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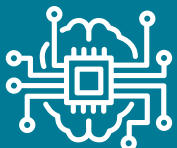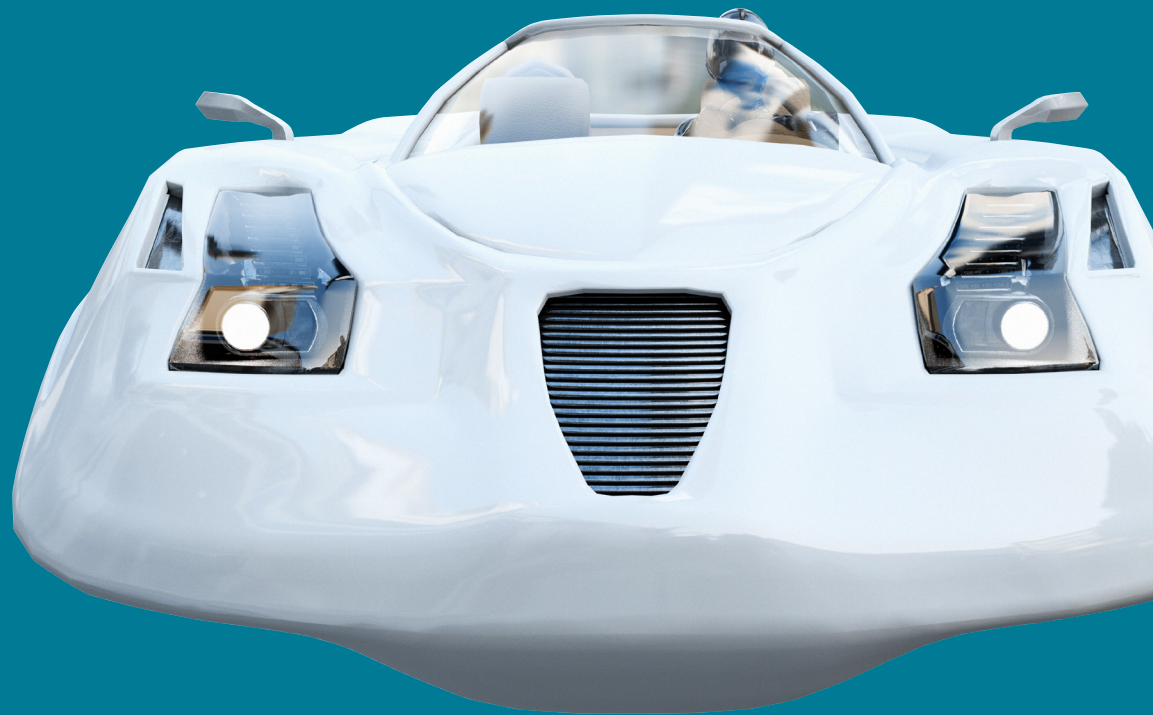
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Intelligent Transport

Artificial
Intelligence

As part of a firm-wide analysis of artificial intelligence (AI) and intelligent technologies and their effects and potential effects on the UK and global economy, CMS has now turned its attention to the transport sector.

We assembled a number of transport industry leaders to discuss the transport landscape and how it is likely to develop in line with technological and operational innovation.

The dinner at CMS's Edinburgh office explored a range of key issues including the advent of automated vehicles and intelligent transport infrastructure, Mobility as a Service (MaaS), cyber security, energy supply and emissions reduction, and the impact of advanced technologies on the workforce. We also looked at how the regulatory environment is shaping progress and innovation, and how the issue of liability is likely to shift from human to machine.

One further consideration is the impact of industry disruptors and how sector incumbents are responding to risk and opportunity.

As ever, we recognise that accurate predictions are impossible to make, but we hope that this report will provide some further insight into the potential evolution of the transport sector. We also look forward to discussing these issues with those that have an interest in this report and the individual topics that are covered.

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Cutting congestion, emissions and democratising mobility

Transport planners and authorities should not be hindered by uncertainties surrounding the future direction of transport innovation.

The history of transport is littered with false predictions. Quarterly Review asked in March 1825: 'What can be more palpably absurd than the prospect held out of locomotives travelling twice as fast as stagecoaches?' Scientific American stated in 1909 'that the automobile has practically reached the limit of its development is suggested by the fact that during the past year no improvements of a radical nature have been introduced.'

