Project Breakthrough

Disruptive Technology Executive Briefs

AUTONOMOUS ROAD VEHICLES

Revolutionising travel and logistics

Over the last five years, the automotive sector has made significant advances towards fully autonomous vehicles. This will impact cars and trucks, but also all types of road vehicle from buses to refuse collection. It will offer huge advantages. Eliminating vehicle collisions (making our roads much safer), optimising the movement of vehicles (reducing congestion and leading to greater efficiency), and freeing up drivers' time (to do other things rather than driving) – to name just a few. Pilots are underway and over a 30 - 40 year timescale it will have a significant impact on our lives.

The technology

Technologies being developed enable the full transfer of driving function from the driver to vehicle systems. Manufacturers are testing, on public roads, vehicles with greater levels of autonomy, including those with full self-driving capability. This capability is dependent on vehicle systems being able to analyse, in real-time, large volumes of complex data, make appropriate decisions and draw together many existing and developing technologies into an integrated system. It is this integration where much of the technical complexity lies, both in ensuring that the constituent technologies are sufficiently mature and that they will work together seamlessly. It is not just the technologies on board the vehicle but those embedded into the road infrastructure that need to be considered.

The potential

The autonomous road vehicles revolution will change the way we think and interact with the sector. It is opening up new business opportunities, such as the provision of healthcare as you commute. It will change ownership models, with people opting to buy mobility when they need it – allowing vehicle assets to be used more and therefore transport costs to be reduced. It will also pose interesting challenges for town planners – if vehicles are in use much longer what can valuable parking space be used for?

Current activity is focused on the developed world. However, the developing world has huge potential for this technology and the ability to potentially jump ahead in some cases.

The barriers

The eco-system in which autonomous road vehicles will exist is incredibly complex. Successful deployment is dependent on more than the technology. Regulation, insurance and commercial models are just some of the areas that need to come together – and are arguably where the real complexity lies.
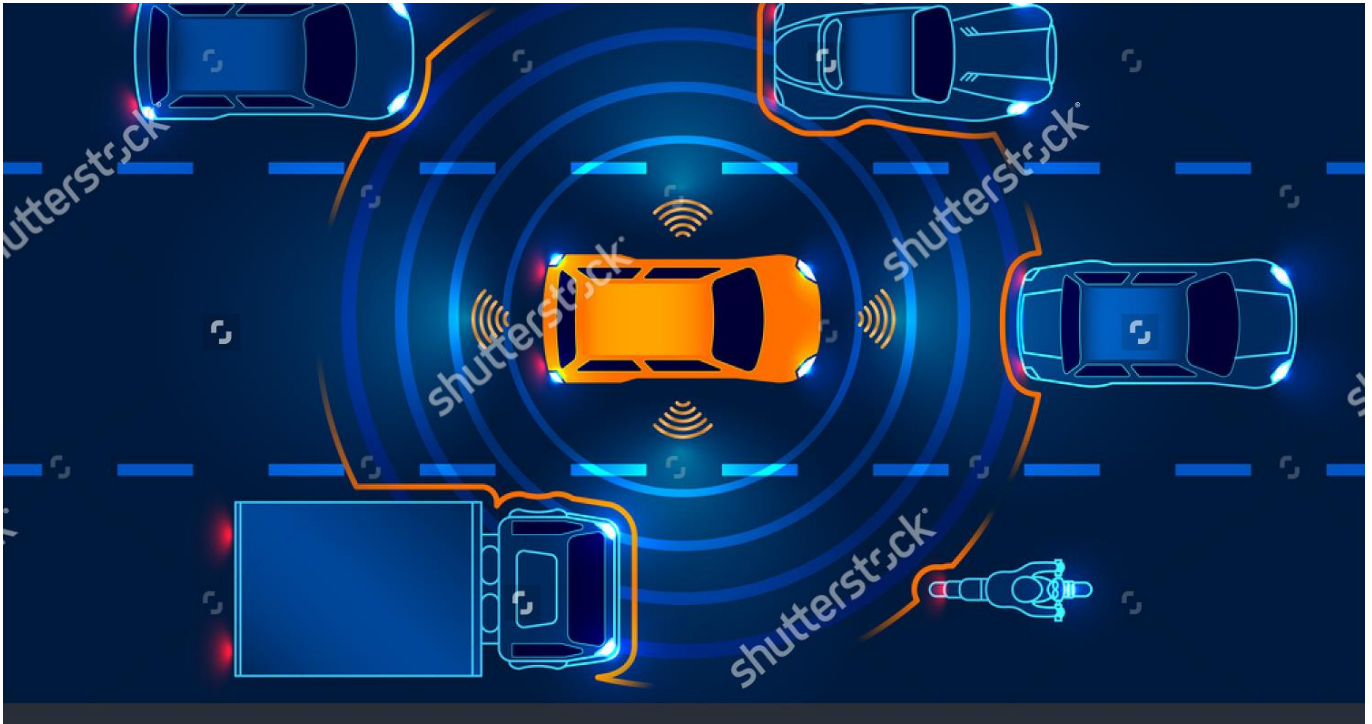
The impacts on employment will need to be actively addressed to minimise negative affects and avoid public resistance.

