Schroders
TalkingPoint

Self-driving cars: closer than you think?

Katherine Davidson, Global Sector Specialist - Autos

May 2014

Katherine Davidson

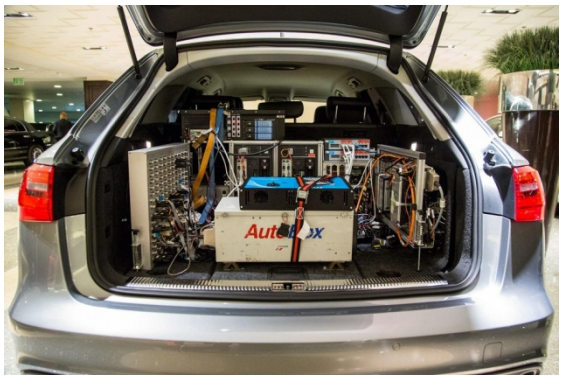
Global Sector Specialist - Autos

The technology required for fully automated driving is moving at an impressive pace, and commercially viable highly-automated cars could be hitting the roads as early as 2020. Katherine Davidson explores the likely direction of this nascent market and asks who are the likely winners and losers.

Much of the technology for fully-automated driving already exists. The first self-driving cars were developed in the 1970s and 80s, albeit with rather limited capability. Google – one of the pioneers in the field (see box on page 4) – has already logged nearly 700,000 autonomous (i.e. self-driven) miles and several manufacturers have also run successful pilots on real roads.

At this year's Consumer Electronics Show, Audi showcased its self-driving A7. The systems that filled its entire boot only last year, have now shrunk to the size of a notepad (See figure 1), illustrating the impressive pace of development in the industry.

Figure 1: Audi A7 self-drive system, one year ago (lhs) and today (rhs)



Source: www.digitaltrends.com

There is little doubt that most of us will see autonomous cars on the roads in our lifetimes. German car manufacturer Continental has said it aims to offer partially automated capabilities by 2016, highly automated by 2020, and fully automated by 2025. Nissan is targeting 2020 for a "commercially viable self-driving system, at a realistic price", and BMW aims to have autonomous cars on the road by 2025.

Many vehicles, particularly at the luxury end, are already offering self-driving elements, or "limited driver substitution". Continental estimates that the penetration of advanced driver assistance systems (or ADAS – a catch-all term encompassing features such as adaptive cruise control, blind spot detection, emergency brake assist, assisted parking, and lane departure warning) is around 10-30% of new vehicles in developed markets, with these features available as options on most luxury models. Some ADAS features are even being mandated by regulators: all cars sold in the US will be required to have rear cameras by 2018, and emergency brake assist is now required for a vehicle to achieve the highest safety rating (Euro NCAP 5) in Europe.

Mercedes is pioneering the most advanced ADAS systems, with the new S-Class featuring an advanced adaptive cruise control system with "steering assist", which allows the car to drive hands free on the motorway for 10 seconds. Other top-of-the-range vehicles are expected to imminently follow suit.

There are still significant barriers to fully-automated driving, from liability to customer acceptance. The key challenges are:

– **Technology:** Continental characterises the driving process as "sense-plan-act". The technology largely exists for the "sense" and "act" phases – i.e. sensors, radars and cameras for the former, and actuators and control systems for the latter. However, the "plan" phase represents much more of a challenge. Essentially, the vehicle needs to have a high degree of artificial intelligence, enabling it to not just see but also interpret the world around it and decide on the best course of action. The vehicle also needs the ability to handle a situation where some systems fail, without endangering the occupants. Car companies are now employing thousands of software engineers working on this challenge.

– **Liability:** This seems to be the biggest sticking point at present, with a practical and ethical debate over who is responsible for a crash involving an autonomous car: the manufacturer, the driver, or no one? It seems likely that carmakers will have to bear at least part of the insurance cost, but ultimately the total cost of insurance should also fall as there are fewer accidents. BAST Germany, a highway research institute, estimates that 70% of serious accidents could be avoided by driver assistance systems, and insurance premiums have already fallen for vehicles with some assistive technology.