An inability to accurately envisage the future makes planning for it especially testing. The remit of transport authorities and planners is continually evolving, with considerations now surrounding the potential of intelligent transport and the impact of AI.

Planners and authorities have to look ahead to whether domestic deliveries might be carried out by drones, if more people will work remotely from home and elsewhere, and if cycling's popularity will continue to rise. There is also the continued pressing issue of cutting emissions and encouraging the use of electric vehicles (EVs).

Investing in transportation systems is unusually difficult when the natural course of innovation is unclear and when there is a significant chance that a particular mode of transport will be made redundant or outdated in the medium to longer term. For example, while EVs account for a small proportion of vehicles on the road in the UK and elsewhere, their use is rapidly growing. Moreover, it is hoped that private vehicle ownership will diminish as public transport becomes even more accessible and personalised, and the Mobility as a Service (MaaS) concept begins to take hold.

A transport Shangri-La

There is no benchmark for intelligent transport systems. Every authority must plan according to its unique characteristics and the applicable regulatory requirements.

A utopian future involving inexpensive and personalised transport is not so hard to imagine if you take into account the pace of technological innovation and the public appetite for it, especially amongst the younger generations.

Intelligent transport networks have already been pioneered in the Nordic countries. In Finland, the regulatory and legislative landscape is especially supportive of innovation and the use of new technology. The Kalasatama quarter in Helsinki, where the Finnish authorities are testing the 'Smart City' concept, is one such example. The district, formerly a major harbour and now ripe for transformation, has been able to leverage the Helsinki authorities' efforts to promote open data, artificial intelligence (AI) and the Internet of Things (IoT).

In the city of Tampere, Finland's second largest urban area, a partnership between Siemens and city-owned public transport operator Tuomi Logistiikka is building a MaaS ecosystem that will enable users to travel on multiple modes of transport under a single ticket. Crucially, this is expected to reduce the cost of subsidised transport, a major expense for public authorities.

The idea is compelling but while other Nordic states, including Sweden and Denmark, are also setting the benchmark for intelligent and personalised transport through MaaS and other models, it does not mean that other nations can simply follow their lead. In the UK, for example, planning laws and regulations make the development of intelligent transport networks a long-game vision. Alastair McInroy of MaaS Scotland, a partnership between Technology Scotland and ScotlandIS, says that 'there is no 'one size fits all' approach when it comes to intelligent transport and MaaS.' He praises the open and standardised regulatory environment adopted by Finland, where one new consolidated piece of legislation sets out a regulatory framework across all modes of transport aimed at customer-oriented transport services: 'Rather than having different regulations for different modes of transport, it has the same one for all.' He indicates that Sweden and Denmark are following a similar agenda.

That's not to say that the rest of the world is lagging behind. There is a universal recognition that the rollout of intelligent transport is well underway around the world. Closer to home, an Intelligent Transport System has been introduced on the new Queensferry Crossing motorway in Scotland to enable variable speed limits and lane control. The system is designed to reduce congestion and improve traffic flow and road safety. In September 2018, the Scottish Government announced that up to GBP 2m would be invested into MaaS projects from 2019 to 2021 through the MaaS Investment Fund.

❝ We can look to Copenhagen and Helsinki, but we have to remember that every city is fundamentally different in its topography, demographics, legislation and regulations.

George Lowder MBE,
Chief Executive of Transport for Edinburgh

MaaS participation

Private vehicle ownership may well decline with the advent of Mobility as a Service (MaaS). It is vital that both the private and public sector work in concert to serve consumers and achieve a positive social impact.

MaaS is best defined as the integration of various forms of transport services into a single mobility service which is accessible on demand.

The MaaS movement opens up all kinds of opportunities and completely alters the economic phenomenon that vehicle ownership naturally increases over time. One measure of economic success always used to be car ownership per household. Along with a vehicle's value, this provided an illustration of the wealth of the nation. The younger generations no longer automatically see having a car as a signal of status, and it is now clear that the age of mass vehicle ownership is over.

The digitisation of transport and concerns about pollution and climate change are helping people to move away from vehicle ownership. While there are other factors at play, there is already plenty of evidence that interest in vehicle ownership is dwindling. The National Travel Survey revealed that 31% of 17 to 20 year-olds held driving licenses in 2016, down from 48% in 1994. This and other data has led to suggestions that we have reached 'peak car' use in the UK.