United Nations
Global Compact

PA

Some Example Applications...

Driverless cars

Perhaps the best known examples of autonomous vehicles have been the driverless cars being tested by Uber. In September 2016, Uber started conducting a trial in the city of Pittsburgh (USA) using a fleet of cars laden with lasers, cameras and other sensors to enable it to drive with no one holding the steering wheel. These vehicles were deployed on the roads to pick up Uber passengers and drive them to their destination.

Driverless bus

In 2016, Helsinki trialled a self-driving bus, in one of the first tests of it kind. Since then other cities, such as Las Vegas and London, have followed suit, with more expected to follow.

Freight platooning

MAN and DB Schenker are planning European platooning trials in 2018. Platooning is where a number of vehicles are connected together and control is handed to the lead driver. Platooning has the potential to be one of the first examples of partial autonomy we see on the roads.

Autonomous waste collection

The city of Gothenburg in Sweden is trialing an autonomous refuse collection truck throughout 2017. This reduces collection times by removing the need for operators to constantly jump on and off the vehicle.

Key Numbers

$42 bn

Estimated autonomous vehicle market size (all levels/types)

Source: Statista

2309

Autonomous vehicle patents filed by leading automotive and digital companies in the last 6 years
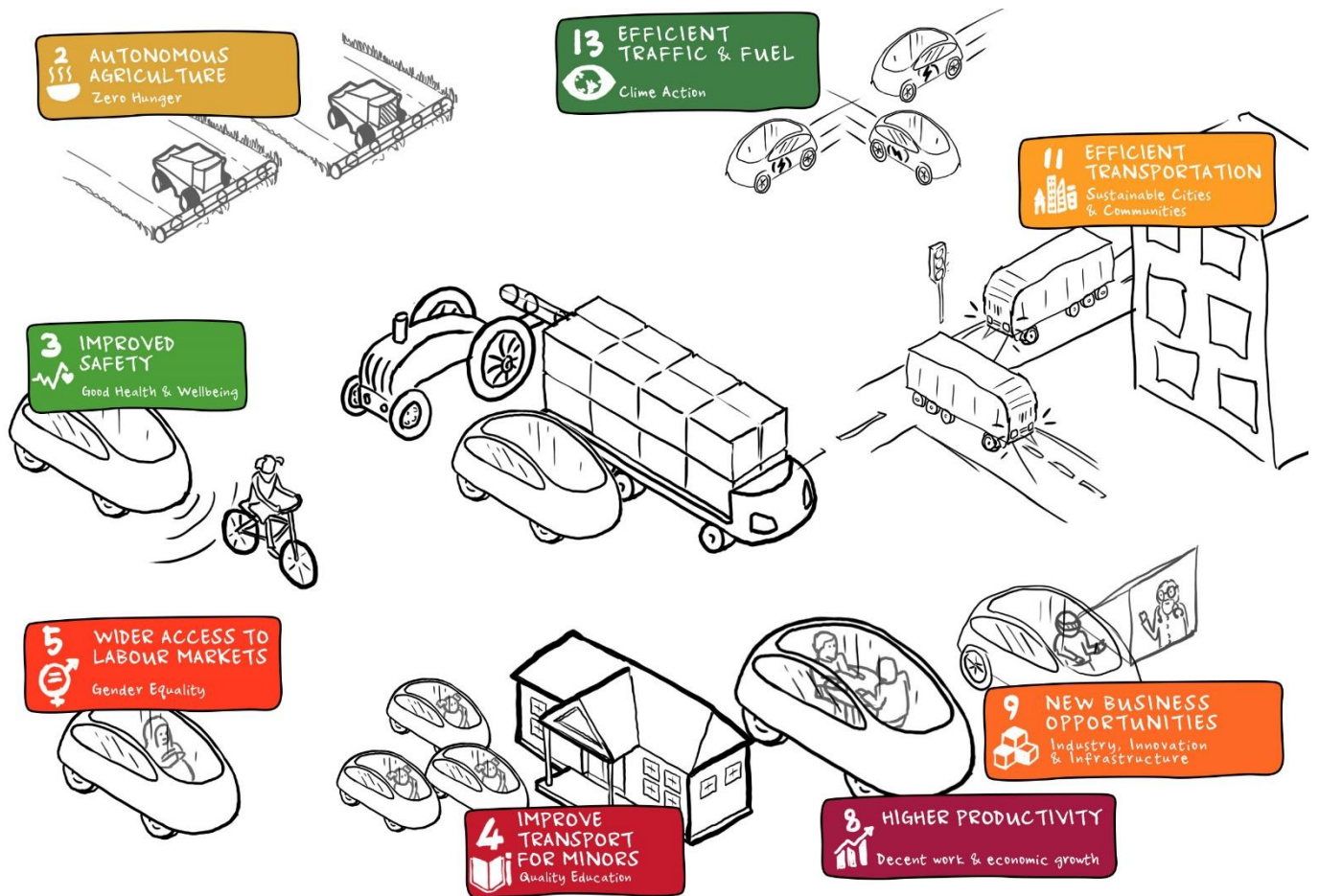
Source: Statista