– **Regulatory:** Some companies have been granted special licences to operate autonomous cars on real roads, generally within tight geographic confines. However, there will be much higher regulatory barriers to selling autonomous cars to ordinary consumers. For example, the Vienna Convention on Road Traffic currently requires the driver to remain in control of the vehicle at all times.

– **Infrastructure/connectivity:** Fully automated driving would likely require an uninterrupted internet connection, which is not currently feasible outside big cities.

– **Customer acceptance:** It will take consumers a while to get used to the idea of handing over full control to the vehicle, though they will be eased in by ADAS. Surveys conducted by KPMG suggest that women, older drivers and drivers of premium vehicles are the keenest on autonomous technology, but that most people were receptive once the benefits were explained (see box above).

– **Cost:** Continental estimates a content cost of $2000-3000 per autonomous car by 2020, while Morgan Stanley estimates $5000 of content plus around $5000 in research and development. A 2012 JD Power survey found that 37% of respondents would be interested in buying an autonomous car, falling to 20% when told they would pay an

Benefits of autonomous driving

Safety: More than three quarters of accidents are caused solely by the driver, and over 90% are partially driver-related. Highway research institute BAST Germany estimates that 70% of serious accidents could be avoided by driver assistance systems. According to the American Automobile Association, traffic accidents cost the US $300 billion a year.

Insurance premiums: A related benefit is that the total cost of insurance should fall given fewer accidents. Indeed, insurance premiums have already fallen for vehicles with some assistive technology, such as emergency brake assist, which reduces incidence of whiplash.

Efficiency: Self-driving cars should result in more efficient driving patterns and lower fuel consumption. For example, autonomous cars should be able to drive more smoothly and at a steady pace, reducing fuel wastage from surge braking and accelerating. Empirical tests have demonstrated that simply using cruise control can improve fuel efficiency by up to 30%. Cars should also be able to drive closer together, reducing drag.

Journey quality/productivity: The average American commuter now spends 250 hours a year behind the wheel of a vehicle. In a world where cars require zero human intervention, these "drivers" will become passengers and will be free to use their commute as they wish. A survey by JD Power suggested that consumers would be willing to pay up to $2000-3000 for the extra leisure time associated with autonomous driving. Autonomous cars should also reduce time wasted due to congestion.

extra $3000 for it. The charts below shows what drivers in different countries would pay for automated features, according to a survey conducted in 2013:

Figure 2: How much would you pay for automated features?

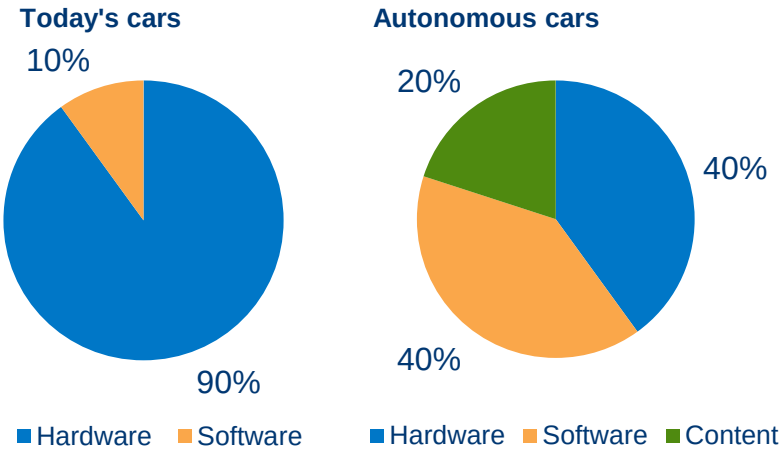
Source: 2013 Continental survey

None of these barriers are insurmountable, but it is likely that the final leap – where the driver can actually take their hands off the wheel and read the paper – will take much longer than the initial stages

Who are the winners and losers?