The MaaS concept can only accelerate this trend. With the consolidation of public and private sector transport services into one place, it enables users to make different decisions on a journey at any one time and date. Transport choice can be based on cost, the effect on the environment, the weather and other key factors. Ride sharing services, car pooling and bike sharing should also significantly reduce traffic and congestion, making MaaS an even more attractive proposition.

Added to this, the democratisation of air travel over the last two decades - thanks to the internet and the growth in low-cost carriers - has caused a massive uptick in air traffic. Air passenger demand has grown annually by more than 5% since 2005, except for in 2008 and 2009, according to Statista.

It has never been easier to book travel. There are however still hurdles to negotiate. MaaS is expected to depend on effective partnerships between the public and private sector, which is not an entirely straightforward prospect. Reservations are understandably strong when considering the sharing of personal, financial and/or travel data with big technology giants and the fact that the private sector's primary concern is its bottom line revenues. However, there is recognition that the public sector typically struggles to keep pace with technological innovation and effective partnerships with the private sector are the only way to achieve this.

Steve Wakeland, General Manager of ITSO says 'there are further advantages to partnership as big technology giants such as Google and Apple will encourage homogeny: The transport system is so fragmented. I think they will force standardisation.'

Dr Steve Cassidy, Director at ESP Group and Viaqqio, agrees, saying there are scenarios where there are universal benefits: 'I can envisage a collaboration between the private and public sector to achieve a specific outcome.
If there is enough win-win around the table and there is money left for a margin and for investment back into services it will boost spending in a related public policy area, say in rural transport.'

And while there are clear advantages to this progress, there is a difficult balance to be struck. Cheaper and more convenient transport could dissuade people from walking and cycling, having negative implications for road congestion and public health.

Alastair McInroy (MaaS Scotland) reflects on the idea that we need to reduce travel, not encourage more. 'The best journey is the one that is never made,' he says. 'As we move towards automated vehicles, there is no doubt that accessibility will increase dramatically and the cost of mobility will decrease. This could easily result in more vehicles on the road with single-use automated vehicles only adding to congestion. We could be making mobility so convenient that people are less inclined to walk and cycle. How do we get around that?'

> As we move towards automated vehicles...accessibility will increase dramatically and the cost of mobility will decrease.
>
> *Alastair McInroy (MaaS Scotland)*

Potential liabilities and cyber-security

Intelligent transport networks and technologies deliver a variety of economic and environmental positives, but they also create potential weaknesses that are more open to cyber breaches.

This new connected environment will also pose concerns for service providers that enable a customer's journey. With multiple providers collaborating to deliver intelligent transport networks, the potential for cyber-attacks and data breaches is an important consideration.

Those that are part of a complex web of transport providers are only as strong as the weakest link when it comes to protecting data and ensuring that the technology that the networks depend on is fully secure. Where liabilities arise, it must be clear who is responsible.

Eleanor Lane, an Infrastructure partner at CMS says: 'The benefits for the consumer of joined-up MaaS are clear, but it will be crucial for transport operators and service providers to manage the commercial interfaces in shared services carefully. They must know where their liability starts and ends and be able to catch disagreements early before they escalate.'

Duncan Turner, a Technology Media and Telecommunications partner adds: 'The accessibility of electronic information across different organisations is central to bringing transport into the future, but this obviously raises cyber-security risks. Following the introduction of the General Data Protection Regulations in May 2018, organisations need to ensure their data management practices and policies are robust before allowing information to be shared.'

Better economic and health outcomes

Innovation in transport networks is set to have a positive impact on local economies and public health.

Poor transport infrastructure and congestion adversely affect the economy and the environment. INRIX, the transport data analysts, estimates that the economic cost to London from congestion would reach GBP 42bn by 2025. Delayed travel means lower economic output with workers unable to reach their place of work. Badly functioning transport links discourage shoppers, tourists and other visitors to town and city centres.

There are plenty of success stories in the UK. London, for example, has seen a dramatic increase in cycling. The City of London Corporation's Traffic in the City 2018 report indicated that cycling was four-times as popular than 19 years previously. Cycle hire schemes are also proliferating across the UK, such as Just Eat Cycle in Edinburgh, Santander Cycle in London and dockless equivalents including Ofo and Mobike (though Chinese firm Mobike has pulled out of Manchester due to vandalism and bike theft).