91.5 mn

Estimated number of driver assistance systems to be on the roads by 2020

Source: Statista

Advancing the Sustainable Development Goals (SDGs)

Autonomous vehicles have the potential to advance many of the SDGs. Below are some examples of areas of applications across a wide variety of sectors.

SDG 2 Zero hunger
- Reduce agriculture costs through autonomous vehicle provision.
- Provide vehicle access to farmers who might not have had it previously.

SDG 3 Good health and wellbeing
- Contribute to reductions in deaths from road traffic accidents through improved road safety.
- Contribute to reduced automotive emissions and improved air quality and health.

SDG 4 Quality education
- Increase access to education through provision of automated transport, changing the balance of how schooling is delivered and increasing quality for all.

SDG 5 Gender equality
- Empower a wider female workforce through removing the need to drive to access labor markets.

SDG 8 Decent work and economic growth
- Higher levels of economic productivity through greater efficiencies in labour-intensive sectors involving transportation.

SDG 9 Industry, innovation and infrastructure
- Introduction of technologies that enable reduction in carbon footprint through greater efficiencies.
- Efficient use of people by removing the limiting conditions surrounding certain roles.
- Opportunities for new and innovative products and service models.

SDG 11 Sustainable cities and Communities
- Improved road safety through fewer road collisions and deaths.
- The opening up of parking space for other uses
- Affordable transportation systems of goods and people through increased efficiencies.
- Improved transportation access for the elderly and disabled.

SDG 13 Climate action
- Contribute to improving the climate through the combined effects of air quality improvements and reduced fossil fuel usage.

Potential Negative Impacts and Barriers

When thinking of autonomous vehicles, people often focus on the car and the technology behind it. However, much of the complexity lies in bringing together all of the other supporting parts of the system, from insurance to commercial models. There are also significant challenges in balancing the positive and negative impacts, with improved safety and a reduced environmental impact on one side against loss of employment on the other.

Employment

Autonomous vehicles promise cheaper transport of people and goods due to reduced labor costs but this must be considered against the impact on jobs.

Sharing the roads

Safety is a leading benefit of autonomous vehicles due to their ability to monitor the environment and react to incidents far more quickly than human drivers. They also reduce erratic behavior by drivers or the risk of driving under the influence of alcohol or drugs. But there are major uncertainties about how these vehicles will safely integrate with non-autonomous vehicles, and some studies predict they will initially worsen congestion in a mixed fleet. The safe operation of partially autonomous vehicles is also challenging, particularly when the vehicle requires the driver to take back control.

