THE DRIVERLESS CAR: A LONG ROAD AHEAD
Imagine a trip to the mall or gym where you face the prospect of navigating a busy, crowded parking lot before beginning your shopping trip or workout. But rather than breathe a sigh of frustration for the delay in finding parking, you instruct your car to drop you off at the entrance and park itself. Then, when you’re ready to go home, use your smartphone to command your car to come pick you up, saving you time and reducing hassle. No, that vision is not from a James Bond movie. Although not widely available, that technology does exist, and is just one of several potential benefits and features of the driverless car.

The driverless car is one of the most talked about visions of the future, but just how close is it to reality and affecting everyday life? Some automakers and technology companies have stated that automation may arrive as early as 2022–2025 period, with Tesla stating the shortest period of time at two years. However, other groups, such as the Highway Loss Data Institute, state that crash avoidance systems (let alone a fully automated car), at the current rate of adoption, won’t be available until almost 2050.

In this piece, we seek to provide clarity and a better understanding of the many moving parts and underlying issues of driverless cars. We hold a longer-term view compared to that of the automakers; however, that does not mean we should ignore this developing technology in the meantime. The path from partial automation to a fully autonomous roadway could have various implications and potential investment opportunities that are worth watching. Partial automation is a more likely outcome than full automation.

Both automakers and tech titans, such as Google and Apple, are pursuing a path to driverless cars. Corporations and governments are spending billions in pursuit of automated cars, trucks, and roadways.

So what are the benefits of automated cars?

- **Improved safety.** Roughly 33,000 people are killed each year in motor vehicle accidents in the U.S. and approximately 1.2 million globally.

- **Environmental benefits.** Studies vary but all agree that “platooning” of cars, where cars or trucks follow each other closely at steadier speeds, can generate significant fuel savings.

- **Greater efficiency.** Cars spend most of the time parked, but a sharing/automated system has the potential to make greater use of each car. According to a University of Texas at Austin study, every shared autonomous car replaced about 11 conventional vehicles.

- **Time savings and increased productivity.** Less time driving frees individuals to do other things, such as consumption.
An auto industry standard for driverless cars remains far away. Aside from the infrastructure needed for an automated roadway and logistical issues, social and legal issues remain large question marks.

The Long Road to Driverless Cars

Who’s Responsible?
- Determine fault in an accident
- Updated rules to govern the road
- New infrastructure & maintenance

Can It Really Be Done?
- Reliable sensors
- Shift from heavy industry
- New software

Legal
- Are We Ready for This?
  - Decades to remove non-automated cars
  - Consumer acceptance is unknown
  - Highly skilled labor force

Social
- Decades to remove non-automated cars
- Consumer acceptance is unknown
- Highly skilled labor force

What’s the Upside?
- Improved safety records
- Greater efficiency
- Environmental benefits
- Potential lower insurance costs for consumers

Source: LPL Research 04/10/16
IMPLICATIONS AND OPPORTUNITIES

In addition to convenience, improved safety, and environmental benefits, there are other potential wide-ranging impacts to sectors, industries, and consumers. Potential implications and opportunities are far from resolved but include:

- **Sensors.** Reliable and accurate sensors are a key component for success of the automated car. Over 50% of the sensors supplied to the automobile industry are manufactured by a privately held German company, meaning there is currently not a clear path for an investment opportunity.

- **Software.** New and developing software is an industry within the technology sector that may benefit. However, software for the automotive industry may come from diversified firms, making it difficult as a pure play investment. Nonetheless, the ability to write code and develop software may continue to be an in-demand skillset for the future labor force.

- **Insurance and consumers.** Improving safety records could mean significant declines in auto insurance costs and insurance costs broadly. Consumers may benefit from the lower costs, and the consumer discretionary sector may be a modest beneficiary. Additionally, increasing the use of automated buses or cars (partially under human monitoring) could increase mobility for lower-income households globally (just as ride-sharing services are today).

- **The big three.** The big three U.S. automakers will have to adapt to survive in an increasing automated world. So far, it appears the big three are doing just that, benefiting in part by strong auto sales, but also increasing features in new models, significant spending on R&D, and the consideration of ride-sharing services.

- **Shift from heavy industry to technology.** Technology may continue to rise in importance as an industry and economic driver in the U.S., perhaps adding pressure to lower-skill, heavy industry jobs at the expense of higher-skilled technology jobs requiring more advanced education and training.

AUTOMATION IS ALREADY HERE

The first partial automation arrived in 1981 when Mercedes launched the first car with a self-deploying airbag. Over the next few years, airbags became standard equipment, followed by antilock brakes in the late 1980s, and features have since increased. Over recent years, newer cars are equipped with lane warnings, automated parking, adaptive cruise control (where sensors measure the distance to the car ahead), and electronic stability control (to limit sliding or
fishtails. Braking assistance, which increases braking force, is another recent feature; and while it may not avoid a collision, it can help reduce the impact, a stronger protection if a driver has fallen asleep.

**CHOOSING THE RIGHT AUTOMATION**

With various levels of automation available, choosing the right environment is one of the questions facing the world of driverless cars.

- **Partial automation:** certain aspects are automated but human input is primary control.
- **Monitored control:** features are completely automated but dependent on human monitoring.
- **Emergency takeover:** human control is cut off in pending collision or crash situations.
- **Full automation:** just tell the car where to go.
- **Distributed automation:** multiple fully autonomous cars.