The transition to automated driving will be highly disruptive for the auto industry, potentially on the scale of that seen in the PC/mobile phone industries since the advent of smartphones and tablets. This is in part because more of the value in an automated vehicle will come from the software side, with the hardware generally quite straightforward. The charts below show how the value of a car might change:

Figure 3: The changing value of cars



Source: Morgan Stanley Research, November 2013

We believe original equipment manufacturers (OEMs) will likely follow one of the following paths:

1. **Fully integrated:** the OEM will operate a closed system, designing and manufacturing the vehicle and owning the operating system, as per the Apple model. This only seems viable for the largest carmakers – which have the balance sheet capability – and the premium players. These companies have been at the forefront of autonomous technology so far.
2. **Hardware only:** in parallel with the smartphone industry, we would expect to see some players focus on hardware rather than spending large sums developing second rate operating systems. So, while today you buy a Samsung device running Android, in the future might you buy a Hyundai-made Google car? This will be feasible only for the most efficient manufacturers with operations in low-cost countries.
3. **Capital light/fully outsourced:** players that have strong brand but lack scale could exit the capital-intensive and low-margin activity of actually making cars, and focus on design and branding while outsourcing the rest of the production process to suppliers or hardware-only companies and the software side to Google or similar. The worry here is that the design and brand of the vehicle becomes less relevant as the value shifts to the software, especially as "driving pleasure" is less relevant: a KPMG study found that consumers cared less about factors such as styling and interior in a self-driving car.
4. **Bust:** in this vision of the future, there is no place for small or inefficient manufacturers with mass market brands. These players are already struggling but progress towards autonomous driving will hasten their decline as they do not have sufficient resources to keep pace on intermediary technology nor the brand equity to get customers to pay up for additional content.

The outlook for suppliers is also somewhat polarised. On the one hand, the declining share of hardware in the overall value of a car and the further commoditisation of vehicles will put downward pressure on the price of basic content. On the other hand, further outsourcing should benefit volumes, and some suppliers are well-positioned in terms of the higher value-add content necessary for autonomous driving.

Will your children be driving a Google?

Google has been producing self-driving cars since at least 2005 and is one of the highest-profile programmes in the US. It currently consists of around a dozen vehicles which, as of April 2014, had racked up almost 700,000 accident-free kilometres.

What is Google's motivation? The project fits within the remit of GoogleX, a programme that makes a few targeted bets on technologies that have a low initial probability of success but high expected payoff if success is achieved.

The traditional auto industry is certainly watching Google very closely. There is a great deal of interest in what Google's plans are and whether it could become, as unlikely as it seems now, a real competitor.

According to Morgan Stanley, the commercial possibilities open to Google include:
– Using self-driving vehicles to improve its market-leading maps;
– Perfecting and licensing its vehicle operating software to OEMs;
– Producing vehicles to sell to consumers.

Of course, Google could abandon its autonomous vehicle research at any time so visibility is limited. But the possibility of buying a Google car in the future is not an entirely wacky idea.

Overall vehicle demand

The impact on overall car ownership is not clear. If (or when) we reach the "ideal" world where cars can drive themselves with close to zero human interaction, the benefits of car ownership will rise as you can be as productive as on public transport but with added comfort and personal space.

On the other hand, how many households will need two cars when the vehicle need never be parked up at a workplace or airport? Car sharing becomes more viable if a car can pick you up for work in the morning and again to take you home at the end of the day. Indeed a fleet of self-driving cars could become more akin to personalised public transport. KPMG describes it as "Zipcar on steroids".

The future is near

Ideas that were once confined to the realms of science fiction are now firmly on the horizon. This is radical change for an industry that has changed relatively little since the development of the internal combustion engine.

There are many unanswered questions, most critically on the pace and timing of adoption, and how the auto industry will adapt. What's more, this could impact a wide range of sectors from telecoms (cars will become another connected device) and media (there will be more time to consume content) to insurance (an industry at the forefront of the liability debate).

Investors and companies must watch closely and try to stay ahead of the game. To quote Larry Burns, a technology and transport consultant and former vice president of R&D at General Motors: "Incumbent players rarely do well when industries disrupt."