency personnel, saving lives.

CHANGING EXPECTATIONS POINT TO AN EXCITING FUTURE

As confidence about the development of driverless technology has shifted, especially over the past five years, expectations about the pace of progress toward a fully autonomous future have also shifted dramatically.

The auto world, in general, needs to think about partnering with the tech world more than they have in the past. The transformation for this industry is the shift away from technology of the past. Manufacturers will need to reconsider how to reinvent the driving experience—to support their brand through the inside of the vehicle and how to offer other services like fleet management.

Advances in other autonomous vehicles such as buses and trucks will also influence the future of driving. The potential for improved safety and lower fuel costs may dramatically change commonplace needs ranging from traditional driving occupations to how insurance policies are structured and much more. Nevertheless, the journey to that future may include some detours and may create some opportunities for smart investors with their eye on the bigger picture.

IMPORTANT LEGAL INFORMATION

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