Better transport networks and more choice are further encouraging the use of public transport. The Edinburgh Tram system opened in May 2014 and in 2017 passenger numbers increased by 24% from 2016 to 6.6 million. This rose again to 7.3 million in 2018. It raised GBP 1.6 million pre-tax for the City of Edinburgh Council, but the economic benefits to the city go far beyond that. The local development plan ensured that it served key locations such as the airport, Murrayfield Stadium, Haymarket and Princes Street. Drivers can also make use of the Ingliston Park and Ride and travel into the city centre for £1.70, further helping to reduce urban congestion and increasing economic activity.

Recently announced are the self-driving trials for Edinburgh and London. These pilot projects include Project CAV Forth (a 14-mile self-driving bus service over the Forth Bridge in Edinburgh), deployment of four self-driving taxis in Greenwich, and an autonomous Land Rover fleet in London, all of which have secured backing from the GBP 25m Connected and Autonomous Vehicles Intelligent Mobility Fund.

George Lowder MBE (Transport for Edinburgh) believes that local authorities and transport authorities need to constantly reassess transport networks, including bus routes, to ensure that they are tapping into and meeting further demand. He suggests that Lothian Buses, which serves Edinburgh and The Lothians, is bucking the national trend in declining bus patronage because it has recast its networks, concentrates on excellent customer service and has delivered a number of innovative schemes including better seating and WiFi access. It unveiled new larger double decker buses in November 2018 that will further increase capacity and come into service in early 2019.

However, the potential ripple effect of inner-city congestion alleviation programmes and emission reduction schemes must also be considered. While these initiatives may encourage people to reduce private vehicle use, we may simply push congestion and pollution to other areas, according to Jim Grieve, Head of Programmes at SEStran. The Edinburgh bypass A720, for example, is notorious for bottlenecks. INRIX Roadway Analytics' survey of UK roads shows it is the most congested route after the M25, London's orbital motorway.

Phasing out fossil fuels

Electric and low-emission vehicles are already having a significant impact.

Efforts to reduce vehicle emissions and improve air quality are being made. Lothian Buses is expanding its fleet of fully-electric powered buses; the Clermiston to Easter Road route is now entirely electric. Transport Scotland's Scottish Green Bus Fund is there to support such initiatives and forms part of a wider programme to enable the greater proliferation of EVs.

Yet more needs to be done to aid the growing use of private EVs, an area where supporting infrastructure is lacking.

Those without private driveways have few chances to charge their vehicles and charging points around the UK are still sparse. 'How do people in tenement flats and terraced properties get their vehicles charged?' asks Alex Macaulay, former Director at SEStran and appointed member at SPT (Strathclyde Partnership for Transport).

To encourage greater EV use, local authorities need to invest in strategically placed charging facilities including rapid charge points. Other countries are trialling inductive and conductive technologies where the charging network is embedded in the road. The cost of this is generally being met by the public sector (albeit, in Sweden, in partnership with the private sector), but it is not immediately apparent that this would be affordable in the UK in the foreseeable future.

In September 2018, Prime Minister Theresa May announced a GBP 106 million investment package for EV development and battery and charging technology. A report by Emu Analytics in May 2018 said that the UK required more than 100,000 EV charging points by 2020, when it is projected that there will be in excess of one million EVs on the roads.

At present, it is not clear what the future is for the traditional combustion engine other than the fact that new petrol and diesel car sales will be banned in Scotland by 2032, eight years ahead of the UK Government target for 2040. Other places have much more ambitious plans; Paris is expected to ban all non-EVs by 2030. In Norway, where there are a handful of incentives to go electric, 52% of 2017 new car sales were EVs. Many automotive giants have seen that the writing is on the wall and won't hang around in a declining industry; Volvo will only ship electric or hybrid vehicles from 2019.

Consumer and Payment Technologies

Transport planners and authorities must embrace consumer and payment technologies to effect real change and reap the rewards.

Consumer and payment technologies are also providing compelling incentives for people to ditch the traditional car. 'You need to convince people with a carrot and stick to use the car less and public transport more. You have to think about ensuring movement and maintaining journey times,' says Jim McFarlane, Chairman of Lothian Buses.

Contactless payments for transport in London are now part of the fabric. Similar schemes are being developed across the UK.