Monitored control has so far proven the least successful, as human nature often leads to distractions and poor monitoring. In fact, one tech company is moving to a car with no pedals, steering wheel, or rearview mirrors in response to human failures in monitoring. Distributed automation requires automated roadways and is the most challenging to implement.

Distributed automation, which includes vehicle-to-vehicle communication, offers potentially the most societal benefits via significant fuel savings. A fully autonomous roadway means no need for stoplights, because traffic is fully integrated. Such roadways could lead to notable savings from reduced spending on infrastructure, in addition to time and safety benefits. Another example of time savings is the ability of automated cars to drive through fog at higher speed. Expectations for better safety records are further supported by some of the latest car cameras and systems that can detect trees, buildings, and other objects, and can even read speed limits posted on signs. The Department of Transportation estimates that 76% of crashes may be preventable using vehicle-to-vehicle communications and safety systems.
The legal question of whom or what is responsible is just one of the many challenges facing a world of driverless cars. No single group as of yet has stepped forward to meet the challenge. The move to a fully automated roadway system requires new infrastructure and maintenance needs (many of which aren’t fully known yet), but broken or faulty infrastructure, like a knocked down road sign, fading lane paint, etc., are some examples that can
lead to failure or risks. Furthermore, not all roads can be automated. In a fully automated roadway system, if only one car turns off automation the whole system fails. In addition, how does an automated car handle multiple factors, such as a busy Manhattan intersection complete with pedestrians, bikers, and double-parked cars or trucks?

Automated cars are yet to be ruled broadly legal. So far only four states, California, Nevada, Michigan, and Florida, along with the District of Columbia, have laws that allow for the testing of automated vehicles. Still, cars are required to have a human presence in the vehicle for public roadways while full automation must continue to be tested on dedicated test tracks.

Automated cars are highly dependent on sensors. The reliability of sensors has improved, but even a small bumper-to-bumper impact, from something as innocent as a car trying to park adjacent to yours, can impair the sensor and automated functionality. Social issues pose another challenge. GPS may route cars through neighborhoods to distribute traffic burdens or save time, but this raises the controversial issue of individual conveniences versus the collective good.

Next Generation Airspace (NextGen) from the airline world illustrates the challenges automated cars may face. NextGen is the airline industry’s attempt at fully automated air travel where airplanes, traffic control, and other airplanes all communicate to one another to improve efficiency. The NextGen technology has been available for more than a decade but has yet to be fully implemented. The FAA moved forward with NextGen in 2012 as a 20-year, $20 billion project with the aim of environmental benefits and costs savings from fuel efficiency as routes are streamlined. However, social issues, with planes taking new routes over different neighborhoods, have led to noise complaints and/or lawsuits in several cities including Phoenix, San Francisco, Chicago, and Minneapolis.

Cyber security is an issue for automated cars as well. Just like a personal computer, the computer running an electric car or automated system can be hacked into. And similar to the business world, significant software and hardware protections can limit this risk, but it nonetheless remains something to consider.

THE MULTIPLE PATHS TO INNOVATION

As if the challenges above were not enough, automakers and technology companies are taking different routes to a driverless car world. The automakers are gradually adding features into current vehicles in production, while technology companies are seeking to bypass automakers and make the leap directly to a fully automated car. One major tech company is spending a significant amount on detailed maps of roadways to help support its fully automated car.
Automakers have nonetheless set out aggressive timelines for automated cars and improvements. Some are striving for a fully automated car by 2025 or working toward a goal of zero accidents by 2020. Until then, automakers are likely to continue to add features, starting with higher-end, more expensive models before they trickle down to more affordable models.

But these two approaches also highlight the lack of an industry standard, which requires significant human collaboration. The airline industry still lacks this collaboration, with Airbus and Boeing providing different versions of automated systems. The Boeing 777 Asian Airlines flight that crashed on approach to San Francisco was flown by two pilots who had never flown a Boeing plane before and assumed the plane would land on autopilot, a feature that is part of Airbus autopilot—the only planes each pilot had flown before.

DON’T HOLD YOUR BREATH

An auto industry standard remains far away, as do other preparations for the world of driverless cars. Aside from the infrastructure needed for an automated roadway and logistical issues, social and legal issues remain large question marks. Furthermore, new auto sales, currently running at an annualized rate of 17.4 million units, suggest it will take decades to remove non-automated cars from the roadways. There are also auto enthusiasts and vintage car owners who may not want any part of an automated world. Technology is advancing quickly but the degree of consumer acceptance is unknown. The stumbling block of NextGen for automated flight could mean a similar stall for fully automated cars. A fully automated automobile world is a long, long way off. In the meantime, partial automation is the path of least resistance on the journey to a world of driverless cars.
DISRUPTIVE INSIGHTS  THE DRIVERLESS CAR: A LONG ROAD AHEAD

SOURCES
Federal Aviation Administration (FAA)
Highway Loss Data Institute (HLDI)
Insurance Institute for Highway Safety (IIHS)
Japan Ministry of Land Infrastructure Transport and Tourism
National Highway Traffic Safety Administration (NHTSA)
University of California, San Diego, Dept. of Cognitive Science.

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