Rebound effect

Autonomous vehicles will make transport cheaper, as such, many experts think this could result in more journeys being made. However, given the efficiency gains this is still likely to result in a net positive environmental impact.

Liability and regulations

The question of liability when the vehicle is being driven by an autonomous system has led some automotive manufacturers to accept responsibility for any system error that has led to an incident, fueling a whole new model for insurance. National and international regulations will also be required to ensure the safety and road worthiness of vehicles.

Ethics

Autonomous systems will need to be able to make very difficult decisions which would traditionally be managed by a human's value system. An example might be whether they system will have to reflect whether it is better to hit a pedestrian or brake heavily causing the vehicle behind to hit the autonomous vehicle potentially injuring the "driver".

International cooperation

A truly autonomous travel experience will require inter-governmental agreement on a long term vision and identification of programs of action to establish a common framework to realise its benefits and allow autonomous vehicles to operate seamlessly across international borders.

Business Case

The true costs for autonomous road vehicles and likely benefits are predicated on assumptions. If any of these assumptions turn out to be false their business case could be impacted, either slowing or pausing the roll out of this technology.
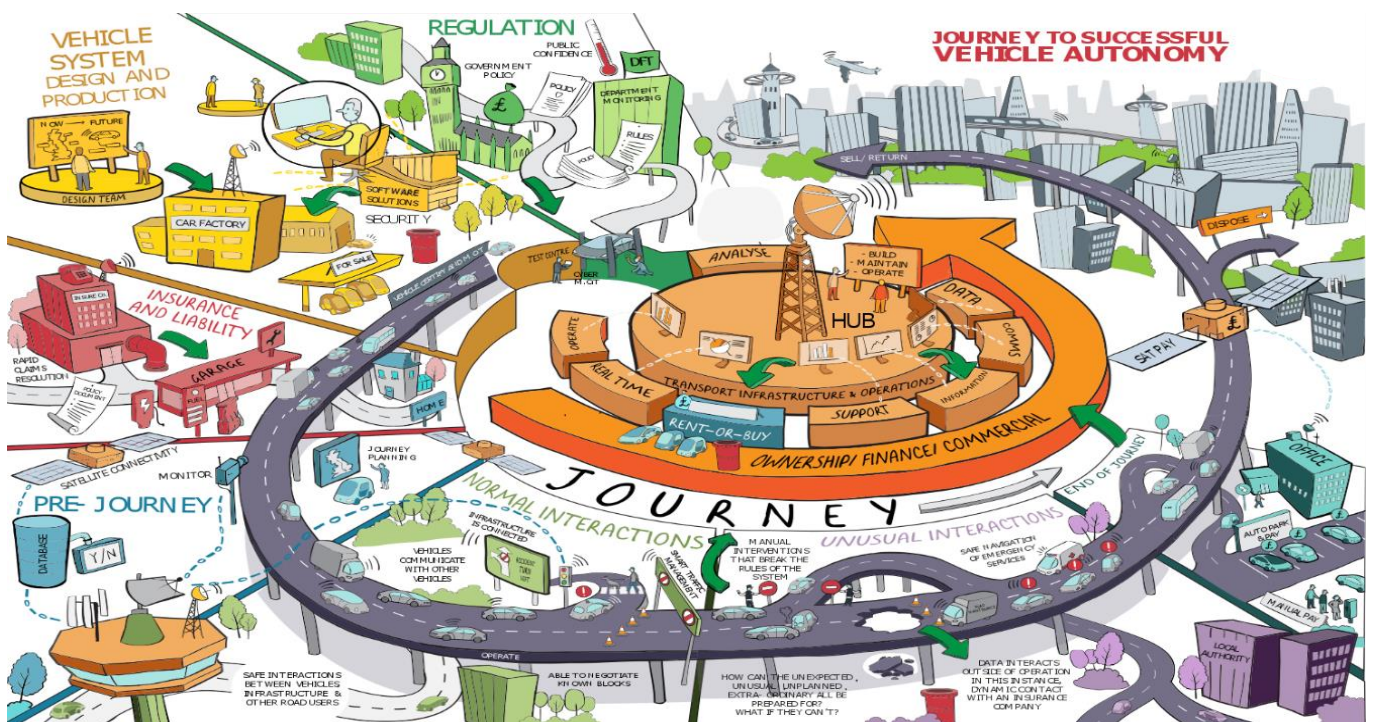
Technical Considerations

The advent of autonomous vehicles brings with it new and diverse challenges for both manufacturers and consumers, and these will need to be overcome as they adapt to them.