Apps and other consumer technologies are enabling people to plan smarter journeys, where they can limit costs and the environmental impact of the journey.

Technology can also be used to drive environmentally conscious behaviours; NaviGoGo is a new MaaS platform for young people in Scotland, which provides incentive points for positive/sustainable travel choices.

The personalisation of transport choices through MaaS systems can be very cost effective for consumers. 'There is no doubt that the internet, connectivity, data analysis/algorithms enable hyper-personalisation,' says Dr Steve Cassidy. 'People can ask 'how does the system work for me and do I trust the service?'

Steve adds that an example of hyper-personalisation would present information linked to stored and learned user preferences, and includes breaking break down the cost of each section of a longer journey, providing greater transparency and enabling more informed choices.

Contactless payments can ensure that transport users pay the cheapest prices for daily, weekly and monthly travel. App driven technology can also enable commuters and passengers to embrace the cashless society and have a clear idea of costs before beginning their journeys.

However, more work needs to be done in this area. Macaulay says, 'People expect to go onto an app on their phone and do whatever business they need to do, but you can't yet do that with all public transport.'

Kenny Rose, a Corporate partner at CMS, says that the transport sector should look to industry disruptors like Uber for inspiration: 'Take my son who is using Uber in Chile at the moment because he can pay through his phone and doesn't need to haggle with the taxi driver.'

Reskilling the workforce

Widespread fear that AI and intelligent technologies – for instance fully self-driving taxis and lorries – will lead to mass redundancies is wide of the mark. Redundancies could be a natural consequence, but this kind of innovation is likely to result in more fulfilling and impactful employment.

The idea that the internet, connectivity, AI and other smart technologies will transform the transport sector continues to create excitement and trepidation in equal measure. Clearly there will be roles in the transport sector that become redundant as technology brings greater efficiency and reliability, but this quickly transforming environment will also demand new skills to support it.

Steve Cassidy (ESP Group) believes that the picture is not necessarily bleak, suggesting that 'a highly trained workforce' is required to support MaaS and autonomous vehicles, supporting a 'high value' service while technology delivers on 'low value' tasks. He says, such an environment will enthuse the workforce and that retention rates will be higher.

Accessing such skills poses a tough challenge as the economy and education system is not yet set up to provide the right kind of candidates.

'There are recognised skills gaps in areas like engineering and physics that support the development of the infrastructure that underpins the digital economy,' says Alastair McInroy (Maas Scotland). 'With the digitisation of the economy, there is a corresponding need for a lot of hardware.'

> Jobs in transport are increasingly going to be replaced by technology, but this is not unique to the transport sector.
>
> *Alex Macaulay*
> *Elected member SPT*

Building a long-term outlook

Given the pace of change, planning for the future is not an easy proposition, but well-informed decisions can still be made.

The pace and direction of travel is impossible to predict, meaning that the public and private sectors have especially tough decisions to make. Like their forebears, who grappled with the potential of the locomotive and the impact of the automobile, today's transport authorities and service providers have a huge number of factors to consider.

'Decision-making will inevitably entail taking an informed gamble or two,' says Eleanor Lane, an Infrastructure & Projects partner at CMS: 'Given the rapidly changing transport landscape, are we spending public money in the right areas? While the current and proposed Scottish transport infrastructure projects will provide very welcome progress towards meeting Scotland's existing transport needs, it is vital that investment decision-makers are mindful of the continued changes that technology will drive.' She believes that public and private sector collaboration and communication will be pivotal to the effective introduction of intelligent transport networks that meet consumer needs:

'The changing trends in the type of transport that we use and the ways in which we interact with transport providers will make it essential for governments to work with the private sector to ensure that we invest in infrastructure that supports the wider population over the long term.'

A long-term vision is not easy to come by, but unlike those that dismissed the impact of the locomotive and the further development of the automobile, we can be sure that intelligent transport networks are a growing part of our future.
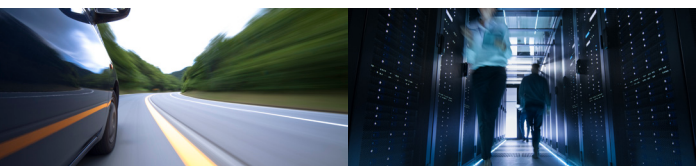
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