Disengagement

Disengagement is the process where a human driver intervenes in the normal autonomous operation of the car to prevent an accident. Autonomous system manufacturers are investing significant resources in overcoming the challenges of this kind of intervention through a combination of hardware and software as early research shows that drivers take a substantial amount of time (seconds) to readjust to driving again bringing consequent safety risks.

Testing

For the technology to be proved an increasing amount of testing in ever more complex environments will need to be conducted. Though some countries are more mature in their testing legislation than others, all will need to develop and grow their testing regulations in order to facilitate the growth of this technology.

Security

Just as theft of modern vehicles with keyless entry technology has increased, autonomous vehicles bring with them their own security challenges. If the network or vehicle security were to be breached, control of the vehicle could be gained by a third party. Ensuring security in such a highly technical environment across national borders will also prove difficult unless certain international standards for the necessary security measures are developed.

Road Infrastructure

Without clearly defined standards and emerging autonomous vehicle technologies, the technology that will enable the road infrastructure to adapt to autonomous vehicles has not yet been defined. The changes to existing infrastructure, such as traffic signals or road layout, could be significant and would require extensive design work to ensure it is suitable for both autonomous and non-autonomous vehicles (in the interim), as well as other users such as pedestrians and cyclists.

Enabling New Business Models

Autonomous vehicles open the door to mobility as a service

Autonomous vehicles have the potential to transform the efficiency and effectiveness of transport and logistics. Removing the need for a human driver coupled with new mobility service models may change the current model of car ownership and radically improve the utilisation of vehicles (it is estimated that cars are idle for 92% of time). In logistics, autonomous vehicles will not be limited by the legislative and physical constraints on how long human drivers can safely drive for, and may also benefit from smarter routing and offer ways to reduce the costs of the final stages of delivery of goods to a customer.

Current manufacturers of vehicles are already well aware of the impact of non-traditional new entrants. Technology companies such as Google and Apple experimenting with autonomous vehicles and Tesla producing new electric vehicles threaten to take market share. Equally, companies like Uber or Lyft are changing the competitive dynamics of the taxi business.

The business model for vehicle ownership will develop. Manufacturers will need to decide whether to provide mobility services, act as fleet owners, transport service providers or continue to sell vehicles to individuals.

However, in the short term, the impact of autonomous vehicles is likely to be seen more in urban areas, where increased population densities make the economic benefits more attractive.

Autonomous vehicles will enable a number of the disruptive business model levers identified in the Business Model section of the Project Breakthrough website, specifically:

A more personalised product or service

By enabling transport as a service, autonomous vehicles will allow personalisation of meeting transportation needs, rather than being tied to a personally owned vehicle.

Asset sharing

By removing the need for a human driver, autonomous vehicles may de-personalise transport ownership and enable asset sharing.

Usage-based pricing

Providing transport as a service rather than through vehicle ownership will require usage-based pricing provided by autonomous vehicles.

More Examples...

United Nations Global Compact

The United Nations Global Compact is a call to companies everywhere to align their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption, and to take action in support of UN goals and issues embodied in the Sustainable Development Goals.

The UN Global Compact is a leadership platform for the development, implementation and disclosure of responsible corporate practices. It is the largest corporate sustainability initiative in the world, with more than 9,000 companies and 3,000 non-business signatories globally.

Project Breakthrough

Project Breakthrough – a collaboration between UN Global Compact, Volans and partners – spotlights the best thinking in sustainable innovation. It showcases innovators across mainstream companies and next generation entrepreneurs who are developing solutions with the potential to achieve exponential impact. It features analysis and resources designed to help leaders understand the new business models and technologies that will be crucial in achieving the SDGs, catalysing action amongst today's businesses to meet the needs of tomorrow's world.

PA

The Disruptive Technology Executive Briefs are produced in collaboration with PA Consulting Group, combining cross sector technology, innovation and business design expertise. The briefs are intended as an easy to digest introduction to disruptive technologies, to help organisations understand how they could advance the Sustainable Development Goals and business performance. These overviews explore key features, examples of applications, potential positive and negative impacts, and how they may enable the new business models.

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